DANISH MINISTRY OF
CLIMATE, ENERGY AND BUILDING

Denmark's Sixth National Communication and First Biennial Report

Under the United Nations Framework Convention on Climate Change

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Under

the United Nations Framework Convention on Climate Change

and the Kyoto Protocol

and

Denmark's First Biennial Report

Under

the United Nations Framework Convention on Climate Change

December 2013

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Foreword

I am pleased to present Denmark's Sixth National Communication under the United Nations 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".

Anthropogenic climate change is real, it is happening and must be taken seriously. However, progress so far in global efforts to combat climate change has been modest. Therefore the political rhetoric has to be followed up by real action if we are to reverse the current trend of increasing global greenhouse gas emissions.

Science recommends that developed countries reduce their total greenhouse gas emissions by 80%-95% by 2050 compared with 1990, as part of an overall 50% reduction in global greenhouse gas emissions.

The Danish government wants Denmark to contribute actively to meeting calls from scientists that significant reductions in greenhouse gas emissions are necessary.

The government also wants Denmark to be the showcase to the rest of the world that a green transition can be reconciled with economic growth.

The Danish government's strategy to put Denmark on track for the 2050 target includes an interim target of a 40% reduction by 2020 in all Danish greenhouse gas emissions compared to 1990 levels.

In August 2013, the Danish Government's Climate Policy Plan was published. This Climate Policy Plan calls for a broad dialogue with all relevant players on future action. In addition to starting this dialogue, the Danish government will present a Climate Change Act in 2014. This Climate Change Act will establish a framework for the green transition and progress in reduction efforts so that Denmark can meet the emission reduction targets.

There are two basic elements to the Danish government's strategy: national efforts and European efforts. An ambitious Danish climate policy is highly dependent on developments in the EU, and therefore the Danish government will work actively for more ambitious climate policies at European level.

However, ambitious climate policies in Denmark and at European level will not by themself be sufficient to reduce global emissions and keep the increase in global temperature below 2 degrees Celsius. It will also require further international cooperation to reverse global emissions as soon as possible. Negotiations on a legally binding agreement in 2015 on further action after 2020 will continue to be a major global challenge.

Both in developed country Parties and in developing country Parties 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.

Experience from Denmark shows that it is possible to maintain high economic growth while at the same time reducing dependency on fossil fuels. Through persistent and active energy policies focusing on enhanced energy efficiency and promotion of renewable energy, Denmark has been able to sustain high economic growth and at the same time reduce fossil-fuel dependency and protect the environment. Since 1990, the Danish economy has grown by 38%, while energy consumption has remained more or less constant. From 1990 to 2012 a 19% decrease in actual greenhouse gas emissions has been observed with a corresponding 28% decrease in CO_2 emissions adjusted for inter-annual fluctuations in the weather and cross-border exchange of electricity to 2012. This development reflects an increase in energy and CO_2 efficiency. Furthermore, the composition of energy consumption in Denmark has changed significantly as a consequence of energy policy measures to promote the use of renewable energy. Renewable energy today makes up 26% of final energy consumption. This has increased the security of energy supply and has contributed considerably to fulfilling Denmark’s climate goals.

In this Sixth National Communication you can read more about Denmark’s climate policies and measures underlying these, as well as planned future targets for Danish efforts towards achieving the ultimate goal of the Climate Convention – to stop dangerous anthropogenic interference with the climate system.

For the third time the National Communication also contains information required under the Kyoto Protocol. Moreover, as agreed in Durban in 2011, Denmark’s First Biennial Report is also included in this National Communication.

This Sixth 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. For Denmark and Greenland it also contains information on the action taken on the commitments under the Kyoto Protocol.

Copenhagen, December 2013

Martin Lidegaard

Minister for Climate, Energy and Building

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. Currently, there are 195 Parties (194 States and 1 regional economic integration organization) to the United Nations Framework Convention on Climate Change.

This report is Denmark's Sixth National Communication under the Climate Convention and the third under the Kyoto Protocol. Since Denmark's ratification of the Climate Convention covers the entire Realm, the report also includes information on Greenland and the Faroe Islands. The Kyoto Protocol, however, only covers Denmark and Greenland due to a ratification with a territorial exclusion to the Faroe Islands. The report is organised in accordance with the guidelines for national communications adopted by the parties to the Climate Convention and as far as possible it follows the Annotated Outline for the Fifth National Communication suggested by the Climate Secretariat in June 2009.

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 Sixth National Communication submitted to the UNFCCC in December 2013.The Danish Energy Agency, under the Ministry of Climate, Energy and Building, has been in charge of coordinating the work relating to Denmark's Sixth National Communication. Contributions have been made by the following institutions:

Danish Building Research Institute at Aalborg University;
Danish Energy Agency, Danish Meteorological Institute and Geological Survey of Denmark and Greenland under the Ministry of Climate, Energy and Building;
Danish Environmental Protection Agency and Danish Nature Agency under the Ministry of the Environment;
DCE - Danish Centre for Environment and Energy and Department of Agroecology at Aarhus University;
Department of Environmental, Social and Spatial Change at the Roskilde University;
Department of Geosciences and Natural Resource Management at the University of Copenhagen;
Faroe Islands - Environment Agency and Statistics Faroe Islands;
Greenland - Department of Nature, Energy and Climate under the Ministry of Housing, Nature and Environment; Greenland Institute of Natural Ressources and University of Greenland;
Ministry of Education;
Ministry of Food, Agriculture and Fisheries and the Danish AgriFish Agency there under;
Ministry of Foreign Affairs;
Ministry of Taxation;
Ministry of Transport and the Danish Transport Authority and the Danish Coastal Authority there under;
Statistics Denmark under the Ministry of Economic Affairs and the Interior;
Technical University of Denmark;
University of Southern Denmark.

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Executive Summary

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 5.5 mill. and a total area of 43,000 km^2. More than 66% of the area is used for agricultural purposes, while 14% 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 7.7ºC 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 approx. 2% per year until the global economic crisis from 2007. After the economy contracted in 2008-2009 modest but positive growth rates have been seen. In 2012, GDP amounted to DKK 1,826 billion, corresponding to DKK 326,000 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 has doubled 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. In 2011, renewable energy accounted for about 22% of Denmark's observed energy consumption.

The observed energy consumption in 2011 was 792 PJ and was distributed over the following energy sources: oil 303 PJ (38%), natural gas 157 PJ (20%), coal 136 PJ (17%), and renewable energy etc. 192 PJ (24% of which 22%-point was renewable energy). The net export of electricity was insignificant in 2011, corresponding to 5 PJ (0.6%).

The distribution of gross energy consumption (energy consumption adjusted for foreign electricity trade) in 2011 was as follows: industry and agriculture accounted for 23%, domestic sector for 28%, transport for 26% and commerce and service for 16%. Refining and non-energy purposes accounted for the remaining 7%. In 2011, energy production and supply alone accounted for 36% of Denmark's total emissions of greenhouse gases.

The energy consumption in the household sector primarily comprises heating and electricity consumption. Since 2000 the net heat demand per m^2 has decreased and was in 2011 approx. 7% below the level in 1990. In the period 1990-2011 total household electricity consumption increased by 2.6%, whereas electricity consumption for appliances and lighting etc. increased by 16.0%. This big difference is due to a significant fall in electricity consumption for heating.

Denmark is a relatively small and densely populated country with a large share of the population living in cities. This influence the transport activity in Denmark. In urban areas most people have good access to public transport and major investments in better public transport infrastructure are currently taking effect. In 2011, CO_2 emissions by the transport sector were about 23% over the 1990 level and accounted for 23% of Denmark's total greenhouse gas emissions.

1.1.3 Business sector and waste

Industry's production value accounts for about 18% of total production. The largest sectors of industry are food and beverages, manufacturing of machinery and transport equipment, chemical and pharmaceutical industry and metal industries. By far the largest part of the greenhouse gas emissions in the business sector, is CO_2 from energy consumption, which in 2011 accounted for about 11% of Denmark's observed emissions of CO_2 related to energy consumption. The sector is also a source of emissions of industrial greenhouse gases, which in 2011 accounted for 1.5% of Denmark's total greenhouse gas emissions.

The waste sector's methane emissions account for 1.8% of the total greenhouse gas emissions in 2011. 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% (26,394 km^2) in 2012. The number of farms has fallen by 66% from 1980 to 2012, while the average size of farms has increased by more than 150% in the same period, from 24 ha to 64 ha. At approximately 10%, agricultural exports still account for a considerable proportion of all Danish export. Emissions of methan and nitrous oxide from agriculture (i.e. excluding emissions from energy consumption) accounted for approximately 17% of Denmark's total emissions of greenhouse gases in 2011.

Approximately 14% 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 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 around 56,400, 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 around 48,300. 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.

Fishery and related industries are of such importance that their influence determines the overall performance of the Faroese economy. The Faroese economy is very sensitive to the international market for fish. Consequently, export income can fluctuate significantly from one year to the next, and these fluctuations spread quickly throughout the economy. The national accounts to 2012 indicate that a proportionally larger output value now comes from production of private and public services. The proportional output value from fishery and manufacturing fish products has declined correspondingly.

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, Greenland’s and Faroe Islands’ 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 2011, 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 (LULUCF).

Table 1.1 Denmark's, Greenland’s and the Faroe Islands’ total emissions of greenhouse gases, 1990 – 2011

Source: Nielsen et al., 2013.

GREENHOUSE GAS EMISSIONS	**1990**	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
	CO_2 equivalent (Gg)							
CO_2 emissions including net CO_2 from LULUCF	59 602	65 641	58 275	57 178	50 941	52 699	49 793	42 622
CO_2 emissions excluding net CO_2 from LULUCF	54 146	62 006	55 071	52 495	52 252	49 780	50 279	45 299
CH_4 emissions including CH_4 from LULUCF	6 069	6 163	5 913	5 684	5 652	5 559	5 620	5 525
CH_4 emissions excluding CH_4 from LULUCF	6 068	6 162	5 913	5 684	5 652	5 559	5 620	5 525
N_2O emissions including N_2O from LULUCF	9 846	8 809	7 990	6 375	6 430	6 059	6 017	6 076
N_2O emissions excluding N_2O from LULUCF	9 829	8 794	7 976	6 362	6 417	6 046	6 005	6 063
HFCs	NE,NO	218	613	819	872	817	823	778
PFCs	NE,NO	1	18	14	13	14	13	11
SF_6	44	108	59	22	32	37	38	73
Total (including LULUCF)	**75 561**	**80 938**	**72 867**	**70 092**	**63 939**	**65 185**	**62 306**	**55 084**
Total (excluding LULUCF)	**70 088**	**77 288**	**69 649**	**65 396**	**65 237**	**62 253**	**62 779**	**57 748**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**1990**	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
	CO_2 equivalent (Gg)							
1. Energy	53 413	61 246	54 217	51 695	51 679	49 577	50 195	44 972
2. Industrial Processes	2 240	2 726	3 390	2 458	2 273	1 782	1 704	1 873
3. Solvent and Other Product Use	116	137	154	190	157	170	188	167
4. Agriculture	12 586	11 633	10 513	9 894	9 985	9 639	9 655	9 712
5. Land-Use, Land-Use Change and Forestry	5 473	3 650	3 218	4 696	-1 298	2 932	-473	-2 664
6. Waste	1 733	1 546	1 376	1 160	1 143	1 084	1 037	1 024
7. Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)	**75 561**	**80 938**	**72 867**	**70 092**	**63 939**	**65 185**	**62 306**	**55 084**

Table 1.2 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 2011, calculated in CO_2 equivalents.

TABLE 1.2 DENMARK'S TOTAL EMISSIONS OF GREENHOUSE GASES, 1990 – 2011
Source: Nielsen et al., 2013.

GREENHOUSE GAS EMISSIONS	**1990**	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
	CO_2 equivalent (Gg)							
CO_2 emissions including net CO_2 from LULUCF	58 309	64 566	56 941	55 810	49 566	51 378	48 324	41 213
CO_2 emissions excluding net CO_2 from LULUCF	52 853	60 932	53 737	51 128	50 878	48 459	48 811	43 890
CH_4 emissions including CH_4 from LULUCF	6 038	6 131	5 882	5 652	5 620	5 528	5 589	5 493
CH_4 emissions excluding CH_4 from LULUCF	6 037	6 131	5 882	5 652	5 620	5 528	5 589	5 493
N_2O emissions including N_2O from LULUCF	9 803	8 768	7 946	6 330	6 384	6 016	5 975	6 034
N_2O emissions excluding N_2O from LULUCF	9 786	8 753	7 932	6 317	6 371	6 004	5 962	6 022
HFCs	NE,NO	218	607	802	853	799	804	759
PFCs	NA,NO	1	18	14	13	14	13	11
SF_6	44	107	59	22	32	37	38	73
Total (including LULUCF)	**74 193**	**79 790**	**71 453**	**68 630**	**62 467**	**63 772**	**60 743**	**53 583**
Total (excluding LULUCF)	**68 720**	**76 141**	**68 235**	**63 934**	**63 766**	**60 840**	**61 217**	**56 248**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**1990**	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
	CO_2 equivalent (Gg)							
1. Energy	52 111	60 165	52 875	50 317	50 295	48 246	48 717	43 554
2. Industrial Processes	2 240	2 726	3 384	2 441	2 254	1 764	1 685	1 854
3. Solvent and Other Product Use	116	137	154	189	157	170	187	167
4. Agriculture	12 545	11 592	10 471	9 852	9 943	9 598	9 614	9 672
5. Land-use, Land-Use Change and Forestry (LULUCF)	5 473	3 649	3 218	4 695	-1 299	2 932	-474	-2 665
6. Waste	1 709	1 521	1 351	1 135	1 118	1 062	1 015	1 002
7. Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)	**74 193**	**79 790**	**71 453**	**68 630**	**62 467**	**63 772**	**60 743**	**53 583**

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 23% in 2011. 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 2011, total actual CO_2 emissions inventoried under the Climate Convention, excluding land-use, land-use change and forestry (LULUCF), were about 16% lower than in 1990. If LULUCF is included, net emissions were about 28% lower.

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. However legislation establishing emission limits for existing gas-driven engines and decreased use of gas engines has resulted in lower emissions.

In 2011, total methane emissions were 9% below the 1990 level.

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 33.5% fall in nitrous oxide emissions from agriculture since 1990. That is due to less and better use of fertiliser. A small share of nitrous oxide emissions originates from power and district heating plants, and cars with catalytic converters.

In 2011, total nitrous oxide emissions were 38% below the 1990 level.

1.2.4 The industrial gases HFCs, PFCs and SF_6

The contribution of f-gases (HFCs, PFCs and SF_6), to Denmark's total emissions of greenhouse gases is relatively modest. However, the emissions of these gases increased significantly during the 1990s. HFCs, which are primarily used in refrigeration and air conditioning, are the biggest contributor to f-gas emissions. From 1995 to 2011 annual emissions of HFCs increased from 218 to 778 Gg of CO_2 equivalents.

The total emissions of HFCs, PFCs and SF_6 increased by 165% from 1995 to 2011.

1.2.5 Total Danish emissions and removals of greenhouse gases

In 2011 the total Danish emissions (i.e. without Greenland and the Faroe Islands) were estimated to 56.2 mill. tonnes of CO_2 equivalents,

Of the total Danish greenhouse gas emissions in 2011, CO_2 made up 78%, methane 9.8%, nitrous oxide 10.7%, and f-gasses 1.5%. If net contributions of CO_2 emissions by sources and removals by sinks from forests and soil are included (i.e. with LULUCF), then net total Danish greenhouse gas emissions corresponded to 53.6 mill. tonnes of CO_2 equivalents in 2011.

1.2.6 The national system for the estimation of greenhouse gas emissions

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 Danish Centre for Environment and Energy (DCE) is responsible for producing the Danish greenhouse gas emission inventories and the annual reporting to the UNFCCC and the DCE has been designated the single national entity under the Kyoto Protocol. DCE is therefore the contact point for Denmark's national system for greenhouse gas inventories under the Kyoto Protocol.

The work on the annual inventories is carried out in cooperation with other Danish ministries, research institutes, organisations and private enterprises.

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 and the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories and the European CORINAIR 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).

Uncertainty in the greenhouse gas inventories is calculated as recommended in the IPCC guidelines and covers 100% of total Danish greenhouse gas (GHG) emissions. The result of the calculations shows that total GHG emissions were calculated to have an uncertainty of 6.7% and the decrease in GHG emissions since 1990 was calculated to be -27.7% ± 2.9 %. Uncertainty is greatest for N_2O emissions from stationary combustion and agricultural land and CH_4 emissions from enteric fermentation and solid waste disposal on land.

As part of the national system, DCE is drawing up a manual to use in quality assurance and quality control of the emission inventories.

DCE produces an annual report (National Inventory Report) 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.

A number of improvements of the emission inventories have been made since Denmark's Fifth National Communication to the Climate Convention, and procedures for the official consideration and approval of the inventory have been introduced.

1.2.7 The National Registry for accounting of assigned amounts and credits from sinks and JI- and CDM-projects

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. The 16th of October 2008 the EU ETS was included in the international emissions trading system under the Kyoto Protocol after successful connection to the International Transaction Log.

Since Denmark's Fifth National Communication to the Climate Convention was published, major changes have occurred regarding the National Registry. As of June 2012 the EU ETS operations were centralized into a single European Union registry operated by the European Commission. Furthermore, as of August 2012 the administration of the Danish national registry and, thus, the role as registry administrator was moved from the Danish Energy Agency under the Danish Ministry of Climate, Energy and Building to the Danish Business Authority under the Danish Ministry of Business and Growth.

Businesses and users of the Registry are kept informed about regulations, news etc. through regular updates from the Danish Business Authority's website, the news on the Registry website and a newsletter from the Registry staff.

1.2.8 Denmark's and Greenland's base year emissions, assigned amount and greenhouse gas inventories under the Kyoto Protocol

As mentioned above the GHG inventory of the Kingdom of Denmark under the Kyoto Protocol covers Denmark and Greenland. Denmark is part of the European Union while Greenland is not.

As Denmark is part of the European Union, of which 15 Member States will meet their reduction commitment 2008-2012 under the Kyoto Protocol jointly in accordance with Article 4 of the Kyoto Protocol, Denmark's quantified emission limitation for the 1st commitment period 2008-2012 under the protocol is 79 percent. The quantified emission limitation for Greenland is 92 percent because Greenland is not part of the European Union. Denmark's assigned amount is calculated based on the Article 4 commitment. Greenland's assigned amount is based on 92 per cent.

According to the initial report for the first commitment period under the Kyoto Protocol submitted in 2006 and the initial review report published by the UNFCCC secretariat in 2007 the total assigned amount for Denmark and Greenland for the period 2008-2012 is 276,838,955 tonnes CO_2 equivalent. This is shown in table 1.3 together with base year figures and the calculated minimum holding of 249,155,060 tonnes CO_2 equivalent in the national registry – the so-called commitment period reserve.

TABLE 1.3 DENMARK'S AND GREENLAND'S BASE YEAR EMISSIONS AND ASSIGNED AMOUNT FOR 2008-2012 UNDER THE KYOTO PROTOCOL

Source: The Kingdom of Denmark's initial report on assigned amount, 2006, the UNFCCC's report of the review of the initial report of Denmark, 2007 and Nielsen et al., 2013.

Tonnes CO_2 equivalents	**Denmark under the EU**	**Greenland**	**Denmark and Greenland**
CO_2 (1990)*	52,712,457	629,996	53,342,453
CH_4 (1990)	5,692,000	16,155	5,708,155
N_2O (1990)*	10,593,311	8,523	10,601,834
HFCs (1995)	217,728	25	217,753
PFCs (1995)	502	0	502
SF_6 (1995)	107,338	36	107,374
Base year	**69,323,336**	**654,734**	**69,978,070**
Annual Assigned Amount in %	79%	92%	DK79%+GR92%
Annual Assigned Amount in tonnes	54,765,435	602,356	55,367,791
Total Assigned Amount 2008-12	**273,827,177**	**3,011,778**	**276,838,955**
a. 90% of AA	246,444,459	2,710,600	249,155,060
Most recently reviewed inventory (2010)*	61,065,429	715,368	61,780,797
b. Times 5 (100%)	305,327,144	3,576,839	308,903,983
Most recently inventory (2011)*	56,248,450	762,618	57,011,068
c. Times 5 (100%)	281,242,252	3,813,088	285,055,340
CPR (lowest of a and b *or c*)	**246,444,459**	**2,710,600**	**249,155,060**

* without LULUCF

The full annual inventory reporting under the Kyoto Protocol started in 2010 for emissions and removals in 2008, which was the first year of the commitment period. The inventory

1.2.9 Trends in Danish greenhouse gas emissions from the base year under the Kyoto Protocol

The developments in Danish emissions and removals of greenhouse gases from the base year under the Kyoto Protocol to 2007 (the most recent inventory year), as they are to be inventoried under the Kyoto Protocol, are shown in Figure 1.1 together with a preliminary estimate for 2012.

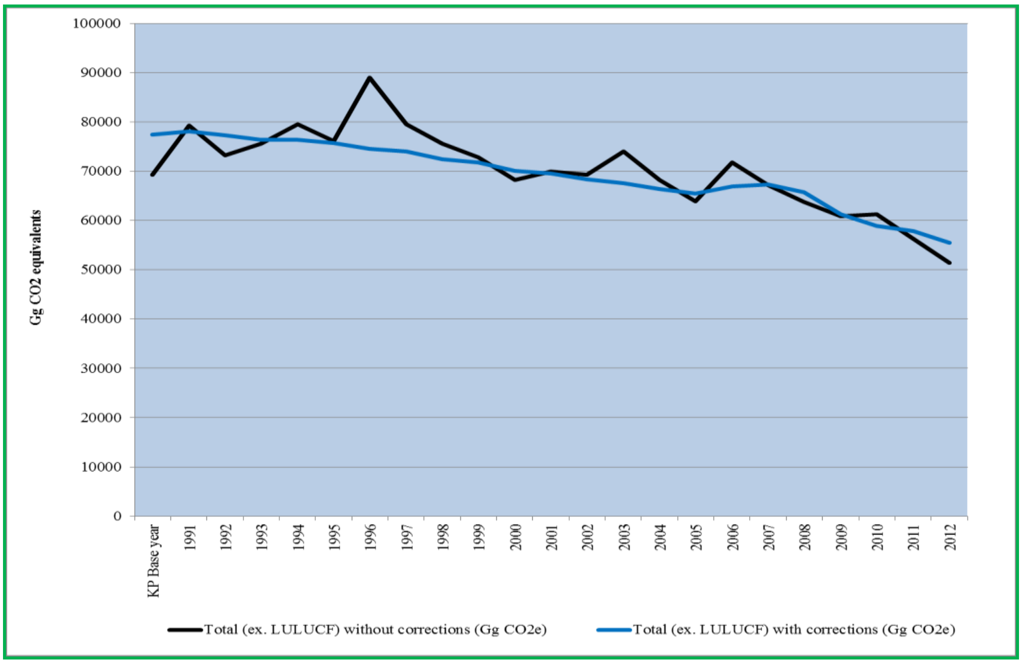
The relatively great variations in previous total emissions and removals of greenhouse gases are especially due to variations in Denmark's exchange of electricity with neighbouring countries. Furthermore, emissions of CO_2 from energy consumption vary considerably from year to year, depending on winter temperatures.

In order to facilitate the assessment of developments in CO_2 emissions associated with Denmark's own energy consumption in normal winters, estimates with corrections made for exchange of electricity and variations in temperature are also calculated in the annual energy statistics. The development in emissions with these correction is also shown in Figure 1.1.

As it can be seen from this Figure there has been a 25% drop from the base year to 2011. The preliminary estimate for 2012 suggests a further 3 percentage point drop.

FIGURE 1.1: DENMARK'S GREENHOUSE GAS EMISSIONS AND REMOVALS 1990-2012 WITHOUT AND WITH CORRECTIONS FOR INTER-ANNUAL VARIATIONS IN TEMPERATURES AND EXCHANGE OF ELECTRICITY

Source: The UNFCCC's Report of the review of the initial report of Denmark, 2007 (base year), Nielsen et al., 2013 (1990-2011), the 2012 preliminary estimate is based on the preliminary energy statistics for 2012 by the Danish Energy Agency and DCE assumptions and with corrections of CO_2 emissions for degree days and net electricity imports and the preliminary estimate for 2012 from the Danish Energy Agency.



1.3 POLICIES AND MEASURES

1.3.1 Denmarks climate policy

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, and in line with international climate policy, and results from related scientific research.

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

Some of the measures have been implemented with reduction of greenhouse gas emissions as the main objective, others 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 also been on efforts to reduce emissions and meet the international greenhouse gas emission reduction targets for 2008-2012 under the Kyoto Protocol and the EU Burden Sharing.

In 2011, focus shifted to meeting the international targets for 2013-2020 under the EU Climate and Energy Package and under the Kyoto Protocol and to meeting the domestic targets with a medium-term goal of 40% reduction in Denmark's greenhouse gas emissions by 2020 compared to 1990 levels and the government's long-term target for 2050: All energy supply to be covered by renewable energy by 2050.

Important steps in the follow-up of the Danish government's Government Platform from October 2011 have been the energy plan, "Our Future Energy" published in November 2011, the Energy Agreement reached with a majority of parties in the Parliament in March 2012 and the government's Climate Policy Plan "Towards a low carbon society" published in August 2013.

The 2012 Energy Agreement contains a wide range of ambitious initiatives, bringing Denmark a good step closer to the target of 100% renewables in the energy and transport sectors by 2050.

The Agreement will lead to large investments up to 2020 in energy efficiency, renewable energy and the energy system. Results in 2020 include approximately 50% of electricity consumption supplied by wind power, and more than 35% of final energy consumption supplied from renewable energy sources.

The long-term goal for Danish energy policy is that the entire energy supply – electricity, heating, industry and transport – is to be covered by renewable energy by 2050.

Only by improving energy efficiency, electrifying Danish energy consumption, and expanding supply from renewables, will it be possible to phase out fossil fuels completely. The initiatives in Denmark's Energy Agreement for the period 2012–2020 cover these crucial areas.

These are the headline results for 2020:

- More than 35% renewable energy in final energy consumption.
- Approximately 70% of electricity consumption to be supplied by renewable energy sources in total and about 50% of electricity consumption to be supplied by wind power.
- Approximately 8% reduction in gross energy consumption in relation to 2010.
- 34% reduction in greenhouse gas emissions in relation to 1990.

Consequently, in 2020 Danish enterprises and households will be significantly less dependent on scarce and expensive fossil fuels.

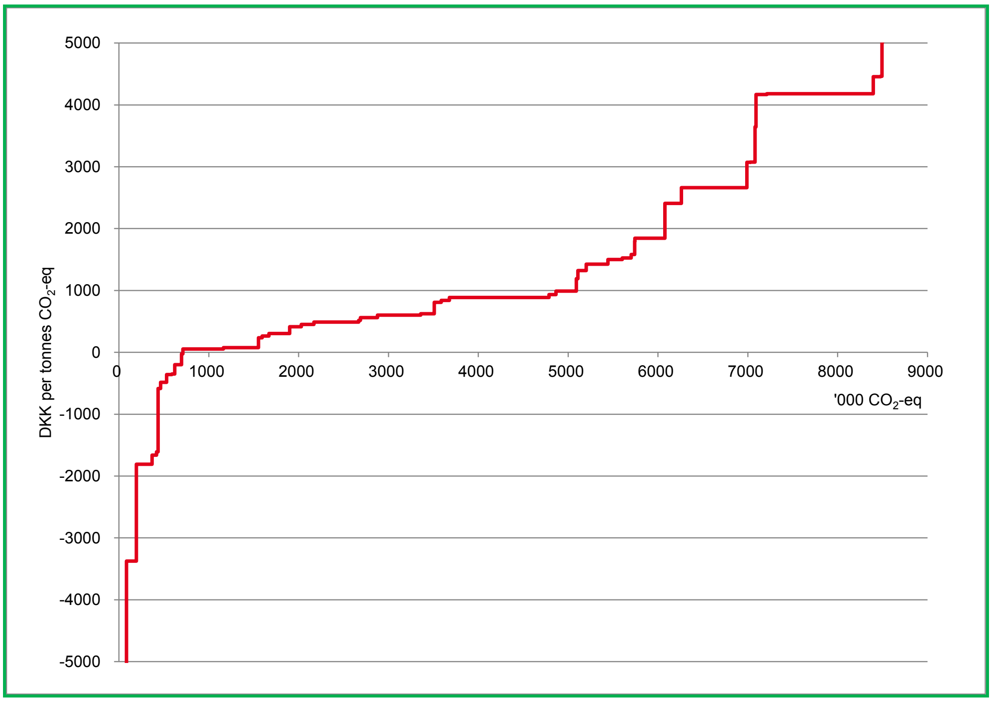
The Danish government has increased its ambition and set a domestic goal of a 40 per cent reduction in Denmark's greenhouse gas emissions by 2020 compared with the base year under the Kyoto Protocol.

The 2013 Climate Policy Plan takes stock of the progress towards the domestic and international targets and presents the government's strategy on how additional policies and measures should be determined to achieve the reduction target most efficiently. This plan was published with a view to dialogue with the business community and the civil society on climate mitigation efforts. The Danish Government will put forward a climate change bill in 2014 in order to amplify monitoring and evaluation of climate policy and to contribute to that the public have access to information on climate change.

To facilitate the continued dialogue with the business community and the civil society on future decisions on additional policies and measures across all sectors, a catalogue of potential additional measures has been drawn up by an inter-ministerial working group and published in parallel with the Climate Policy Plan. In Figure 1.2 the resulting MAC curve (Marginal Abatement Cost curve) from this work is shown.

Figure 1.2: Potential curve with marginal reduction costs (MAC-curve)

Source: Danish Energy Agency, August 2013.



Note: The graph shows the reduction potentials on the x axis and the associated socio-economic costs on the y axis. The graph only includes measures, which can be realised technically and will have an impact before 2020. Measures analysed qualitatively by the inter-ministerial working group have also been excluded from the graph. These include certain EU initiatives decided independently of national climate policy. The graph takes account of the overlap between different mitigation measures, as the effect of various energy savings measures aimed at the same energy consumption, for example, cannot be aggregated.

1.3.2 Denmark's climate policy – as part of the EU climate policy

Danish climate policy is based on two pillars – the European and the national. As a small country with an open economy, it is clear that the more Denmark can implement climate policy with common European solutions, the better the total effect of climate policy and the easier it will be to maintain Danish competitiveness in relation to trading partners in the EU.

The EU is also a crucial player in international climate negotiations. The Danish government's ambition is before 2015 to have a decision on new and more ambitious EU climate and energy targets for 2020 and beyond. In light of this, the Danish government welcomes the indicative targets in the Commission's 2030 green paper for a reduction in the EU's internal greenhouse gas emissions of 40% by 2030 compared with 1990 as well as a target for renewable energy of 30% by 2030.

Furthermore, the Danish government supports a binding energy efficiency target for 2030, the size of which is to be assessed on the basis of the evaluation of the Energy Efficiency Directive in 2014. The final Danish government position will be set once economic impact assessments for Denmark have been completed.

The Danish government has also decided to support a number of proposals from the European Commission which can contribute to limiting Danish emissions:

- proposals to tighten the CO_2 requirements for cars and vans - it has been assessed that this will limit emissions from the Danish transport sector,
- proposal for a greener EU agricultural policy greener, which may lead to a small, but as yet not quantified, reduction in greenhouse gas emissions from agriculture,
- proposals to revise the Energy Tax Directive,
- new proposed energy efficiency standards under the Eco-Design Directive,
- a specific proposal from the European Commission to amend the EU ETS Directive by postponing auctions of allowances in order to stabilise the allowances price through temporary "back loading" contingent on a timetable for a structural reform of the EU ETS and
- proposals for structural changes of the EU ETS.

Denmark also supports tightening EU reduction targets in 2020 from 20% to 30% compared with 1990, with the associated considerable reduction in total emissions rights.

1.3.3 Legislative arrangements and enforcement and administrative procedures

The legal basis for the division of powers into the legislative, executive, and judicial power is the Danish Constitution, Danmarks Riges Grundlov .

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.

1.3.4 Policies and measures and their effects

Allowance regulation

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 form the framework for Danish efforts. The companies that are covered by the scheme, and whose activity thus is 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.

In 2007 the European Commission approved the Danish National Allocation Plan (NAP2) for the period 2008-2012. This allowances regulation covers a little less than half of Denmark's total greenhose gas emissions. This gives certainty about the activites covered regarding these activities' effect on Denmark's greenhouse gas accounting under the Kyoto Protocol and the allocation plan documents how Denmark will achieve its reduction target 2008-2012 under the Kyoto Protocol.

The Kyoto Protocol mechanisms

In the first commitment period under the Kyoto Protocol the flexible Kyoto Protocol mechanisms are contributing to the fulfilment of Denmark's international climate commitment. For this purpose approximately DKK 1.7 billion have been allocated for the development of JI and CDM projects and purchase of JI- and CDM-credits in 2003-2009. The allocated funds should correspond to 3.7 million tonnes of CO_2 annually in the period 2008-2012.

Taxes and duties

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 placed 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, PFCs, SF_6, SO_2, and sewage). Taxes are imposed on mineral oil, tobacco, and alcohol in accordance with EU legislation.

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.

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. From 2008 the allowance scheme has become 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.

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 have been taken with the objective to save energy in the business sector:

- Efficiency consultancy and information efforts, including more focus on realising the savings assigned.
- Promotion of sales of energy services. Efforts for business and industry is organised so that energy services are promoted. Information campaigns are still running 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.

The action plan was evaluated in December 2008. New political measures will be adopted during 2010 in order to organise the energy saving effort more effectively and to implement new energy saving measures. December 15th 2010 a broad majority of the Danish parliament passed a bill on the establishment of an energy saving program with ten year duration (2010 to 2020). The aim of the program is to strengthen the energy saving efforts as a total in order to achieve a more coherent and efficient approach.

As an element in the implementation of the 2012 energy policy agreement, a DKK 3.75 billion (€500m) fund has been established to subsidise industries to convert to renewable energy. As of August 2013, businesses will be able to get support from this fund to convert to renewable energy sources or district heating in accordance with the following objectives:

- Support businesses to replace fossil fuels with renewable energy – such as wind, solar, biogas or biomass – to power manufacturing

- Support businesses to replace fossil fuels by district heating. E.g. horticulture will be able to change from coal-fired boilers to district heating

- Support businesses to invest in energy-efficiency measures.

The estimated effect of this “Renewables for industry” initiative is a reduction of 1 million tonnes of CO_2 per year from 2020 and onwards.

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.

A great number of additional initiatives aiming directly or indirectly at reducing CO_2 emissions have been implemented within various areas. The effects of these initiatives are hard to quantify and in themselves they are not considered to have contributed significantly to CO_2 reductions.

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. 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.

The measures in the transport sector comprises both EU initiatives and national initiatives or a mix.

One example is the use of biofuels. From 2012 all petrol and diesel for transport sold in Denmark must contain an average of 5.75% of biofuels, which must live up to the EU sustainability criteria. According to the Energy Agreement of March 2012 a 10 percent target is foreseen by 2020, however pending analyses of alternative instruments carried out by 2015.

In the Energy Agreement DKK 70 million has been allocated to transport infrastructure projects in the fields of electric vehicles, gas and hydrogen. An ongoing pilot scheme for electric vehicles has been prolonged until 2015 with an additional funding of DKK 15 million on top of the DKK 35 million from the former Energy Agreement. According to the new Energy Agreement of March 2012 the tax exemption for hydrogen fuelled cars and electric cars will be prolonged until 2015.

A strategy for the promotion of energy-efficient vehicles will be set up based on a number of analyses to be carried out in 2013-2015 - including a number of wells-to-wheels analyses of various powerplants.

In 2009, as a result of a broad political agreement regarding transport policy in Denmark, funds were allocated to the activities listed below:

- DKK 200 million for projects on energy-efficient transport. A large number of projects have been initiated within the areas listed below:
    - A large-scale field operational test of electric vehicles
    - Off-peak delivery scheme for goods using low-noise equipment
    - City logistics for goods transport
    - Hybrid electric buses
    - Lightweight materials
    - Mobility Management
    - Intelligent Transport Systems
    - CNG city buses
    - Electric city buses

- DKK 28 million has been allocated to campaigns to promote energy-efficient driving. Experience shows that most people are able to save between 5% and 15% fuel by adopting a more energy-efficient driving style.

- DKK 14 million for a campaign aimed at raising public awareness about energy labelling of new cars and vans.

- Introduction of a certification system for "green transport companies" and "green Cities" should promote the use of energy-efficient cars and better use of the existing car fleet.

In 2013, the Danish government decided to allocate DKK 27.5 billion to improve the rail infrastructure in Denmark substantially. The upgrade is expected to be finalized by 2025 and will reduce travel times substantially. A CO_2 reduction of around 100,000 tonnes per year is expected.

Furthermore the Danish government has allocated funds to several larger projects, which will result in emission reductions. The largest fund allocations are DKK 1.2 billion to the electrification of parts of the rail infrastructure; DKK 328 million to the establishment of a metro line to the new Nordhavn area in Copenhagen – and DKK 1 billion to improve and promote Danish cycle transport facilities.

The household 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).

The portefolio of initiatives in the household sector include energy taxes, CO_2 taxes , energy labelling of buildings, energy labelling of buildings when built, sold or rented, regular energy labelling of large buildings and public buildings, minimum energy requirements and energy labelling of appliances, information initiative towards private households and support for the substitution of individual oil-based furnaces.

Regarding the latter an impartial and free-of-charge phone-based and web-based guidance on substitution of individual oil-based furnaces with renewable energy heating sources was established in September 2013. Another way of supporting the substitution of individual oil-based furnaces is a one-stop-shop solution for building owners who want to energy-renovate their building and need guidance on technical and financial matters.

Regarding CO_2 and energy taxes have steadily increased throughout the 1990s, but since 2002 they have been almost stable. The increases have mainly affected households, helping to reduce their energy consumption. In February 2013 the phasing in of a new energy security tax started. This new tax is an element in the implementation of the Energy Agreement from March 2012.

In the Energy Agreement from March 2012 several new measures for the period until 2020 are also included. The background for the agreement is the long-term objective that Danish energy consumption is to be solely based on renewable energy sources.

In 2050 there is to be no use of fossil fuels. One of the key ambitions in the agreement is to further improve energy efficiency and energy savings.

Industrial processes

Process emission of CO_2 from cement production have since 2005 been subject to regulation under the EU ETS.

When the only nitric acid production facility in Denmark stopped in 2004, nitrous oxide emissions decreased with by approx. 0,9 mill. tonnes of CO_2 equivalents.

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, the Ammonia Action Plan, Action Plan for Joint Biogas Plants and subsequent follow-up programmes, Environmental Approval Act for Livestock Holdings, New Energy Policy Agreement - supporting biogas and the Agreement on Green Growth 2009: Reduction of the agricultural sector's emissions of greenhouse gasses by an anticipated 800,000 tonnes of CO_2 eq. annually as a consequence of the energy, nature and environment initiatives.

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 with an estimated reduction in emissions of nitrous oxide corresponding to 34,000 tonnes of CO2 equivalents annually in 2010 and thereafter.

Regarding biogas aid has been provided to investments in biogas plants in 2010 and in 2012 as part of the Danish Rural Development Programme 2007-2013. In 2012 support was awarded to both new and existing biogas plants to the amount of DKK 262 million.

Consequently the latest projection from the Danish Energy Agency expects an increase in the biogas production from 4 PJ in 2007 to 17 PJ in 2020. This is expected to imply a five to six fold increase in the volume of manure used for biogas generation before 2020.

The political objective in the Green Growth Agreement is to use up to 50% of livestock manure in production of green energy by 2020.

The increase is expected to result in annual emissions of methane and nitrous oxide from agriculture being additionally reduced by approx. 0.24 million tonnes of CO_2 equivalents by 2020. An additional reduction of almost 1 million tonnes of CO_2 equivalents in greenhouse gas emissions from the energy sector is expected by 2020 due to reduced CO_2 emissions from substitution of fossil fuels, primarily natural gas, with the increased production of biogas.

The LULUCF sector

The emission of GHGs from the LULUCF sector (Land Use, Land Use Change and Forestry) includes primarily the emission of CO_2 from land use and small amounts of N_2O from disturbance of soils not included in the agricultural sector.

The LULUCF sector is subdivided into six major categories:

- Forest
- Cropland
- Grassland
- Wetlands
- Settlements
- Other Land

Forests and forestry are important due to CO_2 sequestration and emissions as a consequence of trees growing, respiring and decomposing. Danish forests contain 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.

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.

For the agricultural soils and land-uses measures such as ban on burning straw on fields and support for planting of windbreaks have reduced, or will reduce CO_2 emissions and enhance CO_2 sequestration.

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 2009-2012.

1.3.5 Policies and measures in accordance with Article 2, of the Kyoto Protocol

Denmark’s climate efforts – a step on the way to sustainable development

In accordance with the government platform (October 2011) the government is elaborating a new sustainability strategy with fixed goals, time limits and associated indicators and monitoring process.

The strategy is expected in the near future and will include all three pillars of sustainable development: economic, social and environmental aspects, including elements on climate/energy.

Efforts for international air transport and shipping

Denmark recognises that the international aviation and maritime transport sectors are large and rapidly growing sources of greenhouse gas emissions and have to be dealt with at international level. Given the global nature of the two sectors Denmark believes that the international organisations for civil aviation and maritime transport – ICAO and IMO – should decide and implement appropriate global measures to control greenhouse gas emissions from international aviation and maritime transport with levels of keeping EU’s 2 degrees Celsius objective within reach.

Denmark welcomes that in 2008 the EU adopted a directive whereby emissions of CO_2 from aviation are included in the EU emission trading scheme as of 2012.

Within the IMO Denmark has proposed the creation of a marked based instrument in the context of an International GHG Fund to address GHG emissions from maritime transport. The basic idea of such a fund is a specific GHG contribution linked to the purchase of bunker fuel. This contribution is channelled to a compensation fund, where the majority of the revenues are allocated to offset and climate-change-related purposes in the Least Developed Countries (LDCs).

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.

1.3.6 Greenland

Greenland is faced by a series of challenges in energy supply and demand. Due to climatic and infrastructural conditions as well as future developments in the industry, Greenland's consumption of energy is not likely to decrease. But Greenland is also witnessing the effects of climate change in the Arctic.

Greenland has therefore initiated policies and a series of political measures for the energy areas, supporting the objectives of the Climate Convention and the Kyoto Protocol on the reduction of emissions of greenhouse gasses through e.g. The Energy Plan 2010, The Energy Supply Act, The Energy Strategy and Plan of Action 2008-2015 and Economic incentives for fuel-efficient behaviour. Initiatives are made to further the use of renewable and environmentally sustainable energy, i.e. hydropower, wind energy, solar energy and hydrogen.

1.3.7 Faroe Islands

The Climate Convention was ratified by the Realm, and therefore it also applies for the Faroe Islands. When ratifying the Kyoto Protocol the Danish government followed a request from the Faroese Government took a territorial reservation for the Faroe Islands.

In the spring 2008 the Faroese Government started a process formulating a Climate Strategy, and in the autumn 2008 a catalogue of potential options to reduce emissions of greenhouse gases was published.

In December 2009 the Faroese Climate Policy was adopted by the Faroese Parliament. The policy is adopted by all the political parties in the Parliament. The national target is to reduce the domestic emissions of greenhouse gases by at least 20% in the period 2010 to 2020 compared with the level of emissions in 2005.

1.4 Projections and the Total Effect of Policies and Measures

In September 2012, the latest baseline scenario with a projection of Denmark's future greenhouse gas emissions 2011-2035 was published followed by a full documentation report in English in March 2013.

The purpose of the baseline scenario – the so-called "with measures" projection - is to get an assessment of how energy consumption and emissions of greenhouse gases will evolve in the future if no new policies are introduced. This is often referred to as a "frozen policy" scenario or a "business-as-usual" scenario. The actual development will continue to be influenced by new political initiatives, and the scenario is not considered as a long-term forecast, but rather as a calculation that, on the basis of some given assumptions, we can identify the challenges which future climate policy must address.

The baseline scenario is based on a number of general economic assumptions (the output of industries, private consumption, fuel prices etc.), a number of specific assumptions on technology (what are the costs of different types of plants, what is the efficiency etc.) and assumptions about how the energy market players will act with pure market conditions. Scenarios of this nature will always be subject to many key and uncertain assumptions. A different development than the assumed may therefore move the result in both directions. The baseline scenario includes the effects of already adopted, but not necessarily implemented, measures.

The projection goes up to 2035, and its findings are obviously very uncertain.

Based on baseline scenario projections of activity data from sectors withe greenhouse gas emissions, e.g. energy consumption in the energy sector, number of livestock in the agricultural sector etc., projections of greenhouse gas emissions are calculated.

The energy-related CO_2 emissions account for the vast majority of Denmark's total emissions of greenhouse gases.

A major part of the energy-related CO_2 emissions falls under the EU Emissions Trading System (EU ETS), not least electric utilities. Changes in these emissions do not directly influence Denmark’s compliance with reduction commitments under the Kyoto Protocol, since the final result for Denmark’s accounting of emissions and credits under the Kyoto Protocol is determined by the quota for Danish installations covered by the EU ETS. In case of emissions above the quota, the responsible entities under the EU ETS have to buy and surrender extra quotas or credits to cover this excess of emissions. This means that the excess of emissions are covered by an equivalent amount of emission reductions elsewhere.

Progress towards the target for 2008-2012

According to the Kyoto Protocol, Denmark's total greenhouse gas emissions may not exceed 54.8 million tonnes of CO2 equivalent on average for the period 2008-2012. The baseline scenario shows that the Kyoto targets are met. Table 1.4 shows the estimate of the average annual greenhouse gas emissions from the September 2012 baseline scenario compared with expectations as the basis for the allocation plan in 2007.

TABLE 1.4: KYOTO ACCOUNT WITH ADOPTED MEASURES, MILLION TONNES CO_2 EQUIVALENT

Source: Danish Energy Agency, September 2012

Kyoto-account with adopted measures (Average emissions 2008-2012, million tonnes CO_2 equivalent.)	NAPII (2007)	September 2012
Kyoto objective	**54.8**	**54.8**
Allocated emission allowances in the ETS sectors	24.5	24.5*
Expected emissions in the Non-ETS sectors	36.8	35.2
Credits from sinks**	-2.3	-1.8
Base year compensation***	-1.0	-1.0
Remaining requirements to adopted measures******	**3.2**	**2.2**

** Including allocated government allowances auctioned in 2013*

***DCE estimate*

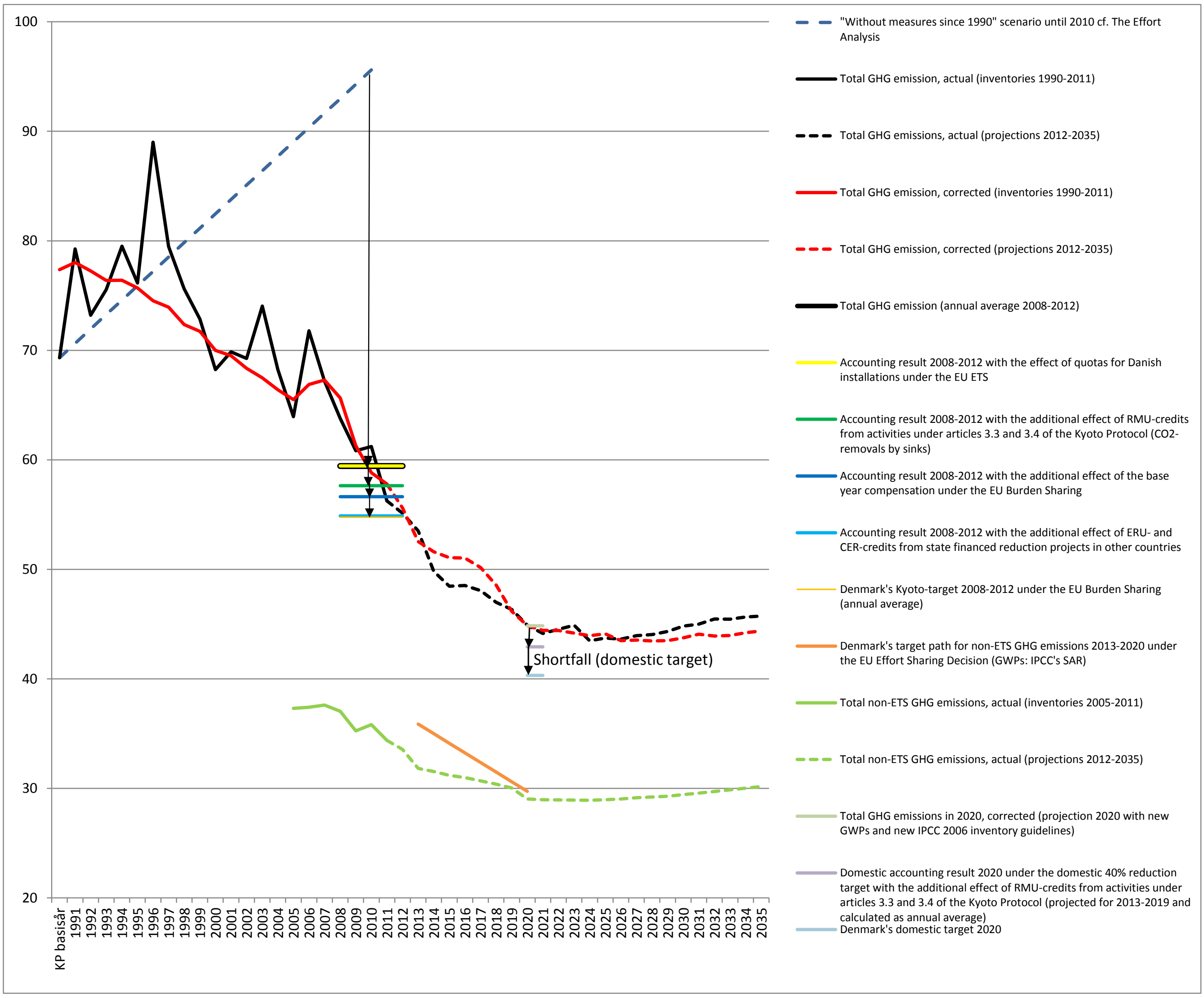
**** Assigned amount units allocated to Denmark as the base year compensation under the EU burden sharing of the joint reduction target under the Kyoto Protocol pursuant to the European Commission's decision of 15 December 2010 (2010/778/EU).*

***** This requirement is covered by Kyoto units from the state portfolio, including the national JI and CDM program.*

The progress towards the 2008-2012 target under the Kyoto Protocol is also shown in Figure 1.3.

FIGURE 1.3: HISTORIC AND PROJECTED PROGRESS TOWARDS DENMARK'S 21 PER CENT REDUCTION TARGET 2008-2012 UNDER THE EU BURDEN SHARING OF THE EU TARGET UNDER THE KYOTO PROTOCOL (KP), TOWARDS DENMARK'S NON-ETS 20 PER CENT REDUCTION TARGET 2020 AND TARGET PATH 2013-2020 UNDER EU EFFORT SHARING DECISION (EU-ESD) AND TOWARDS DENMARK'S DOMESTIC 40 PER CENT REDUCTION TARGET (DK). THE PROJECTIONS SHOWN IN RELATION TO THE KP- AND EU-ESD TARGETS ARE THE "WITH MEASURES" PROJECTION FROM SEPTEMBER 2012. IN RELATION TO THE DK TARGET THE PROJECTION SHOWN FOR 2020 IS BASED ON THE AUGUST 2013 INTERIM UPDATE TAKING INTO ACCOUNT NEW GWPS AND NEW INVENTORY GUIDELINES. THE RESULT OF THE "WITHOUT MEASURES SINCE 1990" PROJECTION FOR 2010 IN THE EFFORT ANALYSIS IS ALSO SHOWN.

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035: Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al., DCE, February 2013.



Progress towards the EU non-ETS target for 2013-2020

The result from the baseline scenario shows that Denmark is in accordance with the non-ETS reductions target path for Denmark under the Effort Sharing Decision (ESD) adopted in the EU with the EU climate and energy package. Under the ESD Denmark is committed to a reduction of greenhouse gas emissions in non-ETS sectors in the period 2013-2020, rising to 20 % by 2020 relative to 2005.

From Figure 1.3 it can be seen that the projection of total greenhouse gas emissions in the non-ETS sectors is clearly below Denmark's reduction target path for 2013-2020 under the EU Effort Sharing Decision (ESD). However, both the energy scenario and projections of non-energy related emissions are subject to uncertainty.

Progress towards the government's domestic target for 2020

The Danish government has increased its ambition and set a domestic goal of a 40 per cent reduction in Denmark's greenhouse gas emissions by 2020 compared with the base year under the Kyoto Protocol. In the assessment of the achievement of this domestic goal, credits from the CO_2-sink activities under articles 3.3 and 3.4 of the Kyoto Protocol, as well as adjustment for electricity trade in 2020 will be taken into account.

The Energy Agreement from March 2012 has brought Denmark a long way towards realising the domestic target of a 40% reduction by 2020 compared with 1990. This is illustrated in Figure 1.3. However, significant additional efforts will be needed to reach the domestic target. Sensitivity analyses show that a higher allowance price will reduce Danish emissions significantly, while a lower allowance price will only increase emissions slightly. But still, both the energy scenario and projections of non-energy related emissions are subject to uncertainty.

1.5 VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

The climate is changing, and in all likelihood we will see more changes in the future. In the long term, the future climate is strongly dependent on the future emissions of greenhouse gasses and other substances that influence the climate. The development in greenhouse gas emissions is especially dependent on three factors: demographic development, the rate and spread of implementation of energy-efficient technologies, particularly in the energy and transportation sectors, and the socio-economic development in general. The changing climate with rising temperatures, changing precipitation patterns, an increase in extreme weather events and rising sea levels will have a broad impact on ecosystems and society in general.

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 of such events.

Adaptation measures in Denmark

In March 2008, the Danish government launched the first Danish strategy for adaptation to a changing climate.

Following the change in government in 2011, an action plan for a climate-proof Denmark was launched in December 2012. The action plan is based on the notion that a responsible climate policy must do more than just work towards limiting climate change in the long term. It must also ensure the action necessary right now to adapt our society to a climate that is already changing.

All parts of society must contribute to climate change adaptation in Denmark. Dealing with the climate challenge requires collaboration between authorities, organisations, private enterprises and individuals, regardless of whether the project is maintenance of existing roads, coastal protection, construction, or investments in new infrastructure.

Climate change adaptation is first and foremost based on initiatives at local level and involves the local authorities, companies or individuals. The individual stakeholders know the local conditions best, and are consequently in the best position to make decisions on adaptation.

Central government itself has a responsibility as the owner of infrastructure, buildings and land. However, the principle role for central government is to establish an appropriate framework for local climate change adaptation by, for example, adapting laws and regulations, but also by ensuring coordination and providing information. A solid framework for the efforts must support the specific parties involved, so that they can address the challenge in a socio-economically appropriate manner at the right time.

Climate change adaptation measures can also contribute to the development of new innovative solutions. The government will create the basis for continued technological and knowledge development, so that Denmark will have a strong position on the global market for climate change adaptation.

A series of initiatives and changes in relevant regulations have already been implemented. As an example, an amendment to the Planning Act now makes it possible for the municipalities to include climate change adaptation directly in the local development plans from 1 June 2012. The possibility for wastewater companies to invest in climate change adaptation has been clarified with an amendment in the Water Sector Act in spring 2012.

Central to climate change adaptation efforts is a strong interaction between state and municipalities. The government and the municipalities have agreed that the municipalities will increase investments in climate change adaptation of wastewater treatment by DKK 2.5 billion. This agreement also entails that all municipalities carry out a risk assessment and prepare municipal climate change adaptations plans.

The Minister for the Environment has established a task force on climate change adaptation. The objective of this task force is to ensure up-to-date data and relevant knowledge on the Danish Portal for Climate Change Adaptation www.klimatilpasning.dk. The portal also contains news, concrete cases about climate change adaptation and many interactive tools. A number of tools aimed at municipalities, enterprises and individuals were made available in 2012. These tools can be used to assess risk from rising sea levels and to climate-proof buildings.

A mobile team has been established as part of the task force. This team offers guidance and facilitates collaboration between municipal authorities and other stakeholders in the field, for example with regard to preparing municipal climate change adaption plans.

Adaptation measures in Greenland

The Government of Greenland has launched a national initiative aimed at mainstreaming adaptation efforts in the management and development of various sectors. A series of assessments of how the public sector can promote adaptation to climate change was initiated in 2011. The first assessment focus on 'Opportunities for climate change adaptation in the fisheries and hunting industry' (September 2012). The assessement is conducted on the basis of existing scientific assesments and local knowledge. The assessment report draws up a range of conlusions pointing to the fact that climate change has both direct and indirect consequences, often resulting in significant and unpredictable impacts on the fishing and hunting sector.

Efforts and actions towards the adaptation to climate change should therefore be viewed as a continuous process to be dealt with in close cooperation with the public administration, the scientific community and the industry and various local stakeholders.

1.6 Financial resources and transfer of technology

In 2011 Danish development assistance amounted to about DKK 15.728 bn., corresponding to 0.85% of GNI. Assistance is primarily funded through section 06(3) of the Danish Finance Act. Denmark will continue to be amongst those countries that grant 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 to be significantly above the UN target of 0.7% of GNI.

Sustainable global development requires the ability to link protection of the environment, the climate and nature with economic growth, poverty reduction and social development. Denmark is working to achieve this under the heading of "green economy". Green economy implies that we show consideration for the protection of natural resources, reduction of CO_2 emissions alongside considerations of economic development and poverty reduction in developing countries. For example, Denmark's efforts to promote growth and employment in many countries also have a green aspect.

Green growth should be understood as an integral part of sustainable growth which promotes general economic growth and development in a manner that enables the environment today and in future to deliver the resources and environmental services on which our welfare depends.

Under the priority area with the heading Green Growth Denmark will:

- Support developing countries in fighting poverty and creating sustainable development through green growth, increased earnings and more jobs, especially for the youth.
- Support green growth based on sustainable management and use of natural resources.
- Contribute to strengthening international and national framework conditions for green growth and enhance coherence with environmental protection.
- Promote innovative technological and financial solutions in the areas of agriculture, forestry, environment, energy, water and climate.

- Promote resource-efficient food production capable of feeding a growing population sustainably and effectively.
- Contribute to increasing developing countries' access to sustainable energy and increase efforts towards more sustainable and resource-efficient management and use of energy and water.
- Promote poor men and women's participation and improved access to water, land, knowledge and finance.

Climate focused activities will be an important and integrated element in Danish development cooperation, and should contribute to green growth, job creation and promote climate adapted agricultural production. Denmark wants to be a leading development partner with regard to climate change and work for increased international prioritisation of climate finance.

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 sub-programmes. 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) under Aarhus University (AU) 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) under KU, the Danish Institute of Agricultural Sciences (DJF under AU), Risø National Laboratory under the the Technical University of Denmark (DTU), University of Southern Denmark, Roskilde University, Aalborg University and the Danish Coastal Authority 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.

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.

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 political reactions in terms of policies and measures. In 2011, the new government published its government platform which included new objectives for Denmark's strategy for sustainable development and Denmark's climate policy on both mitigation efforts and adaptation to a changing climate.

The concrete follow-up of these objectives involves both the parliament and the public through openness about strategies, 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 change, 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 Danish ministries, universities and institutions.

Information on climate change and sustainable development in general for teachers involved in primary and lower secondary education is also available on several web-sites e.g. under the Ministry og Education.

Among the most recent and specialist dedicated web-sites targeted at elementary school are "the ice school" and "the new Arctic". "The ice school" offers complete e-learning materials on the Greenland ice sheet for two levels (7^{th}-10^{th} grade, launched in 2010, and 4th-6th grade, launched in 2011). "The new Arctic" was launched in February 2013 with web-based teaching materials for 8th-9th grade. The focus is on Arctic climate change and its regional and global importance.

An introduction to climate change through a computer game for 7th-10th grade is available at the web-site of the Danish science communication centre "Experimentarium".

The universities in Denmark also offers education in climate as an integral part of many educational programmes – which are often offered with cooperation with other relevant institutions such as DMI, DCE, GEUS etc.

2

National circumstances

– relevant to greenhouse gas emissions and removals

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 Change 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

Denmark's national circumstances relevant to greenhouse gas emissions and removals are described in this Section. Among the most significant circumstances affecting greenhouse gas emissions and removals in Denmark are the following:

- Denmark is situated in a temperate climate zone. This implies a need for heating, especially during wintertime, and significant inter-annual variations in greenhouse gas emissions due to inter-annual variations in winter-temperatures.

- Denmark is an industrialised country with arable land and an economy based on manufacture of commodities, agricultural products and services for the global market. This implies a need for energy supply and electricity production.

- Denmark is a flat country. This implies insignificant access to hydro power in domestic electricity production and a long history of dependence on fossil fuels in the country's energy supply, especially coal and oil. Until 1980s this was almost solely based on imports, but since 1997 Denmark has been self-sufficient in energy due to production of oil and gas in the North Sea.

- Denmark has no nuclear power. Since 1990 Denmark has increasingly had a shift from coal and oil to natural gas and renewable energy sources, increased the use of combined heat and power production and decentralised power production, where the combined production is utilised for district heating. Together with improvements in energy efficiency, keeping energy demand almost constant despite a significant economic growth, and initiatives regarding the agricultural sector, waste, industrial greenhouse gases etc., Denmark's emissions of greenhouse gases related to domestic activities, including domestic electricity demand, have been decreasing.

- Denmark's electricity production capacity is an integral part of the Nordic electricity market, in which hydro power in Norway and Sweden is also an integral part. This implies significant inter-annual variations in Denmark's total greenhouse gas emissions, with elevated emission levels in years with low precipitation in Norway and Sweden and vice versa. In 1990, the base year under the United Nations Framework Convention on Climate Change and the Kyoto Protocol, Denmark's total greenhouse gas emissions were extremely low due to an extremely large electricity import from the Nordic countries, which experienced particularly high precipitation that year.

These highlighted national circumstances are not the only national circumstances relevant to Denmark's greenhouse gas emissions and removals. In the rest of this Section, further information on relevant national circumstances and indicators is given.

As briefly introduced above, policies and measures in Denmark also affect Denmark's greenhouse gas emissions and removals. Further information on policies and measures relevant to Denmark's greenhouse gas emissions and removals is included in Chapter 4.

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 in 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, which also had primary responsibility for Denmark's policy on climate change until 2007. In 2007 a Ministry of Climate and Energy (now: Ministry of Climate, Energy and Building) was established, with a Minister for Climate, Energy and Building representing Denmark in international negotiations on climate and with primary responsibility for coordination and implementation of legislation, plans etc. relating to Denmark's climate policy.

For the last twenty-five 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, an overall status report was presented in connection with the proposal for ratification of the Kyoto Protocol in April 2002. This status report was followed by a national Climate Strategy for Denmark for 2008-2012, which was adopted by the Folketing on 13 March 2003. As an element in the implementation of the EU Climate and Energy Package adopted in December 2008, the government's Climate Policy Plan was published in August 2013 with a view to initiating a process for adopting additional policies and measures to achieve the 40% national reduction target for 2020 mentioned in the Government Platform from October 2011.

One of the main cornerstones of Danish democracy is autonomous local government. Specific environmental action takes place not only at national level but also at municipal level. The state sets the national rules and framework for environmental administration, while the 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 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.

In the light of Denmark's role as host for the Fifteenth Conference of the Parties under the UNFCCC in December 2009, many additional initiatives to raise awareness and involve citizens, municipalities, the business community and other stakeholders have been taken – both at national and local level. Several municipalities have committed themselves to local targets for reducing greenhouse gas emissions (see http://www.dn.dk/Default.aspx?ID=4994 and http://www.kl.dk/Fagomrader/Teknik-og-miljo/Klima/) .

2.1.2 Population

Today, Denmark has a population at around 5.6 mill. As can be seen from Table 2.1, population growth has been relatively small in the last 33 years.

TABLE 2.1 POPULATION OF DENMARK

Source: Statistics Denmark.

	1980	1990	2000	2010	2013
Denmark's population (in mill.)	5.1	5.1	5.3	5.5	5.6

The latest forecasts show that population growth will continue to be moderate in the years ahead. For example, the population is expected to reach 5.7 mill. in 2020, rising to 6.1 mill. in 2050.

Today, the population density is 130 per km^2.

Today, 79% of Danish wage earners are employed in service sectors, while 19% are employed in manufacturing, construction and supply sectors and 2% in agriculture, forestry and fisheries.

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 64% of the land is used for agriculture or horticulture. Woodlands take up approx. 14%, while towns, roads and scattered habitation take up 11.4%. 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 westerly 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

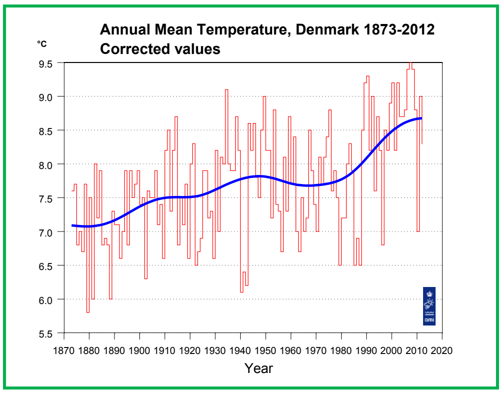
The annual mean temperature varies from year to year, from below 6ºC to more than 9ºC, with an average of 7.7ºC (1961-90 level; 8.8ºC (2001-2010 level). The coldest year so far was 1879, with a mean temperature of 5.9ºC, while the hottest recorded year was 2007, with 9.5ºC. The three years 2006, 2007 and 2008 are the warmest ever recorded in Denmark. 2008 and 2006 both had a mean temperature of 9.4°C. This is followed by

1990 with 9.3°C. Since 1988, almost every year has been hotter than normal, and the temperature has shown a sharply rising trend from the 1990s. Since 1870, the temperature in Denmark has risen by about 1.5ºC, but the ten hottest years have occurred from the 1930s to present. The present temperature level is the highest in the time series and the period 2001-2010 was the warmest decade since records began.

The temperature in January and February averages around 0ºC (1961-90 level); between 1 and 1.5ºC (2001-2010 level) but can vary greatly from more than 15ºC to below -31ºC. The average temperature in July and August is around 15ºC (1961-90); more than 17ºC (2001-2010), but again can vary from -2ºC to more than 36ºC.

FIGURE 2.1 ANNUAL MEAN TEMPERATURE IN DENMARK 1873-2012 IN ºC

Source: Cappelen 2013b



Precipitation

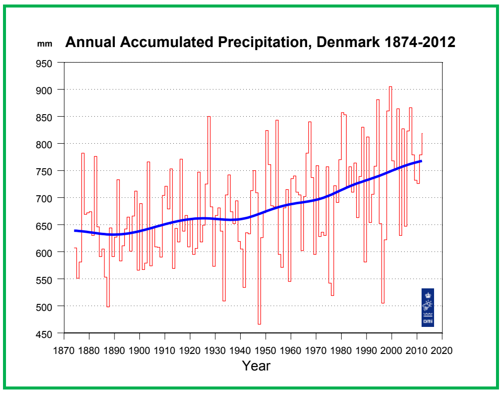
Average annual precipitation varies greatly from year to year and from place to place. The lowest annual precipitation for the country as a whole was 466 mm in 1947, and the highest was 905 mm in 1999, while the average annual precipitation is 712 mm (1961-90 level); 765 mm (2001-2010 level).

The wettest period is normally June to January, while the driest is 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 100 mm since 1870.

FIGURE 2.2 DANISH ANNUAL PRECIPITATION 1874-2012 IN MM

Source: Cappelen 2013b



Hours of sunshine and cloud cover

On average, Denmark as a whole has about 1,495 hours of sunshine annually (1961-90 level); 1,739 hours (2001-2010 level), 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 (1961-90 level); about 45 hours (2001-2010 level), while May and June have the most sunshine, with an average of about 210 hours (1961-90 level); 230-240 hours (2001-2010 level).

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% (1961-90 level).

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

FIGURE 2.3 ANNUAL HOURS OF SUNSHINE IN DENMARK 1920-2012

Source: Cappelen 2013b

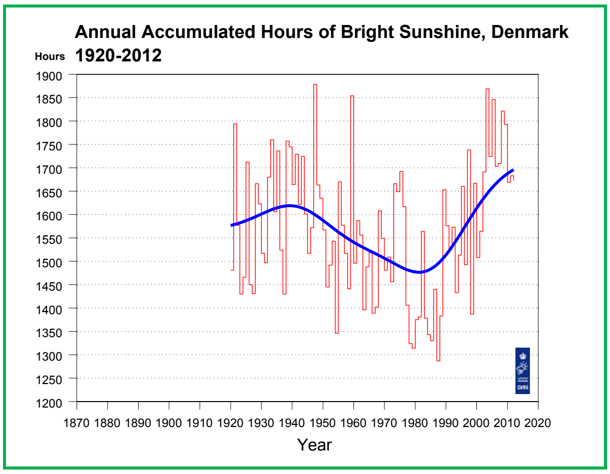
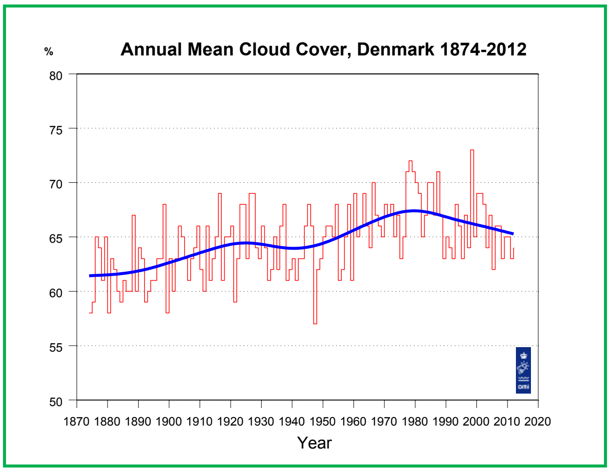


FIGURE 2.4 ANNUAL MEAN CLOUD COVER IN DENMARK 1874-2012 IN PERCENT

Source: Cappelen 2013b



Wind

Countrywide, annual mean wind velocity is 5.8 m/s (1961-90 level); 5.0 m/s (2001-2010 level), 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 (1961-90 level). 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

From 2000 to 2007 the Danish economy grew at an average annual growth rate of 1.6% measured in GDP (fixed prices). In 2008 and 2009 the economy contracted by 0.8% and 5.7% respectively. From 2009 to 2012 the economy showed positive growth rates at an average of 0.7% annually. In 2012, GDP (in current prices) was DKK 1,826 billion, corresponding to DKK 326 thousand per capita (1 Euro = approximately DKK 7.45).

Denmark has a very export and import intensive economy, and thus the country is sensitive to global economic trends. In addition, public expenditure accounts for a large part of final consumption, cf. Table 2.2.

TABLE 2.2 KEY FIGURES FOR THE DANISH ECONOMY. 2012, DKK BILLION, CURRENT PRICES

Source: Statistics Denmark.

GDP	1,826
Imports	908
Exports	1,000
Consumer spending	896
Public expenditure	520
Gross investment	320

The Danish economy is specialised in the tertiary sectors, as both primary and secondary sectors, i.e. agriculture and industry, account for less than 20 percent of total gross value added (GVA), cf. Table 2.3.

TABLE 2.3 THE BUSINESS SECTOR'S CONTRIBUTION TO GVA, 2012, DKK MILLION, CURRENT PRICES

Source: Statistics Denmark.

Sector	Gross Value Added	%
Agriculture	22,696	1.4%
Raw materials, industry and energy	268,100	17.8%
Construction	74,706	4.8%
Trade, transport and communication	372,340	23.7%
Finance and residential business	404,787	25.7%
Services	429,986	27.3%
Total	**1,572,614**	**100%**

2.1.6 Energy

Energy production and energy-consuming activities are the main contributors to the emissions of greenhouse gases in Denmark. In 2011 the energy sector alone (energy production and supply) accounted for 36% of Denmark's total emissions of greenhouse gases (LULUCF), primarily CO_2. In addition there are emissions from the energy-consuming activities in the transport sector, industry and households.

Production and supply

As can be seen from Table 2.4, Denmark's own production of energy has grown more than 20-fold since 1980 and it has doubled since 1990. However, since 2005 the production of energy has decreased by approx. 33% in total. 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. Renewable energy is also increasingly contributing to the country's energy supply.

TABLE 2.4 ENERGY PRODUCTION (PJ)

Source: Danish Energy Agency

	1980	1990	1995	2000	2005	2008	2009	2010	2011
Production, total	**40**	**423**	**656**	**1165**	**1315**	**1122**	**1010**	**984**	**870**
Crude oil	13	254	392	765	796	604	555	523	470
Natural gas	0	116	197	310	393	377	315	307	247
Renewable energy etc.	28	53	67	90	126	141	140	154	153

TABLE 2.5 DEGREE OF SELF-SUFFICIENCY (%)

Source: Danish Energy Agency

	1980	1990	1995	2000	2005	2008	2009	2010	2011
Energy, total	**5**	**52**	**78**	**139**	**155**	**130**	**124**	**121**	**108**
Oil	2	72	105	203	226	178	176	168	155
Oil and natural gas	2	85	116	189	218	190	181	170	154

Energy consumption

For 2011, 22.1% of the observed gross consumption of energy was supplied by renewable energy (according to the EU methodology 23.1% in 2011 and 25.8% in 2012 according to the most recent energy statistics). The renewable energy resources are mainly wind energy and biomass, which are used to produce electricity, combined heat and power, or district heating. Internationally, Denmark is among the leading nations in wind energy.

Despite the economic growth, total energy consumption has remained largely unchanged at approximately 800 PJ since 1990, cf. Tables 2.6 and 2.7.

Denmark's dependence on oil and coal has fallen. In the production of electricity and heat in particular, oil and coal have been substituted with other fuels. Thus, natural gas and renewable energy are increasingly being used in district heating. For electricity, the share of renewables etc. has increased steadily since 1990.

TABLE 2.6 OBSERVED ENERGY CONSUMPTION (PJ)

Source: Danish Energy Agency

	1980	1990	1995	2000	2005	2008	2009	2010	2011
Energy consumption, total	**830**	**753**	**841**	**817**	**835**	**844**	**811**	**846**	**792**
Oil	555	343	372	370	348	336	315	315	303
Natural gas	0	76	133	186	188	172	165	185	157
Coal	252	255	272	166	155	172	168	163	136
Renewable energy etc.	28	53	67	93	139	159	161	187	192
Net imports of electricity	-4	25	-3	2	5	5	1	-4	5

The distribution of gross energy consumption (energy consumption adjusted for foreign electricity trade and climate fluctuations) in 2011 was as follows: industry and agriculture accounted for 23%, the household sector for 28%, transport for 26% and commercial and public services for 16%. Refining and non-energy purposes accounted for the remaining 7%.

TABLE 2.7 GROSS ENERGY CONSUMPTION, BREAKDOWN BY FUELS, ADJUSTED FOR CLIMATE FLUCTUATIONS AND NET EXPORTS (PJ)

Source: Danish Energy Agency

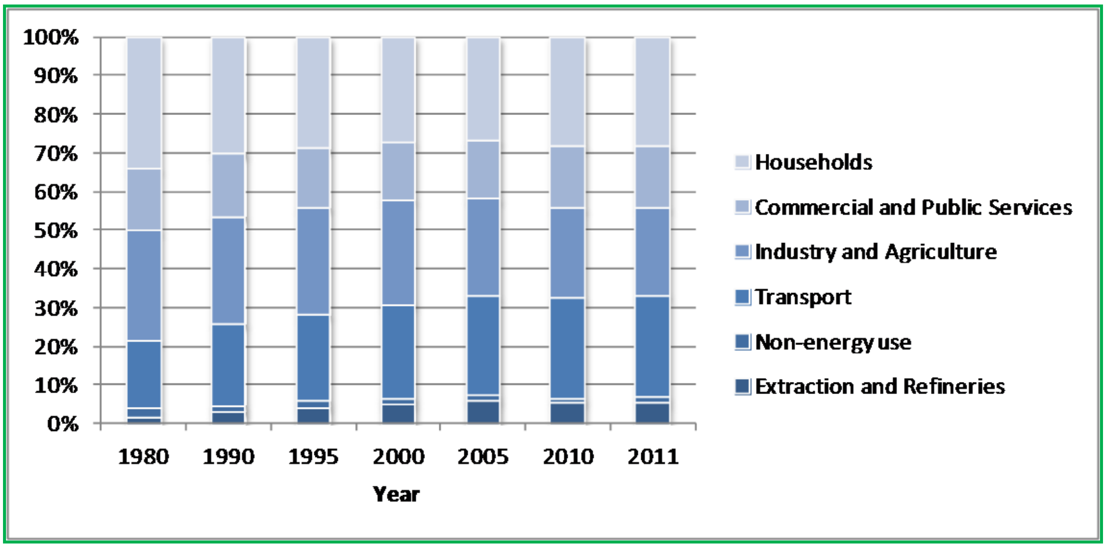
	1980	1990	1995	2000	2005	2008	2009	2010	2011
Gross energy consumption, total	**814**	**819**	**840**	**839**	**851**	**864**	**815**	**816**	**809**
Oil	546	355	374	376	352	338	314	312	304
Natural gas	0	82	134	192	192	177	166	176	161
Coal	241	327	265	175	166	186	172	147	149
Renewable energy etc.	27	56	68	95	141	162	162	181	195

Figure 2.5 shows adjusted energy consumption, sector by sector. Over the 31 years covered by the figure, relative consumption by the transport, industry/agriculture and

extraction/refineries sectors has risen, whereas relative household sector consumption has fallen.

FIGURE 2.5 ADJUSTED GROSS ENERGY CONSUMPTION, BREAKDOWN BY SECTOR

Source: Danish Energy Agency



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.

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.

Oil and gas supply

Oil and gas production activities in the North Sea continue to be of major importance to Danish society. In total there are 19 producing fields of varying size, and three operators are responsible for production from these fields: DONG E&P A/S, Hess Denmark ApS and Mærsk Olie og Gas A/S.

Oil production in 2012 totalled 11.7 million m^3, a 9% decline compared to 2011. Production from the Danish sector of the North Sea has now halved since 2004. The production of sales gas totalled 4.9 billion Nm^3 in 2012, a 14% decline compared to 2011.

The development of existing and new fields may help to counter declining production.

In addition, the implementation of both known and new technology may help to optimize production from existing fields, and any new discoveries made as part of the ongoing exploration activity are expected to contribute with additional production.

On 9 July 2012 the state-owned company “Nordsøfonden” (the Danish North Sea Fund) joined Dansk Undergrunds Consortium (DUC) as a partner with a 20% interest. This added the Danish North Sea Fund to the list of oil-producing companies in Denmark.

In addition to the direct revenue from taxes and fees, the Danish state receives indirect revenue from the North Sea by virtue of its shareholding in DONG Energy, generated by the subsidiary DONG E&P A/S, which participates in oil and gas activities. The state also receives revenue through the Danish North Sea Fund.

The development in 2012 was characterised by a fall in production and a stable oil price. Total revenue is estimated at DKK 25.2 billion for 2012, a decline of just over 15% from 2011. The state’s share of oil company profits, calculated by year of payment, is estimated at 65% for 2012, including state participation.

In April 2012 the Minister for Climate, Energy and Building and the Danish operators agreed on a new action plan to reinforce the measures for reducing energy consumption offshore. The plan covers the period from 2012 to 2014 and contains targets for further reducing energy consumption, so that during the years 2012-2014 energy consumption will be reduced by 19%, 26% and 29%, respectively, compared with energy consumption in 2006.

The energy consumption figures, measured as the use of fuel gas and gas flared in 2012, indicate that the target for 2012 has been achieved, as consumption amounted to 699 million Nm^3, compared to the action plan target of 716 million Nm^3 in 2012.

The action plan is based on experience gained from a similar action plan from April 2009, which set out a series of energy-efficiency initiatives. The target of this action plan was to reduce energy consumption by 3% during the period 2006-2011, compared to the previously expected increase of 1.5%. Implementation of the initiatives in the action plan resulted in an 18% reduction of the energy consumption related to North Sea oil and gas production as of end-2011.

The Danish Energy Agency is preparing the invitation for applications for the licensing round area and expects the 7th Danish Licensing Round to open officially at the end of 2013.

After submitting the matter to the Climate, Energy and Building Committee of the Danish Parliament, the Minister for Climate, Energy and Building will announce the timing and terms and conditions for the 7th Round, which will also be published in the Official Journal of the European Union and the Danish Official Gazette.

In February 2013 the Government completed an overhaul of the terms and conditions for oil and gas production in the North Sea. On the basis of this overhaul, the Government will start preparing a strategy to improve recovery from the Danish fields. As an element of this strategy, the DUC partners will establish a research centre that is to cooperate with Danish and foreign research environments on improving recovery.

District heating

More than 60% of all dwellings are supplied by district heating and 50% of the total heating demand. 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 owned by the consumers. In 2012, approximately 41% of the district heating was produced from renewable energy sources of which 10% was from biodegradable waste.

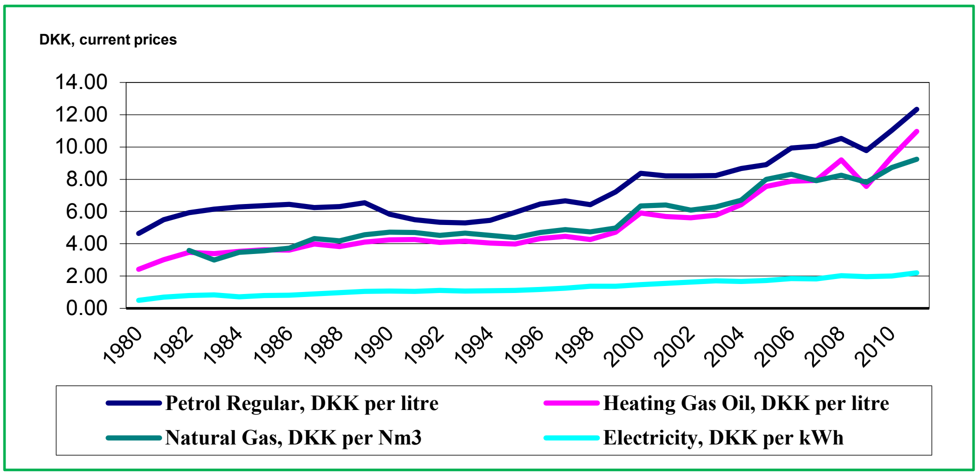
Prices and taxes

Energy prices are one of the key factors governing energy consumption. In 2011 spending on energy (all sectors excluding refineries), including taxes and VAT, amounted to DKK 161 billion. Of this figure, households paid DKK 78 billion, manufacturing industries DKK 25 billion, and the commercial sector and the service industries, including public services, DKK 48 billion. Energy supply paid DKK 11 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 household. Figure 2.6 shows the current consumer prices, including taxes and VAT. Figure 2.7 shows the development in fixed 2011 prices. The fixed prices have been adjusted for the change in general prices according to the consumer price index.

FIGURE 2.6 ENERGY PRICES FOR HOUSEHOLDS IN CURRENT PRICES, DKK

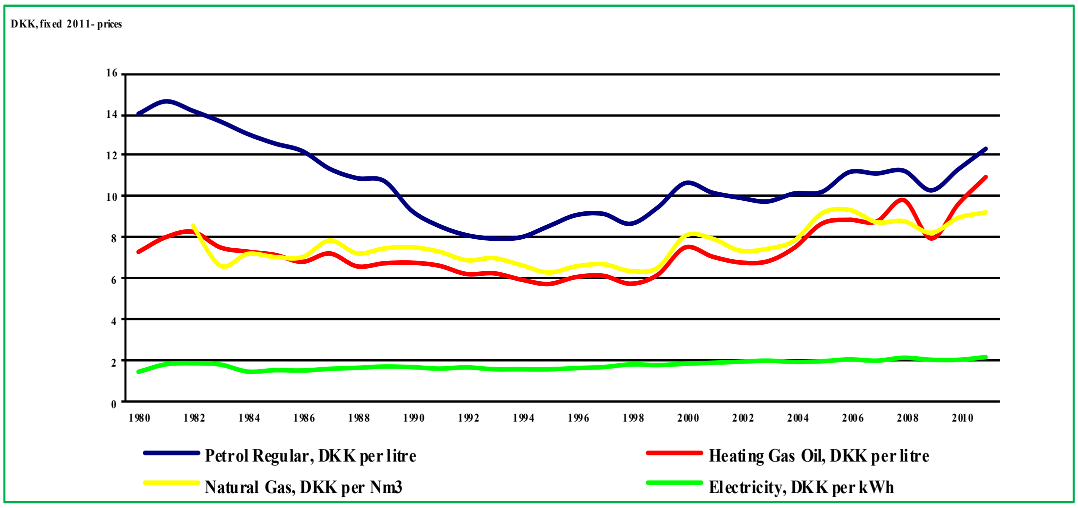
Sources: Petrol regular and Heating gas: Danish Oil Industry Association. Electricity: Danish Energy Association. Natural gas: Eurostat



The tax on petrol has risen over time, and this has affected the price of petrol. Measured in 2011 prices, the price per litre of petrol has increased over the past two years. In 2011, the increase was 8.8%. The price of electricity in 2011 prices was 6.4% higher in 2011 than the year before.

FIGURE 2.7 ENERGY PRICES FOR HOUSEHOLDS IN FIXED 2011 PRICES, DKK

Sources: Petrol regular and Heating gas: Danish Oil Industry Association. Electricity: Danish Energy Association. Natural gas: Eurostat

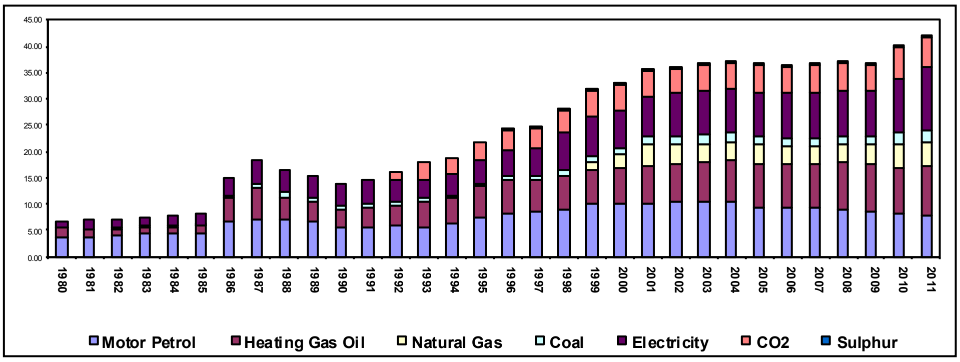


As an added incentive to enterprises to improve their energy efficiency and reduce Danish emissions of CO_2, a green tax package with gradually increasing taxes on CO_2 and SO_2 emissions as well as energy taxes was introduced in 1996. Enterprises with particularly high energy consumption can contract with the Danish Energy Agency on energy-efficiency improvements in return for a discount in CO_2 taxes and possibly heating taxes.

In 2011, revenues from energy taxes calculated in current prices were DKK 41.8 billion, which is 5.1% more than in 2010. In addition to energy taxes, revenues include CO_2 and sulphur taxes. The largest contribution to revenues in 2011 was from electricity (DKK 11.9 billion), gas/diesel fuel (DKK 9.6 billion), petrol (DKK 7.7 billion) and CO_2 taxes (DKK 5.9 billion). Revenues increased by 200% compared with 1990, when there were no CO_2 and sulphur taxes.

FIGURE 2.8 REVENUES FROM ENERGY, CO2 AND SULPHUR TAXES. CURRENT PRICES IN DKK BILLION

Source: Statistics Denmark



Trade

In 2011, net foreign exchange earnings from energy products amounted to DKK 4.3 billion. There was a surplus on foreign trade in oil, natural gas, and a deficit on foreign trade in coal, biomass and electricity.

TABLE 2.8 IMPORTS AND EXPORTS OF ENERGY

Source: Danish Energy Agency

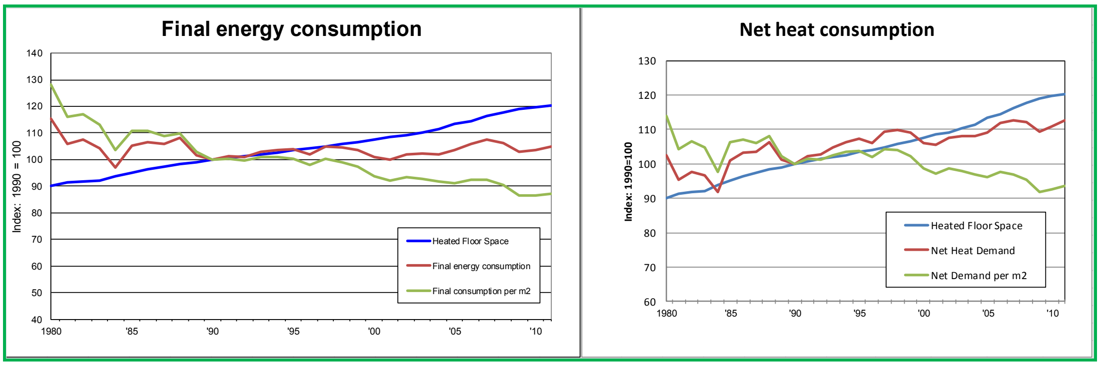
	Imports							
	1990	1995	2000	2005	2008	2009	2010	2011
Crude oil, PJ	174	229	159	117	102	151	117	130
Oil products, PJ	183	205	256	251	300	223	280	262
Coal, PJ	262	321	161	149	186	166	112	150
Natural gas, PJ	0	0	0	0	0	0	6	31
Electricity, Gwh	11,973	4,013	8,417	12,943	12,815	11,208	10,599	11,693
	Exports							
	1990	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
Crude oil, PJ	118	203	576	586	372	368	331	313
Oil products, PJ	126	183	195	178	221	210	226	248
Coal and coke, PJ	1	1	3	2	4	2	2	0
Natural gas, PJ	39	63	121	210	206	150	132	117
Electricity, Gwh	4,925	4,807	7,752	11,573	11,361	10,875	11,734	10,375

2.1.7 Household 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 when losses in boilers and heating installations have been excluded. This is considered as the better measurement of observed heating consumption.

FIGURE 2.9 CHANGES IN ENERGY CONSUMPTION IN HOUSEHOLDS FOR HEATING COMPARED WITH THE AREA HEATED

Source: Danish Energy Agency



After a time period with a significant drop in final energy consumption for heating from the late 1970s to the early 1980s, the heated floor space has continued to increase and final energy consumption has stayed at the same level with fluctuations up to 7.6% higher (2007) compared to the base year 1990.

Since the start of the 1990s the absolute final energy consumption for heating has been roughly constant, implying a drop in consumption per m^2. This is due to considerable conversion from oil to district heating.

Net heat demand per m^2 has also been roughly stable throughout the 1990s. Since 2000 a decrease in net demand per m^2 can be seen.

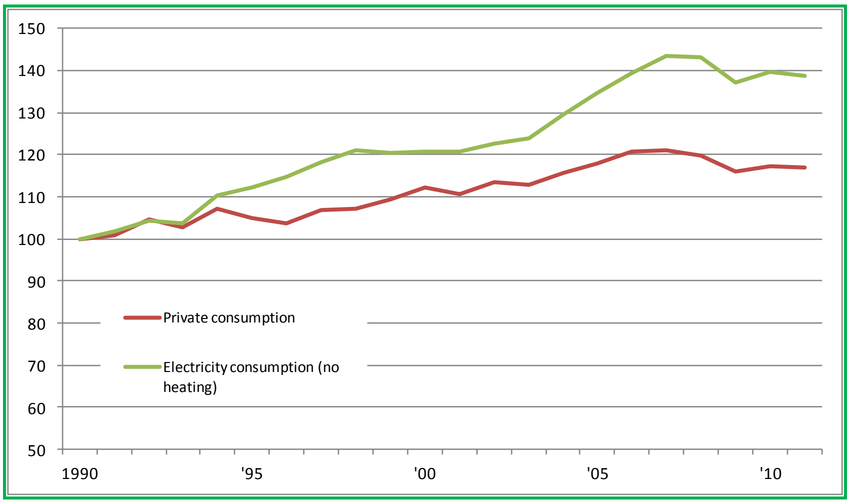
Figure 2.10 shows the changes in electricity consumption by household appliances and lighting (excluding electric heating). Electricity consumption has increased since 1990, peaking in 2007 and 2008 with a steeper slope than the increase in private consumption. On average, the increase has been 1.6% per year, but somewhat lower in recent years; in the period 2000-2011 only 0.7% per year.

In the period 1990-2011 total household electricity consumption increased by 2.6%, whereas electricity consumption for appliances and lighting etc. increased by 16.0%. This big difference is due to a significant fall in electricity consumption for heating.

In the same period, private consumption increased by 38.6%; i.e. considerably more than electricity consumption for appliances and lighting etc. This may seem surprising, considering the large increase in the number of electrical appliances during this period. This is due to significant falls in the specific electricity consumption of electrical appliances.

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

Source: Danish Energy Agency. Energy Statistics 2011.



2.1.8 Transport

Denmark is a relatively small and densely populated country with a large share of the population living in cities.

In urban areas most people have good access to public transport and major investments in better public transport infrastructure are currently taking effect. The main railway connection between West and East Denmark will be improved in the near future and this is expected to reduce travel times substantially and attract more travellers in years to come. Furthermore, the Copenhagen Metro is being extended with a circle line and a new connection to the north of Copenhagen Harbour. However, in many rural areas, public transport is less frequent than in the urban areas.

In Denmark, many commuters use their bicycle to travel to and from work and for other purposes, particularly during the summer. Even though the cost of car ownership is very high in Denmark compared to neighbouring countries, there are approximately 2.2 mill. registered cars in Denmark.

Efficient and flexible transportation of goods and persons is a vital element of the foundation of the Danish welfare society. At the same time, transport as such is an important economic sector that contributes to economic growth, employment, and foreign trade.

Denmark’s geography, with most people travelling short distances to and from work and a very high number of inhabited islands, makes Denmark an attractive country in which to use electric cars. The range of an electric car is sufficient to cover most people’s daily transport needs.

In the 1980s a nationwide network of gas pipelines connecting the gas in the North Sea to individual consumers was established. The conditions for wider use of natural gas in the transport sector are in place. Also, since Denmark is a country with a large agricultural sector, there are good possibilities for production of biogas, which could be used for transport.

2.1.9 The business sector

Industry's production value accounts for about 18.4% of total Danish production. Table 2.11 shows that the largest industries in Denmark are the food, drink and tobacco, engineering, electronics, and the chemical industry.

TABLE 2.11 PRODUCTION VALUE BY INDUSTRY IN 2011, DKK MILL.

Source: Statistics Denmark.

Manufacturing industry	**535,558**
Food, drink and tobacco	132,163
Textile, leather and clothing	8,154
Wood, paper and printing	26,492
Refineries	20,763
Chemical industry	28,320
Phamaceuticals	56,805
Plastics, glass and cement	32,328
Metal	43,417
Electronics	27,198
Manufacturing of electrical equipment	15,183
Machinery	96,099
Transport equipment	14,074
Furniture and Other industries	35,202

The total business sector (manufacturing, building and construction, together with commercial and public services) accounted for about 11% of Denmark's observed emissions of CO_2 related to energy consumption in 2011.

In Denmark, the total business sector's observed final energy consumption accounted for about 29% of total energy consumption in 2011. Manufacturing and building and construction accounted for 16% of total energy consumption. These figures do not include energy consumption for transport and space heating.

From the mid 1980s and to the mid 1990s, energy intensity for the business sector remained at the same level. Since 1994 energy intensity has fallen, see Figure 2.11.

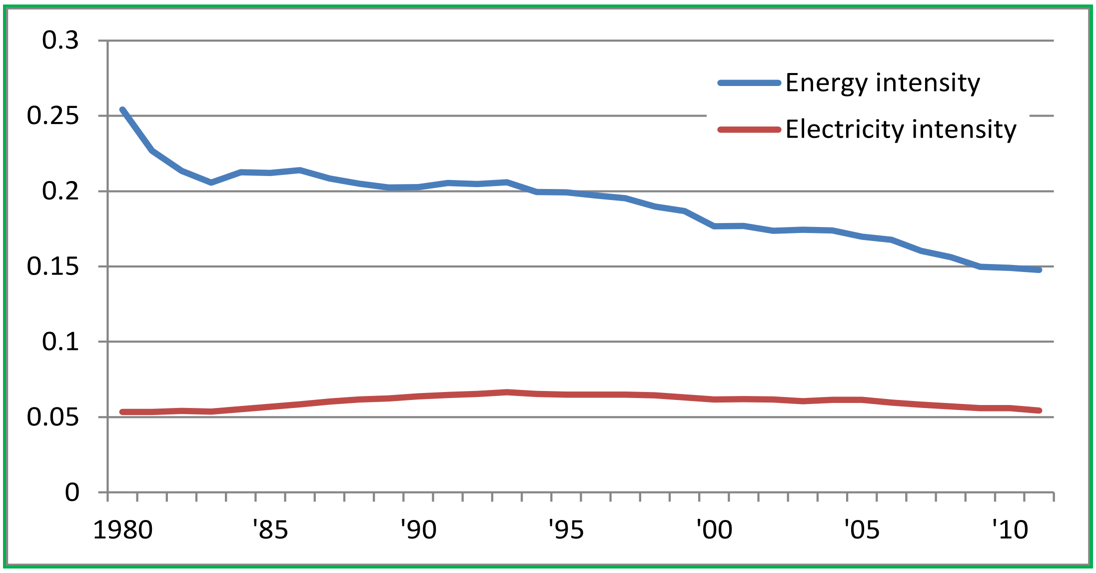
Electricity intensity increased up to 1994, after which it fell off. In 2011 electricity intensity was at the same level as in the early 1980s.

The change in the trend in energy and electricity intensity in 1993 corresponds with a move 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 measures to curb the industrial sector's energy consumption up to 2011 were based on the green tax package for businesses passed by the Folketing (parliament) in 1995. The package contained a combination of taxes and rebates for enterprises through, among other measures, government grants to promote energy savings by enterprises.

FIGURE 2.11 ENERGY AND ELECTRICITY INTENSITY IN THE BUSINESS SECTOR, CLIMATE ADJUSTED TJ PER DKK MILLION GVA (2005 PRICES)

Source: Danish Energy Agency



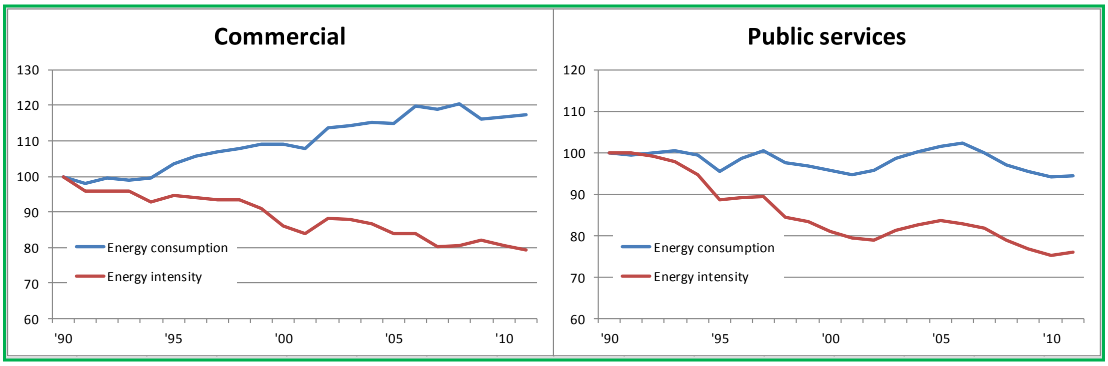
As can be seen from Figure 2.12, over the past 20 years there has been a steady increase in energy consumption by the commercial sector. Primarily district heating and electricity consumption have been rising. The growth in energy consumption by the commercial sector is due to high growth in this sector 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 for the commercial sector of on average 1.1% per year from 1990-2011.

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 took place in the period 2003-2009. Statutory Order no. 552 of 2 July 2002 Regulating Certain Industrial Greenhouse Gases, introduced on 1 January 2007 a ban on the use of HFCs in cooling plants, heat pumps, air conditioning plants (comfort cooling) and dehumidifiers with charges of or above 10 kg.

FIGURE 2.12 ENERGY CONSUMPTION AND ENERGY INTENSITY (ENERGY CONSUMPTION IN RELATION TO GROSS VALUE ADDED) IN COMMERCIAL AND PUBLIC SERVICES, CLIMATE ADJUSTED

Source: Danish Energy Agency, Energy Statistics 2011



2.1.10 Waste

The waste sector's contribution to emissions of greenhouse gases consists primarily of methane and accounted for 1.8% of the total greenhouse gas emissions in 2011. Methane emissions come from the decomposition of organic waste at landfill sites and – to a minor extent – from wastewater treatment plants. In 2010 a total of 956,000 tonnes waste were landfilled in Denmark, corresponding to 6% of the total amount of waste.

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. 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 2011, 31 incineration plants in Denmark converted 29% of the entire waste production, or approx. 2,605,000 tonnes of waste. In the energy supply waste incineration contributed 5% of the entire Danish electricity supply and 18% of total Danish supply 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. As a result, 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 waste strategies for hearing by interested parties. These national strategies announce national targets for waste management, future state initiatives, and guidelines for waste management plans by 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).

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 air pollution problems are therefore concentrated in the towns.

On 1 January 2013, the total built-up area was 727.5 mill. m^2. Table 2.12 shows the distribution of the area between housing, factories, offices, etc.

TABLE 2.12 KEY FIGURES FOR THE STOCK OF BUILDINGS IN 2013 (1 JANUARY), MILL. M2

Source: Statistics Denmark

Total building area	Buildings for year-round habitation	Factories and workshops	Commerce, trade and administration	Institutions and buildings for cultural and recreational purposes	Farm buildings
727.5	367.4	55.9	73.4	42.0	136.5

Today, about 13,000 homes are built per year, which is one-quarter of the annual 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.

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.

	1986	1991	1996	2000	2007	2008	2009	2010	2011	2012	2013
District heating	33.1	38.6	44.0	48.1	49.6	49.8	50.1	50.3	50.6	51.0	51.3
Central heating with oil	51.3	37.4	28.6	25.0	20.0	19.4	18.7	18.0	17.3	16.6	15.9
Central heating with natural gas	1.5	9.0	13.4	15.8	17.6	17.9	18.2	18.4	18.5	18.6	18.6
Heating with electricity	6.4	7.7	7.9	7.8	7.1	7.1	7.0	7.0	6.9	6.8	6.8
Furnaces fired by oil and similar	2.0	1.5	1.2	1.0	0.8	0.7	0.7	0.7	0.7	0.6	0.6
Other heating[1]	5.7	5.6	4.9	4.6	5.0	5.1	5.3	5.6	6.0	6.4	6.7

[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% (26,394 km^2) in 2012. Table 2.14 shows the breakdown by type of crop over the last 42 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, partly due to increasing use of grass fields for dairy farming, and partly due 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 5% in 2006. 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	2006	2012
Grain (%)	59	62	56	57	56	57
Pulses and industrial seed (%)	2	4	14	5	5	5
Root crops (%)	10	8	8	5	3	3
Grass and greenfeed in rotation (%)	17	14	12	16	17	22
Permanent grass (%)	10	9	8	13	7	8
Other crops (%)	2	3	2	4	12	5
Cattle ('000)	2,842	2,961	2,239	1,868	1,535	1,607
Pigs ('000)	8,361	9,957	9,497	11,921	13,361	12,300
Sheep ('000)	70	56	159	145	170	144
Poultry ('000)	19,169	15,507	16,249	21,830	17,425	19319
Nitrogen in fertilisers ('000 tonnes N)	271	394	400	252	195	197

From 1980 to 2011 the number of farms fell from 119,155 to 40,660. In the same period the average size of farms increased from 24 ha to 64 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 - 10% - of Denmark's total exports.

During the 1990s interest in organic farming increased considerably. In 2011 organic farms accounted for approximately 6% of land under cultivation.

During the last 40 years use of nitrogen by agriculture has varied greatly, but stabilised at approximately 200,000 tonnes N in 2006 and in 2012 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 2006 and again in 2012 nitrogen consumption was below the 1970 level. The use of nitrogen originating from manure has dropped since 1980. Consumption of phosphorus and potassium in fertilisers fell throughout the period.

Cattle population fell by 46% from 1970 to 2006, and slightly increased to 1,607,000 in 2012 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 60%. The sheep population has more than doubled in relation to 1970, while the poultry population was below the level of 1970 in 2006 but then increased to the level of 1970, approximately 19 mill. 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 21% since 1990.

The agricultural sector accounted for about 17% of Denmark's total emissions of greenhouse gases in 2011. These were primarily methane and nitrous oxides. CO_2

from fuel consumption in the agricultural sector accounts for about 3% of total Danish emissions.

2.1.13 Forestry

Approximately 14% of Denmark is forested. Originally focus was mainly on the production potential of primarily 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 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, in Denmark forestry does not play 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. This is also the case for afforested areas for which public subsidies are made available. 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

On 21 June 2009, the Act on Greenland Self-Government came into force. The Act recognises the Greenlandic people as a people pursuant to international law with the right to self-determination. It also establishes *Kalaallisut*, the Inuit language spoken in Greenland, as the official language. With Self-Government, Greenland is still within the Realm and shares some fields of responsibility with Denmark and the Faroe Islands, i.e. the Constitution, franchise and the eligibility for election, citizenship and central institutions like the National Bank. While Greenland has taken over responsibility for most domestic areas of governance, responsibility for the Supreme Court, foreign affairs, defence and security policy as well as exchange rate and monetary policy fall within the jurisdiction of the central authorities of the Realm.

Inatsisartut, the parliament, has 31 members. The members are elected directly at general elections held every four years. The last election was held on 12 March 2013. The parliament elects a government responsible for the central administration under the Premier.

Since September 2013, the administration has been divided into nine ministries. The Minister for the Environment and Nature represents Greenland in international negotiations on climate change and the Ministry has primary responsibility for coordination and implementation of legislation, plans etc. for the climate area.

Greenland Self-Government

The Act on Self-Government states that Greenland can have jurisdiction and financial responsibility for almost all aspects of public affairs if Inatsisartut, the Parliament, so decides. The Self-Government Act also outlines the future economic relationship between Denmark and Greenland. The Act states that Greenland has the right to utilise the mineral resources found in the subsoil. § 5 of the Self-Government Act specifies that Greenland will still receive an annual grant of DKK 3,600 mill. Future revenues from mineral and hydrocarbon activities will reduce the state subsidy by half the revenues exceeding DKK 75.0 mill. annually. Under the Self-Government Act financial independence from Denmark will be realized when revenues from activities in the oil and mineral industry reach DKK 6,404 mill. annually. Talks on the future relationship between Denmark and Greenland will then commence. The Act on Home Rule did not address the question of independence, but in accordance with § 21 of the Self-Government Act, the people of Greenland can decide on independence in the future.

International Relations

Greenland is not a member of the European Union, but Greenland participates in the Overseas Countries and Territories (OCT) scheme, that gives Greenland access to the European market. This scheme is important as Europe is the primary market for Greenland's export of fish.

In international forums where discussions and agreements may influence Greenlandic public affairs, Greenland and Denmark participate jointly.

In accordance with the so-called *authorisation arrangement,* the Government of Greenland (Naalakkersuisut) may, on behalf of the Realm, negotiate and conclude international agreements with foreign states and international organisations, including administrative agreements, which exclusively concern Greenland and entirely relate to fields of responsibility taken over by Greenland.

For agreements that fall outside the scope of the authorisation arrangement and which are thus concluded by the Danish Government, the Self-Government Act contains rules and regulations for the involvement of the Self-Government authorities. Accordingly, the Danish Government is required to notify Naalakkersuisut in advance of negotiations regarding agreements under international law which are of particular importance to Greenland. Before they are concluded or terminated, such agreements must be submitted to Naalakkersuisut for comments. If the Danish Government deems it necessary to conclude the agreement without the consent of Naalakkersuisut, this must, to the widest extent possible, have no effect for Greenland.

Denmark has ratified the Climate Convention with the consent of Naalakkersuisut. The Kyoto Protocol was ratified by Denmark in agreement with Greenland, on 31 May 2002. The Greenlandic Government has requested a territorial exemption for reduction commitments when Denmark ratifies the second commitment period of the Kyoto Protocol.

In August 2012 a cooperation agreement relating to the international climate change negotiations was signed by representatives from the Danish Government and the Government of Greenland. The agreement serves to facilitate closer cooperation on matters of mutual interest and to improve Greenlandic access to information and consultation in relation to the UNFCCC negotiations.

2.2.2 Population

The population of Greenland has increased by 13% over the last three decades, and the total population today is around 56,370 cf. Table 2.15. Of these almost 89% were born in Greenland.

TABLE 2.15 POPULATION OF GREENLAND (2013 AND 2025 PROJECTIONS)

Source: Statistics Greenland, 2013

	1980	*1990*	*2000*	*2009*	*2013*	*2025*
Population	49,773	55,558	56,124	56,452	56,370	56,647

Estimated changes in the population show a small increase in 2010 and 2015, but the proportion of the population born outside Greenland is not expected to change.

Migration and immigration patterns are dominated by the strong, historical connections between Greenland and Denmark. Every year throughout the period 1993-2012, more people moved away from Greenland than to Greenland. In 2012 a total of 2,191 people immigrated while 2,900 people emigrated. The net emigration in 2012 of 709 persons was the highest number of annual net emigrations since 1993.

The population density in 2012 was 0.14 per km^2 of ice-free area.

2.2.3 Geography

With an area of 2,166,086 km^2, Greenland is the world's largest island. It extends over almost 24 latitudes. The northernmost point is Cape Morris Jessup, only 740 km from the North Pole, while Cape Farewell in the south shares latitude with Oslo, Norway.

Greenland is covered by the Greenland Ice Sheet, a continuous, slightly convex ice sheet that covers 85% of the island and reaches heights of more than 3,000 m above sea level.

The coastal line stretches 44,087 km and is dominated by deep fiords and archipelagos. The population of Greenland lives mainly in the coastal regions, where there is little ice. Access to open waters implies good opportunities for fishery, hunting and transportation by sea, which are all important to Greenland society.

Greenland is surrounded by Atlantic and Arctic waters. The North Atlantic Ocean lays to the south and the Greenland Sea and the Denmark Strait to the east. The Denmark Strait is located between Greenland and Iceland and is 240 km wide. The west coast of Greenland meets the Davis Strait and Baffin Bay, and in the north, Greenland is separated from Canada by Smith Sound and Nares Strait. In Nares Strait a mere 26 km separates Greenland from Ellesmere Island, Canada. North of Greenland lays Lincoln Sea and Wandels Sea in the Arctic Ocean.

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.

The high arctic zone, with average temperature during the warmest months of the year below 5°C, covers the entire Greenland Ice Sheet and the coastal region of northern Greenland. The high arctic zone borders with the towns of Upernavik and Uummannaq on the west coast and Ittoqqortoormiit on the east coast of Greenland. However inland the high arctic zone reaches as far south as 61°N.

The low arctic zone, with average temperatures during the warmest months of the year between 5°C and 10°C, covers the coastal areas on both the east and west coast from Cape Farewell to 72°N. The open sea area in the south brings relatively cool summers and mild winters to this area.

In the valleys of the deep fiords the average temperature may climb above 10°C in the summer, categorizing these as small and isolated areas with a subarctic climate.

The Arctic Climate Impact Assessment (2004) forecasts increases in average temperatures by 2°C in the low arctic areas of South Greenland over the next century, and along with an increase in rainfall the lengthened growing season this will bring more vigorous plant cover. In North Greenland the average winter temperature will increase by 6 - 10°C, but dramatic changes in the average summer temperature are not expected. According to the ACIA report Greenland will see an increase in rainfall and snowfall by 10 to 50 per cent.

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 largest pressure extremes in Greenland occur in the winter period because of the large 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 autumn 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.

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 30ºC within a relatively short space of time, resulting in melting snow and ice. Relatively high temperatures in the winter period are very often the result of Foehn winds.

The highest temperature recorded in Greenland since 1958 is 25.5ºC. It was recorded 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 (1961-90 level).

The coldest place in Greenland is naturally on the ice sheet, where the temperature can fall to below -70ºC. Temperatures in Greenland have shown a slightly rising trend for the last 135 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 since the 1990s. On the east coast, however there has been a rising trend since the mid 1970s. The present temperature level is the highest in the time series. The period 2001-2010 was the warmest decade in all the series, and in 2010 there were record-high annual temperatures in several parts of Greenland.

Several warm summers in Greenland since 2007 have been registered. Recently, in 2012, such a summer was followed by a number of unusual melting events, also in the middle of the ice sheet (Summit). Events in Greenland during warm summers like 2012 cannot be regarded as 'unnatural', but on the other hand there is an indisputable gradual rise in temperature in Greenland and along the way, any 'warm incident' thus will have an increased likelihood of becoming a little hotter than the preceding one.

FIGURE 2.14 ANNUAL MEAN TEMPERATURE 1873-2012 IN OC. STATIONS IN DENMARK (COPENHAGEN), THE FAROE ISLANDS (TÓRSHAVN) AND WEST GREENLAND (NARSARSUQ, NUUK, ILULISSAT, UPERNAVIK AND PITUFFIK).

Source: Cappelen 2013c

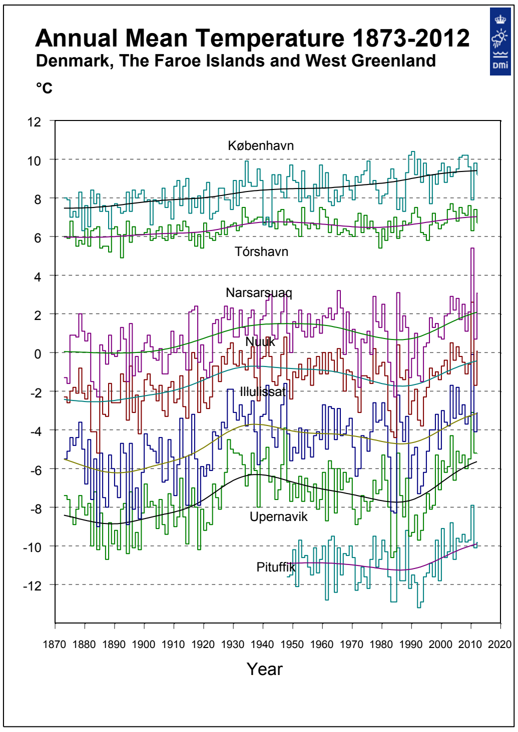
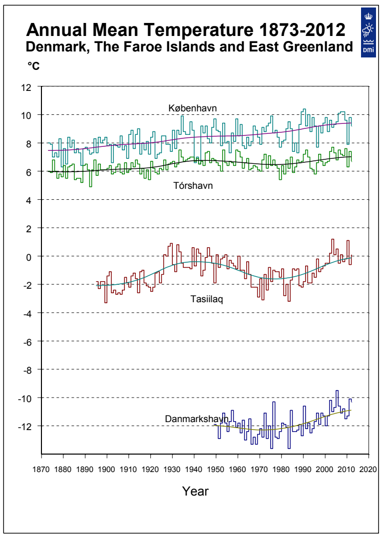


FIGURE 2.15 ANNUAL MEAN TEMPERATURE 1873-2012 IN OC. STATIONS IN DENMARK (COPENHAGEN), THE FAROE ISLANDS (TÓRSHAVN) AND EAST GREENLAND (TASIILAQ AND DANMARKSHAVN).

Source: Cappelen 2013c



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, 66.5ºN, 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

The economy of Greenland is a small-scale economy based on trade with other countries.

Under the Danish Realm, Greenland received an annual state subsidy to finance fields of responsibility assumed from Denmark. Under Self-Government, Greenland will still receive an annual grant, but the new fields of responsibility must be financed by the Greenland Government. Future revenues from mineral activities in Greenland will reduce the state subsidy by half the revenue exceeding DKK 75 mill.

TABLE 2.16 KEY FIGURES FOR THE GREENLAND ECONOMY IN 2006, 2008 AND 2011. CURRENT PRICES IN DKK MILL.

Source: Statistics Greenland (2013)

	2006	2008	2011	2012
GDP[1]	10,500	11,736	13,060	12,655
State subsidy (block grant)	3,120	3,301	3,533	3,587
Imports	3,738	4,702	5,182	4,955
Exports	2,345	2,487	2,541	2,761
Public expenditure	7,983	8,798	9,342	9,743
Annual growth in GDP	2.6 %	5.7 %	2.5 %	-3.1 %

[1] The Gross Domestic Product includes the annual state subsidy. The number for 2012 is a forecast from The Economic Council which forecast a growth of -3.1 percent for 2012 in their annual report for 2013.

Greenland has experienced general growth over the last decade. Annual rates of growth in GDP have ranged from -0.5% to a high 7.1% in 2000. The 2010 national budget of Greenland saw a GDP of DKK 217,800 per capita.

Exports

The fishing industry is of immense importance to the economy of Greenland, as fish and seafood are the only large-scale export from Greenland. The estimated relationship between GDP and the real export value of fish and seafood shows that a 1% increase in the export value of fish and seafood leads to a 0.29% increase in Greenland GDP, according to time series data ranging back to 1966. Therefore, changes in both the world market prices and the availability of important stocks of fish are important to the entire economy.

Commercial hunting is common in the northern and eastern parts of Greenland and locally the income from hunting is important to the wellbeing of the community, but hunting does not contribute extensively to the national economy.

TABLE 2.17 VALUE OF EXPORTS IN 2000, 2007 AND 2012 IN DKK MILL.

Source: Statistics Greenland

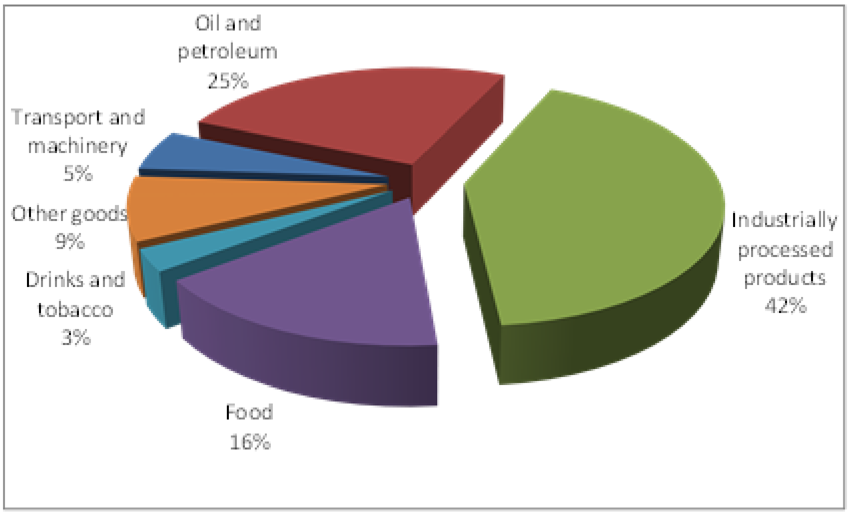
	2000	2007	2012
Total value of exports	2,120	2,436	2,761
Total value of export of food, fish and seafood	2,106	2,188	2,499
Value of export of single stocks as share of total value of export of fish and seafood			
Northern shrimp	63.8 %	60.9 %	56.6 %
Atlantic cod	2.5 %	3.8 %	6.8 %
Greenland halibut	17.3 %	21.4 %	26.3 %
Snow crab	10.9 %	4.7 %	1.7 %
Other	5.5 %	9.1 %	8.6 %

Imports

As the inland production is limited, Greenland is an open economy depending on imports of a wide range of goods.

FIGURE 2.16 IMPORTS IN 2012

Source: Statistics Greenland. 2013



2.2.6 Energy

Greenland has high basic energy demands. Expenditures related to transportation and energy supply are considerable due to the large size of the country, the widely dispersed population and the Arctic climate.

For the past decade, Greenland has been investing significantly in hydropower, and today more than 50% of the national energy supply is based on renewable sources. Despite these investments, Greenland's CO_2 emissions have been increasing and the country is still very dependent on the import of fossil fuels. The last five years has seen a marked growth in fuel-intensive geological investigations, which has further contributed to the total energy consumption and to CO_2 emissions.

Energy production and supply

Because of the vast distances between towns in Greenland, it is neither financially nor technically viable to establish a supply grid connecting them. This means that each town and settlement has its own power plant or combined heat and power plant (CHP plant) – a so-called island operation. At the same time, the climatic conditions mean that towns and settlements cannot tolerate lengthy interruptions in their electricity supply. It is therefore also necessary to have reserve and emergency plants. There is only one power plant that supplies two towns: the Qorlortorsuaq hydropower plant, which has supplied both Narsaq and Qaqortoq in South Greenland with electricity since 2008. In both towns there are still back-up plants.

Hydropower generation

Greenland has invested in renewable energy since the 1990s with annual investments making up 1% of GDP. Until 1993, all energy production for electricity and district heating was based on diesel-driven power generation and CHP plants. Today five hydropower plants cover 50% of total energy supply and contribute to an increasing degree of self-sufficiency in the energy sector cf. Table 2.18.

TABLE 2.18 GREENLAND'S HYDROPOWER PLANTS IN 2013

Source: The Department of Environment and Nature, Government of Greenland (2013)

Name	Area of Supply	In Operation Since	Capacity in Megawatt
Buksefjorden	Nuuk	1993	45 MW
Tasilaq	Tasiilaq	2004	1.2 MW
Qorlortorsuaq	Narsaq og Qaqortoq	2008	7.6 MW
Sisimiut	Sisimiut	2010	15 MW
Pakitsoq	Ilulissat	2013	22.5 MW

Preliminary studies of hydropower potentials continue, but no large-scale hydropower plants are expected in the next few years.

Fossil-fuel-based power generation

Greenland is still very dependent on the import of fossil fuels for power generation. Today, approximately 50% of the total energy supply is based on oil, which is largely a reflection of the island-operation system, in which most settlements outside the larger towns depend on fuel-based power generation.

District-Heating

The production and supply of heating takes place in a number of ways. Integrated supply facilities for heating and electricity exist in a number of places, where hydropower plants and fuel-based power plants generate surplus heat, which is then used for district heating. In addition, waste incineration contributes to the heating supply in a number of towns and settlements.

An increasing share of the heating supply is based on surplus hydroelectricity from the five hydropower plants. When maximum capacity is reached, oil boilers take over to secure stable supply.

Finally, a considerable amount of the heating supply, especially in smaller settlements, is still based on fuel-based district heating systems. This is largely a consequence of the island-operation system, where large-scale power generation facilities are not technically or financially viable.

Energy consumption

Energy consumption has increased significantly over the past years, especially due to the growth in geological surveys, which are very fuel-intensive. As a result Greenland experienced the largest consumption ever recorded in 2012 (11,033 TJ). 2012 showed no oil exploration and this caused total energy consumption to drop to 2009 levels (9,114 TJ).

Despite an increase in the production of renewable energy over the last decade, Greenland is still dependent on imports of fossil fuels. With a total share of approximately 89%, the large majority of energy consumption is based on fossil fuels. This includes consumption in households, production industries, energy and water supply, the transportation sector, public and private services as well as wholesale and retail.

In 2010 and 2011 CO_2 emissions increased significantly due to an increase in fuel combustion caused by the initiation of oil exploration, which caused CO_2 emissions from energy consumption to rise by 14.6% in 2010 and by 6.9% in 2011. Due to the absence of oil exploration in 2012. Emissions from energy consumption dropped to 8.3% below 1990 levels and 20.3% below 2011-levels.

FIGURE 2.17 DISTRIBUTION OF GROSS ENERGY CONSUMPTION IN 2012

Source: Statistics Greenland: Greenland's Energy Consumption 2012.

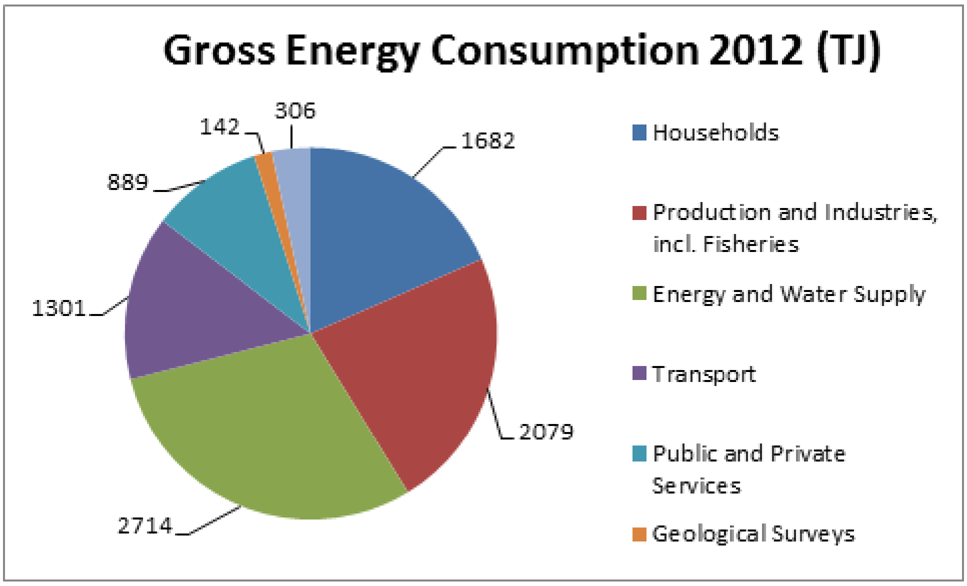


TABLE 2.19 ENERGY CONSUMPTION BY SOURCE IN 2004 AND 2012

Source: Statistics Greenland based on information from Polaroil A/S, Statoil A/S and Nukissiorfiit.

	2004 Unit GJ	**2011 Unit GJ**	**2004 Unit GWh**	**2011 Unit GWh**
Hydropower	691,200	1,215,040	192	338
Energy recovered from waste	88,524	102,628	25	29
Petroleum	725,682	806,879	202	224
Solar	7,418,424	6,339,776	2,061	1,761
Fueloil	0	54,609	0	15
Gasoline	484,236	582,317	135	162
Liquified petroleum gas (LPG)	6,705	3,844	2	1
Wasteoil	9,385	9,368	3	3
Consumption of energy, total	**9,424,156**	**9,114,461**	**2,618**	**2,533**

2.2.7 Transport

Passenger transport is primarily by air, although one ferry and a number of small passenger vessels operate in Greenland waters.

TABLE 2.20 VESSEL DATA SUMMARY

Source: Ministry of Health and Infrastructure, Government of Greenland and Marine Rescue Coordination Center Nuuk

		2008	2010	2012
Research/ Ice breakers/ Government	Private ice breakers	2	3	1
	Research vessels	23	22	24
	Special purpose vessels	10	24	14
Shipping	Bulk carriers and container ships	24	24	21
	Tankers	6	10	6
Passenger Transport	Ferry	1	1	1
	Passenger vessels	11	-	10
	Passenger cruise ship	36	38	30
Fishing	Large commercial fishing vessels	10	29	23

Passenger transport by air

The regions of Greenland are connected by ships, aeroplanes and helicopters.

Since the 1990s, Greenland has seen an increase in both sea and air passenger transport, and the need for flexible and fast transport between the towns has increased in parallel to the general development of society.

Year-round scheduled air services connect Greenland with the outside world, through Copenhagen, Denmark and Reykjavik, Iceland.

Passenger transport by land

There are no roads connecting towns and settlements in Greenland, but in most towns there are bus services. Private car ownership is common and the number of taxies is generally high.

In 2012 there were 7,768 vehicles registered by the motor vehicle administration, and of these 262 vehicles were registered as new. Greenland had 132 registered taxis, 82 busses and 355 trucks.

Passenger transport by sea

Passenger transport by sea is serviced by one ferry and 10 small vessels, operating in Greenland waters. The ferry sails along the west coast of Greenland, while passenger vessels carry both passengers and goods between towns and settlements.

Private boat ownership is common and boats are used for local transportation as well.

Cruise ship tourism

Greenland has seen an increase in tourism since the turn of the century, and especially cruise ship tourism has increased. The number of cruise ships sailing in Greenland has been increasing year by year, but has fallen recently and in general cruise ships have experienced much volatility in passenger demand. With the rise of commercial tourism there has been increased focus on cruise ship activity and the protection of the arctic environment and nature. In 2012 a total of 30 cruise ships operated in Greenland waters, carrying 23,399 passengers.

Shipping

Royal Arctic Line (RAL) is the major shipping agent in Greenland, enjoying a government-issued concession that gives it a virtual monopoly on containerized shipping. Royal Arctic Line connects Greenland with Europe, primarily through the port of Aalborg in Denmark and Nuuk in Greenland. Almost all cargo to and from Greenland passes through this route.

Greenland experienced an increase in shipping during the mid-00s, attributed to an increase in exports of fish and shrimp and increased imports of consumer goods, machinery and materials for construction. In recent years commercial shipping activity has declined from the high in 2008. This appears to be due to a decrease in commerce overall rather than an indication of declining importance of the shipping trade in Greenland.

The planned production of aluminium and the opening of large-scale mining are likely to greatly increase shipping between Greenland and world markets, in particular to Europe and North America.

2.2.8 Industry

Greenland has a small inland production of industrial produce and exports are based almost entirely on fisheries, while most industrial produce is imported.

Fishery

Fish and seafood is the single most important product for export, accounting for 91% of the total value of exports in 2012. Furthermore, the fishery industry is important because many people are employed in the production and transportation of fish and seafood.

Mineral and hydrocarbon industry

The mineral and hydrocarbon industry is developing, and the industry might be of crucial importance to the industrial development of Greenland.

The Bureau of Minerals and Petroleum under the Greenland Government, has issued a series of licences for the exploration of oil, gas and minerals, but licences for exploitation are still few.

The exploration activitives have shown that there are economic potentials related to a wide range of mineralisations. The current exploitation licences are targeted at the exploitation of gold, zink/lead, iron and molybdenum, and promising exploration projects are targeting rubies, eudialyt, iron, rare earth elements and other minerals.

TABLE 2.21 MINERAL ACTIVITIES: PROSPECTING, EXPLORATION AND EXPLOITATION LICENCES IN 1995, 2000, 2004, 2008 AND 2012.
Source: Bureau of Minerals and Petroleum, Greenland Government

	Prospecting licences	*Exploration licences*	*Exploitation licences*
1995	21	35	-
2000	15	24	-
2004	12	22	1
2008	12	68	3
2012	27	93	4

In Greenland a series of mature exploration projects are getting closer to exploitation. Licences to exploit mineral resources are granted by Nalaakersuisut after an exstensive process, including public consultation of an EIA (Environmental Impact Assessment) and a SIA (Social Impact Assessment). For each project an IBA (Impact Benefit Agreement) is signed by the company, the municipality and Nalaakersuisut to ensure benefits from the projects for the local community and Greenland as a whole. The IBA is adjusted annually.

Currently the following projects are approaching maturity:

- Killavaat Alannguat, a worldclass REE (rare earth elements) deposit. The exploration licence was granted to Tanbreez Mining Greenland A/S. The company submitted an application for exploitation in Q3 2013. The resource is estimated at around 4 billion tonnes of ore. The deposit is situated in South Greenland and is expected to employ approximately 60-80 people in an open-pit operated all year round. Mine life is expected to exceed 20 years.

- Citronen Fjord, a giant zink and lead deposit of more than 130 million tonnes ore. The Australian company Ironbark Zinc Ltd. expects to submit an appplication for exploitation in the first half of 2014. The deposit is situated in Northeast Greenland and is expected to employ approximately 100-200 people in an open-pit operated all year round. Mine life is expected to exceed 15 years.

- Fiskenæsset, a ruby and pink saphire deposit, currently being explored by the Canadian company True North Gems Inc. True North Gems Inc. has finalized and submitted an application for exploitation in the spring of 2013. The deposit is situated South of Nuuk and is expected to employ approximately 50-60 people in an open-pit operated for 8 months a year. Mine life is expected to be 10 years.

- Isua, a BIF (Banded Iron ore Formation) with an ore tonnage of more than 1.1 billion tonnes has been explored by the British company London Mining Ltd. During the last quater of 2013, London Mining was granted an exploitation licence by Naalakkersuisut.. The deposit is situated close to Nuuk, the capital, and is expected to employ 6-700 people in an open-pit all year operation. Mine life is expected to exceed 15 years.

- Greenland Minerals and Energy Ltd., an Australian company, is currently exploring Kuannersuit, a REE and uranium deposit of more than 850 million tonnes of ore. The company is currently working on preparing application material, as the policy of Naalakkersuisut on radioactive minerals has changed. The deposit is situated in South Greenland and is expected to employ approximately 80-100 people in an open-pit all year operation. Mine life is expected to exceed 20 years.

- The number of hydrocarbon licences awarded has also increased significantly over the recent years. By 2012, a total of 34 prospecting licences and 20 licences for exploration and exploitation of hydrocarbons have been issued.

Aluminum industry

In 2007 the Greenland Government decided to work with the worldwide producer of aluminium, ALCOA, on establishing an aluminium smelter in Greenland, making use of the vast and undeveloped resources for renewable energy.

Since 2007 both the government and ALCOA have been studying the consequences of establishing an aluminium smelter in Greenland. An Environmental Impact Assessment is currently under preparation, and baseline studies have already been completed.

In the autumn session in 2012, the Greenland Parliament discussed framework conditions for the aluminium project. Implementation talks are continuing with ALCOA. The plans outline a smelter, producing 400,000 metric tonnes of aluminium annually to be established on the Maniitsoq Island in West Greenland. The energy will be provided by two hydropower plants with a total firm output of 650 MW.

According to plans the plant will be in operation in 2017.

Aluminium smelting is an energy-intensive industry producing GHGs in the chemical processes related to smelting and, if based on fossil fuels, also in producing energy for the smelter. In the aluminium industry emissions from smelters based on energy from coal and natural gas have increased. According to industry data from Brook Hunt Wood MacKenzie, in 1995 39% of world aluminium was produced using coal and natural gas, but in 2008 this share had increased to 57%. Meanwhile the share of aluminium produced using renewable energy had decreased from 58% to only 40%.

The smelter in Greenland will be supplied by hydropower energy only. In comparison to plants based on fossil fuels, the plant will emit far less greenhouse gasses.

TABLE 2.22 ESTIMATION OF CO2 EMISSIONS FROM ENERGY SOURCES

Source: Greenland Development (www.aluminium.gl). based on CRU Analysis/Point Carbon, 2007.

Energy Source	Tonnes of CO_2/tonne of aluminium produced	Total annual emissions (400,000 t/a smelter) (t CO_2)
Coal	14.06	5,624,000
Natural gas	8.08	3,232,000
Hydropower	1.7	680,000

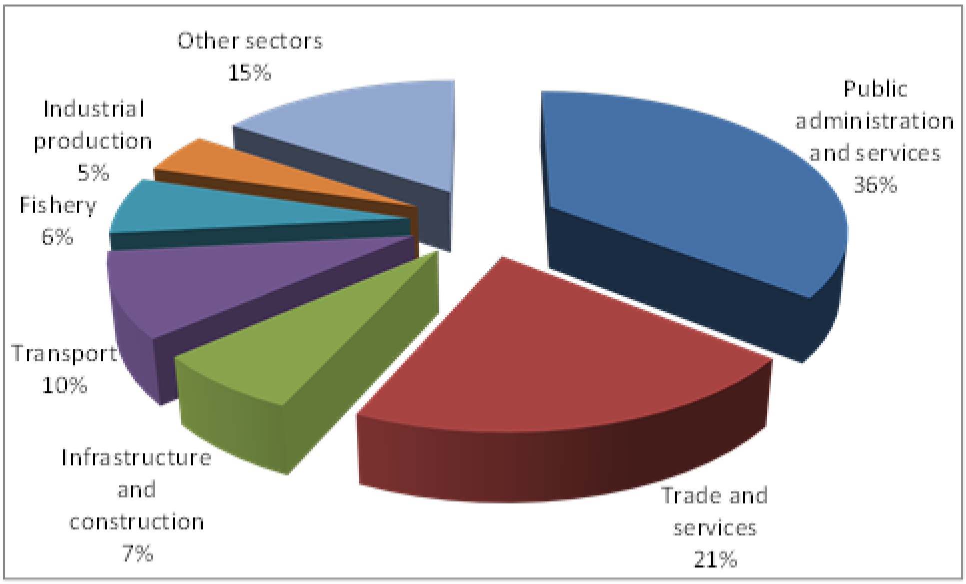
The smelter in Greenland will increase emissions in Greenland by approximately 60%, but globally the project will be able to displace production otherwise based on fossil fuels. In 2009, the Greenland Government commissioned a Life Cycle Assessment from Aalborg University to independently verify these assumptions. The LCA concluded that a smelter in Greenland based on hydro power will have a 3-12-times smaller carbon footprint than smelter projects based on fossil fuels.

The labour market in Greenland

As society resembles strong aspects of the Scandinavian welfare model, public administration and services dominate the labour market in Greenland.

FIGURE 2.17 LABOUR MARKET STATISTICS WITH BUSINESS NOMENCLATURE, 2011, IN FULL-TIME EQUIVALENTS.

Source: Statistics Greenland, 2013



Greenland is likely to see an increase in industrial production within the next decade. The exploration of both hydrocarbons and minerals may result in new mining projects, and in Maniitsoq there are plans to establish an aluminium smelter.

2.2.9 Waste

The waste sector contributed with 2.9% of the total GHG emissions in 2011, 45% of the total CH_4 emissions and 71% of the total N_2O emissions. Two-thirds of waste from other sectors is produced by households, while the remaining waste is produced in commercial activities.

The Ministry of Internal Affairs, Environment and Nature under the Greenland Government conducted a study of the composition of both household waste and waste from commercial activities in 2006. From this study the most important waste fraction is organic waste (44%), followed by combustible waste (17.5%), both wet and dry paper and cardboard (18%), glass (7.5%), plastics (7%), metal (3.5%) and environmentally hazardous waste (1.5%).

The composition of waste from commercial activities includes comparatively more paper and cardboard (27%), more plastic waste (9%), more environmentally hazardous waste (3%) and more non-combustible waste (5%), but less glass (3%), metal (3%), organic waste (34%) and other combustible waste (16%).

Today, solid waste management is based on incineration facilities and open landfills. In six cities incineration plants are in use, handling approximately 65% of the waste produced in Greenland. Much of the residual heat from the six facilities is used for district heating.

In small towns and settlements, 46 small-scale incineration facilities were established during the period 1995-2003. They incinerate approximately 9% of the waste produced. The small-scale incineration facilities were introduced as an environmentally sound alternative to the use of open landfills. The project cannot be deemed successful and the majority of small-scale incineration facilities are either broken or not in use. In these areas open landfills are still in use. Schemes for the recycling of single fractions of waste are established locally, i.e. oil and chemical waste, batteries, electronic waste, glass, hazardous waste, etc. These fractions are shipped to foreign facilities and recycled.

In 2010 the Government of Greenland adopted the Waste Management Plan 2010-2013 which lays down guidelines for the national waste policy.

TABLE 2.23 WASTE MANAGEMENT IN GREENLAND. 1990, 1995, 2000, 2005 AND 2011, IN '000 TONNES. WASTE DISPOSAL IS CORRECTED FOR OPEN BURNING

Source: Statistics Greenland. 2013

	1990	1995	2000	2005	2011
Managed waste disposal corrected for open burning	6.1	6.4	4.9	4.2	4.5
Unmanaged waste disposal corrected for open burning	1.4	1.3	0.9	0.8	0.7
Waste incineration; energy recovery	5.5	6.1	11.3	15.6	17.5
Waste incineration	0.0	0.2	3.1	3.5	3.5
Open burning	16.6	17.2	12.9	11.3	11.5
Total waste produced	**29.5**	**31.2**	**33.1**	**35.4**	**37.7**

Since 1990 Greenland has seen a 28% increase in the amount of waste produced. However, within the same period of time new facilities for waste incineration have increased incineration with energy recovery, while both open burning and disposal has decreased.

There are no waste water treatment plants in Greenland, and waste water produced both on land and at sea is disposed of into the ocean. Households are generally connected to public sewers, but there are still households with no access to sewerage. Industrial waste water management is regulated by Government regulations on environmental operational permits.

2.2.10 Buildings and infrastructure

As of 1 January 2010 there were a total of 23,112 dwellings in Greenland. 83.9% of the housing was available in the 18 towns, while the remaining housing was found in settlements.

The public sector plays a very important role in the housing sector. Most housing is owned by the government 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, e.g. insulation and replacement of windows reducing the energy consumption. A large proportion of the houses are 35 – 40 years old and a refurbishment programme has been initiated. This modernisation includes reducing the energy consumption of individual houses.

TABLE 2.24 HOUSING STATISTICS: DISTRIBUTION OF HOUSING, TOTAL HOUSING, HOUSING SIZE IN M2 AND ROOMS, AND NEW HOUSING - IN 1997, 2006 AND 2009.

Source: Statistics Greenland, 2013.

	1997	2006	2009
Housing in towns	16,568	18,466	19,402
Housing in settlements	3,376	3,609	3,710
Housing, total[1]	19,940	22,075	23,112
Housing, total in m^2	1,289,681	1,488,342	1,580,752
New housing	94	225	274

[1]Housing excludes dormitories and retirement homes.

2.2.11 Agriculture

Agriculture is scarce in Greenland due to climatic conditions, but agricultural activities are found in South Greenland.

Even though Greenland has seen an increase in agriculture, farming and livestock are still small of scale. Since 1990 the area of improved grassland has increased by more than 100%, while the number of farms has seen only small fluctuations.

The average farm is estimated at 18-22 hectares.

TABLE 2.25 CROPLAND, IMPROVED GRASSLAND, MOUNTAINOUS GRASSLAND, IN HECTARES, IN 1990, 2001, 2007 AND 2012

Source: Statistics Greenland. Agricultural Advisory Service, Ministry of Fisheries, Hunting and Agriculture.

	1990	2001	2007	2012
Cropland	0	5	5	6
Improved grassland	490	776	973	1090
Mountainous grassland	242,000	242,000	242,000	242,000

The mountainous grassland is only used for grazing in the short summer period of 3-4 months for the stock of sheep. The major part of the mountainous grassland is bare rock and mountains.

The agricultural yield i.e. hay produced per hectare, compares to farming in marginal lands in Iceland and northern Scandinavia. However, in order to develop sustainable farming and increase the variety of products, more land must be cultivated.

The increase in improved grassland is a result of the increased demand for fodder for sheep, reindeer, cattle and horses.

TABLE 2.26 STOCK OF SHEEP AND REINDEERS IN 1990, 2000, 2008 AND 2012

Source: Statistics Greenland, Agricultural Advisory Service and Ministry of Fisheries, Hunting and Agriculture.

	1990	2000	2008	2012
Sheep	19,929	20,444	21,080	21,110
Reindeer (domestic)	6,000	2,000	2,500	2,000

2.2.12 Forestry

Forestry in Greenland, like agriculture, is found in South Greenland. Coniferous plantations and woods, with trees of an average height more than 5 meters, cover a total area of 54 ha. Up to 2007 more than 200 ha had been afforested in total.

There are four forests which may qualify to meet the FAO criteria defining a forest; the largest covering 45 ha with an average height of 6 meters and approx. 100 trees per ha.

Greenland will probably never be truly competitive in the production of commercial timber, but small-scale plantings, e.g. an inland production of Christmas trees for the national market and a small-scale timber production might accompany the agricultural sector in the nearest future.

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 ratified by the Danish government do not cover the Faroe Islands, unless the Faroese government specifically requests to be a part of the agreement.

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 2012 the Faroe Islands had a population of 48,284 - an increase of 6,057 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. From 1996 to 2003, the population was growing. But since 2004 net-immigration has been negative, except in 2008. In 2012 the capital, Tórshavn, had a population of 12,251, corresponding to slightly more than 25% 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^{o}N and 7^{o}W. The islands extend over 113 km from north to south and 75 km from east to west, and the total land area is 1,399 square kilometres. The highest points, up to 880 metres above sea level, are on the northern islands. 17 of the islands are inhabited.

2.3.4 Climate

The climate in the Faroe Islands is strongly affected by the warm North Atlantic current (the Gulf Stream) 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 relatively 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 Tórshavn 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, violent cyclones develop and pressure falls by more than 80 hPa/24 hours.

Temperature

The annual mean temperature in Tórshavn is 6.5°C (1961-90 level; 7.2°C 2001-2010 level). The temperature in January and February is around 3.5°C (1961-90 level; around 4°C 2001-2010 level), and in July and August, around 10.5°C (1961-90 level; between 11 and 11.5°C 2001-2010 level). The annual mean temperature varies from place to place and is lowest at Vága Floghavn, 6.0°C (1961-90 level), and highest in Sandur on the island of Sandoy, 7.0°C (1961-90 level).

Since the 1990s the temperatures in Tórshavn have exhibited a slightly rising trend (see figure 2.14). The present temperature level is the highest in the Tórshavn time series and the period 2001-2010 was the warmest decade. In 2003 there was a record high annual temperature in Tórshavn (7.7°C).

Precipitation

Annual precipitation in Tórshavn is 1284 mm (1961-90 level; 1359 mm 2001-2010 level), most in autumn and winter and least in summer. There are large geographical variations in precipitation, mainly due to the topography of the islands.

It rains a lot in the Faroe Islands. Indeed, the Hvalvík has as much as 300 days (1961-90 level) with precipitation, and Tórshavn, 273 days (1961-90 level). In the winter, precipitation is often in the form of snow. On average (1961-1990), Tórshavn has 44 days of snowfall per year (1961-90 level), mostly in December and January, but fewer days in recent years. There is no snow at all in June, July, and August, but there can be snow in September.

Since the mid 1970s, precipitation in Tórshavn has been roughly stable, with an increasing trend in recent years.

Hours of sunshine, cloud cover and relative humidity

In the period 2000-2012 Tórshavn had 983 hours of sunshine per year (840 hours 1961-90 level; 952 hours 1998-2007 level), most in May and June, the average in the period 2000-2012 being around 146 hours (125 hours 1961-90 level; 155 and 130 hours respectively 1998-2007 level). 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 (1961-90 level) in Tórshavn.

The number of hours of sunshine in Tórshavn (1961-90 level) has showed an increasing trend in the last 20 years.

The Faroe Islands have a moist climate, and the relative humidity is very high, 88% on an annual basis in Tórshavn (1961-90 level). It is highest around August, and this is also when most fog occurs.

Wind

The mean wind is generally high in the Faroe Islands, particularly in autumn and winter (6-10 m/s; 1961-90 level). The wind is normally lightest in summer (4.5-6 m/s; 1961-90 level). 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 Faroe Islands is a modern, developed society with a standard of living comparable to other Nordic countries. However, the economy is not yet as diversified as in other highly developed countries.

Fishery and related industries are of such importance that their influence determines the overall performance of the Faroese economy. An economy with high dependence on fish products and exporting them is bound to be vulnerable to the changes in catches, fish prices, and exchange rates. These often cyclical and unforeseen changes are volatile, and have left their mark on the economic history of the islands.

The Faroese economy is very sensitive to the international market for fish. Consequently, export income can fluctuate significantly from one year to the next, and these fluctuations spread quickly throughout the economy.

The national accounts to 2012 indicate that a proportionally larger output value now comes from production of private and public services. The proportional output value from fishery and manufacturing fish products has declined correspondingly. Faroese companies are also actively seeking investment opportunities abroad at a much higher level than in the past. These developments, together with a shift since the mid-1990s towards a more market-oriented economic policy, will most likely contribute to a more diverse and stable economy and this has also most markedly already shown up as growth in international transport services.

TABLE 2.27 GROSS NATIONAL PRODUCT AT FACTOR COST 1999 - 2011, BREAKDOWN BY SECTOR
Source: Hagstova Føroya

Million DKK	1999	2000	2005	2010	2011
Non-financial sector	3,942	4,364	4,994	6,232	6,484
Financial sector	145	148	204	319	318
Public services	1,484	1,602	2,328	3,003	3,040
Households and NPISH	1,115	1,191	1,315	1,601	1,663
Total	**6,686**	**7,305**	**8,841**	**11,155**	**11,505**

2.3.6 Energy

The joint municipal company, SEV, is responsible for the production and sale of electricity in the Faroe Islands. In 2012 production amounted to about 290 mill. kWh cf. Table 2.28. Of this, about 34% was based on hydroelectricity, 4% on windpower while the remainder was produced at diesel-driven plants.

Sales of electricity in 2012 were distributed between 33% for households, 27% for industry, agriculture and fisheries, and 28% for the service sector, with the remainder for street lighting etc.

TABLE 2.28 ELECTRICITY PRODUCTION 1999-2012 (GWH)

Source: The Office of the Danish Chief Administrator in the Faroe Islands (2008) and the Environment Agency

	1999	2000	2005	2010	2011	2012
Hydropower	70.2	76.0	99.0	67.4	92.5	99.8
Diesel power	130.6	136.4	135.6	199.3	166.8	181.0
Wind power	0.6	0.5	10.3	13.6	14.5	10.8
Total	**201.4**	**212.9**	**244.9**	**280.8**	**273.8**	**291.6**

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 2000, the second in 2004 and the third was held in 2008. 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. Since then five wells have been drilled (2003, 2006, 2007/08, 2010 and 2012). So far none of the finds have been commercially viable.

2.3.7 Transport

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

Besides Vágar Floghavn, the Faroe Islands have 12 helicopter pads. Air services are provided by 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 mainly takes place 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 in the islands and the communication links with the outside world. The first undersea tunnel in the Faroe Islands, Vágatunnilin, opened in 2002, connecting Vágoy (airport) with Streymoy. In 2006, the second undersea tunnel in the Faroes, Norðoyartunnilin, which joins Borðoy with Eysturoy, opened. 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 been increasing by almost 1,000 per year since 1995 and in 2012 there were 29,914 motor vehicles, of which about 20,000 were cars and 8,100 lorries, vans and buses.

2.3.8 Industry

The sectoral composition of the Faroese economy reveals a relatively large primary sector, brought about by the sizeable fishing fleet and a thriving fish farming industry.

TABLE 2.29 DISTRIBUTION OF EMPLOYMENT BY SECTORS, 2011
Source: Hagstova Føroya – Statistics Faroe Islands

	Denmark	Iceland	Faroe Islands
Primary sector	3.4%	7.3%	10.6%
Secondary sector	23.4%	23.0%	18.0%
Tertiary sector	73.2%	69.7%	72.0%

As a result, fish and fish products accounted for 85.2% of the export of goods in 2011 and about 52% of total foreign income stemmed from fish and fish-related industries.

However, during the past several years, employment in the primary sector has been decreasing and this trend shows no signs of abating, hence reinforcing sectoral diversification, which in the long term ought to make the economy less volatile.

2.3.9 Buildings and urban structures

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. In recent years some apartment buildings have been built.

2.3.10 Agriculture

Until the end of the nineteenth century, farming was the Faroe Islands' main industry, but this has changed with the economic and industrial development since then, particularly within fisheries. Farming in 2012 accounted 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, and a small fraction of demand for beef. In 2012 the Faroe Islands had about 950 dairy cows and about 79,000 sheep.

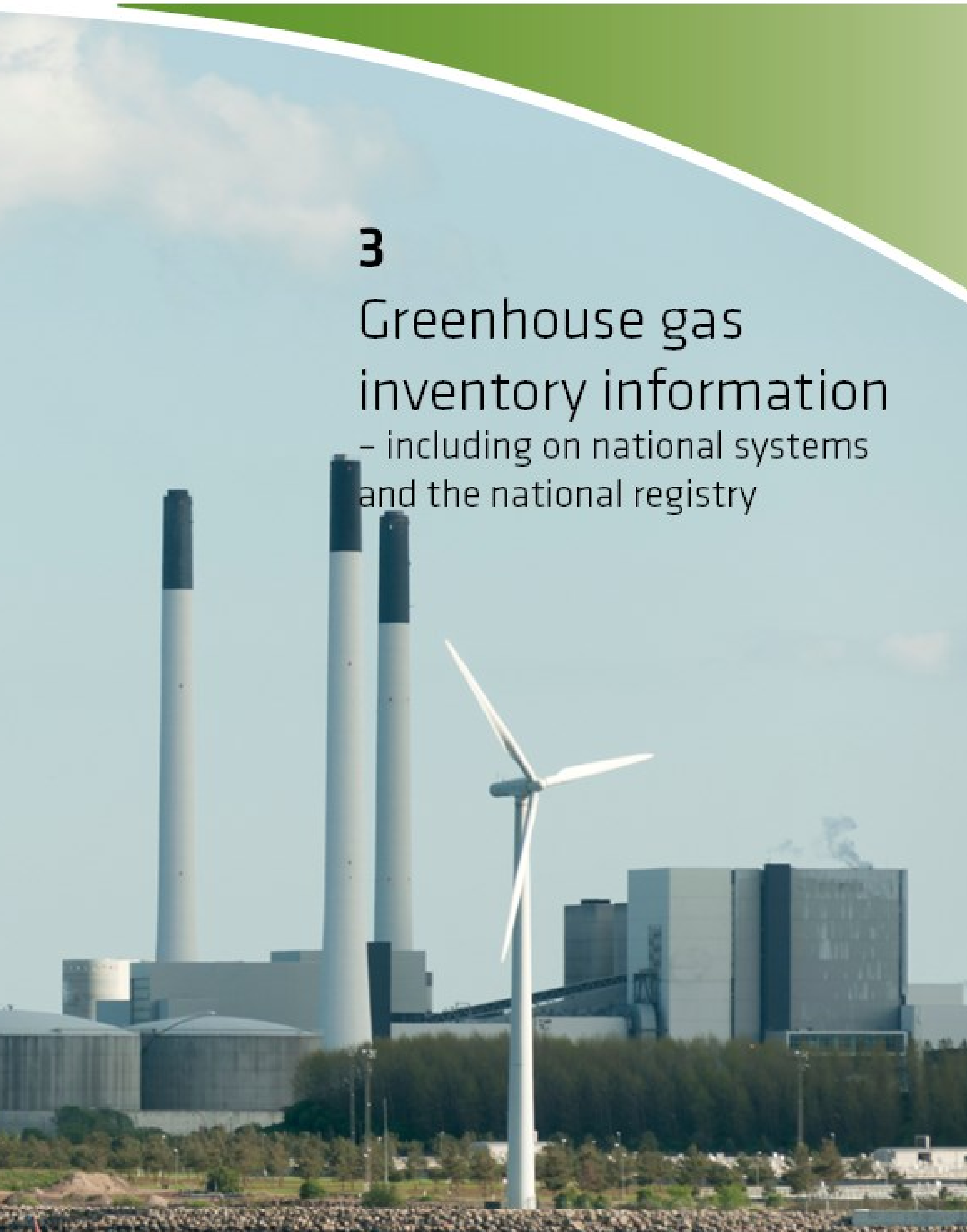
2.3.11 Forestry

There is no commercial forestry in 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

– including on national systems and the national registry



3 Greenhouse gas inventory information

- including on national systems and the national registry

3.1 Summary Tables of 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.

The Danish emission inventories follow the methodologies described in the EMEP/EEA guidebook[1] and the IPCC's guidelines[2]. In accordance with the latter guidelines, some of the methodologies and emission factors have been modified so that they better reflect Danish conditions.

A description of methods, emission factors and activity data is given in Denmark's national inventory reports (NIR)[3] to the Climate Convention and the Kyoto Protocol, which also includes 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 Aarhus University's website[4] and in Nielsen et al., 2013.

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

Since the UNFCCC has been ratified on behalf of all three parts of the Realm, the Kyoto Protocol has been ratified on behalf of Denmark and Greenland, and only Denmark is a part of the European Union territory to which the EU agreement on joint fulfilment under Article 4 of the Kyoto Protocol applies, three sets of summary tables have been reported in the NIR 2013. The most aggregated summary tables are shown in this Chapter in Table 3.1 (Denmark, Greenland and the Faroe Islands), Table 3.2 (Denmark) and Table 3.4 (Denmark and Greenland) respectively.

CRF summary tables for Denmark with more disaggregated information on Danish source categories are given in Annex A1.

In all summary tables, the base year presented is the base year under the Climate Convention; 1990. Under the UNFCCC, time series of emission inventories, including emissions in 1990, are often recalculated in the annual reporting due to new knowledge regarding emission factors, activity data, methodologies, etc. Under the Kyoto Protocol, the assigned amount for Denmark and Greenland for the period 2008-2012 was determined in 2007 on the basis of the base year reported in the

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[1] EMEP/EEA (2009): EMEP/EEA air pollutant emission inventory guidebook - 2009. Available at: http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009 (02-07-2013).

[2] IPCC (1996): 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. IPCC (2000): Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. Available: http://www.ipcc-nggip.iges.or.jp/public/gp/english/ (02-07-2013). IPCC (2003): Good Practice Guidance for Land Use, Land-Use Change and Forestry Available: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html (02-07-2013).

[3] Nielsen et al., 2013.

[4] http://envs.au.dk/videnudveksling/luft/emissioner/emissioninventory/

annual inventory reporting in 2006. The fixed base year and the calculation of the assigned amount under the Kyoto Protocol are further described in section 3.5.

3.2 Descriptive Summary of Denmark's emissions and removals of greenhouse gases

The total inventories for Denmark, Greenland and the Faroe Islands (the Realm) are given in Table 3.1.

Since the fifth National Communication, full CRF tables have been elaborated for Greenland and the Faroe Islands. This means that three separate CRF tables are created and then the submissions to the Climate Convention and the Kyoto Protocol are aggregated. The process for aggregating the different submissions is described in the NIR (Nielsen et al., 2013). The documentation of the Greenlandic and Faroese inventories has also been greatly expanded and the documentation for Greenland is now presented in a separate chapter in the NIR, while the documentation for the Faroe Islands is included in an annex to the NIR.

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.

The emissions from the Realm (i.e. including emissions from Greenland and Faroe Islands) of the greenhouse gases CO_2 (carbon dioxide), CH_4 (methane), N_2O (nitrous oxide), and the so-called potent greenhouse gases (F-gases), which include HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), and SF_6 (sulphurhexafluoride) during the period 1990-2011 are shown in Table 3.1 and Figures 3.1-3.4 aggregated into the IPCC's six main sectors and the most relevant sub-sectors. Total greenhouse gas emissions for the Realm measured in CO_2 equivalents on the basis of the global warming potential of each gas are shown together with the distribution with respect to gas and source/sector in Table 3.2. The development in Danish greenhouse gas emissions from 1990-2011, broken down by source and sink categories from Table 10 of the CRF, is shown in Annex A1.

In the following sections 3.2.1 to 3.2.6, further information on Danish emissions of individual greenhouse gases, indirect greenhouse gases and SO_2 is provided.

TABLE 3.1 DENMARK'S, GREENLAND'S AND THE FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES, 1990 - 2011

Source: Nielsen et al., 2013.

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	CO_2 equivalent (Gg)																					
CO_2 emissions including LULUCF	59 602	68 787	65 286	63 989	69 549	65 641	77 658	69 696	64 522	63 565	58 275	61 438	62 486	66 383	60 539	57 178	66 113	58 262	50 941	52 699	49 793	42 622
CO_2 emissions excluding LULUCF	54 146	64 807	59 067	61 216	65 170	62 006	75 417	66 087	62 013	59 458	55 071	56 899	56 466	61 627	56 151	52 495	60 463	55 704	52 252	49 780	50 279	45 299
CH_4 emissions including LULUCF	6 069	6 135	6 135	6 230	6 126	6 163	6 205	6 046	6 030	5 917	5 913	6 016	5 932	5 912	5 755	5 684	5 693	5 694	5 652	5 559	5 620	5 525
CH_4 emissions excluding LULUCF	6 068	6 135	6 135	6 230	6 126	6 162	6 205	6 046	6 030	5 917	5 913	6 016	5 932	5 912	5 755	5 684	5 693	5 694	5 652	5 559	5 620	5 525
N_2O emissions including LULUCF	9 846	9 603	9 240	9 056	9 078	8 809	8 234	8 198	8 372	8 215	7 990	7 688	7 532	7 220	7 004	6 375	6 224	6 379	6 430	6 059	6 017	6 076
N_2O emissions excluding LULUCF	9 829	9 587	9 225	9 040	9 063	8 794	8 219	8 183	8 358	8 201	7 976	7 674	7 518	7 206	6 990	6 362	6 211	6 366	6 417	6 046	6 005	6 063
HFCs	NE,NO	NE,NO	NE,NO	94	135	218	329	325	413	509	613	660	689	716	772	819	840	868	872	817	823	778
PFCs	NE,NO	NE,NO	NE,NO	NE,NO	0	1	2	4	9	12	18	22	22	19	16	14	16	15	13	14	13	11
SF_6	44	64	89	101	122	108	61	73	60	65	59	30	25	31	33	22	36	30	32	37	38	73
Total (including LULUCF)	**75 561**	**84 589**	**80 751**	**79 471**	**85 009**	**80 938**	**92 490**	**84 343**	**79 406**	**78 284**	**72 867**	**75 855**	**76 686**	**80 281**	**74 120**	**70 092**	**78 922**	**71 249**	**63 939**	**65 185**	**62 306**	**55 084**
Total (excluding LULUCF)	**70 088**	**80 593**	**74 515**	**76 682**	**80 615**	**77 288**	**90 234**	**80 718**	**76 883**	**74 162**	**69 649**	**71 302**	**70 653**	**75 511**	**69 718**	**65 396**	**73 259**	**68 678**	**65 237**	**62 253**	**62 779**	**57 748**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	CO_2 equivalent (Gg)																					
1. Energy	53 413	63 952	58 082	60 282	64 275	61 246	74 676	65 174	61 169	58 636	54 217	56 085	55 622	60 932	55 333	51 695	59 662	54 850	51 679	49 577	50 195	44 972
2. Industrial Processes	2 240	2 347	2 380	2 457	2 555	2 726	2 828	3 017	2 994	3 220	3 390	3 299	3 210	3 229	3 039	2 458	2 538	2 559	2 273	1 782	1 704	1 873
3. Solvent and Other Product Use	116	133	143	126	148	137	148	135	144	152	154	141	165	160	165	190	171	174	157	170	188	167
4. Agriculture	12 586	12 425	12 200	12 107	11 997	11 633	11 088	10 979	11 226	10 785	10 513	10 420	10 340	9 878	10 008	9 894	9 701	9 929	9 985	9 639	9 655	9 712
5. Land-use, Land-Use Change and Forestry (LULUCF)	5 473	3 996	6 235	2 789	4 394	3 650	2 256	3 624	2 524	4 122	3 218	4 553	6 033	4 769	4 402	4 696	5 663	2 571	-1 298	2 932	-473	-2 664
6. Waste	1 733	1 736	1 711	1 710	1 640	1 546	1 494	1 414	1 350	1 368	1 376	1 358	1 315	1 312	1 173	1 160	1 187	1 166	1 143	1 084	1 037	1 024
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)	**75 561**	**84 589**	**80 751**	**79 471**	**85 009**	**80 938**	**92 490**	**84 343**	**79 406**	**78 284**	**72 867**	**75 855**	**76 686**	**80 281**	**74 120**	**70 092**	**78 922**	**71 249**	**63 939**	**65 185**	**62 306**	**55 084**

3.2.1 Carbon dioxide, CO_2

Most CO_2 emissions come from combustion of coal, oil and natural gas at power stations and in residential properties and industry; road transport is also a major contributor. Outside the energy sector, the only major CO_2 emissions come from cement production, which accounts for 2-3% of the annual national total. The transport sector is the only major emitting sector that has shown an increasing trend since 1990. However, in recent years CO_2 emissions from the transport sector have stabilised and even decreased slightly.

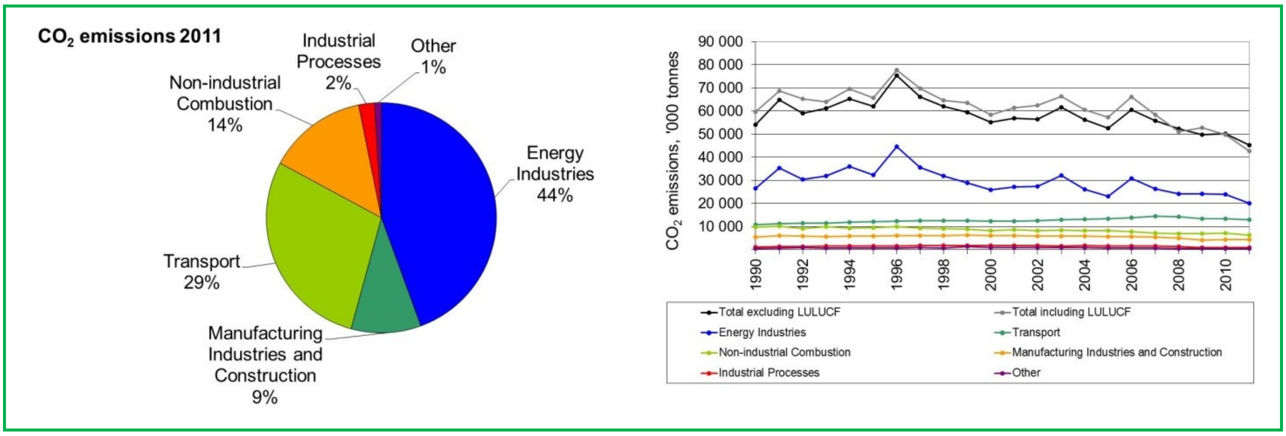
The relatively large fluctuations in the emissions from year to year are due to trade in electricity with other countries - primarily the Nordic countries. The large emissions in 1991, 1994, 1996, 2003 and 2006 are due to large electricity exports. This effect is further demonstrated in section 3.6 in which emission trends with corrections for inter-annual variations in temperature and electricity exchange are shown.

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 or oil-based products, both in stationary and mobile sources. Also, there has been a decrease in gross energy consumption, especially since 2006.

In 2011, total actual CO_2 emissions inventoried under the Climate Convention, excluding land-use change and forestry (LULUCF), were about 16% lower than in 1990. If LULUCF is included, net emissions were about 28% lower.

FIGURE 3.1: CO2 EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.



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. Over the time series from 1990 to 2011, emissions of CH_4 from enteric fermentation decreased by around 13% due to the decrease in the number of cattle. However, the emission from manure management increased in the same period by around 32% due to a change in traditional stable systems towards an increase in slurry-based stable systems.

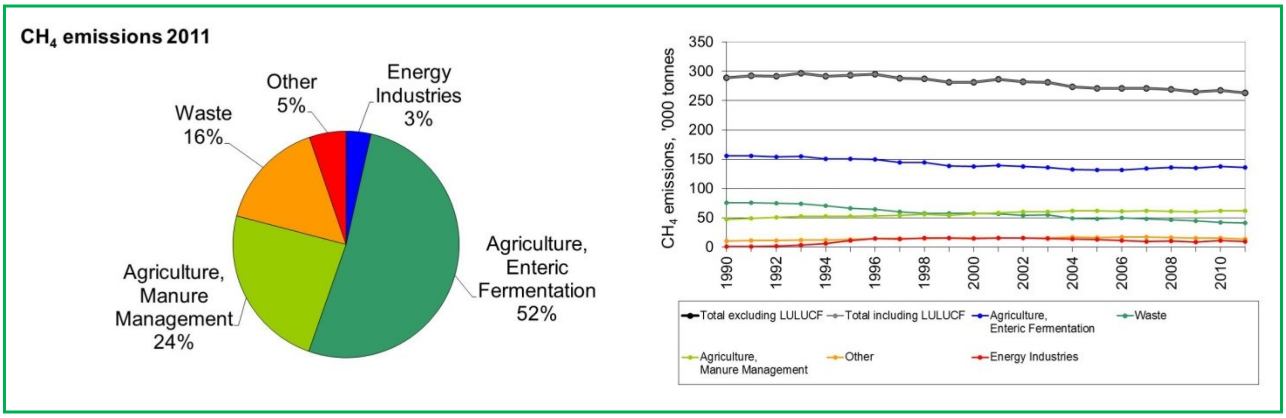
Emissions of methane from landfills are decreasing because of the ban on landfilling of combustible waste. This has led to a decrease in the amount of landfilled waste and hence the emissions. Also contributing to the decrease in emissions was the increased CH_4 recovery in the early part of the time series. This recovery decreased in later years due to less CH_4 production in the landfills.

Emissions of methane from the energy sector increased until 2003 due to an increased use of gas-driven engines, which emit large amounts of methane compared to other combustion technologies. However in later years new legislation establishing emission limits for existing gas-driven engines came into force pursuant to Statutory Order No. 720 of 5 October 1998, and combined with decreased use of gas engines, this has resulted in lower emissions.

In 2011, total methane emissions were 9% below the 1990 level.

FIGURE 3.2 CH4 EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.



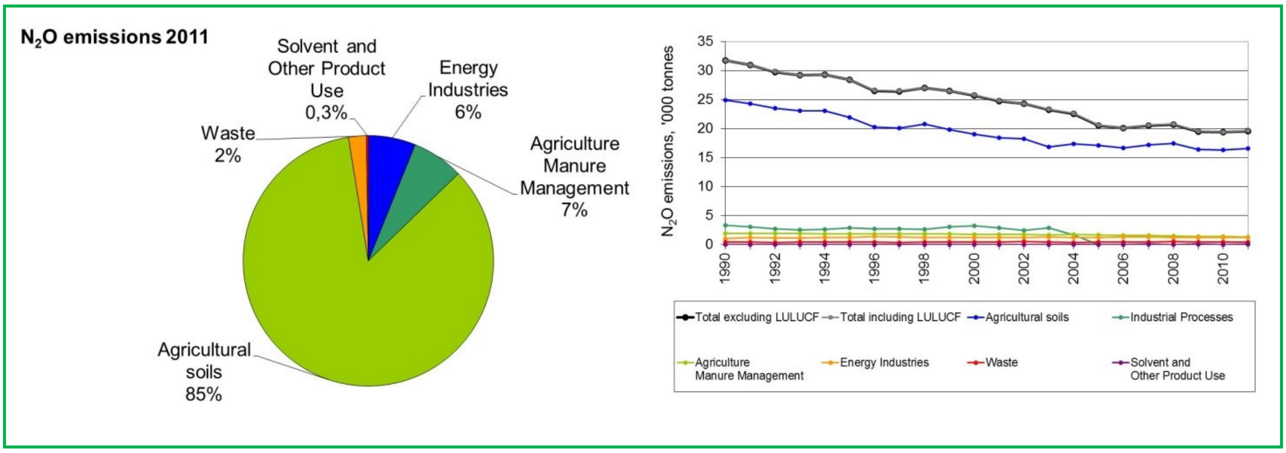
3.2.3 Nitrous oxide, N_2O

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 fertiliser 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 dropped by 33.5% due to legislation to improve the utilisation of nitrogen in manure. This legislation resulted in less nitrogen excreted per unit of livestock produced and a considerable reduction in the use of nitrogen fertilisers. This reduced the basis for the N_2O emissions. A small share of nitrous oxide emissions originates from power and district heating plants, and cars with catalytic converters. Previously, a plant producing nitric acid was in operation in Denmark. However, this plant shut down in 2004, eliminating N_2O emissions from this activity.

In 2011, total nitrous oxide emissions were 38% below the 1990 level.

FIGURE 3.3 N2O EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.



3.2.4 The f-gases: HFCs, PFCs, and SF_6

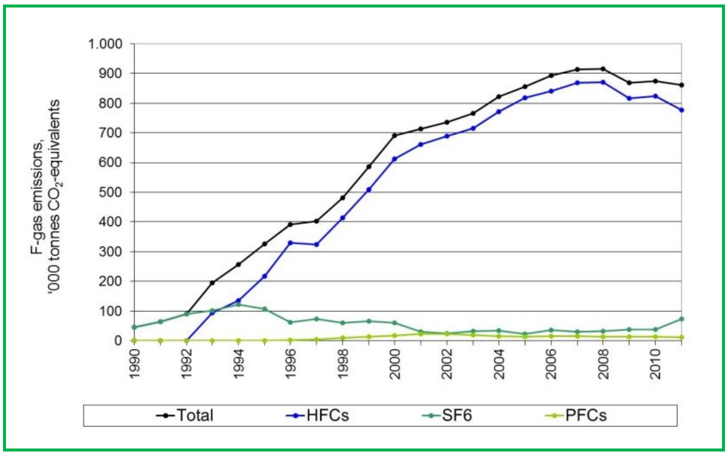
The contribution of f-gases (HFCs, PFCs and SF_6), to Denmark's total emissions of greenhouse gases is relatively modest. However, the emissions of these gases increased significantly during the 1990s. Collection of data on the consumption of these substances started in the mid-1990s. Therefore, f-gas data and emissions inventories from before 1995 are 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.

HFCs, which are primarily used in refrigeration and air conditioning, are the biggest contributor to f-gas emissions. From 1995 to 2011 annual emissions of HFCs increased from 218 to 778 Gg of CO_2 equivalents. However, emissions of HFCs peaked at 872 Gg of CO_2 equivalents in 2008. Emissions of PFCs increased in the same period from 0.5 to 11.1 Gg of CO_2 equivalents. Emissions of PFCs peaked in 2002 at 22.2 Gg of CO_2 equivalents. Emissions of SF_6 decreased from 108 Gg in 1995 to 73 Gg of CO_2 equivalents in 2011. Emissions of SF_6 peaked in 1995.

The total emissions of HFCs, PFCs and SF_6 increased by 165% from 1995 to 2011.

FIGURE 3.4 DEVELOPMENT IN HFC, PFC, AND SF6 EMISSIONS IN 1990-2011

Source: Nielsen et al., 2013.



3.2.5 Total Danish emissions and removals of greenhouse gases

Table 3.2 and figures 3.5 and 3.6 show the development in the Danish greenhouse gas emissions and removals as CO_2 equivalents and by gases and sources according to the reporting guidelines under the Climate Convention (i.e. without Greenland and the Faroe Islands). CO_2 is the most important greenhouse gas, followed by N_2O and CH_4. As mentioned previously, emissions fluctuate in line with trade in electricity. To illustrate this, the emissions in 1996 (excl. LULUCF) were estimated to 89 002 Gg of CO_2 equivalents, whereas the total greenhouse gas emissions in 2003 were estimated to 74 036 Gg of CO_2 equivalents (excl. LULUCF). In 2011 the total emissions were estimated to 56 248 Gg of CO_2 equivalents,

Of the total Danish greenhouse gas emissions in 2011, CO_2 made up 78%, methane 9.8%, nitrous oxide 10.7%, and f-gases 1.5%. If CO_2 emissions by sources and removals by sinks from forests and soils are included (i.e. with LULUCF), then net total Danish greenhouse gas emissions corresponded to 53 583 Gg of CO_2 equivalents in 2011.

As mentioned, the emissions from Greenland and the Faroe Islands only contribute with a very small share to the total emissions; hence the trends as described in sections 3.2.1-3.2.4 are basically the trends in the emissions from Denmark. Therefore the discussion is not repeated in this section. The discussion of emissions of precursor gases, i.e. NO_x, NMVOC, CO and SO_2, is included in this section because the inventory of these gases is not complete for the Realm.

FIGURE 3.5 DANISH GREENHOUSE GAS EMISSIONS BY TYPE OF GAS IN 1990 - 2011.
Source: Nielsen et al., 2013.

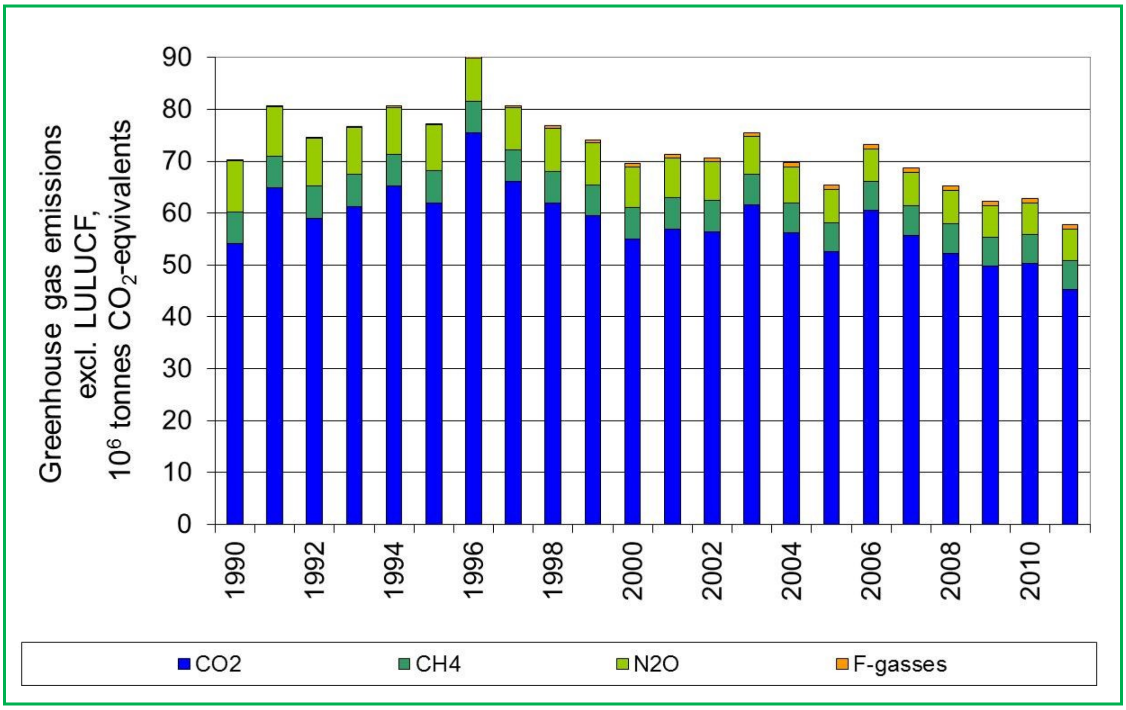


TABLE 3.2 DANISH GREENHOUSE GAS EMISSIONS AND REMOVALS BY GAS AND SOURCE AND SINK CATEGORIES IN 1990 - 2011

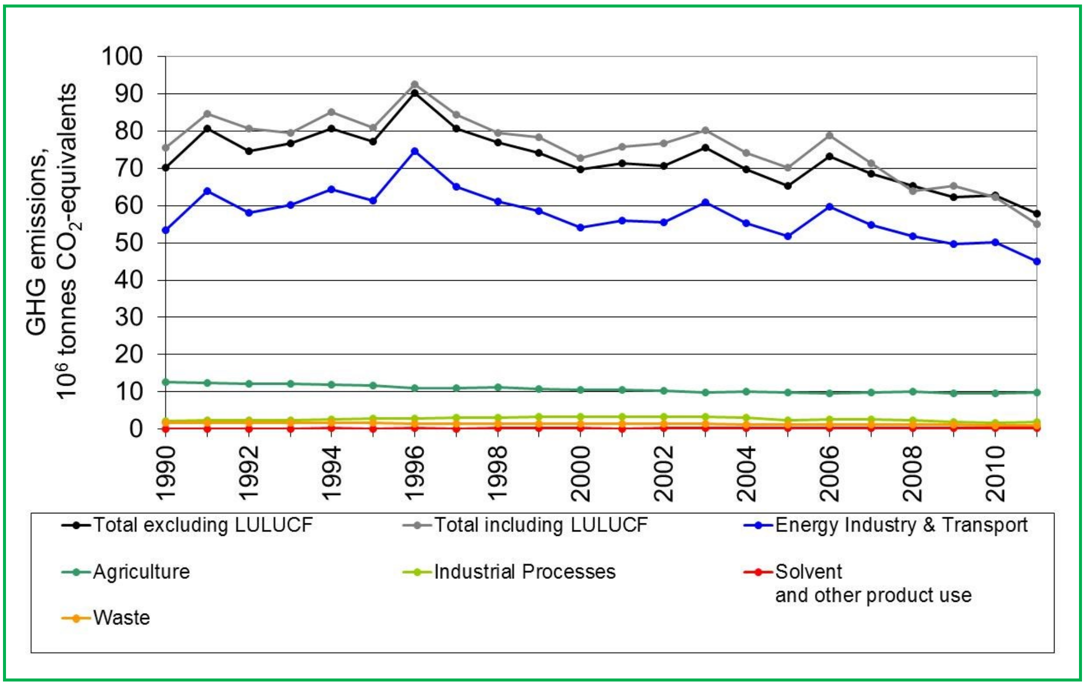
Source: Nielsen et al., 2013.

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	CO_2 equivalent (Gg)																					
CO_2 emissions including LULUCF	58 309	67 528	64 051	62 914	68 519	64 566	76 500	68 522	63 326	62 329	56 941	60 084	61 181	64 997	59 159	55 810	64 725	56 865	49 566	51 378	48 324	41 213
CO_2 emissions excluding LULUCF	52 853	63 548	57 831	60 141	64 140	60 932	74 260	64 913	60 817	58 222	53 737	55 546	55 162	60 242	54 772	51 128	59 076	54 308	50 878	48 459	48 811	43 890
CH_4 emissions including LULUCF	6 038	6 104	6 104	6 200	6 095	6 131	6 174	6 013	5 998	5 884	5 882	5 985	5 901	5 880	5 724	5 652	5 661	5 662	5 620	5 528	5 589	5 493
CH_4 emissions excluding LULUCF	6 037	6 104	6 104	6 200	6 095	6 131	6 174	6 013	5 998	5 884	5 882	5 985	5 901	5 880	5 723	5 652	5 661	5 662	5 620	5 528	5 589	5 493
N_2O emissions including LULUCF	9 803	9 561	9 199	9 016	9 037	8 768	8 192	8 156	8 329	8 172	7 946	7 644	7 488	7 175	6 959	6 330	6 179	6 335	6 384	6 016	5 975	6 034
N_2O emissions excluding LULUCF	9 786	9 545	9 183	9 000	9 022	8 753	8 177	8 141	8 314	8 157	7 932	7 630	7 474	7 162	6 945	6 317	6 166	6 322	6 371	6 004	5 962	6 022
HFCs	NE,NO	NE,NO	NE,NO	94	135	218	329	324	411	504	607	650	676	701	755	802	823	850	853	799	804	759
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	0	1	2	4	9	12	18	22	22	19	16	14	16	15	13	14	13	11
SF_6	44	64	89	101	122	107	61	73	59	65	59	30	25	31	33	22	36	30	32	37	38	73
Total (including LULUCF)	**74 193**	**83 256**	**79 443**	**78 325**	**83 908**	**79 790**	**91 258**	**83 093**	**78 132**	**76 966**	**71 453**	**74 416**	**75 293**	**78 804**	**72 646**	**68 630**	**77 439**	**69 757**	**62 467**	**63 772**	**60 743**	**53 583**
Total (excluding LULUCF)	**68 720**	**79 261**	**73 208**	**75 537**	**79 514**	**76 141**	**89 002**	**79 469**	**75 609**	**72 845**	**68 235**	**69 864**	**69 260**	**74 036**	**68 245**	**63 934**	**71 777**	**67 187**	**63 766**	**60 840**	**61 217**	**56 248**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	CO_2 equivalent (Gg)																					
1. Energy	52 111	62 684	56 838	59 201	63 239	60 165	73 512	63 993	59 965	57 391	52 875	54 723	54 309	59 537	53 944	50 317	58 264	53 443	50 295	48 246	48 717	43 554
2. Industrial Processes	2 240	2 347	2 380	2 456	2 555	2 726	2 828	3 015	2 992	3 215	3 384	3 289	3 197	3 214	3 022	2 441	2 521	2 541	2 254	1 764	1 685	1 854
3. Solvent and Other Product Use	116	132	142	126	147	137	148	135	144	152	154	141	165	160	164	189	171	174	157	170	187	167
4. Agriculture	12 545	12 385	12 161	12 068	11 957	11 592	11 046	10 937	11 184	10 744	10 471	10 378	10 299	9 837	9 966	9 852	9 659	9 888	9 943	9 598	9 614	9 672
5. Land-use, Land-Use Change and Forestry (LULUCF)	5 473	3 995	6 235	2 788	4 394	3 649	2 256	3 624	2 523	4 121	3 218	4 552	6 033	4 769	4 401	4 695	5 662	2 570	-1 299	2 932	-474	-2 665
6. Waste	1 709	1 712	1 686	1 685	1 615	1 521	1 468	1 388	1 325	1 343	1 351	1 333	1 290	1 287	1 148	1 135	1 162	1 141	1 118	1 062	1 015	1 002
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)	**74 193**	**83 256**	**79 443**	**78 325**	**83 908**	**79 790**	**91 258**	**83 093**	**78 132**	**76 966**	**71 453**	**74 416**	**75 293**	**78 804**	**72 646**	**68 630**	**77 439**	**69 757**	**62 467**	**63 772**	**60 743**	**53 583**

FIGURE 3.6 DANISH GREENHOUSE GAS EMISSIONS BY SOURCE/SECTOR IN 1990 – 2011

Source: Nielsen et al., 2013



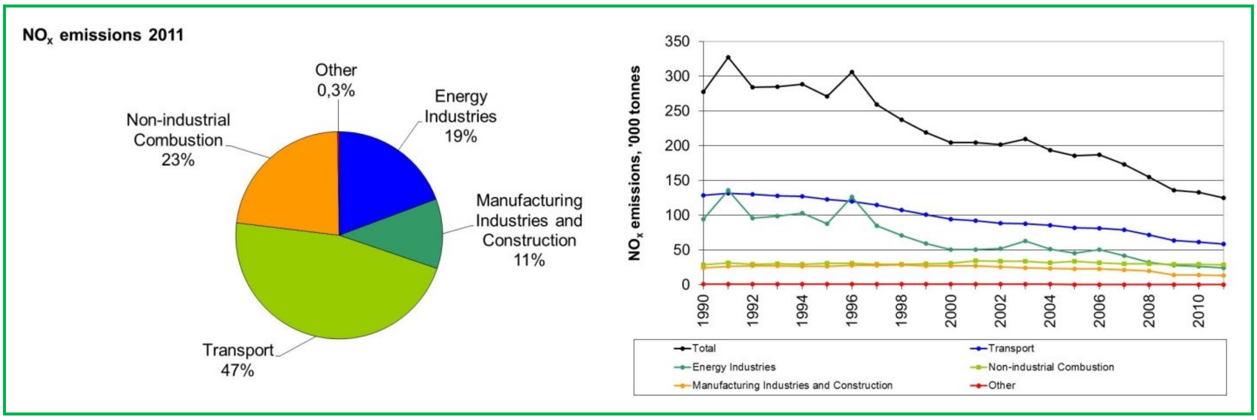
3.2.6 Danish emissions of indirect greenhouse gases and SO_2

NO_X

The three largest sources of emissions of nitrogen oxide (NO_x) are transport, power and district heating plants, and finally other mobile sources such as fishing vessels and agricultural vehicles. In 2011, the transport sector contributed 47% of total Danish NO_x emissions, which had fallen from 278,000 tonnes in 1990 to 125,000 tonnes in 2011 – a fall of 55%. The increased use of low-NO_x burners and de-NO_x units at power and district heating plants has reduced emissions from these plants. In addition, the increased number of cars fitted with catalytic converters has contributed to the trend in reductions.

FIGURE 3.7: NOX EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.

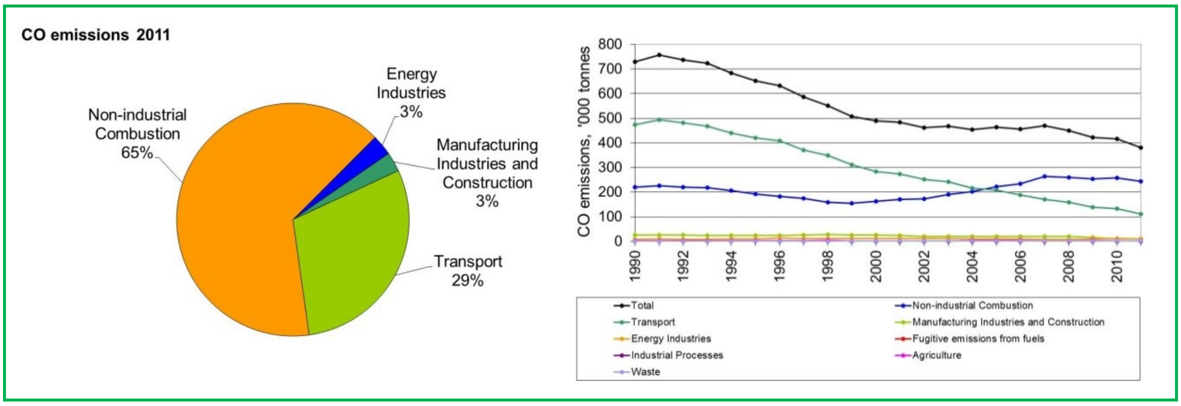


CO

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 48% from 1990 to 2011.

FIGURE 3.8: CO EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.

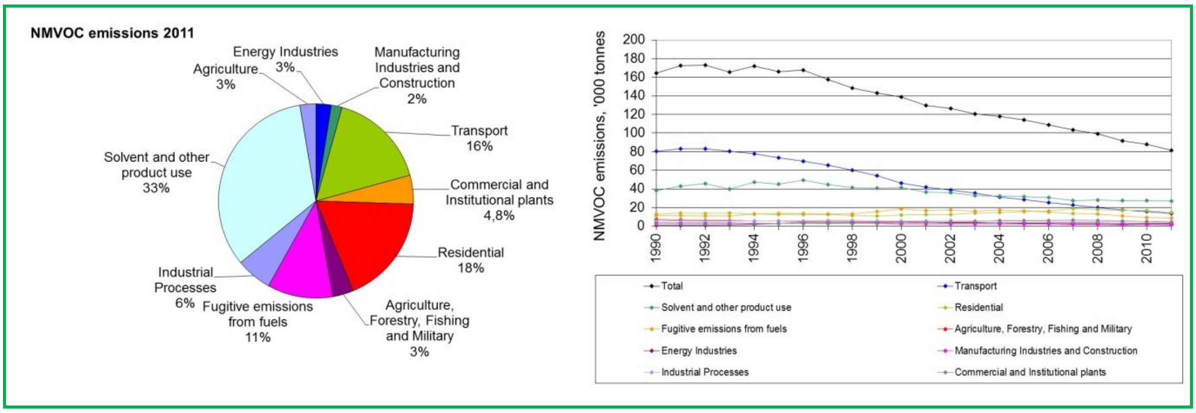


NMVOC

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 50% from 1990 to 2011 – especially due to the increased number of cars fitted with catalytic converters and reduced emissions in connection with use of organic solvents.

FIGURE 3.9: NMVOC EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.

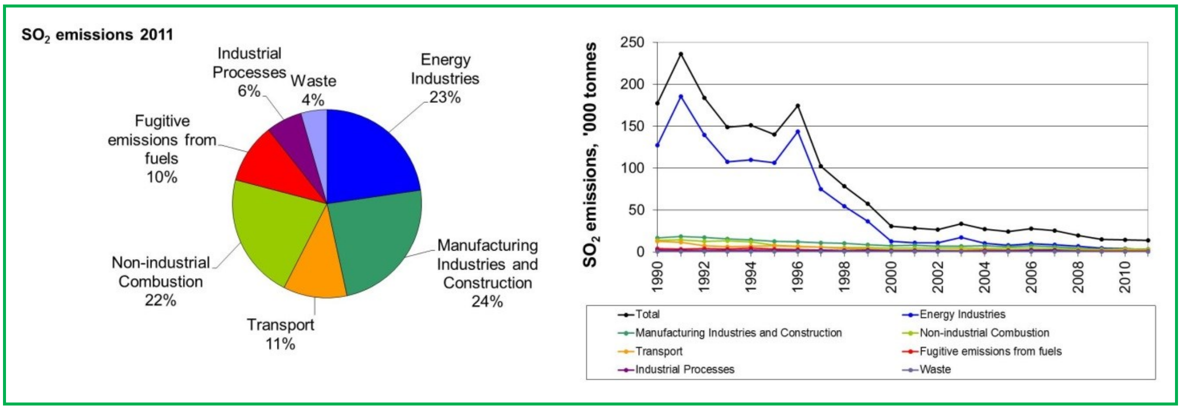


SO_2

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 2007 total emissions fell by 95%. 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.

FIGURE 3.10: SO2 EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.



3.3 NATIONAL SYSTEMS IN ACCORDANCE WITH ARTICLE 5, PARAGRAPH 1, OF THE PROTOCOL

This section contains information required under Article 7 of the Kyoto Protocol. The table given in Annex A2 allows identification of all the Kyoto Protocol elements that are allocated in different sections of this report.

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 Centre for Environment and Energy (DCE) is responsible for producing the Danish greenhouse gas emission inventories and the annual reporting to the UNFCCC and the DCE has been designated the single national entity under the Kyoto Protocol. The DCE is therefore the contact point for Denmark's national system for greenhouse gas inventories under the Kyoto Protocol. Furthermore, the DCE participates in work under the auspices of the UNFCCC, where guidelines for reporting are discussed and decided upon, and it participates 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 mentioned in Box 3.1. For more comprehensive information, please see Nielsen et al. (2013).

BOX 3.1 DCE'S PARTNERS IN THE WORK ON THE ANNUAL INVENTORIES

The Danish Energy Agency, the Danish Ministry of Climate, Energy and Building:
Annual energy statistics that are compatible with the format used for emission inventories, fuel consumption data for large incineration plants and plant data reported under the EU ETS.

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

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

Department of Animal Science, Aarhus University:
Data on use of fertiliser, fodder, and data on nitrogen emissions from livestock.

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

The National Centre for Forest, Landscape and Planning, Copenhagen University:
Background data for forests and emissions/ removals associated with forestry.

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

DSB (Danish Railways), the Danish Ministry of Transport:
Fuel-related emission factors for diesel locomotives.

Danish enterprises:
Environmental accounts and other information.

The partners mentioned in Box 3.1 provide a range of data that are needed to produce the inventory. The DCE therefore has formal agreements with many of the partners to ensure that the DCE receives the necessary data on time.

Calculation methods

The Danish emission 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 plant-specific, country-specific, default factors from the IPCC guidelines or values from international scientific literature.

Key categories

The choice of methodological tier for the individual categories depends among other things on the significance of the source. The categories that together accounted for 95% of greenhouse gas emissions in 2011 or accounted for 95% of the change in emission levels from the base year to the most recently calculated year (2011) are defined as key categories according to the IPCC guidelines. An analysis of the Danish Kyoto Protocol inventory shows that 22 sources account for 95% of total greenhouse gas emissions and that the three largest sources – that together account for 50% – are CO_2 emissions from the combustion of solid fuels at stationary combustion plants, CO_2 emissions from road transport and CO_2 emissions from combustion of natural gas at stationary combustion plants.

Procedure for recalculation

At the same time as the annual calculation of emissions for a new year are being made, 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, e.g. updated statistical data, improvements of methodologies, and updated emission factors due 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 and following the guidance in the IPCC good practice guidance.

Uncertainty

Uncertainty in the greenhouse gas inventories is calculated as recommended in the IPCC guidelines and covers 100% of the total Danish greenhouse gas (GHG) emissions reported under the Kyoto Protocol. The result of the calculations shows that total GHG emissions were calculated to have an uncertainty of 6.7% and the decrease in GHG emissions since 1990 was calculated to be -27.7% ± 2.9%. Uncertainty is greatest for N_2O emissions from stationary combustion and agricultural land and CH_4 emissions from enteric fermentation and solid waste disposal on land.

Quality assurance and quality control

As part of the national system, the DCE is drawing up a manual to use in quality assurance and quality control of the emission inventories. The manual is in accordance with the guidelines provided by the UNFCCC (IPCC, 1997), and the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000). The ISO 9000 standards are also used as important input for the plan.

Reports are written for all sources of emissions and these describe in detail and document the data and calculation methods used. These reports are evaluated by persons external to the DCE who are experts in the area in question, but not directly involved in the inventory work. In addition, a project has been completed 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.

For more detailed description of the QA/QC system, please see the Danish National Inventory Report (Nielsen et al., 2013).

Annual reporting

The DCE produces an annual report (National Inventory Report (NIR)[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. Over the years, improvements have been made regarding the quality and documentation of the greenhouse gas inventory 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 the following section.

Activities under Article 3.3 and 3.4 of the Kyoto Protocol

Under the Kyoto Protocol, Denmark and Greenland elected activities in Forest Management, Cropland Management and Grazing Land Management. The documentation for the methodologies used in estimating the emissions and removals from the elected activities are described in detail in the National Inventory Report (Nielsen et al., 2013). Documentation is provided in the NIR for both Denmark and Greenland in separate chapters as per recommendations received by Expert Review Teams during their annual reviews of the greenhouse gas inventory.

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

A number of improvements have been made to the Danish greenhouse gas emission inventories since Denmark's Fifth National Communication to the Climate Convention (NC5). The improvements have either been done on the initiative of the DCE, or as a result of external reviews of the inventories. The majority of improvements have been concerned with better documentation, i.e. improvements in transparency. Furthermore, overall focus in future will be on improving procedures for quality assurance and control and on improving documentation of the national emission factors.

Procedures for the official consideration and approval of the inventory

The complete emission inventories for the three different submissions (EU, Kyoto Protocol and UNFCCC) by Denmark are compiled by the DCE and they are submitted for official approval along with the documentation report (NIR). In recent years the body responsible for official approval has changed. Previously it was the Danish Environmental Protection Agency (Ministry of the Environment), now it is the Danish Energy Agency (Ministry of Climate, Energy and Building). This means that the emission inventory is finalised by no later than March 15, after which official approval is done prior to the reporting deadlines under the UNFCCC and the Kyoto Protocol.

3.4 National Registry

Background

Since NC5 was published, major changes have occurred regarding the National Registry. This chapter describes the National Registry as it has been operated since June 2012, when the EU ETS operations were centralized into a single European Union registry operated by the European Commission.

The ETS operates in 31 countries: the 28 EU Member States plus Iceland, Liechtenstein and Norway. It covers CO_2 emissions from installations such as power stations, combustion plants, oil refineries and iron and steel works, as well as factories making cement, glass, lime, bricks, ceramics, pulp, paper and board.

Directive 2009/29/EC, adopted in 2009, provides for the centralization of the EU ETS operations into a single European Union registry operated by the European Commission as well as for the inclusion of the aviation sector. At the same time, and with a view to increasing efficiency in the operations of their respective national registries, the EU Member States who are also Parties to the Kyoto Protocol plus Iceland, Liechtenstein and Norway decided to operate their registries in a consolidated manner in accordance with all relevant decisions applicable to the establishment of Party registries - in particular Decision 13/CMP.1 and Decision 24/CP.8.

Statutory basis

The National Allowances Registry (the Danish accounts in the EU ETS Registry as well as the Danish national KP Registry) is administered pursuant to Danish Act no. 1095 of 28 November 2012 on CO_2 Allowances. The Act implements EU Directive 2003/87/EC (EU ETS directive) as amended by EU Directive 2009/29/EC. Pursuant to sections 21 and 22 of the Act, the Danish Minister for Business and Growth is responsible for administering the Danish KP Registry as well as Danish accounts in the consolidated EU ETS Registry. In Executive Order no. 1357 of 17 December 2012, the Danish Minister for Business and Growth delegated the administration of the registries to the Danish Business Authority.

Executive Order no. 1180 of 11 October 2013 on Accounts in the EU ETS Registry and the Danish Kyoto Registry sets e.g. the applicable fees to be paid for accounts in the registries.

Organisation and operation of the Registry

With a view to complying with the new requirements of Commission Regulation 389/2013 and Commission Regulation 1193/2011, in addition to implementing the platform shared by the consolidating Parties, the registry of the EU has undergone a major re-development. The consolidated platform which implements the national registries in a consolidated manner (including the registry of EU) is called Consolidated System of EU Registries (CSEUR) and was developed together with the new EU Registry on the basis the following modalities:

(1) Each Party retains its organization designated as its registry administrator to maintain the national registry of that Party and remains responsible for all the obligations of Parties that are to be fulfilled through registries;

(2) Each Kyoto unit issued by the Parties in such a consolidated system is issued by one of the constituent Parties and continues to carry the Party of origin identifier in its unique serial number;

(3) Each Party retains its own set of national accounts as required by paragraph 21 of the Annex to Decision 15/CMP.1. Each account within a national registry keeps a unique account number comprising the identifier of the Party and a unique number within the Party where the account is maintained;

(4) Kyoto transactions continue to be forwarded to and checked by the UNFCCC Independent Transaction Log (ITL), which remains responsible for verifying the accuracy and validity of those transactions;

(5) The transaction log and registries continue to reconcile their data with each other in order to ensure data consistency and facilitate the automated checks of the ITL;

(6) The requirements of paragraphs 44 to 48 of the Annex to Decision 13/CMP.1 concerning making non-confidential information accessible to the public would be fulfilled by each Party individually;

(7) All registries reside on a consolidated IT platform sharing the same infrastructure technologies. The chosen architecture implements modalities to ensure that the consolidated national registries are uniquely identifiable, protected and distinguishable from each other, notably:

   (a) With regards to the data exchange, each national registry connects to the ITL directly and establishes a distinct and secure communication link through a consolidated communication channel (VPN tunnel);

   (b) The ITL remains responsible for authenticating the national registries and takes the full and final record of all transactions involving Kyoto units and other administrative processes such that those actions cannot be disputed or repudiated;

   (c) With regards to the data storage, the consolidated platform continues to guarantee that data is kept confidential and protected against unauthorized manipulation;

   (d) The data storage architecture also ensures that the data pertaining to a national registry are distinguishable and uniquely identifiable from the data pertaining to other consolidated national registries;

   (e) In addition, each consolidated national registry keeps a distinct user access entry point (URL) and a distinct set of authorisation and configuration rules.

Following the successful implementation of the CSEUR platform, the 28 national registries concerned were re-certified in June 2012 and switched over to their new national registry on 20 June 2012. During the go-live process, all relevant transaction and holdings data were migrated to the CSEUR platform and the individual connections to and from the ITL were re-established for each Party.

Administrative set-up

As of 1 August 2012, the administration of the Danish national registry and, thus, the role as registry administrator was moved from the Danish Energy Agency under the Danish Ministry of Climate, Energy and Building to the Danish Business Authority under the Danish Ministry of Business and Growth following a Royal Decree reorganizing responsibilities between ministers in the Danish government.

Users can contact the Danish Business Authority directly by phone or email for help in using the Registry.

Businesses and users of the Registry are kept informed about regulations, news etc. through regular updates from the Danish Business Authority's website, the news on the Registry website and a newsletter from the Registry staff. The newsletter is issued quarterly or as required and informs about new regulations and opportunities as well as any planned temporary closures (for updates etc.).

Registry software

The Danish Business Authority is using the common software developed by the European Commission. Further information on the National Registry is in Annex A3.

3.5 Denmark's and Greenland's base year emissions, assigned amount and greenhouse gas inventories under the Kyoto Protocol

As mentioned above, the GHG inventory of the Kingdom of Denmark under the Kyoto Protocol covers Denmark and Greenland. Denmark is part of the European Union while Greenland is not.

As Denmark is part of the European Union, of which 15 Member States will meet their reduction commitment jointly in accordance with Article 4 of the Kyoto Protocol, Denmark's quantified emission limitation for the 1st commitment period 2008-2012 under the Protocol is 79%. The quantified emission limitation for Greenland is 92% because Greenland is not part of the European Union. Denmark's assigned amount is calculated based on the Article 4 commitment. Greenland's assigned amount is based on 92%.

As reported in 2006 in the initial report under the Kyoto Protocol, Denmark's and Greenland's base year emissions (excluding LULUCF) were estimated at 69,323.34 Gg CO_2 equivalents and 654.73 Gg CO_2 equivalents, respectively.

On the basis of total base year emissions estimated at 69,978,070 tonnes, the initial review report concluded in 2007 that the total assigned amount for Denmark and Greenland for the period 2008-2012 is 276,838,955 tonnes CO_2 equivalents. This is shown in Table 3.3 together with the calculated minimum holding of 249,155,060 tonnes CO_2 equivalents in the National Registry – the so-called commitment period reserve.

TABLE 3.3 DENMARK'S AND GREENLAND'S BASE YEAR EMISSIONS AND ASSIGNED AMOUNT FOR 2008-2012 UNDER THE KYOTO PROTOCOL

Source: The Kingdom of Denmark's initial report on assigned amount, 2006, the UNFCCC's report of the review of the initial report of Denmark, 2007 and Nielsen et al., 2013.

Tonnes CO_2 equivalents	**Denmark under the EU**	**Greenland**	**Denmark and Greenland**
CO_2 (1990)*	52,712,457	629,996	53,342,453
CH_4 (1990)	5,692,000	16,155	5,708,155
N_2O (1990)*	10,593,311	8,523	10,601,834
HFCs (1995)	217,728	25	217,753
PFCs (1995)	502	0	502
SF_6 (1995)	107,338	36	107,374
Base year	**69,323,336**	**654,734**	**69,978,070**
Annual Assigned Amount in %	79%	92%	DK79%+GR92%
Annual Assigned Amount in tonnes	54,765,435	602,356	55,367,791
Total Assigned Amount 2008-12	**273,827,177**	**3,011,778**	**276,838,955**
a. 90% of AA	246,444,459	2,710,600	249,155,060
Most recently reviewed inventory (2010)*	61,065,429	715,368	61,780,797
b. Times 5 (100%)	305,327,144	3,576,839	308,903,983
Most recently inventory (2011)*	56,248,450	762,618	57,011,068
c. Times 5 (100%)	281,242,252	3,813,088	285,055,340
CPR (lowest of a and b *or c*)	**246,444,459**	**2,710,600**	**249,155,060**

* without LULUCF

In Table 3.4, the combined greenhouse gas emissions of Denmark and Greenland are shown.

TABLE 3.4 DENMARK'S AND GREENLAND'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES, 1990 - 2011

Source: Nielsen et al., 2013.

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	CO_2 equivalent (Gg)																					
CO_2 emissions including LULUCF	58 934	68 139	64 648	63 461	69 015	65 101	77 099	69 141	63 924	62 925	57 610	60 704	61 762	65 649	59 799	56 454	65 387	57 518	50 244	51 971	49 003	41 938
CO_2 emissions excluding LULUCF	53 478	64 159	58 428	60 688	64 637	61 467	74 857	65 532	61 414	58 817	54 406	56 165	55 742	60 893	55 411	51 771	59 737	54 960	51 555	49 051	49 489	44 615
CH_4 emissions including LULUCF	6 051	6 118	6 117	6 212	6 107	6 144	6 187	6 027	6 012	5 897	5 894	5 997	5 913	5 892	5 736	5 664	5 673	5 674	5 632	5 540	5 601	5 506
CH_4 emissions excluding LULUCF	6 050	6 118	6 117	6 212	6 107	6 144	6 187	6 027	6 012	5 897	5 894	5 997	5 913	5 892	5 735	5 664	5 673	5 674	5 632	5 540	5 601	5 506
N_2O emissions including LULUCF	9 823	9 581	9 219	9 035	9 057	8 788	8 213	8 177	8 351	8 193	7 968	7 666	7 509	7 197	6 981	6 352	6 201	6 356	6 408	6 036	5 994	6 053
N_2O emissions excluding LULUCF	9 807	9 565	9 203	9 020	9 042	8 773	8 198	8 162	8 336	8 179	7 953	7 652	7 495	7 183	6 967	6 339	6 188	6 343	6 395	6 023	5 981	6 041
HFCs	NE,NO	NE,NO	NE,NO	94	135	218	329	324	412	505	609	653	680	705	761	808	829	856	859	805	811	766
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	0	1	2	4	9	12	18	22	22	19	16	14	16	15	13	14	13	11
SF_6	44	64	89	101	122	107	61	73	59	65	59	30	25	31	33	22	36	30	32	37	38	73
Total (including LULUCF)	**74 853**	**83 901**	**80 072**	**78 904**	**84 436**	**80 359**	**91 890**	**83 747**	**78 766**	**77 598**	**72 158**	**75 072**	**75 911**	**79 494**	**73 325**	**69 313**	**78 141**	**70 450**	**63 188**	**64 402**	**61 461**	**54 347**
Total (excluding LULUCF)	**69 379**	**79 905**	**73 837**	**76 115**	**80 042**	**76 709**	**89 634**	**80 123**	**76 242**	**73 477**	**68 940**	**70 520**	**69 878**	**74 725**	**68 923**	**64 617**	**72 478**	**67 879**	**64 486**	**61 470**	**61 934**	**57 011**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	CO_2 equivalent (Gg)																					
1. Energy	52 737	63 295	57 435	59 747	63 735	60 700	74 109	64 611	60 562	57 986	53 544	55 342	54 889	60 188	54 583	50 960	58 925	54 095	50 972	48 838	49 394	44 279
2. Industrial Processes	2 240	2 347	2 380	2 456	2 555	2 726	2 828	3 016	2 992	3 217	3 386	3 292	3 201	3 219	3 028	2 446	2 526	2 547	2 261	1 771	1 691	1 861
3. Solvent and Other Product Use	116	133	143	126	148	137	148	135	144	152	154	141	165	160	165	190	171	174	157	170	188	167
4. Agriculture	12 554	12 394	12 169	12 075	11 965	11 600	11 055	10 947	11 194	10 753	10 480	10 387	10 307	9 846	9 976	9 862	9 669	9 897	9 954	9 607	9 623	9 681
5. Land-use, Land-Use Change and Forestry (LULUCF)	5 473	3 996	6 235	2 789	4 394	3 650	2 256	3 624	2 524	4 122	3 218	4 553	6 033	4 769	4 402	4 696	5 663	2 571	-1 298	2 932	-473	-2 664
6. Waste	1 733	1 736	1 711	1 710	1 640	1 546	1 494	1 414	1 350	1 368	1 376	1 358	1 315	1 312	1 173	1 160	1 187	1 166	1 143	1 084	1 037	1 024
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)	**74 853**	**83 901**	**80 072**	**78 904**	**84 436**	**80 359**	**91 890**	**83 747**	**78 766**	**77 598**	**72 158**	**75 072**	**75 911**	**79 494**	**73 325**	**69 313**	**78 141**	**70 450**	**63 188**	**64 402**	**61 461**	**54 347**

3.6 TRENDS IN DANISH GREENHOUSE GAS EMISSIONS IN THE EU TERRITORY FROM THE BASE YEAR UNDER THE KYOTO PROTOCOL

The developments in Danish emissions and removals of greenhouse gases in the EU territory (i.e. excluding Greenland and Faroe Islands) from the base year under the Kyoto Protocol to 2011 (the most recent inventory year), as they are to be inventoried under the Kyoto Protocol, are shown in Table 3.5 together with a preliminary estimate for 2012.

TABLE 3.5 DANISH EMISSIONS OF GREENHOUSE GASES IN THE EU TERRITORY INVENTORIED ACCORDING TO REGULATIONS UNDER THE KYOTO PROTOCOL

Source: The UNFCCC's Report of the review of the initial report of Denmark, 2007 (base year), Nielsen et al., 2013 (1990-2011), the 2012 preliminary estimate is based on the preliminary energy statistics for 2012 by the Danish Energy Agency and DCE assumptions.

	Base year[1]	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Million tonnes of CO_2 equivalents	69.3	68.7	79.3	73.2	75.5	79.5	76.1	89.0	79.5	75.6	72.8	68.2
Index (base year=100)	100	99	114	106	109	115	110	128	115	109	105	98
Continued	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Million tonnes of CO_2 equivalents	69.9	69.3	74.0	68.2	63.9	71.8	67.2	63.8	60.8	61.2	56.2	*51.4*
Index (base year=100)	101	100	107	98	92	104	97	92	88	88	81	*74*

[1] In accordance with the Kyoto Protocol, the base year is composed of emissions of CO_2, methane and nitrous oxide in 1990 and emissions of so-called industrial greenhouse gases in 1995.

The relatively great variations in previous total emissions of greenhouse gases are especially due to variations in Denmark's exchange of electricity with neighbouring countries. Furthermore, emissions of CO_2 from energy consumption vary considerably from year to year, depending on winter temperatures.

In order to facilitate the assessment of developments in CO_2 emissions associated with Denmark's own energy consumption in normal winters, the figures are shown in Table 3.6 with corrections made for exchange of electricity and variations in temperature. As can be seen from this table, there has been a 25% drop from the base year to 2011. The preliminary estimate for 2012 suggests a further 3 percentage point drop.

TABLE 3.6 DENMARK'S GREENHOUSE GAS EMISSIONS CORRECTED FOR INTER-ANNUAL VARIATIONS IN TEMPERATURES AND EXCHANGE OF ELECTRICITY

Source: As in Table 3.4 but with the Danish Energy Agency's corrections of CO_2 emissions for degree days and net electricity imports applied.

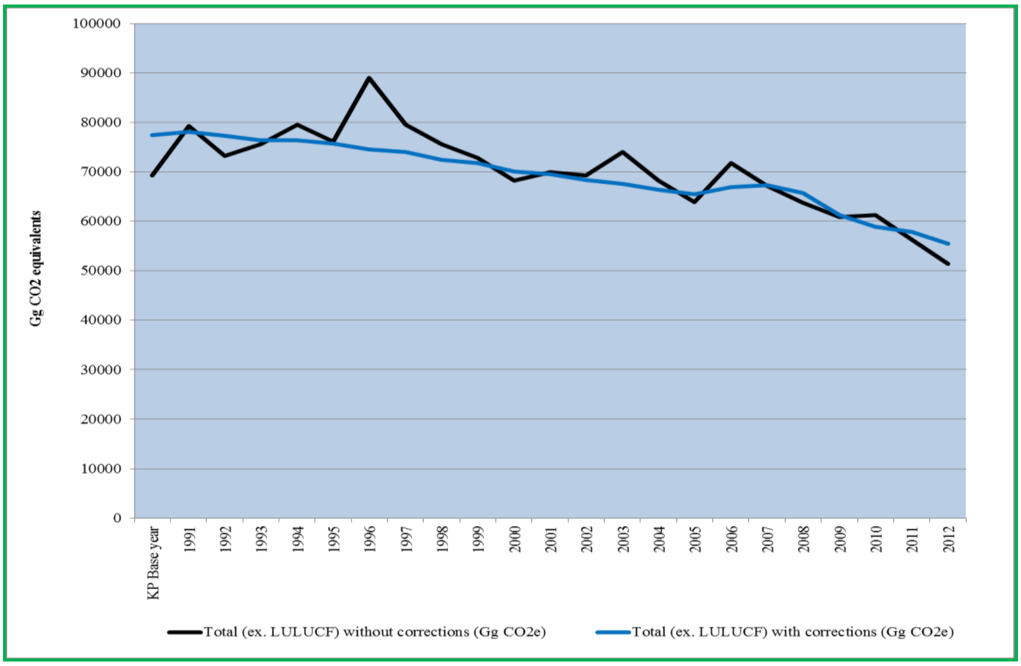
	Base year[1]	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Million tonnes of CO_2 equivalents	77.4	76.8	78.0	77.3	76.4	76.4	75.7	74.5	73.9	72.4	71.7	70.0
Index (base year=100)	100	99	101	100	99	99	98	96	96	94	93	90
Continued	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Million tonnes of CO_2 equivalents	69.5	68.4	67.5	66.4	65.5	66.9	67.3	65.7	61.3	58.8	57.8	*55.5*
Index (base year=100)	90	88	87	86	85	86	87	85	79	76	75	*72*

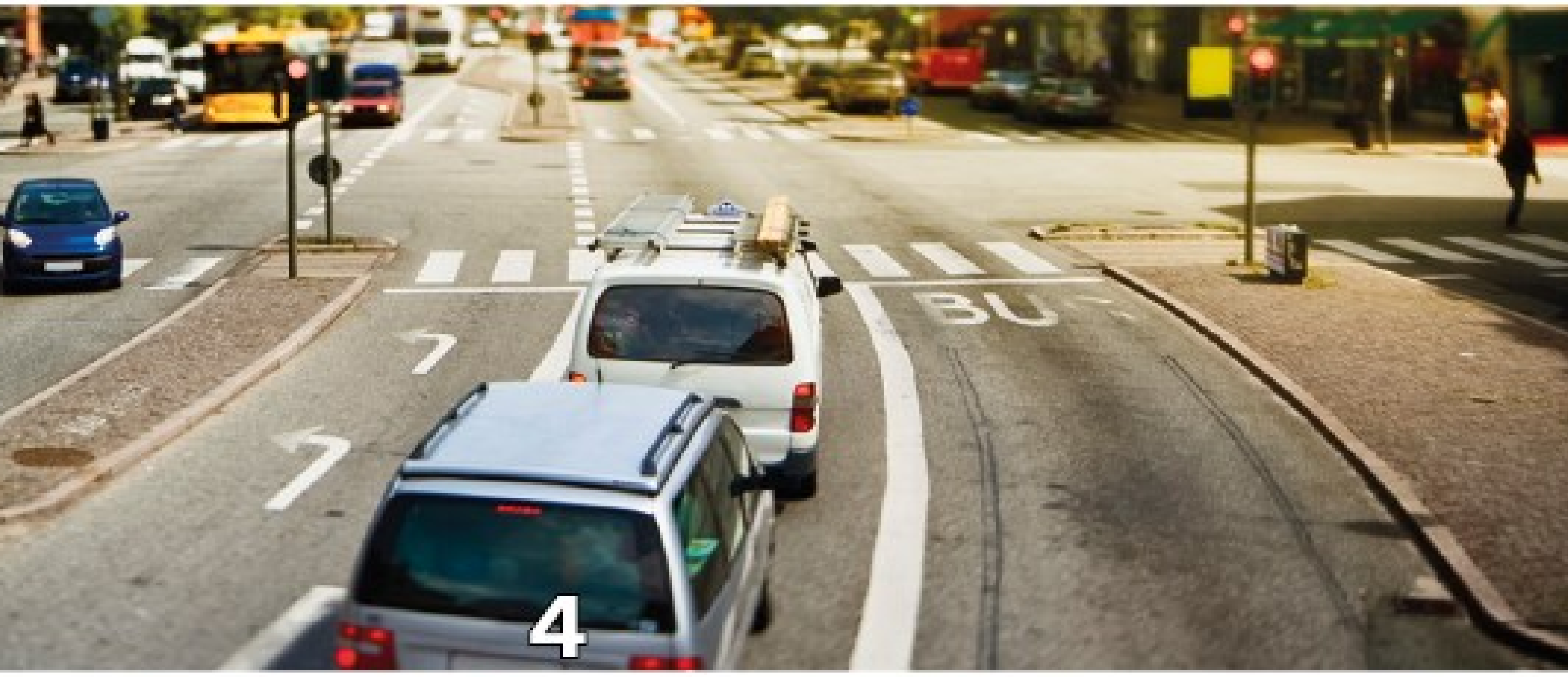
[1] The base year is composed of emissions of CO_2, methane and nitrous oxide in 1990 and emissions of so-called industrial greenhouse gases in 1995. Since Denmark's legal commitments under the Kyoto Protocol is to be seen in relation to figures without corrections, the figures in the table can only be used to illustrate the effects of measures taken to limit CO_2 emissions associated with Denmark's own energy consumption.

The effects of inter-annual variations in temperatures and exchange of electricity are illustrated in Figure 3.11.

FIGURE 3.11: DENMARK'S GREENHOUSE GAS EMISSIONS 1990-2012 WITHOUT AND WITH CORRECTIONS FOR INTER-ANNUAL VARIATIONS IN TEMPERATURES AND EXCHANGE OF ELECTRICITY

Source: The UNFCCC's Report of the review of the initial report of Denmark, 2007 (base year), Nielsen et al., 2013 (1990-2011), the 2012 preliminary estimate is based on the preliminary energy statistics for 2012 by the Danish Energy Agency and DCE assumptions and with corrections of CO_2 emissions for degree days and net electricity imports and the preliminary estimate for 2012 from the Danish Energy Agency.





4

Policies and measures

- including those in accordance with Article 2 of the Kyoto Protocol, and domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures

4 Policies and measures

- including those in accordance with Article 2 of the Kyoto Protocol, and domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures

4.1 Climate policy and the policy-making process

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, and in line with international climate policy, and results from related scientific research.

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

Some of the measures have been implemented with reduction of greenhouse gas emissions as the main objective, others 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 also been on efforts to reduce emissions and meet the international greenhouse gas emission reduction targets for 2008-2012 under the Kyoto Protocol and the EU Burden Sharing.

In 2011, focus shifted to meeting the international and domestic targets for 2013-2020 and 2020 and the government’s long-term target for 2050: All energy supply to be covered by renewable energy by 2050.

Denmark’s international climate targets are described in Box 4.1.

The following sections contain more information about the Danish government’s Government Platform from October 2011, the energy plan, “Our Future Energy”, from November 2011, the Energy Agreement from March 2012 and the Danish Climate Policy Plan, “Towards a low carbon society”, from August 2013.

This is followed by sector by sector descriptions of Denmark’s climate policies and measures.

BOX 4.1 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 for total emissions excluding the land-use sector (LULUCF). Due to windfalls total emissions including LULUCF brought the Realm to within 1% of the target.
- As a contribution to stabilisation in the EU, Denmark committed itself to reducing CO_2 emissions in 2000 by 5% compared to the adjusted 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 base year; 1990 for CO_2, methane, and nitrous oxide and either 1990 or 1995 for industrial greenhouse gases. As stated in section 3.5, Denmark has committed itself to a reduction of 21% as an element of the burden-sharing agreement within the EU.
- In relation to the period after 2012, the EU reached an agreement in December 2008 on a climate and energy package and on a regulation on CO_2 from new vehicles. According to this package the EU is committed to reducing its overall emissions to at least 20% below 1990 levels by 2020, and is ready to scale up this reduction to as much as 30% under a new global climate change agreement when other developed countries make comparable efforts. Under burden sharing for this EU target, Denmark is committed to a reduction in non-ETS emissions in the period 2013-2020, rising to 20% by 2020 relative to 2005. The EU is also committed to reducing its ETS emissions to 21% below 2005 levels by 2020, where the final decision on the free allocation under the ETS is expected to be taken in 2013. The EU has also set itself the target of increasing the share of renewables in energy use to 20% by 2020. Under burden sharing for this EU target, Denmark is committed to reaching a 30% share of renewables by 2020.

4.1.1 National action plans

In 1988 the government 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 into 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 the environment is an integral element. The sector action plans deal with the entire development in a sector combined with solutions to environmental problems caused by the sector. The sector plans for energy, transport, forestry, agriculture, the 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 developments within the area in question have 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)
- 1st National Allocation Plan 2005-2007 under the EU-ETS (2004)
- Energy Strategy 2025 (2005)
- Action Plan for Strengthened Energy-saving Efforts (2005)
- 2nd National Allocation Plan 2008-2012 under the EU-ETS (2007)
- Political agreement on Energy (2008)
- Political agreement on a Green Transport Vision for Denmark (2009)
- Political agreement on a Tax Reform (2009)
- Growth with Consideration – the government’s strategy for sustainable development (2009)
- Strategy for reducing energy consumption in buildings (2009)
- Political agreement on a Green Growth Plan (2009)
- Waste Strategy 2009-2012 – Part I (2009)
- Waste Strategy 2009-2012 – Part II (2010)

- Energy Strategy 2050 (2011)
- Our Future Energy (2011)
- Political Agreement on Energy (2012)
- The Danish Climate Policy Plan – Towards a low carbon society (2013)

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. 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 through the EU emissions trading scheme (EU ETS) has been the key instrument to ensuring that the Danish energy sector can contribute to the reductions requisite to fulfilling Denmark's climate commitments.

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. 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 nitrogen emissions from the agricultural sector, which is the result of the aquatic environment plans, is at the same time reducing 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 on-going 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 sectors. The initiatives in the energy sector have resulted in reduced energy consumption despite significant economic growth and, with that, reduced CO_2 emissions.

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 Policy

4.1.2.1 The 2011 Government Platform

In October 2011, the new Danish government stated in its Government Platform that climate challenge must be taken seriously and at the same time used as a lever for innovation, job creation, increased exports of green technologies, upgrading the skills of the workforce and involvement of local authorities and citizens in the transformation. The government also highlighted that reducing greenhouse gas emissions will reduce other forms of air pollution significantly, since a large proportion of air pollution, including NO_x and particles, comes from burning fossil fuels.

As stated in the Government Platform, this means that ambitious targets for climate and energy policy in Denmark have to be set:

- All energy supply to be covered by renewable energy by 2050. Electricity and heat supply to be covered by renewable energy already by 2035. Coal to be phased out from Danish power plants and domestic oil furnaces to be phased out by 2030.
- Denmark's emissions of greenhouse gases in 2020 to be reduced by 40% compared to 1990 levels.
- Half of Denmark's traditional electricity consumption to come from wind by 2020.
- Development of a comprehensive new strategy for the creation of smart grids in Denmark.
- Increase in research and development funding for climate and green energy technologies.
- In the EU, the government will work to establish binding targets for greenhouse gases, energy savings and renewable energy for the period after 2020 period. Furthermore Denmark will support increasing the EU's CO_2 emissions reduction target in 2020 from 20% to 30%.
- Internationally Denmark will work actively for an ambitious and binding international climate agreement, and ensure that Denmark meets its share of responsibility regarding emission reductions, technology transfer and climate financing.
- The government will put forward a proposal for a Climate Act - inspired by the British and Scottish Climate Act.

A broad effort is required to meet these goals. This includes energy, transport and agriculture. The Danish government will ensure that the necessary initiatives are taken in the future by integrating climate change mitigation measures into different sector policies. Often, the most socio-economically beneficial reductions can be achieved with mitigation measures that have synergy effects with other policy goals and priorities. Therefore, it is generally most cost effective to integrate climate change mitigation across other policy areas.

The government will focus on financing of the expected losses in tax revenues as a result of phasing out of coal, oil and gas, reduced energy consumption, etc. This will be through tax measures as also suggested in previous government's Energy Strategy 2050. A large proportion of the expansion of renewable energy will be financed as today, through PSO and similar schemes.

In the follow-up on strengthening EU climate policies, and in response to the Commission's *Green Paper on a 2030 Framework for Climate and Energy Policies,* in June 2013 the government, supported the Commission's proposals for:

- A binding target to reduce domestic EU greenhouse gas emissions by 40% in 2030 compared with 1990.
- A binding renewable energy target of 30% in 2030.
- An energy efficiency target for 2030 in light of the evaluation in 2014 of the Energy Efficiency Directive. This target should also be binding.

In parallel to the need to agree on targets for 2030, the government also think that the EU's greenhouse gas reduction target in 2020 should be increased unilaterally from 20% to 30% compared with 1990 and that the European Emission Trading Scheme (ETS) should be permanently strengthened by deciding on a structural reform that is considered necessary to restore the credibility of the ETS as the main instrument in EU climate change policy to enable the green transition.

The government's proposal for a Climate Act is expected to be put forward in the first half of 2014.

4.1.2.2 The 2011 energy plan "Our Future Energy"

In November 2011, the current government published its energy plan "Our Future Energy". The plan outlines steps up to 2020 underpinning the broader ambition to help Denmark convert to 100% renewable energy use by 2050.

A number of policy proposals in the plan were similar to the previous government's Energy Strategy 2050, though the overall level of ambition was raised.

The long-term goal of the plan is to convert the energy and transport sectors to rely solely on renewable energy sources. By 2020, the concrete policy proposals outlined in the plan will lead to extensive reductions in energy consumption, making it possible for half of Denmark's electricity consumption to be covered by wind power. Coal is to be phased out of Danish power plants by 2030, and by 2035, all electricity and heating will be generated using renewable sources.

On the basis of this plan, in March 2012 the government reached an Energy Agreement with all Parties but one in the Danish Parliament on how a selection of proposed elements in the plan are to be turned into concrete actions in the period 2012-2020. The content of the Energy Agreement is described in the following section.

4.1.2.3 The 2012 agreement on Danish energy policy 2012-2020

As a follow-up on the 2011 energy plan and the elements in the government Platform mentioned above, the government reached a political agreement on 22 March 2012 on Danish energy policy for the years 2012-2020.

The elements in the 2012 Energy Agreement are described in greater detail below.

The most ambitious energy plan in the world

The 2012 Energy Agreement contains a wide range of ambitious initiatives, bringing Denmark a good step closer to the target of 100% renewables in the energy and transport sectors by 2050.

The Agreement will lead to large investments up to 2020 in energy efficiency, renewable energy and the energy system. Results in 2020 include approximately 50% of electricity consumption supplied by wind power, and more than 35% of final energy consumption supplied from renewable energy sources.

Denmark in 2020 – results of the Energy Agreement

The long-term goal for Danish energy policy is that the entire energy supply – electricity, heating, industry and transport – is to be covered by renewable energy by 2050.

Only by improving energy efficiency, electrifying Danish energy consumption, and expanding supply from renewables, will it be possible to phase out fossil fuels completely. The initiatives in Denmark's Energy Agreement for the period 2012–2020 cover these crucial areas.

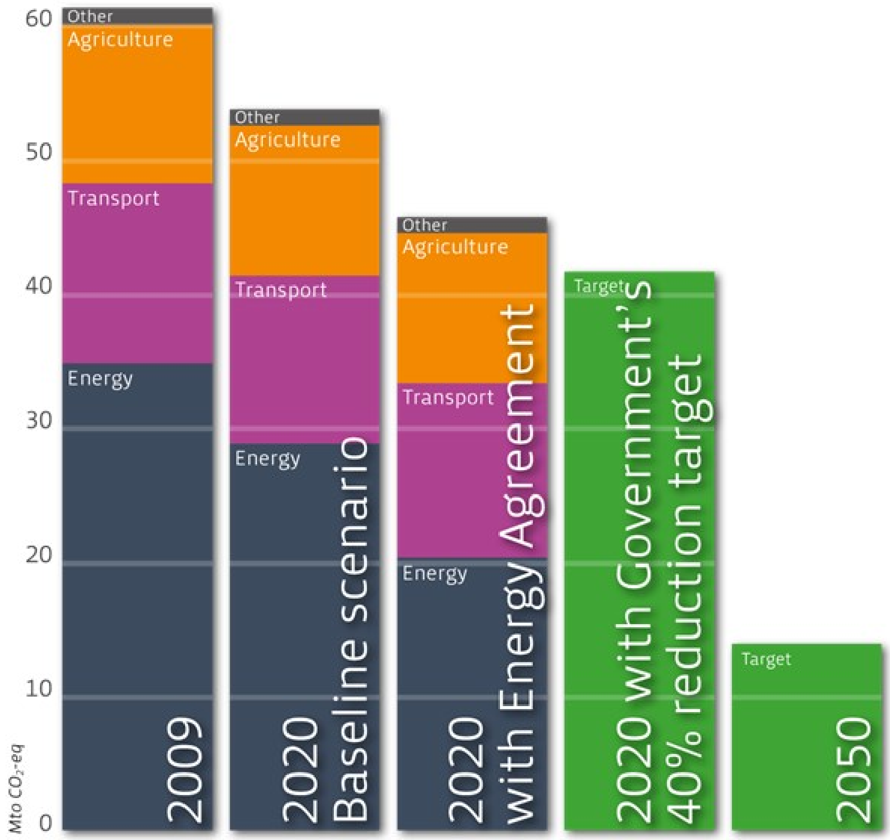
These are the headline results for 2020:

- More than 35% renewable energy in final energy consumption.
- Approximately 70% of electricity consumption to be supplied by renewable energy sources in total and about 50% of electricity consumption to be supplied by wind power.
- Approximately 8% reduction in gross energy consumption in relation to 2010.
- 34% reduction in greenhouse gas emissions in relation to 1990.

Consequently, in 2020 Danish enterprises and households will be significantly less dependent on scarce and expensive fossil fuels.

FIGURE 4.1: TOTAL DANISH GREENHOUSE GAS EMISSIONS (WITHOUT LULUCF) IN MILLION TONNES CO2-EQUIVALENT IN 2009 AND 2020* AND DOMESTIC TARGETS IN 2020 AND 2050

Source: Ministry of Climate, Energy and Building



* The April 2011 Baseline scenario.

A more energy efficient Denmark

A crucial element in the transition to 100% renewable energy will be that Denmark uses less energy by switching to more energy efficient technologies. Otherwise, economic growth will push up energy consumption and make it disproportionally expensive to expand the share of renewables in the energy supply. Moreover, investment in more energy efficient technology will often quickly pay itself back.

It is important to invest in retrofitting buildings. Extensive retrofitting is only carried out a few times in the life span of a building.

Initiatives to make energy consumption more efficient:

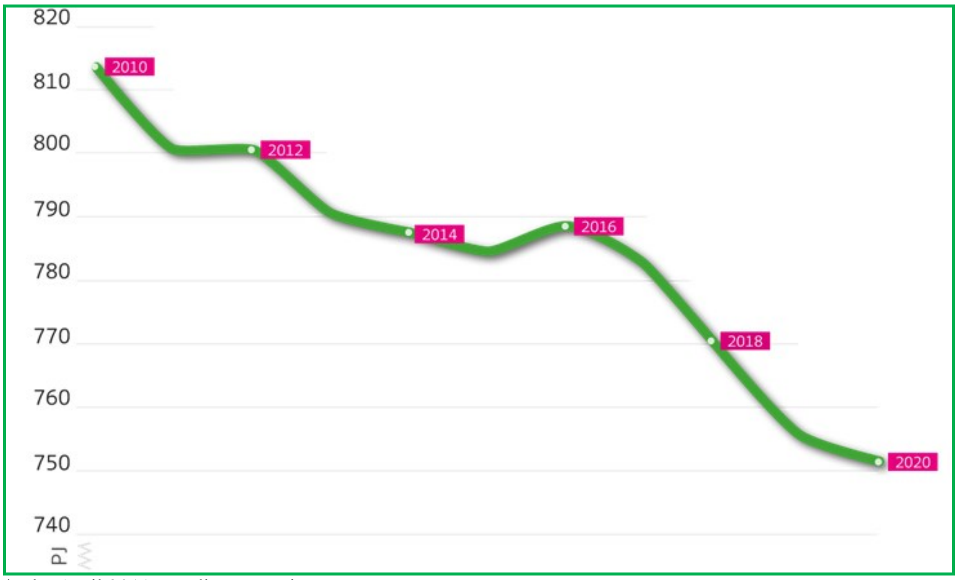
- In 2013 and 2014, energy savings realised by energy companies have to increase by 2.6% of final energy consumption excl. transport compared to the 2010 level. From 2015 to 2020 this figure will rise to an annual 2.9% compared to the level in 2010. In comparison, the EU's Energy Efficiency Directive suggests a yearly reduction up to 2020 of 1.5% of 2010 final energy consumption excl. transport. Energy companies are obliged to realise energy savings in enterprises and households by offering subsidies or consultancy, for example. The initiatives will target industry and buildings.

- A comprehensive strategy for energy retrofitting of all Danish buildings will be presented in 2013.
- The efforts by the Knowledge Centre for Energy Savings in Buildings will continue.

As a result of these and other initiatives, Danish gross energy consumption will decrease by approximately 8% in 2020 in relation to 2010.

FIGURE 4.2: DEVELOPMENT IN GROSS ENERGY CONSUMPTION (PJ) 2010-2020*

Source: Ministry of Climate, Energy and Building



* The April 2011 Baseline scenario.

Wind power and new energy technologies

Denmark has sufficient renewable energy resources to satisfy energy consumption in the long term. The Energy Agreement ensures a substantial expansion of wind power in particular, corresponding to the annual electricity consumption of 1½ million households. Consequently, approximately 50% of Danish electricity consumption is expected to be covered by wind power in 2020. In comparison, the share was 2% in 1990 and 28% in 2011.

Initiatives to expand renewable energy production:

- 600 MW offshore wind turbines at Kriegers Flak and 400 MW offshore wind turbines at Horns Rev.
- 500 MW offshore wind turbines in coastal areas.
- New planning tools will encourage an increase in net capacity of 500 MW onshore wind power. This will entail increasing electricity production from onshore turbines, despite the decommissioning of older turbines.

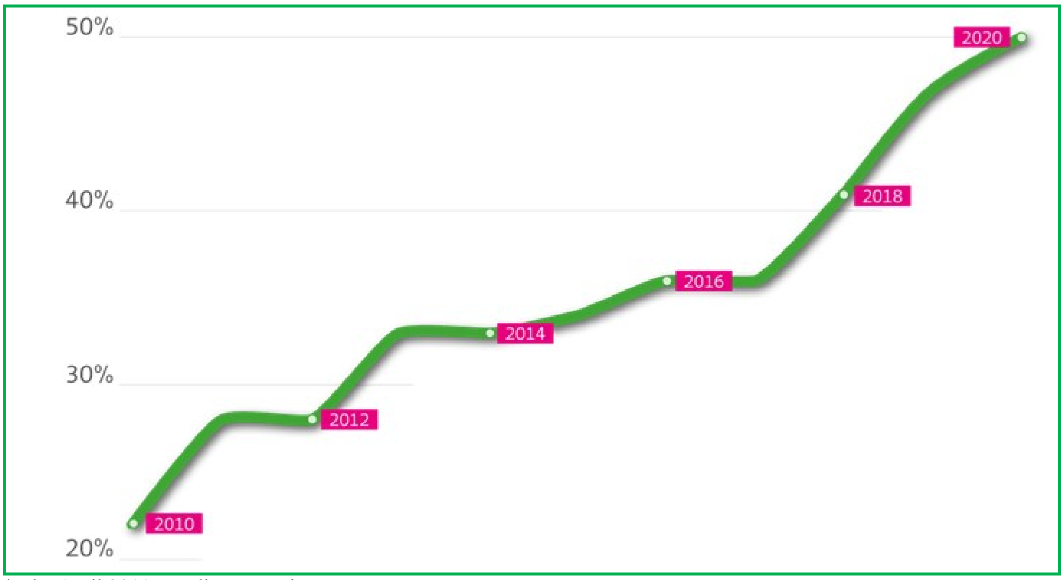
In order to transform the energy system intelligently and cost-effectively, continuous research, development and testing of new technological solutions is needed. Initiatives include:

- DKK 60 million has been committed to funding the development and use of new renewable energy technologies for electricity production (solar, wave power, etc.)
- DKK 35 million has been committed to funding the development and use of new renewable energy technologies in district heating (large heat pumps, geothermal energy, etc.)
- DKK 9.5 million has been committed to the project to make the island of Samsø independent of fossil fuels.

The parties behind the Energy Agreement stress that efforts to uphold a high level of research, development and demonstration in green energy technology in areas with commercial and growth potential should be maintained. Investing in new green technologies contributes to building Denmark's future prosperity.

FIGURE 4.3: SHARE OF WIND POWER IN ELECTRICITY CONSUMPTION 2010-2020*

Source: Ministry of Climate, Energy and Building



* The April 2011 Baseline scenario.

Renewable energy in industry, buildings and transport

Consumption by industrial processes is also to be converted to renewable energy. Therefore, the Energy Agreement has laid down the following:

- A new green business scheme of DKK 250 million in 2013 and DKK 500 million per year from 2014 to 2020 will promote the efficient use of renewable energy in enterprises.
- DKK 30 million per year from 2013 to 2020 has been committed to maintaining and promoting industrial CHP in industry and greenhouses.

The Energy Agreement contains a number of initiatives which will reduce individual heating based on oil and gas in buildings substantially and promote renewable alternatives:

- A halt to installation of oil-fired and gas-fired boilers in new buildings from 2013
- A halt to installation of oil-fired boilers in existing buildings from 2016 in areas with district heating or natural gas
- DKK 42 million has been committed to fund the conversion from oil-fired and gas-fired boilers in existing buildings to renewable alternatives (solar, heat pumps, etc.)
- A comprehensive analysis of the future alternative use of the gas infrastructure will be presented in 2013.

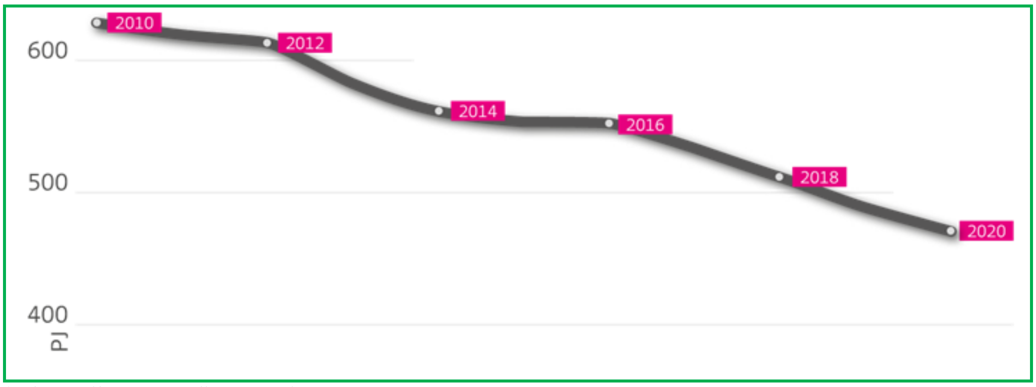
Today, the Danish transport sector runs almost entirely on fossil fuels. Conversion to renewable energy in transport is a tremendous challenge. In the longer term, electric cars will be important. In the short term biofuels will play a role. Initiatives to promote the green transition in the transport sector are:

- DKK 70 million to establish more recharging stations for electric cars and to promote the infrastructure for hydrogen cars, etc.
- A strategy for the promotion of energy efficient vehicles.
- Fuels must contain 10% biofuels in 2020.
- DKK 15 million to continue the pilot scheme for electric cars.

As a result of the initiatives in the Energy Agreement, Denmark's total use of oil, coal and gas is expected to be reduced by approximately 25% in 2020 in relation to 2010.

FIGURE 4.4: TOTAL CONSUMPTION OF OIL, COAL AND GAS (PJ) 2010-2020*

Source: Ministry of Climate, Energy and Building



* The April 2011 Baseline scenario.

Bioenergy in Danish energy supply

Biomass is an important replacement for coal. In the long term, biomass will also be a vital element for flexible electricity production and for the transport sector.

Initiatives in the Energy Agreement to increase the consumption of biomass include:

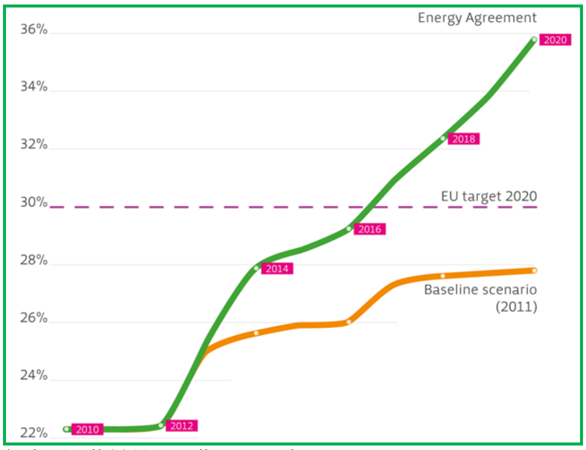
- Conversion from coal to biomass at large-scale CHP plants will be made more attractive by allowing producers and consumers to make price agreements.
- Smaller open-field plants struggling with high heating prices can now produce heating based on biomass.
- An analysis of the future role of district heating in the energy system will be presented in 2013.
- An analysis of the use of bioenergy in Denmark will be presented in 2013. The analysis will focus on the effective and sustainable use of the Danish biomass resources for energy purposes.

An important challenge for Denmark is to ensure the expansion of biogas. Biogas is useful in the energy system, and the technology reduces environmental problems. The ambitious plan for biogas expansion is underpinned by the following initiatives in the Energy Agreement:

- Funding of biogas for CHP to continue.
- Introduction of subsidy equality so that biogas sold to the natural gas grid receives the same subsidy as biogas used at CHP plants.
- Introduction of a new subsidy when biogas is used in industrial processes or as a fuel for transport.
- The start-up aid for new biogas projects has been increased from 20% to 30%.
- A task force has been established with the view to studying and supporting specific biogas projects.
- If the required number of new biogas projects is not realised in 2012 and 2013, the parties behind the Energy Agreement will discuss further options, e.g. a proposal making it compulsory to purchase biogas in order to secure expansion.

FIGURE 4.5: SHARE OF RENEWABLE ENERGY IN FINAL ENERGY CONSUMPTION 2010–2020*

Source: Ministry of Climate, Energy and Building



* The April 2011 Baseline scenario.

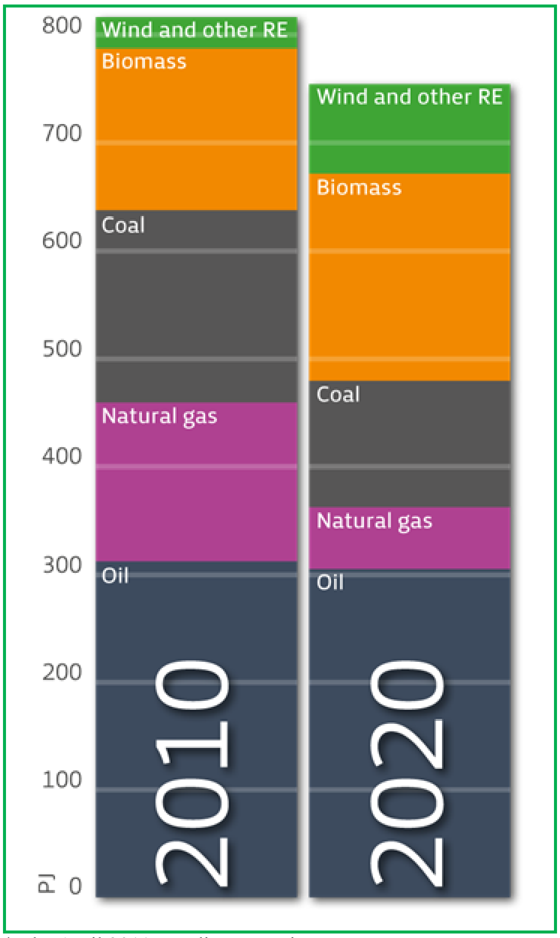
Smart grids

Due to the increasing share of wind power in the Danish energy system, electricity will be a main energy carrier in the future. However wind power is volatile and energy storage is still expensive. Consequently, initiatives in the Energy Agreement point towards transforming and future-proofing the energy system:

- A strategy for smart grids in Denmark was presented in 2012 and implemented through legislation in 2013.
- Agreements will be established with grid companies on the installation of intelligent, remotely readable hourly electricity meters.
- New electricity transmission lines between Denmark and Germany.
- A comprehensive analysis of the continued functionality of the grid with an increased share of wind power in the system will be presented in 2013.
- A thorough analysis of the regulation of the Danish electricity supply sector will be carried out to ensure cost effectiveness, competition and consumer protection.

FIGURE 4.6: CONSUMPTION OF FOSSIL FUELS AND RENEWABLE ENERGY (PJ) IN 2010 AND 2020*

Source: Ministry of Climate, Energy and Building



* The April 2011 Baseline scenario.

Financing the initiatives in the Energy Agreement

The Energy Agreement requires financing. The total financing requirement amounts to DKK 3.5 billion in 2020. The initiatives are to be fully financed and should not impact the general public finances. The Agreement thus stipulates the following:

- Energy saving initiatives by energy companies will be financed via the companies' tariffs and therefore through consumers' energy bills.
- The expansion of renewables in electricity production such as offshore and onshore wind turbines will be financed through the Public Service Obligation schemes (PSO) which are a supplement to the price of electricity paid by electricity consumers. In addition, a new gas PSO scheme is under way pending comments from the European Commission. The gas PSO will be collected through the gas bills and it will finance subsidies for renewable energy for the gas grid.
- As consumption of fossil fuels drops, state revenues from taxes on coal, oil and gas will also drop correspondingly. Therefore, a security of supply tax has been introduced on all fuels – biomass and fossil – for space heating. This new tax will also finance some of the subsidies for renewable energy which cannot be financed via the PSO schemes.

4.1.2.4 The 2013 Danish Climate Policy Plan - Towards a low carbon society

In August 2013 the Danish government published its Climate Policy Plan[5] with a view to dialogue with the business community and the civil society on climate mitigation efforts.

As mentioned above, the government's domestic medium-term goal is a 40% reduction in Denmark's greenhouse gas emissions by 2020 compared to 1990 levels.

The 2013 Climate Policy Plan takes stock of the progress towards this target and presents the government's strategy on how additional policies and measures should be determined to achieve the reduction target most efficiently. Box 4.2 contains a brief overview of the key elements in the Climate Policy Plan. Further information on Denmark's greenhouse gas projections and distance to the domestic 40% reduction target is provided in Chapter 5.

[5] The Danish Climate Policy Plan – Towards a low carbon society, The Danish Government, August 2013, ISBN 978-87-93071-29-2 (http://www.kebmin.dk/sites/kebmin.dk/files/climate-energy-and-building-policy/denmark/Climate-policy-plan/danishclimatepolicyplan.pdf)

BOX 4.2 THE DANISH GOVERNMENT'S CLIMATE POLICY PLAN IN BRIEF

What is the target?

- The Danish government's target is to reduce total Danish greenhouse gas emissions by 40% by 2020 compared with the 1990 level.
- This is ambitious, but necessary in order to put developments on track towards the long-term EU target of 80%-95% reduction by 2050 in line with recommendations from climate scientists.

How useful is this target, given that there is no international agreement on global reduction efforts?

- The ambitious Danish efforts will demonstrate to other countries that it is possible to reduce emissions significantly.
- Furthermore Denmark will show that this can be reconciled with continued growth and welfare.

Can Denmark achieve this target?

- Projections indicate that without new initiatives Denmark will emit about 4 million tonnes more than the 40% reduction target in 2020. This is a lot, but it is not insurmountable.
- Calculations also show that developments in prices in the European emission trading system, as well as economic growth, are decisive for Danish emissions. All else being equal, a higher allowance price could significantly reduce the shortfall.
- There are reduction potentials in all sectors, but current estimates indicate that realizing the 40% target in 2020 will not be without cost.

How can Denmark achieve the reduction target most efficiently?

- Some mitigation initiatives can be implemented with subsequent economic benefits, while others can only be implemented at considerable socio-economic costs.
- Generally, the most socio-economically beneficial reductions can be achieved with mitigation measures that have synergy effects with other policy goals and priorities. Therefore, it is generally most cost effective to integrate climate change mitigation across other policy areas.
- The world is not static. Technologies, the economic framework, and knowledge about mitigation opportunities are developing all the time. Consequently, constant follow-up on efforts to reduce emissions and assessment of the specific measures are crucial in reaching the 40% target.
- A well-functioning European emission trading system, and consequential higher allowances prices, could contribute considerably to meeting the national target. And, just as importantly, it could ensure reduces emissions in the rest of Europe. Tightening the EU CO_2 requirements for cars and the reform of the EU Common Agricultural Policy could also entail important reductions.
- The Danish government's climate policy therefore has two strings; national and international.

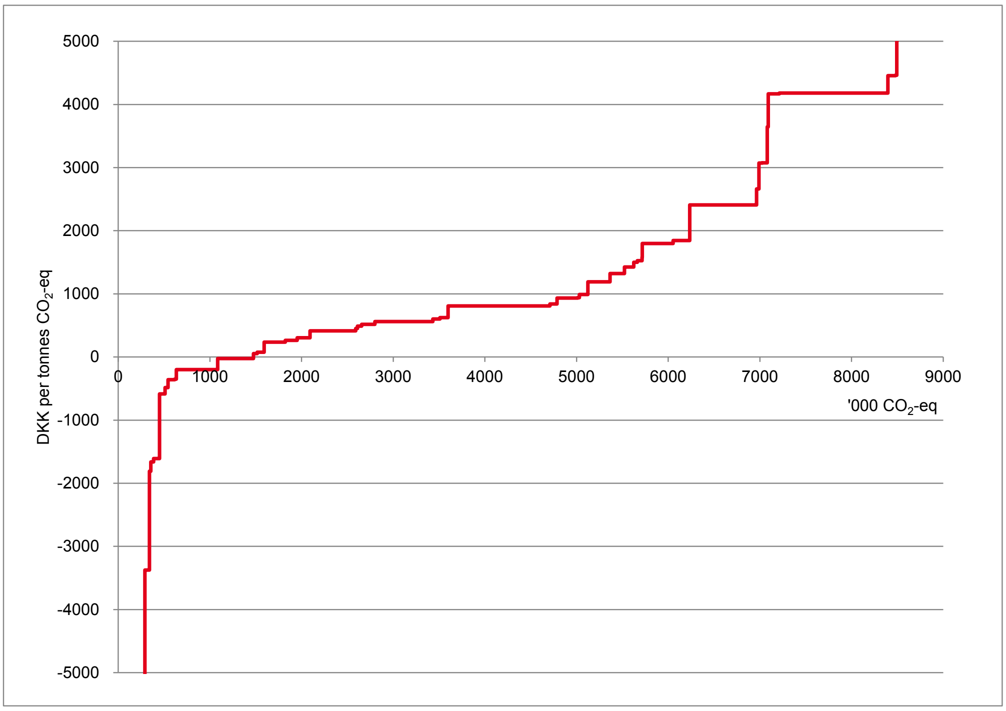
What is the next step?

- The Danish government will ensure that the necessary initiatives are taken in the future by integrating climate change mitigation measures into different sector policies.
- For example, there will be follow up in agriculture, amongst other things on the basis of recommendations from the Nature and Agriculture Commission, which has carried out an extensive review of the agricultural sector and proposed recommendations on nature, environment and climate-related policies in the agricultural sector.
- The Danish government will also present a Climate Change Act at the next session of the Danish Parliament (the Folketing). The Act will form the framework for the future climate policy.
- In the EU the Danish government will strive for agreement on initiatives for structural improvements of the European emission trading system and thus a better and more effective climate policy at EU level. Similarly, the Danish government will work for tighter EU CO_2 requirements for cars and vans and for a greening of the EU Common Agricultural Policy.

To facilitate the continued dialogue with the business community and the civil society on future decisions on additional policies and measures across all sectors, a catalogue of potential additional measures has been drawn up by an inter-ministerial working group and published in parallel with the Climate Policy Plan[6]. In Figure 4.7 the resulting MAC curve (Marginal Abatement Cost curve) from this work is shown. Further information on the individual measures analysed can be found in the catalogue – including information on data, assumptions and methodologies used for the calculations of the reduction potentials and socio-economic costs expressed as CO_2 shadow prices. The data used for the MAC-curve can be found in Annex E3.

FIGURE 4.7: POTENTIAL CURVE WITH MARGINAL REDUCTION COSTS (MAC-CURVE)

Source: Danish Energy Agency, August 2013, corrigendum.



Note: The graph shows the reduction potentials on the x axis and the associated socio-economic costs on the y axis. The graph only includes measures, which can be realised technically and will have an impact before 2020. Measures analysed qualitatively by the inter-ministerial working group have also been excluded from the graph. These include certain EU initiatives decided independently of national climate policy. The graph takes account of the overlap between different mitigation measures, as the effect of various energy savings measures aimed at the same energy consumption, for example, cannot be aggregated.

4.1.2.5 Denmark's climate policy – as part of the EU climate policy

Danish climate policy is based on two pillars – the European and the national. As a small country with an open economy, it is clear that the more Denmark can implement climate policy with common European solutions, the better the total effect of climate policy and the easier it will be to maintain Danish competitiveness in relation to trading partners in the EU.

The EU is also a crucial player in international climate negotiations. An ambitious international climate agreement requires an ambitious common EU approach for

[6] Virkemiddelkatalog – Potentialer og omkostninger for klimatiltag, Inter-ministerial working group, August 2013, ISBN 978-87-93071-24-7(http://www.ens.dk/sites/ens.dk/files/climate-co2/Klimaplan/virkemiddelkatalog_tilweb.pdf- in translation)

the period after 2020. The need for a common EU approach was highlighted by the European Council in May 2013. The European Council has asked the European Commission to draw up specific proposals for a framework for EU climate and energy policy in 2030. In light of this, the Commission is currently considering new and more ambitious climate and energy targets for the period after 2020. This will follow up on the EU's 2008 Climate and Energy Package that established EU targets for 2020 of a 20% reduction in greenhouse gases compared with 1990, 20% renewable energy and 20% energy-efficiency improvements.

The Danish government's ambition is before 2015 to have a decision on new and more ambitious EU climate and energy targets for 2020 and beyond. The EU should move towards the target adopted by the European Council for a reduction in EU greenhouse gas emissions by 2050 of 80%-95% compared with 1990 levels. Long-term targets are particularly important for the energy sector due to its long investment horizons.

In light of this, the Danish government welcomes the indicative targets in the Commission's 2030 green paper for a reduction in the EU's internal greenhouse gas emissions of 40% by 2030 compared with 1990 as well as a target for renewable energy of 30% by 2030. Furthermore, the Danish government supports a binding energy efficiency target for 2030, the size of which is to be assessed on the basis of the evaluation of the Energy Efficiency Directive in 2014. The final Danish government position will be set once economic impact assessments for Denmark have been completed.

Amongst other things, the Danish government calls for the Commission to examine the advantages and disadvantages of changing the basis of allocation and/or the architecture for EU climate regulation. This includes the possibility of transferring all the current non-ETS energy consumption (e.g. energy consumption by transport and to heat individual buildings) into the EU emission trading scheme (ETS).

In a new commitment period, fair burden sharing must be ensured, taking into account countries which, like Denmark, undertake massive expansion of renewable energy.

The transition will come at a cost. More ambitious EU targets will increase costs for European citizens and companies. At the same time, higher targets will also lead to greater demand for new renewable technologies. This may in turn lead to these technologies becoming cheaper and thus make it easier to realise the Danish government's goal of a fossil-fuel-free energy supply by 2050. Tightening the EU's climate and energy policy may generally contribute to enhancing the EU's green growth potential in areas where Danish companies have strongholds, e.g. energy technology.

The majority of Danish exports of climate and energy technologies go to EU countries.

The Danish government will continue actively to support and promote an ambitious green climate and energy policy in the EU as a crucial component of Danish climate policy.

Not only because this will mean the EU can play a positive role at the global level, but also because the EU's climate and energy policy is vital to being able to realise domestic targets. At the same time, greater climate efforts by the other EU countries entail European and Danish enterprises being subject to uniform conditions, and this will favour growth and competition conditions for Danish enterprises.

These are some of the reasons why the Danish government has also decided to support a number of proposals from the European Commission which can contribute to limiting Danish emissions. The Commission has presented proposals to tighten the CO_2 requirements for cars and vans, and it has been assessed that this will limit emissions from the Danish transport sector. Similarly, the Danish government has been striving to make EU agricultural policy greener, and this may lead to a small, but as yet not quantified, reduction in greenhouse gas emissions from agriculture. The Danish government is also supporting proposals to revise the Energy Tax Directive to improve cohesion between the ETS and non-ETS areas and to increase minimum tax levels.

Finally, there is on-going support for new proposed energy efficiency standards under the Eco-Design Directive. Allowances prices are decisive in promoting climate-friendly investments in the EU, including in Denmark. Therefore, allowances prices are also linked to reaching the national 40% target by 2020. The current low allowances price makes it more difficult to initiate the necessary transition and green investments.

Developments in allowances prices have particular significance for Danish emissions and they affect the need to initiate other, new mitigation initiatives. The low allowances price makes the situation relatively more expensive for countries like Denmark, who want to take the lead. Therefore, efforts to increase the level of ambition in EU climate policy are key in the Danish government's climate change policy to achieve the national target.

Since 2010, the European Commission has published several ideas for structural changes which could correct the emission trading system. For example a reduction in the number of allowances may push the allowances price to a level which will improve support for investments in low-emissions technologies. Denmark supports tightening EU reduction targets in 2020 from 20% to 30% compared with 1990, with the associated considerable reduction in total emissions rights.

Most recently, the Danish government has decided to support a specific proposal from the European Commission to amend the ETS Directive by postponing auctions of allowances in order to stabilise the allowances price through temporary ”back loading”. The Danish support is contingent on a timetable for a structural reform of the EU ETS. In July 2013 the European Parliament voted to support the proposal, which is now to be negotiated between the Council and the European Parliament.

4.2 Legislative arrangements and enforcement and administrative procedures

The legal basis for the division of powers into the legislative, executive, and judicial power is the Danish Constitution, *Danmarks Riges Grundlov*[7].

The Constitution includes the legal basis for how the Regent acts on behalf of the Realm in international affairs, and the Regent 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.

After a motion from 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 in the first commitment period 2008-2012 has been effectuated by following up on the national Climate Strategy, sector-policy strategies with climate considerations, and concrete initiatives contributing 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

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[7] The Danish Constitution (Danmarks Riges Grundlov) (http://www.retsinfo.dk/_GETDOCI_/ACCN/A19530016930-REGL /: http://www.folketinget.dk/pdf/constitution.pdf)

legislation made necessary by the Kyoto Protocol, enforcement of legislation and initiation of necessary administrative procedures.

The total set of regulations (in Danish) can be accessed via Retsinformation[8] (online legal information system). 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, these tasks have been delegated to the Danish Energy Agency (DEA) under the Ministry of Climate, Energy and Building. The DEA is also responsible for legislation and administration of the EU emission trading scheme. The supplementary regulations regarding the approval and use of JI/CDM credits and the Registry are now regulated in Statutory Order No. 118 dated 28 February 2008 with later amendments (https://www.retsinformation.dk/Forms/R0710.aspx?id=144489).

Among the national legislative arrangements and administrative procedures that seek to ensure that the implementation of activities under Article 3, paragraph 3, and the elected activities under Article 3, paragraph 4, also contribute to the conservation of biodiversity and sustainable use of natural resources is The Forest Act No. 945 of 24 September 2009, entering into force on 1 October 2009, and the implementation thereof by the Danish Nature Agency under the Danish Ministry of the Environment. Preservation of areas designated as forest reserve land and protection of natural habitats and habitats for species are among the foremost objectives of the Forest Act.

Furthermore, activities under Article 3, paragraph 3, and the elected activities under Article 3, paragraph 4 have to be implemented in accordance with Natura 2000, which are the Sites of Community Importance (SCI) designated according to the European Union's Habitats Directive and the Special Protection Areas (SPA) designated according to the European Union's Birds Directive. The Danish Ramsar Sites are all parts of the Special Protection Areas.

The Danish Nature Agency, under the Danish Ministry of the Environment, is responsible for the implementation of the Habitats Directive and the Birds Directive. The implementation includes the designation of 254 Sites of Community Importance, 113 Special Protection Areas and 27 Ramsar Sites. The rules for administration of the Danish Natura 2000 are laid down in Executive Order No. 477 of 7 June 2003 on the Demarcation and Administration of International Protection Areas, as amended by Executive Order No. 902 of 25 August 2004, entering into force on 14 September 2004, Executive Order No. 1076 of 9 November 2004, entering into force on 24 November 2004, and Executive Order No. 905 of 26 August 2006, entering into force on 9 September 2006.

[8] http://www.retsinfo.dk/

4.3 POLICIES AND MEASURES AND THEIR EFFECTS

In this section, the individual measures relevant to Denmark's climate policy are described.

Sections 4.3.1-4.3.3 include descriptions of the cross-sectoral policies and measures, allowance regulation, the Kyoto Protocol mechanisms, and taxes and duties. Sections 4.3.4-4.3.8 contain descriptions of policies and measures in the following IPCC source, sink and sector categories: Energy (including Transport), Industrial Processes (including Solvent and Other Product Use), Agriculture, LULUCF (Land-use, Land-use change and Forestry) and Waste.

Table 4.1 shows how the allocation to be used in connection with the annual emission inventories (the CRF/IPCC format) is aggregated into the sectors included in this Chapter on policies and measures and in Chapter 5 on projections.

TABLE 4.1 AGGREGATION OF SOURCE, SINK AND SECTOR CATEGORIES IN THE CRF/IPCC FORMAT INTO THE SECTORS INCLUDED IN CHAPTER 4 AND CHAPTER 5

Sectors in Chapter 4 and Chapter 5	Sources/Sectors in the CRF/IPCC format	
Energy including Transport	1A 1B 1A3	Fuel combustion activities (including/excluding Transport) Fugitive emissions from fuels. Transport (national)
Industrial Processes and Solvent and Other Product Use	2 3	Industrial processes Solvent and Other Product Use.
Agriculture	4	Agriculture
LULUCF	5	Land-use, Land-use Changes and Forestry (LULUCF).
Waste	6	Waste

Table 4.2 and Figure 4.8 show the main result of this aggregation for 1990/95[9], annual average 2008-12, annual average 2015, 2020, 2025, 2030 and 3035 without emissions and removals in connection with land use, land-use change and forestry (LULUCF)[10].

In accordance with the reporting guidelines, the following sector sections are subdivided by gas.

Regarding the greenhouse-gas-reducing effects of measures, a major ex-post 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 March 2005 in the report, "Denmark's CO_2 emissions - the effort in the period 1990-2001 and the associated costs"[11], hereafter *the Effort Analysis*. The results of the *Effort Analysis* are described in Annex B.

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

[9] Under the Kyoto Protocol, Denmark's base year is 1990 for CO_2, methane and nitrous oxide, and 1995 for the industrial gases (HFCs, PFCs, and SF_6) cf. Article 3.8 of the Protocol from the inventory reported in 2006, and reviewed and approved in 2007.

[10] Under the Kyoto Protocol, the LULUCF category is dealt with separately under Articles 3.3 and 3.4.

[11] 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).

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 Climate Strategy of the government in 2003.

In December 2013 the Ministry of Climate, Energy and Building published a paper with another ex-post analysis in response to recommendations in a report published by the National Audit Office in October 2012. This paper contains an evaluation of the effects of certain climate change mitigation measures selected by the National Audit Office. A translation of this paper is contained in Annex C.

TABLE 4.2 DENMARK'S GREENHOUSE GAS EMISSIONS 1990/95-2011 AND THE SEPTEMBER 2012 "WITH MEASURES" PROJECTION 2012-35 BY SECTOR AND BY GAS*

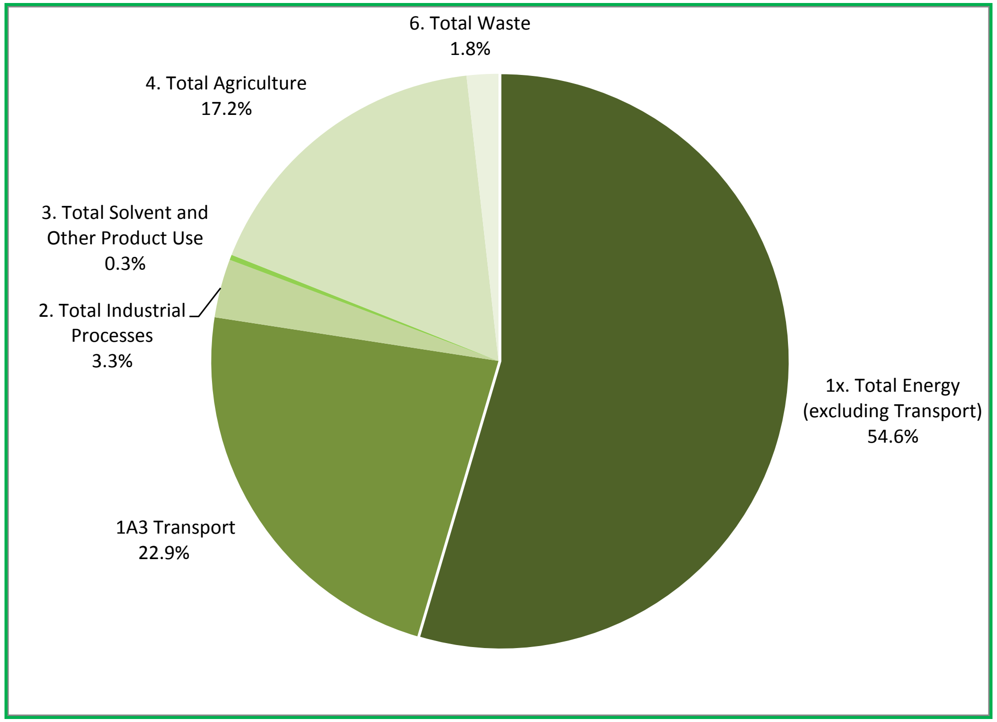
Source: Nielsen et al. (2013) and the Danish Energy Agency

GHG emissions (1990-2011) and projections (2012-2035)	KP BY# MtCO2e	KP BY# % share	2011 MtCO2e	2011 % share	Change from BY	2008-12 MtCO2e	2008-12 % share	Change from BY	2013-20 MtCO2e	2013-20 % share	Change from BY	2015 MtCO2e	2015 % share	Change from BY	2020 MtCO2e	2020 % share	Change from BY	2025 MtCO2e	2025 % share	Change from BY	2030 MtCO2e	2030 % share	Change from BY	2035 MtCO2e	2035 % share	Change from BY
Total (excluding LULUCF)	**69.3**	**100.0**	**56.2**	**100.0**	**-18.9%**	**59.4**	**100.0**	**-14.3%**	**48.3**	**100.0**	**-30.3%**	**48.5**	**100.0**	**-30.1%**	**44.9**	**100.0**	**-35.2%**	**43.7**	**100.0**	**-36.9%**	**44.8**	**100.0**	**-35.3%**	**45.7**	**100.0**	**-34.0%**
CO_2	52.7	76.0	43.9	78.0	-16.7%	47.0	79.1	-10.8%	37.2	77.1	-29.3%	37.2	76.7	-29.5%	34.4	76.6	-34.7%	33.4	76.3	-36.7%	34.4	76.9	-34.7%	35.4	77.3	-32.9%
Methane	5.7	8.2	5.5	9.8	-3.5%	5.5	9.3	-3.1%	5.1	10.5	-11.2%	5.1	10.5	-10.6%	4.9	11.0	-13.6%	4.9	11.2	-13.6%	5.0	11.1	-12.7%	5.0	10.9	-12.1%
Nitrous oxide	10.6	15.3	6.0	10.7	-43.2%	6.0	10.2	-43.0%	5.6	11.6	-47.2%	5.6	11.6	-46.7%	5.4	12.1	-48.8%	5.4	12.3	-49.3%	5.3	11.9	-49.7%	5.3	11.6	-50.1%
Industrial gases	0.3	0.5	0.8	1.5	158.9%	0.8	1.4	160.6%	0.4	0.9	32.7%	0.6	1.2	76.1%	0.1	0.3	-56.3%	0.1	0.2	-74.5%	0.1	0.2	-76.9%	0.1	0.2	-76.8%
1. Total Energy	**52.1**	**75.2**	**43.6**	**77.4**	**-16.4%**	**46.7**	**78.6**	**-10.3%**	**36.8**	**76.1**	**-29.4%**	**36.7**	**75.8**	**-29.5%**	**33.8**	**75.4**	**-35.1%**	**32.8**	**75.0**	**-37.1%**	**33.9**	**75.6**	**-35.0%**	**34.8**	**76.1**	**-33.3%**
CO_2	51.5	74.3	42.7	75.9	-17.0%	45.9	77.1	-10.9%	36.0	74.6	-30.0%	36.0	74.3	-30.1%	33.1	73.8	-35.6%	32.0	73.3	-37.7%	33.1	73.8	-35.7%	33.9	74.2	-34.1%
Methane	0.2	0.3	0.5	0.9	117.9%	0.5	0.9	135.7%	0.4	0.8	80.5%	0.4	0.8	78.5%	0.4	0.8	65.4%	0.4	0.9	76.0%	0.4	1.0		0.5	1.1	
Nitrous oxide	0.4	0.6	0.4	0.6	-15.3%	0.4	0.6	-13.4%	0.3	0.7	-21.0%	0.3	0.7	-21.8%	0.3	0.7	-21.8%	0.3	0.8	-18.7%	0.4	0.8	-14.1%	0.4	0.8	-11.1%
2. Total Industrial Processes	**2.5**	**3.6**	**1.9**	**3.3**	**-25.0%**	**1.9**	**3.2**	**-24.0%**	**1.6**	**3.2**	**-37.0%**	**1.7**	**3.4**	**-32.8%**	**1.3**	**3.0**	**-45.7%**	**1.3**	**3.0**	**-46.4%**	**1.4**	**3.1**	**-44.1%**	**1.5**	**3.2**	**-41.1%**
CO_2	1.1	1.6	1.0	1.8	-8.2%	1.0	1.7	-6.6%	1.1	2.3	2.0%	1.1	2.2	-1.4%	1.2	2.7	8.9%	1.2	2.8	12.7%	1.3	2.9	18.5%	1.4	3.0	25.2%
Nitrous oxide	1.0	1.5	0.0	0.0	-100.0%	0.0	0.0	-100.0%	0.0	0.0	-100.0%	0.0	0.0	-100.0%	0.0	0.0	-100.0%	0.0	0.0	-100.0%	0.0	0.0	-100.0%	0.0	0.0	-100.0%
Industrial gases	0.3	0.5	0.8	1.5	158.9%	0.8	1.4	160.6%	0.4	0.9	32.7%	0.6	1.2	76.1%	0.1	0.3	-56.3%	0.1	0.2	-74.5%	0.1	0.2	-76.9%	0.1	0.2	-76.8%
3. Total Solvent and Other Product Use	**0.1**	**0.2**	**0.2**	**0.3**	**22.0%**	**0.2**	**0.3**	**10.5%**	**0.1**	**0.1**	**-48.5%**	**0.1**	**0.1**	**-47.5%**	**0.1**	**0.1**	**-50.8%**	**0.1**	**0.1**	**-53.5%**	**0.1**	**0.1**	**-55.7%**	**0.1**	**0.1**	**-57.5%**
CO_2	0.1	0.2	0.2	0.3	10.0%	0.1	0.2	-0.8%	0.1	0.1	-59.5%	0.1	0.1	-58.5%	0.1	0.1	-61.9%	0.0	0.1	-64.5%	0.0	0.1	-66.7%	0.0	0.1	-68.5%
4. Total Agriculture	**13.0**	**18.8**	**9.7**	**17.2**	**-25.9%**	**9.6**	**16.2**	**-26.1%**	**9.1**	**18.8**	**-30.4%**	**9.2**	**18.9**	**-29.8%**	**8.9**	**19.8**	**-31.8%**	**8.9**	**20.3**	**-31.9%**	**8.9**	**19.8**	**-32.0%**	**8.9**	**19.4**	**-32.1%**
Methane	4.0	5.8	4.2	7.4	3.5%	4.1	6.9	2.6%	4.0	8.3	-0.6%	4.0	8.2	-0.3%	4.0	8.8	-1.1%	4.0	9.2	0.3%	4.1	9.1	1.8%	4.1	9.0	2.9%
Nitrous oxide	9.0	13.0	5.5	9.8	-38.9%	5.5	9.3	-38.8%	5.1	10.6	-43.6%	5.2	10.6	-42.9%	4.9	11.0	-45.4%	4.9	11.1	-46.2%	4.8	10.7	-47.0%	4.7	10.3	-47.7%
6. Total Waste	**1.5**	**2.2**	**1.0**	**1.8**	**-35.3%**	**1.0**	**1.7**	**-33.7%**	**0.8**	**1.7**	**-46.8%**	**0.9**	**1.8**	**-44.8%**	**0.7**	**1.7**	**-51.6%**	**0.7**	**1.5**	**-56.6%**	**0.6**	**1.4**	**-60.3%**	**0.6**	**1.3**	**-62.9%**
Methane	1.5	2.1	0.9	1.5	-41.1%	0.9	1.5	-39.7%	0.7	1.4	-54.5%	0.7	1.4	-52.2%	0.6	1.3	-59.9%	0.5	1.1	-65.6%	0.4	1.0	-70.0%	0.4	0.9	-73.2%
Nitrous oxide	0.1	0.1	0.1	0.2	41.6%	0.1	0.2	43.2%	0.1	0.3	58.9%	0.1	0.3	56.8%	0.1	0.3	63.8%	0.1	0.3	70.9%	0.2	0.3	78.0%	0.2	0.4	84.8%
1x. Total Energy (excluding Transport)	**41.6**	**60.0**	**30.7**	**54.6**	**-26.2%**	**33.5**	**56.4**	**-19.4%**	**23.8**	**49.3**	**-42.7%**	**23.9**	**49.3**	**-42.6%**	**21.2**	**47.2**	**-49.0%**	**19.7**	**45.1**	**-52.5%**	**20.1**	**44.8**	**-51.7%**	**20.0**	**43.8**	**-51.8%**
CO_2	41.1	59.3	30.0	53.3	-27.1%	32.8	55.2	-20.3%	23.2	48.1	-43.5%	23.3	48.0	-43.4%	20.6	46.0	-49.8%	19.2	43.8	-53.4%	19.4	43.4	-52.7%	19.4	42.3	-52.9%
Methane	0.2	0.2	0.5	0.8	177.9%	0.5	0.9	200.0%	0.4	0.8	131.2%	0.4	0.8	128.3%	0.4	0.8	112.3%	0.4	0.9	126.4%	0.4	1.0	161.0%	0.5	1.0	179.7%
Nitrous oxide	0.3	0.4	0.2	0.4	-21.2%	0.2	0.4	-18.8%	0.2	0.4	-29.7%	0.2	0.4	-30.1%	0.2	0.4	-32.1%	0.2	0.4	-31.4%	0.2	0.5	-28.6%	0.2	0.5	-27.8%
1A3 Transport	**10.5**	**15.2**	**12.9**	**22.9**	**22.2%**	**13.2**	**22.2**	**25.5%**	**12.9**	**26.8**	**22.9%**	**12.9**	**26.5**	**22.0%**	**12.6**	**28.2**	**20.1%**	**13.0**	**29.8**	**23.9%**	**13.8**	**30.8**	**31.1%**	**14.7**	**32.2**	**40.0%**
CO_2	10.3	14.9	12.7	22.6	23.0%	13.1	22.0	26.3%	12.8	26.5	23.8%	12.7	26.2	22.9%	12.5	27.8	20.9%	12.9	29.5	24.7%	13.6	30.4	½	14.6	31.9	40.9%
Methane	0.1	0.1	0.0	0.0	-74.3%	0.0	0.0	-70.3%	0.0	0.0	-82.3%	0.0	0.0	-81.3%	0.0	0.0	-85.1%	0.0	0.0	-86.0%	0.0	0.0	-86.2%	0.0	0.0	-85.1%
Nitrous oxide	0.1	0.2	0.1	0.2	-3.3%	0.1	0.2	-2.3%	0.1	0.3	-3.5%	0.1	0.3	-4.9%	0.1	0.3	-1.0%	0.2	0.3	6.9%	0.2	0.4	15.1%	0.2	0.4	22.6%
2.&3. Total Industrial Processes and Solvent and Other Product Use	**2.6**	**3.8**	**2.0**	**3.6**	**-22.5%**	**2.0**	**3.4**	**-22.2%**	**1.6**	**3.4**	**-37.6%**	**1.7**	**3.6**	**-33.6%**	**1.4**	**3.1**	**-45.9%**	**1.4**	**3.2**	**-46.7%**	**1.4**	**3.2**	**-44.7%**	**1.5**	**3.3**	**-42.0%**
CO_2	1.2	1.8	1.2	2.1	-6.2%	1.2	2.0	-5.9%	1.2	2.4	-4.8%	1.1	2.4	-7.7%	1.3	2.8	1.1%	1.3	3.0	4.2%	1.4	3.0	9.0%	1.4	3.1	14.8%
Nitrous oxide	1.0	1.5	0.0	0.0	-98.4%	0.0	0.0	-98.5%	0.0	0.0	-98.6%	0.0	0.0	-98.6%	0.0	0.0	-98.6%	0.0	0.0	-98.6%	0.0	0.0	-98.6%	0.0	0.0	-98.6%
Industrial gases	0.3	0.5	0.8	1.5	158.9%	0.8	1.4	160.6%	0.4	0.9	32.7%	0.6	1.2	76.1%	0.1	0.3	-56.3%	0.1	0.2	-74.5%	0.1	0.2	-76.9%	0.1	0.2	-76.8%

* I.e. without the effects of new GWPs, new inventory guidelines and of changes in policies and measures in the August 2013 interim update of the baseline scenario for 2020.

FIGURE 4.8 DENMARK'S GREENHOUSE GAS EMISSIONS IN 2011 BY IPCC SECTOR*

Source: Nielsen et al. (2013) and the Danish Energy Agency



* Without the effects of new GWPs and new inventory guidelines to be applied from 2015.

4.3.1 Allowance regulation

Directive 2003/87/EC on trading in CO_2 allowances (the EU ETS Directive) in 2005 introduced a greenhouse gas emissions allowance trading scheme in the EU. The objective of the allowance scheme is to reduce emissions of greenhouse gases so that the EU and its Member States can meet their reductions commitments under the Kyoto Protocol and the EU Burden-Sharing Agreement.

According to the EU ETS Directive, each Member State had to prepare a national allocation plan before the trading period 2008-12.

The European Commission approved the Danish National Allocation Plan (NAP2) in 2007. The NAP contains a detailed plan for the reduction efforts and ensures that Denmark reaches its goal for the Kyoto Period. In the NAP, the gap between the emission target and emission under business as usual amounted to 13 million tonnes CO_2 per year. Of this gap, 5.2 million tonnes CO_2 are covered by efforts in the emission trading sector, while the remaining 7.8 million tonnes CO_2 are covered by efforts in the non-emission trading sector using various instruments, including the use of CDM credits, sinks and additional domestic efforts. The NAP also ensures that Denmark honours the supplementarity principle.

Via the NAP, the present allowance regulation in Denmark includes individual emission limits 2008-2012 for CO_2 emissions from several sectors, which together produce approx. half of Denmark's total greenhouse gas emissions. Denmark has allocated a total of 125 million CO_2 emission allowances during the five years of the scheme. Of these, 2.5 million have been allocated to new production units and major expansions. The rest have been allocated free of charge to those production units covered by the trading scheme in 2007.

In the following, only the principles and general figures for Denmark's implementation of the EU ETS Directive via NAP2 will be described.

From the 1 January 2008 the first Kyoto Commitment Period (CP1) commenced. In practice the EU ETS has not changed for the Danish operators under the EU ETS, even after the Community Independent Transaction Log and the registries under the EU ETS connected to the International Transaction Log under the UN on 28 October 2008, as the registry was already ready to work in the international emissions trading system.

Relevant key figures in the NAP for Denmark for the period 2008 – 2012 are shown in Table 4.3.

TABLE 4.3: KEY FIGURES IN THE PROPOSAL FOR DENMARK'S NATIONAL ALLOCATION PLAN 2008-12

Source: Denmark's National Allocation Plan 2008-12 (NAP2), 2007

	2003 emissions	Projected emissions 2008-12	Quota allocation 2008-12	Quota allocation 2005-07
	Million tonnes CO_2 equivalents per year			
Sectors subject to allowances, in total	36.6	29.7	24.5	33.5
- electricity & heat production	28.1	20.5	15.8	21.7
- other sectors subject to allowances, incl. offshore industries-	8.5	9.2	8.2	7.1
- auction			0	1.7
- new installations			0.5	1
Sectors not subject to allowances	*37.8*[1]	*38.1*		
Total	74.4	67.8		

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

Denmark is committed to reducing its national greenhouse gas emissions by 21% in 2008-12, compared to 1990/1995 level. This means that emissions must be reduced to an average 54.8 million tonnes of CO_2 equivalents annually for the period.

In NAP2, the deficit between expected Danish emissions of CO_2 and the target Denmark is committed to achieving was expected to 13 million tonnes for the period 2008-12 if no further initiatives were implemented. The NAP documents how this deficit will be reduced to zero. As stated in NAP2, Denmark will meet its commitment through a combination of domestic and foreign environmental and energy measures by the government and by Danish enterprises with CO_2 emissions.

Denmark has had an active, environmentally oriented energy policy since the 1970s, and since 1990 this has been supplemented by an actual climate policy which, on an international scale, has entailed a major strain - economically and/or via administrative regulations - on most greenhouse gas emissions, especially from businesses and sectors not subject to allowances.

The period 2008 – 2012 was finalized in 2013 with the final surrendering of allowances and credits by companies participating under the EU ETS.

The final EU ETS accounting in Denmark for the period 2008-2012 shows that total verified CO_2 emissions under the EU ETS in Denmark were a little below the total amount of allocated allowances cf. Table 4.4. However, some companies have to some extent surrendered credits from JI and CDM projects and presumably instead sold or banked their surplus EU allowances.

TABLE 4.4: VERIFIED CO_2 EMISSIONS UNDER THE EU ETS IN DENMARK, FREE ALLOCATIONS AND SURPLUS/DEFICIT FOR THE PERIOD 2008-2012

Source: Danish Energy Agency, May 2013

	Verified CO_2 emissions under the EU ETS in Denmark						Free allocation	Excess of quotas (negative number represents a deficit)
	2008	2009	2010	2011	2012	Annual Average 2008-12	Annual Average 2008-12	Annual Average 2008-12
	Million tonnes CO_2						Million tonnes EUAs	Million tonnes EUAs
Central power plants	17.6	17.8	17.2	13.8	10.9	15.46	13.4	-2.06
Industry and Service	5.3	4.3	4.2	4.3	4.3	4.48	5.8	1.32
Offshore	2.0	1.8	1.9	1.7	1.7	1.82	2.3	0.48
Other electricity and heat production	1.6	1.6	2.0	1.6	1.4	1.64	2.4	0.76
Total stationary[1]	**26.5**	**25.5**	**25.3**	**21.5**	**18.2**	**23.4**	**23.9**	**0.5**
Aviation[2]			(1.5)	(1.4)	1.3	1.3	1.1	- 0.2

[1] In 2012, a total of 375 stationary installations were covered. Of these were 16 central power and heat plants, 111 manufacturing industries, 241 decentralized electricity and district heating plants and 7 offshore companies.

[2] In 2012, total CO_2 emissions from the 26 aircraft operators covered by the EU ETS in Denmark exceeded the free allocation of allowances for 2012. It should be noted that aviation emissions for 2012 cannot be compared with previous years, as aircraft operators in 2012 have been able to make use of the EU Commission's "stop- the-clock " decision. This decision, which applies only for 2012, gives an operator the opportunity to deduct CO_2 emissions related to flights in and out of the EU. Most operators chose to make use of this opportunity.

For the period 2013 – 2020 the allowances to the companies are still being calculated according to the EU benchmarking decision 2011/278/EU. The Danish NIM list, has not yet been finalized and approved by the European Commission. The preliminary Danish NIM list, as submitted to the European Commission, is included in Annex A3.

Denmark's national allowance registry

Denmark's national allowance registry – (DK ETR – Emission Trading Registry[12]) has been operating since 1 January 2005. The DK ETR is used to allocate allowances to production facilities subject to allowances and enables trade in allowances among the allowance holders found in the registry. The DK ETR is constructed so it also fulfils all Kyoto requirements.

The DK ETR has also been prepared to contribute to Denmark's implementation of the Kyoto Protocol in such a way that Denmark's EU allowance registry is now also functioning as the national registry under the Kyoto Protocol. The establishment of a functioning DK ETR pursuant to the Kyoto Protocol is a prerequisite for the application of the Kyoto mechanisms. Section 3.4 contains a more detailed description of the national registry.

[12] https://www.kvoteregister.dk

4.3.2 The Kyoto Protocol mechanisms

For the period 2008-2012, the flexible Kyoto Protocol mechanisms have been important elements in supplementing domestic reduction measures aimed at fulfilling the international climate commitment under the Kyoto Protocol and the subsequent EU Burden Sharing Agreement. The purchasing of CO_2 credits is primarily a task for private businesses under the regulations of the EU Allowance Directive. By involvement in project development, the government has contributed to "start up" the market for CO_2 credits earlier than would otherwise have been the case. Buying credits has also contributed to fulfilment of Denmark's international climate commitment, just as climate projects will entail a number of additional environmental benefits such as reduced pollution of air and water.

On this basis approximately DKK 1.4 billion has been committed for the development of JI and CDM projects and purchase of credits. The allocated funds are expected to deliver the amount of credits needed for closing the projected gap of 2.2 million tonnes of CO_2 on average per year for the period 2008-2012. In accordance with the reporting guidelines and the Annotated Outline, information on how the use of the Kyoto Protocol mechanisms is supplemental to domestic action is included in section 5.3.

4.3.3 Taxes and duties

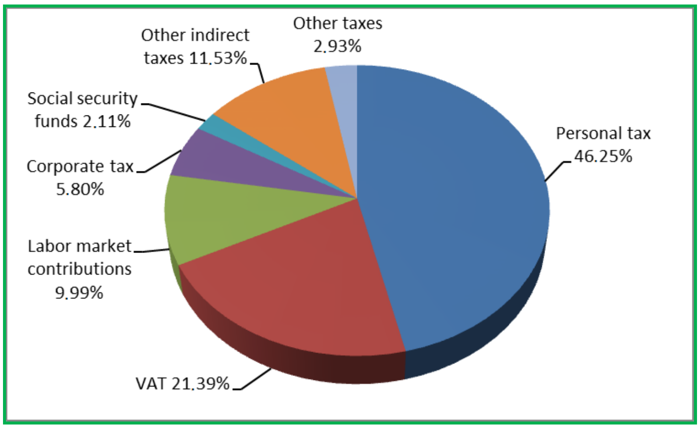
In Denmark, collected taxes and duties make up a total of approx. 48% of GDP. The public sector provides childcare, education, unemployment benefits, health and disability benefits, old-age pensions, and many other services.

Personal income tax is the most important tax, constituting about half (50.7% in 2011) of total tax revenues. Other taxes are VAT, duties, corporation taxes, and labour market contributions. 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 25%.

Total revenue from all taxes and duties is expected to amount to DKK 858.5 billion in 2011. The relative distribution is shown in Figure 4.9.

FIGURE 4.9 RELATIVE DISTRIBUTIONS OF TAXES AND DUTIES 2011

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 past 25 years a number of new environmental taxes have been introduced. These taxes are imposed on consumer goods that cause pollution or are scarce (water, energy products such as oil, petrol, electricity, etc.) or on discharges of polluting substances (CO_2, HFCs, PVC, SF_6, SO_2, NO_x and sewage). Taxes are imposed on mineral oil, tobacco, and alcohol in accordance with EU legislation.

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.

4.3.3.1 CO_2, CH_4, and N_2O - taxes and duties relevant to these emissions

4.3.3.1.1 *Energy*

Denmark has had taxes on energy for many years[13]. Since the first oil crisis in the early 1970s, the rates of the taxes have been aimed at reducing consumption and promoting the instigation of more energy-saving measures. Lower energy consumption will reduce emissions of 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 4.5 below.

TABLE 4.5 ENERGY TAXES 2008-2013

Source: Ministry of Taxation

	Unit	2008[1]	2009	2010	2011	2012	2013
Coal	*DKK/toe*	2,211	2,252	2,399	2,445	2,487	2,533
Natural gas	*DKK/toe*	2,203	2,242	2,405	2,449	2,493	2,538
Natural gas	*DKK/Nm^3*	2.079	2.116	2.270	2.311	2.353	2.395
Oil products: Diesel[2]	*DKK/toe*	2,206.2	2,245.8	2,399.9	2,443.1	2,487.5	2,531.8
Oil products: Fuel oil	*DKK/toe*	2,194	2,233	2,400	2,443	2,487	2,532
Electricity: For heating	*DKK/kWh*	0.520	0.529	0.545	0.614	0.624	0.341
Electricity: Other	*DKK/kWh*	0.587	0.596	0.659	0.730	0.742	0.755
Waste: Heating from waste	*DKK/toe*	548	561	1,930	2,035[3]	2,072	2,110
Other compostable biomass	*DKK/toe*	0	0	0	0	0	0

[1] As of 1 January 2008 the tax rates follow a yearly regulation of 1.8% in the period 2008-2015.
[2]Only diesel oil used for other purposes than motor fuels
[3]From 1 January 2011 – 30 June 2011 the rate was 1955.2 DKK/toe, where toe is the energy unit "tonnes oil equivalents".

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[13] 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.

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). As from 1 January 2008 the tax rates set in these four tax acts follow a yearly regulation of 1.8% in the period 2008-2015. It has been estimated that the indexation will lead to a reduction in emissions of 0.14 million tonnes CO_2 in 2008 and 0.98 million tonnes CO_2 in 2015.

From 1 January 2012, a considerable increase in the taxation of NO_x was implemented. The tax was originally introduced as part of a 2008 energy agreement with effect from 1 January 2010. It has been estimated that the increase in 2012 will lead to a 10 million kg reduction in the emissions of NO_x.

In March 2012 a general agreement on Danish energy policy from 2012-2020 was made. The agreement seeks to ensure the transition from an energy supply based on fossil fuels to one based on renewable energy. The initiatives from the agreement are yet to be realised.

In addition, a change in the structure of the taxation of solar panels was passed in November 2012; a change estimated to keep the incentive to install solar panels, and expected to lead to a 0.2 million tonne reduction in CO_2 emissions. As the first part of an increased tax level on heating (tax on security of energy supply), the taxes on fossil fuels were increased from 1 February 2013. From the first part, a reduction in CO_2 emissions of 0.08 million tonnes in 2013 increasing to 0.48 million tonnes in 2020 is expected. This second part has not yet been passed.

The Mineral-oil Tax Act entered into force on 1 January 1993. Before this, 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 4.6.

TABLE 4.6 TRENDS IN TAXES 2002-2013 UNDER THE MINERAL-OIL TAX ACT, STATED IN DKK/LITRE

Source: Ministry of Taxation

DKK per litre	1.1.02-31.12.04	01.01.05-31.12.07	01.01.08-31.12.08[1]	01.01.09-31.12.09	01.01.10-31.12.10	01.01.11-31.12.11	01.01.12-30.06.12	01.07.12-31.12.12	01.01.13-31.12.13
Gas oil and diesel oil used as motor fuels	2.760	2.787	2.837	2.888	2.774	2.825	2.876	2.840	2.891
Light diesel oil	2.660	2.687	2.735	2.785	2.669	2.718	2.767	2.731	2.780
Diesel low in sulphur content	2.480	2.507	2.552	2.598	2.479	2.524	2.570	2.534	2.579
Diesel without sulphur	-	2.487	2.487	2.598	2.479	2.524	2.570	2.534	2.579
Fuel oil	2.060	2.092	2.130	2.168	2.330	2.372	2.415	2.415	2.458
Auto gas	1.730	1.746	1.777	1.809	1.726	1.757	1.788	1.719	1.749

[1] As of 1 January 2008 the tax rates follow a yearly regulation of 1.8% in the period 2008-2015.

From 1 June 1999 a tax differentiation between light diesel and diesel low in sulphur was introduced, to encourage the use of diesel low in sulphur, which is less polluting than light diesel. This was accomplished and a change took place soon after to the effect that almost all diesel sold was 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, and this has been successful.

In addition, tax differentiation has been introduced in order to achieve environmental goals other than direct reductions in greenhouse gas emissions. Thus tax differentiation has been introduced with a view to phasing out lead in petrol. The rate of tax to achieve this environmental goal is shown in Table 4.7.

TABLE 4.7 TRENDS IN TAXES ON DIFFERENT TYPES OF PETROL 2002-2013, STATED IN DKK/LITRE

Source: Ministry of Taxation

Type of petrol:	01.01.02-31.12.04	01.01.05-31.12.7	1.1.08-18.6.08[2]	19.6.08-31.12.08	1.1.09-31.12.09	1.1.10-31.12.10	1.1.11-31.12.11	1.1.12-30.06.12	1.07.12-31.12.12	1.01.13-31.12.13
With lead[1]	4.720	4.500	4.581	4.550	4.632	4.567	4.649	4.733	4.700	4.785
Lead-free	4.070	3.850	3.919	3.889	3.959	3.881	3.951	4.022	3.989	4.062

[1] The term has been kept even though petrol companies in Denmark ceased using lead for octane improvement in 1994.
[2]As of 1 January 2008 the tax rates follow a yearly regulation of 1.8% in the period 2008-2015.

The gas tax on natural and town gas was introduced in its current form on 1 January 1996 with a rate for both natural and town gas at DKK 0.01/Nm^3. 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 from recent years are shown in Table 4.8.

TABLE 4.8 TAXES ON GAS 2002-2013, DKK PER NM3

Source: Ministry of Taxation

DKK per Nm^3	1.1.02-31.12.02	1.1.03-31.12.03	1.1.04-31.12.04	1.1.05-31.12.05	01.01.06-31.12.07	1.1.08-31.12.08[1]	1.1.09-31.12.09	1.1.10-31.12.10	1.1.11-31.12.11	1.1.12-31.12.12	1.1.13-31.12.13
Natural gas	2.020	2.020	2.020	2.042	2.042	2.079	2.116	2.270	2.311	2.353	2.395
Town gas	0.990	1.250	1.500	1.770	2.042	2.079	2.116	2.270	2.311	2.353	2.395

[1] As of 1 January 2008 the tax rates follow a yearly regulation of 1.8% in the period 2008-2015.

The coal tax 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. In the period 1 January 1997 - 31 December 2001 the tax increased from DKK 950/tonne to DKK 1350/tonne for hard coal and DKK 700/tonne to DKK 990/tonne lignite. The rates have since 2002 developed as shown in Table 4.9.

TABLE 4.9 TRENDS IN COAL TAXES 2002-2013, DKK PER TONNE

Source: Ministry of Taxation

DKK per tonne	1.1.02-31.12.04	01.01.05-31.12.07	1.1.08-31.12.08[1]	1.1.09-31.12.09	1.1.10-31.12.10	1.1.11-31.12.11	1.1.12-31.12.12	1.1.13-31.12.13
Hard coal	1425	1449.2	1475.3	1501.8	1605	1634	1663	1693
Lignite	1030	1047.8	1066.7	1085.9	1089	1109	1129	1149

[1] As of 1 January 2008 the tax rates follow a yearly regulation of 1.8% in the period 2008-2015.

The electricity tax was introduced on 1 April 1977. With effect from 1 January 2013, the tax on electricity used for heating was reduced considerably, to take into account, that an increasing amount of renewable energy was being used in electricity production. It has been estimated that this will lead to an emission reduction outside the emissions trading scheme of 0.15 million tonnes CO_2 in 2015 and 0.29 million tonnes in 2018. Table 4.10 shows the development in electricity tax rates since 2002.

TABLE 4.10 TRENDS IN ELECTRICITY TAXES 2002-2013, DKK PER KWH

Source: Ministry of Taxation

DKK per kWh	01.01.02-31.12.04	01.01.05-31.12.07	01.01.08-31.12.08[1]	01.01.09-31.12.09	01.01.10-31.12.10	01.01.11-31.12.11	01.01.12-31.12.12	01.01.13-31.12.13
Consumption of electricity, exceeding 4,000 kWh in all-year residences heated by electricity	0.501	0.511	0.520	0.529	0.545	0.614	0.624	0.341
Other electricity	0.566	0.577	0.587	0.596	0.659	0.730	0.742	0.755

[1] As of 1 January 2008 the tax rates follow a yearly regulation of 1.8% in the period 2008-2015.

The CO_2 tax on energy products was introduced on 1 March 1992 and was imposed on different types of energy products relative to their CO_2 emissions. A tax reduction was given to light and heavy industrial processes. From 1 January 2010 a structural change in the CO_2 tax was implemented as an adaption to the EU Emissions Trading Scheme. The tax rate was increased to DKK 150 /tonne of CO_2 indexed by 1.8%/year, cf. table 4.11. In total, this structural change in the CO_2 tax was estimated to lead to a reduction in the CO_2 emissions of 0.69 million tonnes.

Large waste incineration facilities are from 1 January 2013 included in the emissions trading scheme, which means that in order to avoid double taxation they are exempted from the CO_2 tax. This will lead to a reduction of CO_2 emissions outside the ETS of approximately 8.9 million tonnes.

TABLE 4.11 CO2 TAX RATES, 2000-2013, STATED IN DKK PER TONNE OF CO2

Source: Ministry of Taxation

	2000-2004	2005-2009	2010[1]	2011	2012	2013
Basic rate						
Heating in industry	100	90	155.4	158.2	161.1	164.0
Light industrial processes						
Basic rate	90	90	-	-	-	-
With a voluntary agreement	68	68	-	-	-	-
Resulting subsidy	22	22	-	-	-	-
Heavy industrial processes						
Basic rate	25	25	-	-	-	-
With a voluntary agreement	3	3	-	-	-	-
Resulting subsidy	22	22	-	-	-	-
Industrial processes covered by the Emission Trading Scheme						
Basic rate [2]	-	-	0	0	0	0

[1] As of 1 January 2010 a structural change in the CO_2 tax was implemented. For the industries not regulated by the emissions trading scheme, a fixed lump sum transfer based on historical emissions was given, while the base rate was considerably increased to match the expected price of CO_2 quotas.

[2]Before 2010, the industrial processes covered by the ETS were taxed according to the table, depending on the type of process

Table 4.12 shows examples of the different types of CO_2 taxes converted into consumer units.

TABLE 4.12 EXAMPLES OF CO2 TAXES

Source: Ministry of Taxation

	Unit	1.1.2008-31.12.2008[1]	1.1.2009-31.12.09	1.1.2010-31.12.10	1.1.2011-31.12.11	1.1.2012-31.12.12	1.1.2013-31.12.13
Gas oil and diesel oil	*DKK/litre*	0.247	0.252	0.413	0.420	0.428	0.435
Gas oil and diesel oil containing 4,8% bio fuel	*DKK/litre*	-	-	0.385	0.391	0.399	0.405
Fuel oil	*DKK/kg*	0.293	0.298	0.493	0.502	0.511	0.520
Electricity	*DKK/kWh*	0.088	0.089	0.062	0.063	0.064	0.065
Lignite	*DKK/tonne*	221.7	225.7	225.8	225.9	225.10	225.11
Natural gas and town gas	*DKK/Nm^3*	0.202	0.205	0.351	0.357	0.364	0.370
Petrol	*DKK/litre*	0.224	0.228	0.373	0.379	0.386	0.393
Petrol containing 4,8% bio fuel	*DKK/litre*	-	-	0.355	0.361	0.367	0.374

[1]As of 1 January 2008 the tax rates follow a yearly regulation of 1,8% in the period 2008-2015.

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 4.12, 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.

As of 1 January 2008 the CO_2 taxes follow a yearly regulation of 1.8% in the period 2008-2015, similar to the energy taxes.

As of 1 January 2011 a tax on methane emissions - equal in terms of CO_2 equivalents to the CO_2 tax - from natural gas fired power plants was introduced. This is expected to reduce methane emissions from gas engines through behavioural changes such as changing from motor operation to boiler operation and establishing mitigation measures. Consumption is also expected to fall as the price of heat will increase. These behavioural changes will result in falls in the emissions of unburned methane from power stations. In addition, CO_2 emissions will fall and consumption of natural gas will fall. In total, a decline of 0.06 million tonnes CO_2 equivalent emissions in 2 out of 5 years is expected, corresponding to an average annual reduction effect of approximately 0.02 million tonnes CO_2 equivalent per year in 2008-12.

4.3.3.1.2 *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 fuels. The latter has been described above.

From 15 June 2007, the registration tax for passenger cars and vans has been reduced or increased according to the fuel efficiency of the vehicle. Petrol (diesel) driven passenger cars and vans receive a tax reduction of DKK 4,000 for each kilometre in excess of 16 kilometres (17 kilometres) the vehicles run per litre petrol (diesel). Similarly, a tax increase of DKK 1,000 for each kilometre less than 16 kilometres (16 kilometres) the vehicles run per litre petrol (diesel) is collected. This is expected to lead to a yearly emission reduction of 0.05 million tonnes CO_2. With the 2012 tax reform, the registration tax exemption for electricity driven cars, originally introduced in 1983, was extended to 2015.

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 2013 are shown in Table 4.13.

TABLE 4.13 EXAMPLES FROM THE DANISH STRUCTURE OF TAX INCENTIVES BASED ON ANNUAL TAXES ON MOTOR VEHICLES (2013), DKK/YEAR

Source: Ministry of Taxation

Type of fuel	Fuel consumption (km/l)	Annual tax (DKK/year)
Petrol	**> 20.0**	580
	10.0 – 10.5	6,020
	< 4.5	20,160
Diesel	**> 32.1**	240
	28.1-32.1	1,020
	25-28.1	2,000
	22.5 - 25.0	2,760
	10.2 – 11.3	11,840
	< 5.1	30,180

As the EURO3 and EURO4 standards have become obligatory, the reductions of annual taxes for light commercial vehicles (LCVs) as an incentive to buy vehicles which fulfil these standards are no longer relevant. From 1 January 2007, a reduction of DKK 4,000 in the tax base for the registration tax was implemented for diesel driven personal cars and LCVs fulfilling the standards for emissions of particles set out in EU Council Directive 70/220/EEC, dated 20 March 1970.

To encourage job creation and growth, a tax reform was agreed on 22 June 2012. As part of the tax reform, the green owner tax rates were also increased from 2013 to better reflect real development and compensate for erosion of the tax caused by the tax freeze implemented in 2002. This will increase total costs of owning a car, which is expected to lower car sales and stock and hence decrease emissions of harmful substances and, to some extent, CO_2.

In the tax reform, a higher tax increase was put on diesel-driven cars to better balance the taxation of energy content in diesel and petrol, and to reduce emissions of harmful particles from diesel driven cars. Examples of this development are shown in Table 4.14.

TABLE 4.14 DEVELOPMENT IN ANNUAL TAXES FOR THE THREE MOST ENERGY EFFICIENT CATEGORIES OF DIESEL-DRIVEN PRIVATE CARS, DKK/YEAR

Source: Ministry of Taxation

DKK/year	2000	2001	2002-2012	2013
> 32.1 km/l	140	200	160	240
28.1-32.1 km/l	700	780	740	1,020
25-28.1 km/l	1,280	1,380	1,320	2,000

Furthermore, with the 2012 tax reform, the annual tax exemption for electricity driven cars was extended to 2015.

4.3.3.1.3 *The household sector*

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

4.3.3.2 HFCs, PFCs, and SF_6 - taxes and duties relevant to these emissions

Since 1 March 2001, imports of industrial gases HFCs, PFCs, and SF_6 (F-gases) in the industry/business sector 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 600/kg, cf. the examples in Table 4.15.

TABLE 4.15 EXAMPLES OF TAXES ON F-GASES, 2013

Source: Ministry of Taxation

Substance	GWP	Tax in DKK per kg
HFC-134a	1300	215
R404a (a combination of 3 HFCs)	3780	588
SF_6	23900	600

As the taxes on industrial gases are based on the CO_2 tax, there was an increase in 2011 following the increased CO_2 tax rate shown in Table 4.11. The impact of this increase, which will equate a CO_2 tax rate of DKK 170 per tonne in 2015, is expected to lead to a reduction in the emission of the industrial gasses of 0.02 million CO_2 equivalents.

In Table 4.16 contains an overview of all taxes and duties relevant to greenhouse gas emissions in Denmark.

TABLE 4.16 OVERVIEW OF TAX AND DUTY MEASURES

Source: Ministry of Taxation and Danish Energy Agency

Name of measure/initiative	Objective	GHG affected	Type of instrument	Status of implement-tation	Implementing entity/entities	Estimate of impact on greenhouse gas emissions
Taxes and Duties						Million tonnes CO_2-eq.
TD-1a: Energy taxes	More efficient energy consumption, CO_2 reduction	CO_2, CH_4 and N_2O	Economic/ fiscal	Implemented	Ministry of Taxation	-1.0[1]
TD-1b: Mineral-oil Tax Act	More efficient energy consumption, CO_2 reduction	CO_2, CH_4 and N_2O	Economic/ fiscal	Implemented	Ministry of Taxation	-1.2[1]
TD-2: Gas Tax Act	More efficient energy consumption, CO_2 reduction	CO_2, CH_4 and N_2O	Economic/ fiscal	Implemented	Ministry of Taxation	IE(TD-1a)
TD-3: Coal Tax Act	More efficient energy consumption, CO_2 reduction	CO_2, CH_4 and N_2O	Economic/ fiscal	Implemented	Ministry of Taxation	IE(TD-1a)
TD-4: Electricity Tax	More efficient energy consumption, CO_2 reduction	CO_2, CH_4 and N_2O	Economic/ fiscal	Implemented	Ministry of Taxation	IE(TD-1a)
TD-5: CO_2 tax on energy products	More efficient energy consumption, CO_2 reduction	CO_2	Economic/ fiscal	Implemented	Ministry of Taxation	-0.41[2]
TD-6: Green Owner Tax	More efficient energy consumption, CO_2 reduction - through a fuel-efficiency-dependent annual tax on motor vehicles, electric cars are exempted	CO_2, CH_4 and N_2O	Economic/ fiscal	Implemented	Ministry of Taxation	-0.6[3]
TD-7: Registration Tax	More efficient energy consumption, CO_2 reduction – through a fuel-efficiency-dependant registration tax on passenger cars and vans, electric cars are exempted	CO_2, CH_4 and N_2O	Economic/ fiscal	Implemented	Ministry of Taxation	IE(TD-6)
TD-8: Tax on HFCs, PFCs and SF_6 – equivalent to the CO_2 tax	Reduction of emissions of f-gases	HFCs, PFCs and SF_6	Economic/ fiscal	Implemented	Ministry of Taxation	-0.4/-0.02[4]
TD-9(new): Tax on methane from natural gas fired power plants – equivalent to the CO_2 tax	Methane reduction	CH_4	Economic/ fiscal	Implemented	Ministry of Taxation	-0.02[5]

[1] Average annual CO_2 reduction in 2008-2012 from tax increases in 1990-2001 and no further increases in taxes and demand after 2001 estimated under the energy production angle cf. the assumptions in the Effort Analysis described in Annex B.
[2] Average annual CO_2 reduction in 2008-2012 from the DKK 150 per tonnes of CO_2 tax increase in 2010-2012 cf. the 2013 analysis of selected measures described in Annex C.
[3] Average annual CO_2 reduction in 2008-2012 as the combined effect of the EU voluntary agreement with the automobile industry, the Green Owner Tax, information campaigns, energy labelling of cars etc. cf. the assumptions in the Effort Analysis described in Annex B.
[4] Average annual CO_2 reduction in 2008-2012 was estimated at 0.4 million tonnes CO_2 equivalent in the Effort analyses described in Annex B. In 2013 the reduction in 2015 was estimated at 0.02 million tonnes CO_2 equivalent.
[5] Average annual CO_2 reduction in 2008-2012 cf. the 2013 analysis of selected measures described in Annex C.

4.3.4 Energy (Fuel Combustion, including Transport, and Fugitive Emissions from Fuels)

The energy sector's greenhouse gas emissions made up 77.4% of Denmark's total greenhouse gas emissions in 2011, of which CO_2 was the primary emission. 98.1% of the emissions from the energy sector are CO_2. 1.1% is methane (CH_4), and the remaining 0.8% is nitrous oxide (N_2O).

4.3.4.1 CO_2

Energy production and energy-consuming activities in the transport sector and industry are 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 efforts to reduce 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 measures with the objective to fulfil Denmark's international climate obligations. Danish experience shows that through persistent and active energy policy focus on enhanced energy efficiency and conversion to cleaner and renewable energy sources, it is possible to sustain high economic growth and at the same time reduce fossil fuel dependency and protect the environment.

The energy sector is 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. Thus there is a significant extent of integration in the Northern European electricity market. 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 through the EU emissions trading scheme (EU ETS) has been pivotal for Denmark's possibilities to comply with the climate commitments. The EU ETS constitutes a central instrument in ensuring that the Danish energy sector is enabled to provide the reductions required if Denmark is to comply with its climate obligations. At the same time, the EU ETS permits significant improvements to the cost effectiveness of Denmark's climate effort.

The government's long-term objective is to become a nation with an energy supply solely based on renewable energy sources and thus independent of fossil fuels.

The objective of the Danish energy policy today is security of supply, environmental concerns, energy savings and well-functioning energy markets within frameworks that secure cost effectiveness. Several initiatives often meet more than one of the purposes mentioned at the same time. Efforts concerning climate change should thus be seen in a broader context than CO_2 alone, not least when it comes to the purpose and calculation of effects.

The costs to Denmark of meeting climate obligations are less than they could have been. Denmark gave priority to renewable energy sources and energy efficiency early on. Most of the public support schemes and regulations have prioritised energy efficiency and renewable energy. In this respect the development in Denmark has been quite different from other IEA countries, which have invested in new energy supply – notably nuclear energy.

Danish public support programmes have instigated competition amongst private companies. Most public support for energy research and development in Denmark has been open for competing applicants. Similarly, all procurement of energy technologies induced by public schemes has followed EU rules requiring open tenders or has left it to competitive markets in general.

A large number of policies and measures have been implemented over the years to meet the various energy-policy objectives cf. Table 4.17.

TABLE 4.17 INITIATIVES AND MEASURES IN THE ENERGY SECTOR

Source: Danish Energy Agency

Name of measure/initiative	Objective	GHG affected	Type of instrument	Status of implement-tation	Implementing entity/entities	Estimate of impact on greenhouse gas emissions
The energy sector						Million tonnes CO_2-eq.
EN-1: EU-CO_2-allowances for electricity and district heating production (including business)	CO_2-reduction	CO_2	Economic (financial)	Implemented	State authorities, energy producers, energy-intensive enterprises	NE
EN-2: Biomass Agreement	R&D, demonstration, CO_2 reduction	CO_2	Economic (financial)	Implemented	State authorities, energy producers	-1.1[1]
EN-3: Price supplement and subsidies for environmentally friendly electricity	Energy efficiency, technology development, CO_2 reduction	CO_2	Economic	Implemented	State authorities, energy producers	NE
EN-4: Tenders for offshore wind turbines	Energy efficiency, technology development, CO_2 reduction	CO_2	Regulatory (administrative)/ economic (financial)	Implemented	State authorities, electricity producers	NE
EN-5: Scrapping scheme for old wind turbines	Other environ-mental improvements	CO_2	Economic, financial	Implemented	Local/ regional authorities, interest organisations, energy producers, state authorities	NE
EN-6: Energy research	R&D	CO_2	R&D	Implemented but regularly adjusted	State authorities, research institutions	NE

[1] Average annual CO_2 reduction in 2008-2012 from the effect of the measure on investments in 1990-2001 estimated under the energy production angle cf. the assumptions in the Effort Analysis described in Annex B.

4.3.4.1.1 *The allowance regulation relevant to the energy sector*

A key instrument for reaching the goals for emission reductions is the EU Emission Trading Scheme (EU ETS), which is a CO_2 allowance scheme for energy production and energy-intensive industries as described in section 4.3.1. The EU Member States have devised this trading scheme for greenhouse gas emissions in order to fulfil the international climate commitments set out in the Kyoto Protocol, in particular with the aim of reducing CO_2 emissions from energy production and energy-intensive industries.

The allowances scheme entered into force on 1 January 2005. The 2005-2007 period was used as a testing phase. The EU ETS Directive has been revised a number of times.

The allowance allocation for 2008-2012 was determined on the basis of the national allocation plan, submitted the European Commission in July 2006. The EU ETS 2008-2012 has been an important measure in Denmark's fulfilment of its climate obligations under the first commitment period of the Kyoto Protocol. The scheme aligns well with government policy for the energy area on liberalisation of the energy markets and management of environment efforts by the market.

Annex A3 contains overviews of the installations covered and their allowances for 2008-2012. The installations subject to the allowance regulations account for a little less than half of Danish emissions of greenhouse gases. Almost all major Danish installations with considerable emissions are covered by the ETS. Most of these are generators of power and heat, the rest are industrial enterprises plus a few production units within the offshore sector.

Both the statutory and the administrative basis for the scheme have been established. The necessary legal basis was adopted by the Danish Folketing in June 2004 and the 2008-2012 national allocation plan was approved by the European Commission on 31 August 2007.

According to the national allocation plan for the period 2008-2012 an average annual allowance of 24.5 million tonnes CO_2 has been allocated. According to the allocation plan this should correspond to a drop in annual emissions of about 5 million tonnes per year in 2008-2012, or a reduction of about 17% compared with emissions expected in the national allocation plan for the period. This level was set by balancing environmental considerations against competitiveness and jobs:

- Electricity and heat producers were allocated about 15.8 million EAUs. The allowance for electricity generation is allocated as ”per kWh”, while for heat production allowances are allocated according to emissions in the base years 1998-2004.

- The other 133 installations (industry and offshore) have been allocated allowances corresponding to emissions in the base years 1998-2004. A total of 8.2 million tonnes CO_2 per year have been allocated to industry and offshore.

- A special reserve of 0.5 million tonnes CO_2 per year has been allocated with free allowances for new installations and significant extensions to existing units.

Allowances not allocated by the end of the commitment period or returned due to closures have been auctioned. The period 2008 – 2012 was finalized in 2013 with the final surrendering of allowances and credits by companies participating in the EU ETS as shown in section 4.3.1.

The new EU Climate and Energy Agreement from December 2008 extended the ETS system to 2013-2020 in order for the EU to reduce CO_2 emissions by 20% in 2020. At the same time allocation was centralised and auctioning is to be used more extensively from 2013. The allowances for the enterprises are still being calculated for this period in accordance with the EU benchmarking decision 2011/278/EU.

However, the current low allowances price has made it more difficult to initiate the necessary transition and green investments after 2012.

Developments in allowances prices have particular significance for Danish emissions and they affect the need to initiate other, new mitigation initiatives. The low allowances price makes the situation relatively more expensive for countries like Denmark, who want to take the lead. Therefore, efforts to increase the level of ambition in EU climate policy are key in the Danish government's climate change policy to achieve the national target.

Denmark's efforts in this regard are further described in section 4.1.2.5.

4.3.4.1.2 *Energy and CO_2 taxes*

Taxes have also been used for many years as an instrument to reduce CO_2 emissions from the energy sector, since fuels used for heat production are subject to energy and CO_2 taxes. The main objective is general GHG reductions and the promotion of the use of fuels with lower CO_2 emissions, mainly biomass. Energy and CO_2 taxes are described in detail in section 4.3.3.

4.3.4.1.3 *Combined heat and power*

The main elements of the Danish strategy to promote renewable energy and the efficient use of energy resources since the end of the 1970s have been increased use of CHP and enlarged district heating areas. Effective heat supply planning has ensured the highest share of district heating and CHP in the Western Hemisphere. This has secured early markets for district heating technologies and a possibility for the use of many renewable energy sources like straw, municipal waste, wood waste and geothermal energy. 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. Wind energy is expected to deliver 50% of domestic electricity supply by 2020. For this reason the CHP production is expected to be reduced in the future, though CHP and the valuable services CHP plants provide - also in terms of back up capacity - is expected to remain an integral part of the overall system. 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.

4.3.4.1.4 *Renewable energy*

The increasing use of renewable energy sources is reducing emissions of CO_2 from fossil fuels. The long term goal for Danish energy policy is clear: the entire energy supply, i.e. electricity, heating, industry and transport, is to be covered by renewable energy in 2050. Only by improving energy efficiency, electrifying a larger share of the energy consumption and by expanding supply from renewables, will it be possible to phase out fossil fuels completely. The initiatives in the political energy agreement concluded by the government and a very broad majority in the Parliament in March 2012 cover these crucial areas for the period until 2020.

The expected headline results for 2020 are the following: more than 35% renewable energy in final energy consumption; approximately 50% of electricity consumption to be supplied by wind power; 7.6% reduction in gross energy consumption in relation 2010; and 34% reduction in greenhouse gas emissions in relation to 1990.

Renewable energy sources are promoted with economic measures, including use of energy and CO_2 taxes on fossil fuels and through the Public Service Obligation Schemes (PSO), which are a supplement to the price of electricity paid by all consumers. In addition, a new gas PSO scheme has been introduced. The PSO collected through the gas bills will finance subsidies for renewable energy in the gas sector.

Wind power

In accordance with the energy policy agreement from February 2008, the expansion of wind power since the Fifth National Communication in December 2009 has included a tender for and construction of a 400 MW offshore wind farm at the island of Anholt. This wind farm started to operate in September 2013.

In accordance with the energy policy agreement from March 2012 tenders will be put out in 2013-2015 for two additional offshore wind farms. A 400 MW wind farm is planned for at Horns Rev (Horns Rev 3) in the North Sea and a 600 MW wind farm at Krieger's Flak in the Baltic Sea with expected commissioning in the period 2017-20 beginning with the expansion at Horns Rev.

Biomass

In 2012, biomass accounted for approximately 69% of renewable-energy production (wind accounted for 24% with the remaining 7% from heat pumps, photo voltaic power, geothermal and hydro power) and 77% of renewable energy consumption, mostly in the form of straw, wood and biodegradable waste for incineration. In 2012, 31% of the biomass was imported in the form of wood pellets (31.7 PJ), biofuels (7.0 PJ), wood chips (6.2 PJ) and fire wood (3.3 PJ).

The energy production from biomass has more than doubled since 1990 - primarily due to the policy agreement from 1993 (the Biomass Agreement: requires power plants to use 1.4 million tonnes of straw and wood, equivalent to almost 20 PJ per year) and the policy agreement from February 2008 on the increased use of straw and chips at the large co-generation plants (up to 700,000 tonnes in 2011). At the same time, the consumption of biomass continues to rise as a source of energy for the supply of heat in district-heating plants and in smaller installations for households, enterprises and institutions.

Although it was demonstrated in Denmark in the mid-1990s that biogas plants can be established with reliable operation and with an acceptable economy biogas still only accounted for 2.8% of renewable-energy production in 2012.

Liquid biofuels, such as animal and vegetable oils, biodiesel and bioethanol, is used only on a small scale until it is possible to produce liquid biofuels from bio-waste by the so-called second generation technologies. However, an oil company launched in 2006 petrol with 5% bioethanol derived from grain, corn, sugar and other crops by the so-called first generation technology.

4.3.4.1.5 *Fuel conversion from coal to natural gas*

Substitution of coal and oil by natural gas reduces 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. Since then, consumption has decreased to 157 PJ in 2011 due mainly to high gas prices. Natural gas now covers 20% of gross energy consumption. The use of natural gas is expected to decrease further as a result of introducing more renewable energy and extensive energy-saving policies.

4.3.4.1.6 *Research and development*

Danish support for new energy technologies has been comprehensive and relatively stable. A long list of direct and indirect support schemes and policies have, in combination, created a domestic market which has given Danish companies a boost. This boost has enabled many companies to become international market leaders. Danish companies continue to enjoy commercial success within the energy-related marketplace.

R&D activities include energy savings, more efficient energy conversion and renewable energy technologies.

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.

In 2006 the government suggested that public programmes supporting RD&D in energy technologies should be doubled from approx. DKK 500 million to DKK 1 billion per year in 2010. This goal has been reached and the government has continued the increased effort in the years after 2010. The funding is being administrated by several programmes, including the Energy Technology Development and Demonstration Programme (EUDP), three different PSO funds (Public Service Obligation) programmes, the programme committee on energy and environment under the Strategic Research Council under the Ministry of Education and the Advanced Technology Foundation.

The EUDP focuses on development and demonstration of new energy technologies. A board, nominated by the Minister, is responsible for the allocation of funds. The Board is served by a secretariat established in the Danish Energy Agency. The overall objective of the EUDP 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 focus on new efficient energy technologies. The EUDP was established in 2008. Available funds in 2013 are DKK 365 million. On average, 45% of the activities under the Programme are financed by the EUDP.

Energy research, development and demonstration are supported by PSO funds (Public Service Obligation). One of these is administrated by the transmission system operator Energinet.dk. The programme is aiming at research and development in environmentally friendly power production technology, administering in 2013 support funds amounting to DKK 130 million. Under this scheme support is given to activities relating to fuel cells and renewable energy, for instance solar cells, biomass, hydropower and wave energy.

Another programme administrated by Energinet.dk is a programme of yearly DKK 25 million for the deployment of new technologies. This programme started in 2008 and has been extended to include 2015.

The third PSO programme is administrated on behalf of the power distribution companies by the Danish power association Dansk Energi. The objective is to support research and development within energy-efficient use of electricity. In 2013, DKK 25 million are available under the scheme, which aims at the development of energy-efficient products and processes in buildings, industry etc.

Activities relating to strategic energy research were increased in 2003. The activities are administered by the Danish Council for Strategic Research under the Ministry of Science, Innovation and Higher Education, and are aimed at strengthening the knowledge base within renewable energy and the environment, including support for cross-disciplinary projects that involve technical, environmental, health, social, economic and political aspects. In 2013 the available funding for the Ministry's energy research efforts is expected to be DKK 370 million.

Furthermore, the Danish National Advanced Technology Foundation was established in 2005 under the Ministry of Science, Innovation and Higher Education to support all kinds of technologies. In 2005-2013 the programme has allocated 25-30% of its annual budget to energy technology activities. The funding of projects is decided by an independent board with its own secretariat.

In October 2013, the Government reached an agreement with political parties in the parliament to create a new innovation foundation in 2014. The foundation is expected to have an annual budget of DKK 1.5 billion and will be created by amalgamating the Danish Council for Strategic Research, the Danish National Advanced Technology Foundation and the Danish Council for Technology and Innovation into one foundation.

4.3.4.1.7 *Energy savings*

Reducing energy consumption by increasing energy efficiency and promoting energy saving is a very important element for Danish energy policy.

Among the grid and distribution companies (electricity, natural gas, oil and heating), the electricity companies have been working with energy savings since the early 1990s and the natural gas and district heating companies have been working with energy savings since 2000.

In the most recent years, since 2005 several political agreements to significantly strengthen energy-saving efforts in Denmark have been reached.
In the most recent agreement, the 2012 energy policy agreement, energy-saving efforts were increased even more.

In the 2012 policy agreement the obligation for the grid and distribution companies in the electricity, natural-gas, district-heating and oil sectors was increased by 75% in 2013 and 2014 (to 10.7 PJ) and by 100% from 2015 to 2020 (to 12.2 PJ).

The obligations have been implemented as voluntary agreements between the Minister for Climate, Energy and Building and trade associations representing the electricity-grid, natural-gas, district heating, and oil companies. The companies have a high degree of freedom regarding methodology. The energy companies' costs are financed by a levy on their tariffs.

The development of a comprehensive long-term strategy for renovation of existing buildings was also a part of the agreement.

The Danish Energy Agency 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, energy efficiency requirements (Eco-design), buildings and the new Energy Efficiency Directive, as well as a number of operational tasks such as energy labelling of buildings. Agency tasks include setting the framework for and administrating the savings activities of the grid and distribution companies, and the Agency manages tasks in connection with the agreement scheme with business.

In September 2011 the Danish Energy Agency took over all the energy-related authority tasks in the building area, which until then had been carried out by the National Agency for Enterprise and Construction. These 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.

As a part of the energy policy agreements of 22 March 2012, was it decided to close the Centre for Energy Savings. Some of their activities have been taken over by the Danish Energy Agency.

4.3.4.1.8 *Specific measures in the business sector (Manufacturing Industries and Construction, Commercial/Institutional and Agriculture, Forestry and Fisheries)*

Energy use in the business sector covers energy use in Manufacturing Industries and Construction, Commercial/Institutional and Agriculture, Forestry and Fisheries.

In 2011, the greenhouse gas emissions from energy use in the business sector decreased by 20% from 9.5 million tonnes CO_2 equivalents in 1990 to 7.6 million tonnes CO_2 equivalents in 2011, primarily due to improvements in energy efficiency and energy savings.

According to the September 2012 projection, the expected emissions from the business sector's energy use are an average of 7.6 million tonnes CO_2 equivalents in 2008-2012 falling steadily to 5 million tonnes CO_2 equivalents in 2035.

The on-going initiatives to reduce emissions from the business sector include promotion of energy savings and energy-efficiency improvements as well as conversion of energy production to cleaner fuels. Certain energy-intensive businesses are also subject to allowances regulation as a consequence of the EU Emission Trading Scheme.

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.

The measures implemented in the business sector are shown in Table 4.18.

TABLE 4.18 MEASURES WITHIN THE BUSINESS SECTOR

Source: Danish Energy Agency and the Danish Environmental Protection Agency

Name of measure/initiative	Objective	GHG affected	Type of instrument	Status of implement-tation	Implementing entity/entities	Estimate of impact on greenhouse gas emissions
Business sector						Million tonnes CO_2-eq.
EN-1: EU-CO_2-allowances for electricity and district heating production (including business)	See Table 4.17	See Table 4.17	See Table 4.17	See Table 4.17	See Table 4.17	See Table 4.17
TD-5: CO_2 tax on energy products	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16
BU-1: Agreements on energy efficiency with business	Energy efficiency at energy intensive enterprises	CO_2	Voluntary agreements, economic (financial)	Implemented As of January 1, 2010, the scheme does not cover CO_2 any longer.	State authorities, business enterprises	-0.9[1]
BU-2: Savings activities by elec. grid, gas and district heating companies (including for the household 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	-0.06[2]
BU-6: Circular on energy efficiency in state institutions	Energy savings, technology promotion, environmental effects incl. CO_2reduction	CO_2	Regulation (admin.)	Implemented	State authorities	NE
BU-7: 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	NE
BU-8(new): Renewables for the industry	Promote investment in energy efficient use of renewable energy in the production processes of enterprises	CO_2	Economic (subsidies)	Implemented (August 2013)	State authorities, enterprises	-1.0[3]

[1] Average annual CO_2 reduction in 2008-2012 from the effect of the measure on investments in 1990-2001 estimated under the energy production angle cf. the assumptions in the Effort Analysis described in Annex B.
[2] Average annual CO_2 reduction in 2008-2012 cf. the 2013 analysis of selected measures described in Annex C.
[3] Estimate of annual CO_2 reduction from 2020.

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, due to the raw materials used.

The main instrument to reduce CO_2 emissions in energy-intensive industry is the EU's emission allowance scheme, covering about 120 industry installations.

Business and industry not covered by the emission allowance scheme are subject to a CO_2 tax corresponding to the expected CO_2 allowance cost.

Business and industry have introduced major energy efficiencies over the past 15 years. This is mainly due to a green tax package for the business sector, which was firstly introduced in 1995. The package contained a combination of taxes and rebates for enterprises. The package led to a higher CO_2 tax and the introduction of a space-heating tax for businesses.

In 1996, a scheme was introduced in which companies with high energy consumption could reduce the taxes in return for entering into an agreement on energy-efficiency improvements. In order to become eligible to enter an agreement, companies have to commit themselves to introduce energy management and carry out special investigations on specific areas of their primary production processes. In addition, they have to undertake energy flow screenings and implement investments to improve energy efficiency with a simple economic payback time of less than four years. Danish experience shows, that introduction of energy management alone contributes to a 10-15% reduction in a company's energy consumption. The combination of taxes and return of the proceeds was intended to ensure a reduction of businesses' CO_2 emissions without affecting their international competitiveness.

Various programmes promoting energy-efficiency measures for businesses have been completed over the last 30 years. The present energy-saving programme on development and implementation of campaigns, market impact activities, etc., focussed on private enterprises, and since 2012 this has been run by the Danish Energy Agency.

Energy savings in businesses have been intensified since 2006, due to the energy-saving efforts by energy companies. Around 40% of the energy savings under the initiative were realised by businesses in the period 2006-2009. This share has increased to almost 60% in 2011.

Finally, the programme aims to consolidate and strengthen the Minister's and the Danish Energy Agency's regulatory assignments concerning energy savings.

As an element in the implementation of the 2012 energy policy agreement, a DKK 3.75 billion (€500m) fund has been established to subsidise industries to convert to renewable energy. As of August 2013, businesses will be able to get support from this fund to convert to renewable energy sources or district heating in accordance with the following objectives:

- Support businesses to replace fossil fuels with renewable energy – such as wind, solar, biogas or biomass – to power manufacturing

- Support businesses to replace fossil fuels by district heating. E.g. horticulture will be able to change from coal-fired boilers to district heating

- Support businesses to invest in energy-efficiency measures.

The estimated effect of this "Renewables for industry" initiative is a reduction of 1 million tonnes of CO_2 per year from 2020 and onwards.

Targeted work to improve energy efficiency specifically in the public sector has been going on for many 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 complete inventories of energy consumption in municipalities and state institutions.

The action plan for a renewed energy saving effort from 2005 also contains a number of initiatives to save energy in the public sector. The main initiatives in this respect are:

- A 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.
- Information activities and tools in relation to energy-efficient lighting, ventilation and office equipment, etc.
- Consultancy by supply companies for institutions.

As mentioned above, the action plan was evaluated in December 2008. New political measures were adopted in 2009 and will be further strengthened during 2013-14 through a revision of the circular on energy efficiency in state institutions. Through the revision the Danish state institutions will achieve further energy savings in the public sector in line with the requirements in the EU Energy Efficiency Directive.

4.3.4.1.9 *Specific measures in the transport sector*

In 2010, the transport sector was responsible for 22% of Denmark's total greenhouse gas emissions. The emissions from the transport sector are primarily CO_2 with a share of 98.9% of transport emissions in 2010. Nitrous oxide made up 1.0% and methane about 0.1%.

In 2010, the transport sector's energy consumption - primarily oil products - made up 33% of total energy consumption in Denmark. The consumption of energy for transport has increased by nearly 23% since 1990. The most recent baseline scenario ("with measures projection") from September 2012 predicts a 4% reduction in the sector's CO_2 emissions from 13.5 million tonnes in 2012 to 13.0 million tonnes in 2020. This is mainly due to the fact that cars and vans are becoming more fuel efficient.

In the September 2012 projection, road traffic in vehicles kilometres is estimated to grow at a rate of approximately 1.8% per year until 2030.

The expected increase in vehicle kilometres travelled will be more than compensated for by increased fuel efficiency, which to a large extent is a result of EU demands on the motor vehicle manufacturers.

Table 4.19 shows the existing policies and measures within the transport sector. A number of important steps have been taken by the European Union. Most important of all is probably the EU's requirements on average CO_2 emissions for passenger cars and vans, i.e. the mechanism imposing fines on manufacturers if they fail to comply with the CO_2 targets.

TABLE 4.19 MEASURES CURRENTLY IN FORCE AIMED AT LIMITING CO2 EMISSIONS FROM THE TRANSPORT SECTOR

Source: Ministry of Transport and Danish Energy Agency

Name of measure/initiative	Objective	GHG affected	Type of instrument	Status of implement-tation	Implementing entity/entities	Estimate of impact on greenhouse gas emissions
The transport sector						Million tonnes CO_2
TD-1b: Higher fuel taxes	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16
TD-6: Green Owner Tax	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16
TD-7: Registration tax	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16
TR-1a: EU demands on vehicle manufactures to deliver fuel efficient cars and vans	More efficient energy consumption, CO_2 reduction	CO_2	Regulatory	Implemented	European Commission	-0.6[1]
TR-1b: Campaign on fuel consumption of new cars	More efficient energy consumption, CO_2 reduction	CO_2	Information	Implemented	Road Safety and Transport Agency	IE(TR-1a)
TR-2: Campaign on energy-efficient driving	More efficient energy consumption CO_2 reduction	CO_2	Information	Implemented - included in driving courses	Ministry of Justice	IE(TR-1a)
TR-3: Initiative on enforcing speed limits	More efficient energy consumption, CO_2 reduction	CO_2	Information, economic	Implemented	Ministry of Justice	NE
TR-4: Establishment of intermodal installations	More efficient energy consumption, CO_2 reduction	CO_2	Economic (financial)	Ongoing implementation	Ministry of Transport, regions, municipalities, HUR, DSB	NE
TR-5: Promotion of environmentally friendly goods transport	More efficient energy consumption, CO_2 reduction	CO_2	Economic (financial), information	Implemented	Danish Environmental Protection Agency, haulage contractors	NE
TR-6: Reduced travel times for public transport	More efficient energy consumption, CO_2 reduction	CO_2	Regulatory (Administrative)	Ongoing implementation	Ministry of Transport, regions, DSB	NE
TR-7: Spatial planning	Limitation of transport, CO_2 reduction	CO_2	Regulatory (Administrative)	Ongoing implementation	Regions, municipalities	NE
TR-8(new): EU requirements regarding biofuels	CO_2 reduction	CO_2	Regulatory	Implemented	Danish Energy Agency	0.29[2]

[1] Average annual CO_2 reduction in 2008-2012 as the combined effect of the EU voluntary agreement with the automobile industry, the Green Owner Tax, information campaigns, energy labelling of cars etc. cf. the assumptions in the Effort Analysis described in Annex B

[2] Average annual CO_2 reduction in 2008-2012 from the phasing in of the blending requirement with 0.75% biofuel in 2010, 3.3% in 2011 and 5,75% in 2012 cf. the 2013 analysis of selected measures described in Annex C.

CO_2 measures at EU level and Danish measures aimed at reducing the transport sector's CO_2 emissions are described under the measures section below.

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. The measures ”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 are hard to quantify and in themselves they are not considered to have contributed significantly to CO_2 reductions

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 thus important to note that the various initiatives implemented in the transport area typically address many of these aspects as well - and thus cannot only be considered in relation to CO_2 emissions. In general the increasing traffic intensity has caused increased CO_2 emissions, while other pollution emissions have fallen significantly. Other negative effects of transport have also been reduced. The number of fatalities in accidents fell by 72% from 1990 to 2012.

From 2012 all petrol and diesel for transport sold in Denmark must contain an average of 5.75% of biofuels, which must live up to the EU sustainability criteria. According to the Energy Agreement of March 2012 a 10 percent target is foreseen by 2020, however pending analyses of alternative instruments carried out by 2015.

In the agreement DKK 70 million has been allocated to transport infrastructure projects in the fields of electric vehicles, gas and hydrogen. An ongoing pilot scheme for electric vehicles has been prolonged until 2015 with an additional funding of DKK 15 million on top of the DKK 35 million from the former Energy Agreement.

According to the new Energy Agreement of March 2012 the tax exemption for hydrogen fuelled cars and electric cars will be prolonged until 2015.

A strategy for the promotion of energy-efficient vehicles will be set up based on a number of analyses to be carried out in 2013-2015 - including a number of wells-to-wheels analyses of various power plants.

In 2009, as a result of a broad political agreement regarding transport policy in Denmark, funds were allocated to the activities listed below:

- DKK 200 million for projects on energy-efficient transport. A large number of projects have been initiated within the areas listed below:
    - A large-scale field operational test of electric vehicles

- Off-peak delivery scheme for goods using low-noise equipment
- City logistics for goods transport
- Hybrid electric buses
- Lightweight materials
- Mobility Management
- Intelligent Transport Systems
- CNG city buses
- Electric city buses

- DKK 28 million has been allocated to campaigns to promote energy-efficient driving. Experience shows that most people are able to save between 5% and 15% fuel by adopting a more energy-efficient driving style.
- DKK 14 million for a campaign aimed at raising public awareness about energy labelling of new cars and vans.
- Introduction of a certification system for "green transport companies" and "green Cities" should promote the use of energy-efficient cars and better use of the existing car fleet.

In 2013, the Danish government decided to allocate DKK 27.5 billion to improve the rail infrastructure in Denmark substantially. The upgrade is expected to be finalized by 2025 and will reduce travel times substantially. A CO_2 reduction of around 100,000 tonnes per year is expected.

Furthermore the Danish government has allocated funds to several larger projects, which will result in emission reductions. The largest fund allocations are DKK 1.2 billion to the electrification of parts of the rail infrastructure; DKK 328 million to the establishment of a metro line to the new Nordhavn area in Copenhagen – and DKK 1 billion to improve and promote Danish cycle transport facilities.

4.3.4.1.10 *Specific measures in the residential sector*

In 2010, the residential sector contributed to Denmark's total national greenhouse gas emissions with 3.2 million tonnes of CO_2 equivalents, corresponding to a share of 5.3%. The residential sector in the greenhouse gas inventory only includes CO_2 emissions from burning of oil and natural gas since emissions from production of electricity and district heating used by households are attributed to the plants where the electricity and heat is produced.

Approximately 94.5% of greenhouse gas emissions from the residential sector in 2010 consisted of CO_2. There are also small emissions of methane and even smaller emissions of nitrous oxide.

In this section measures addressing all types of energy consumption in the household sector are described, although some of the energy savings will result in emission reductions in the energy production sector.

The consumption of energy by households, including electricity and district heating, is responsible for almost 30% of the total final 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 CO_2 emissions. A large part of the space heating is in the form of district heating (42.6% in 2011), 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, 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 is by household appliances and light sources, whereas a decreasing amount of electricity is by electric heating. Consumption for electric heating has been almost constant in recent years as a consequence of the 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 2011, the household sector used 163.6 PJ of energy for space heating and hot water (climate-corrected) and 32.4 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. is still increasing. 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.

With a view to reducing energy consumption and environmental impacts from the household sector, a wide range of initiatives have been launched, as described in Table 4.20 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 and the use of renewable energy).

Several concrete measures and incentives already implemented are described below.

TABLE 4.20 MEASURES WITHIN THE HOUSEHOLD SECTOR TO REDUCE EMISSIONS OF GREENHOUSE GASES

Source: Danish Energy Agency

Name of measure/initiative	Objective	GHG affected	Type of instrument	Status of implement-tation	Implementing entity/entities	Estimate of impact on greenhouse gas emissions
Household sector						Million tonnes CO_2
EN-1: EU-CO_2 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	NE
HO-1: Energy labelling of small and large buildings (incl. public sector and business)	Savings in energy water and environmental impacts including CO_2 reductions	CO_2	Information	Implemented	Danish Energy Agency, consumers and others	NE
HO-2: Energy labelling of electric appliances	Energy savings and more efficiency, promote technology env. impacts including CO_2 reductions	CO_2	Information	Implemented	Danish Energy Agency, consumers and others	NE
HO-3 (new): Substitution of individual oil-based furnaces	The promotion of modern, low-emitting heating solutions, including systems based on renewable energy such as heat pumps and solar heating	CO_2	2010-2012: Economic (subsidies) From 2013: Information	Implemented	Danish Energy Agency and consumers	-0.02[1]

[1] Average annual CO_2 reduction in 2008-2012 from the combined effect of replacing oil burners with heat pumps, launching awareness campaigns, labelling of efficient pumps, limited subsidies etc. cf. the 2013 analysis of selected measures described in Annex C.

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 is subject to energy taxes. Throughout the 1990s CO_2 and energy taxes have steadily increased, but since 2002 they have been almost stable. The increases have mainly affected households, helping to reduce their energy consumption. In February 2013 the phasing in of a new energy security tax started. This new tax is an element in the implementation of the Energy Agreement from March 2012.

CO_2 taxes

All energy consumption in households is subject to CO_2 taxes. The CO_2 tax is further described in section 4.3.3.

Energy labelling of buildings

Denmark has long experience with energy efficiency and energy savings in buildings. Since 1980 energy consumption for heating has been reduced by 27% per

m^2. The goal is to reduce energy consumption in new buildings by 75% by 2020 relative to 2006. The benefits of reducing energy consumption are tangible: less fossil fuel is consumed and the environment has improved substantially. Strict and progressively tightened building regulations since 1977 have ensured a stable demand for energy-efficient building technologies.

Energy labelling of buildings when built, sold or rented

Energy labelling of buildings must be implemented after finishing the construction of a building and on the sale or rental of the building - primarily heating consumption. This applies in principle for all buildings, irrespective of size, apart from production facilities, factories etc.

Regular energy labelling of large buildings and public buildings

Energy labels and an energy plan must be prepared regularly every seven to ten years for all large buildings over 1,000 m^2 and for all public buildings over 250 m^2.

Minimum energy requirements and energy labelling of appliances

Energy labelling (A-G) of white goods, lighting, air con etc. is compulsory within the EU. The European Community also has mandatory energy requirements for some 20 energy-consuming products, such as electric motors, circulators, white goods etc. There are also voluntary labelling schemes (Energy Star, Energy Arrow, windows, boilers) for a number of products. Danish authorities play an active role both in negotiation of the requirements and in securing compliance with the compulsory requirements. The Danish Energy Agency offers advice on its website to end-users in order to promote energy-efficient appliances and products.

Information initiative towards private households

In March 2012 the Centre for Energy Savings was replaced by an information initiative placed at the Energy Agency. The main target of this initiative is to promote energy-efficient products and solutions. The measures of the initiative will be information campaigns, web-based information for private households etc.

Support for the substitution of individual oil-based furnaces

Impartial and free-of-charge phone-based and web-based guidance on substitution of individual oil-based furnaces with renewable energy heating sources was established in September 2013 - after the DKK 400 million subsidy scheme for scapping of oil-based furnaces implemented in 2010 ended in 2012. Another way of supporting the substitution of individual oil-based furnaces is a one-stop-shop solution for building owners who want to energy-renovate their building and need guidance on technical and financial matters.

In March 2012 the Danish government and a broad majority in Parliament concluded a comprehensive Energy Agreement with several new measures for the period until 2020. The background for the agreement is the long-term objective that Danish energy consumption is to be solely based on renewable energy sources. In 2050 there is to be no use of fossil fuels. One of the key ambitions in the agreement is to further improve energy efficiency and energy savings.

4.3.4.2 CH_4 (methane)

Total emissions of methane from the energy sector account for about 1.1% of the sector's greenhouse gas emissions, corresponding to about 0.5 million tonnes CO_2 equivalents. Many small sources contribute to this overall relatively minor source of greenhouse gas emissions. The biggest single contribution comes from gas-fired CHP plants, which emit unburnt natural gas. With a view to minimising the emissions, a 1998 Statutory Order, in force from 2006 to 2013, has limited emissions of nitrogen oxides, unburnt carbon hydrides, including methane, and carbon monoxide etc.. However, the limit value for unburned hydro carbons was removed in a revision of the Statutory Order entering into force on 7 January 2013.

4.3.4.3 N_2O (nitrous oxide)

Nitrous oxide accounts for 0.8%, or 0.4 million tonnes CO_2 equivalents, of the energy sector's total greenhouse gas emissions. Within energy, emissions of nitrous oxide from transport have increased since the introduction of new cars with catalytic converters in 1990. However, as the population of cars from before 1990 is almost zero today, no further increase in specific nitrous oxide emissions from cars with catalytic converters is expected.

4.3.5 Industrial Processes (including Solvent and Other Product Use)

4.3.5.1 CO_2 - Cement production

Cement production results in large 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. About half of the emissions come from the company's 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.

Since 2005, all CO_2 emissions from cement production in Denmark are subject to the EU ETS.

4.3.5.2 N_2O - Production of nitric acid

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.

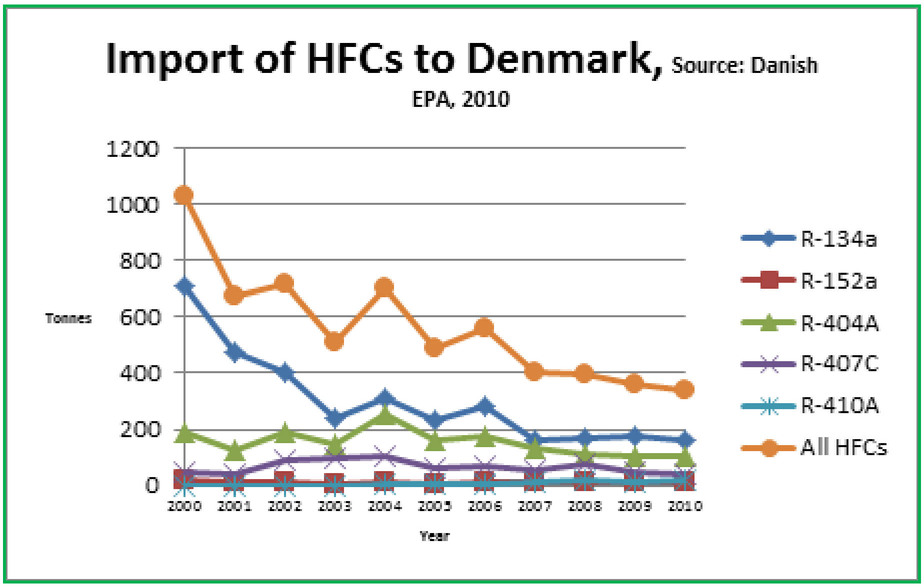
In summer 2004, however, the owner decided to stop production of fertilizer and so production of nitric acid in Denmark. Emissions of nitrous oxide from production of nitric acid in 2003 corresponded to 0.9 million tonnes CO_2 equivalents. In 2004 emissions were about one-half of this, and from 2005 they ceased entirely, and probably also in 2008-2012 cf. market conditions for production of fertilizer in Europe.

4.3.5.3 *HFCs, PFCs and SF_6 - Consumption of these substances*

Emissions of the so-called industrial gases HFCs, PFCs, and SF_6 are in accordance with the emission inventories included in the industrial sector. This is also the case for emissions from other sectors during use and scrapping of equipment containing HFCs, PFCs and SF_6. These gases are used for several purposes including as refrigerants and blowing agents, etc. (HFCs) and insulator gas in high-tension contacts (SF_6). Since there is no production of these gases in Denmark, all emissions are related to the import of the substances. The developments in imports of chemical mixtures containing HFCs in recent years are shown in Figure 4.10.

FIGURE 4.10IMPORT OF HFCS TO DENMARK 2000-2010 IN TONNES HFCS

Source: Danish Environmental Protection Agency



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 use of the gases in new facilities and products. Both measures are further described below.

According to model-based calculations, the combined effect of taxation and regulation of F-gases compared to a business as usual scenario starting in 2000 is an approximately 1.4 million tonnes of CO_2 equivalents reduction in annual F-gas emissions in 2020. The accumulated emission savings over the period from 2000 to 2020 is estimated at approximately 11.2 million tonnes of CO_2 equivalents.

4.3.5.3.1 *Taxes on HFCs, PFCs and SF_6*

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 0.15 per kg CO_2 as described in section 4.3.3. This means that HFC-134a is subject to a tax of DKK 215/kg, as it has a GWP of 1,430. There is a ceiling of DKK 600/kg so although SF_6 has a GWP of 23,900, the tax is only DKK 600/kg and not DKK 3,585/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 as 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 plants, 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 services on existing and new installations/products.

4.3.5.3.2 *Regulation of HFCs, PFCs and SF_6*

On 15 July 2002, a statutory order on the regulation of certain industrial greenhouse gases came into force.

This Statutory 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. However, some products and applications are exempted from the ban. This applies, for example, to servicing 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 and10 kg HFC, SF_6 in high voltage plants, etc.

To ensure the best possible implementation of the phase-out dates for the refrigeration sector, a total of DKK 12 million was reserved for the period 2005-2007 for development of alternatives and for subsidies for implementation of the alternatives developed in the previous years. A knowledge centre for HFC-free cooling has been established. This centre disseminates knowledge and offers technical assistance.

An overview of the above measures regarding industrial processes is given in table 4.21.

TABLE 4.21 MEASURES IN INDUSTRIAL PROCESSES

Source: Danish Energy Agency and the Danish Environmental Protection Agency

Name of measure/initiative	Objective	GHG affected	Type of instrument	Status of implement-tation	Implementing entity/entities	Estimate of impact on greenhouse gas emissions
Industrial Processes						
EN-1: EU CO_2 allowances (see under Energy)	CO_2 reduction in cement production	CO_2	Economic (financial)	Implemented amendment to implement the Linking Directive adopted by the Folketing May 2005	State authorities, energy producers, energy intensive enterprises	NE
TD-8 (BU-3): Tax on HFCs, PFCs and SF_6	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16	See Table 4.16
IP-1 (BU-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	IE(TD-8)
IP-2 (BU-5): Enterprise scheme on HFCs	To reduce use and thus emissions of HFCs in the refrigeration sector	HFCs	Economic (subsidies)	Initiated spring 2005, but ceased by the end of 2011	State authorities	NE

4.3.6 Agriculture

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 CO_2 emissions by sources and removals by sinks in Denmark's agricultural soils and forests are included under the LULUCF sector described in Section 4.3.7. However, CO_2 emissions from energy use in agriculture are included under energy.

In 2011, emissions of methane and nitrous oxide from agriculture were responsible for 17% of Denmark's total greenhouse gas emissions and agriculture is the most important sector regarding the emissions of N_2O and CH_4. In 2011, the contribution of N_2O and CH_4 from agriculture to the total emission of these gases was 92% and 76%, respectively. N_2O emissions decreased by 39% and the CH_4 emissions increased by 3.5% from 1990 to 2011 (*Nielsen et al., 2013*). The greenhouse gas emissions from agriculture consisted of approx. 43% from methane and 57% from nitrous.

It should be noted that preliminary estimates of methane and nitrous oxide from agriculture based on new global warming potentials (GWPs) and inventory guidelines (IPCC 2006 guidelines for GHG inventories) to be used from 2015 onwards as described in Boxes 5.1 and 5.2 in Chapter 5 show significant changes in both absolute levels and in calculations of shares and trends. The greenhouse gas emission estimates and calculation of shares and trends in agriculture are based on the current GWPs and inventory guidelines in this section as well as throughout this national communication - unless otherwise stated.

Table 4.22 shows measures for greenhouse gas emission reductions within agriculture.

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 Agricultural 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/initiative	Objective	GHG affected	Type of instrument	Status of implement-tation	Implementing entity/entities	Impact in 2001	Impact in 2010	Impact in 2020
Agriculture						million tonnes CO_2 eq.	million tonnes CO_2 eq.	Million tonnes CO_2 eq.
AG-1 (AF-1): 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/yr[1]	N_2O	Regulation (order), economic, information	Implemented (1987, 1991, 1998)	State and county authorities	-1.6	-2.2	
AG-2 (AF-2): Action Plan for the Aquatic Environment III	Further reduction of N and P losses from agriculture	N_2O	Regulation (order), economic	Implemented (2004)	State and county authorities		-0.2[2]	
AG-4a/4b/4c/4d/4e (AF-4a/4b/4c/4d/4e): Ammonia action plan and the new statutory order on manure	Reduced emissions of ammonia	N_2O	Regulation (order)	Implemented (2001)	State and county authorities		-0.03	
AG-4f (AF-4f): Environmental Approval Act for Livestock Holdings	Reduction of N and P losses and reduction of the impact on nature. Increased use of technology	N_2O	Regulation in connection to permits made when livestock productions expands.	Implemented (2007/2011)	State and county authorities			
AG-6 (AF-6): Biogas plant	Reduced CO_2 and methane emissions and better exploitation of manure	CO_2, N_2O and CH_4	Economic (subsidies)	Implemented (1987) Reinforced (2012)	State	-0.2	-0.017[3] to -0.036	-0.24
AG-9(new): Agreement on Green Growth	Reduced use of N due to a re-structuring of nitrogen regulation and reduction of N and P losses from agriculture	N_2O	Regulation (order), economic	Ongoing implementation	State and country authorities			-0.8[4]

[1] The actual achieved reduction of N run-off from agriculture has been estimated to amount to 149,000 t N/yr .
[2] 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 CO_2 equivalents/year, and that the effect of the CAP reform will be an additional reduction of 230,000 tonnes CO_2 equivalents/year. All the estimated effects are in the new baseline projection "with measures" The mid-term evaluation of Action Plan III revealed that the expected effects for reduction of N leaching will be difficult to reach .
[3] In the 2013 analysis of selected measures described in Annex C, the average annual CO_2 reduction in 2008-2012 from the related subsidy for biogas plants when biogas is used with natural gas is estimated to amount to 0.017 million tonnes of CO_2 equivalents per year.
[4] Including reduced CO_2, N_2O and CH_4emissions and better exploitation of manure due to installation of new biogas plant as described in the Agreement on Green Growth.

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
- Environmental Approval Act for Livestock Holdings
- New Energy Policy Agreement, supporting biogas
- Agreement on Green Growth 2009: Reduction of the agricultural sector's emissions of greenhouse gasses by an anticipated 800,000 tonnes of CO_2 eq. annually as a consequence of the energy, nature and environment initiatives.

4.3.6.1 CH_4 (methane)

Methane comes mainly from the agricultural sector, contributing with 76% of total Danish CH_4 emissions in 2011. The emissions in 2011 corresponded to 4.2 million tonnes CO_2 equivalents (*Nielsen et al., 2012*). 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 has remained more or less stable in the period from 2003 to 2011, and is expected to remain more or less stable in the years up to 2035. However this could change due to the liberalisation of the European milk-market with scrapping of the milk-quota system in 2013. At present the number of dairy cows in Denmark is projected to remain stable, whereas milk production, feed intake and methane emissions from enteric rumen fermentation are expected to rise. However, this increase is neutralised by a decrease in methane emissions from manure, in line with increasing shares of manure being treated in biogas plants or acidified during storage.

4.3.6.2 N_2O (nitrous oxide)

Agriculture is the biggest source of nitrous oxide emissions in Denmark. Of the total N_2O emissions of 6.0 million tonnes CO_2 equivalents in 2011, 92% or 5.5 million tonnes of CO_2 equivalents, came from agriculture (*Nielsen et al., 2013*). 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 source of nitrous gas emissions. 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. 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[14] (*Nielsen et al., 2013*).

The main reason for the drop in the emissions of N_2O in the agricultural sector of 39% from 1990 to 2011 is legislation to reduce nitrogen leaching by improving the utilisation of nitrogen bound in manure and reduction in the application of mineral fertilizers. The legislation has resulted in less nitrogen excreted per unit livestock produced and a considerable reduction in the use of mineral fertilisers. The basis for the N_2O is then reduced (*Nielsen et al., 2013*). Implementation of the Action Plans for the Aquatic Environment II and III contribute the most to this reduction[15,16].

4.3.6.2.1 *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 nutrient losses 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 in particular requirements concerning closed periods for applying slurry, ensuring a better utilisation of manure as well as minimum slurry storage capacity, mandatory incorporation of manure into the soil shortly after application and winter green fields. The Action Plan for the Aquatic Environment II from 1998 contained a number of additional measures, including re-establishment 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 increased efficiency in 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[17]. The benchmark for the evaluation of the agricultural nitrogen leaching, as part of the final evaluation of the Action Plan for the Aquatic Environment II in December 2003, was 311,000 tonnes N per year. The evaluation showed that measures already implemented in addition to the measures agreed upon and financed by Action Plan II would result in a reduction of the total nitrogen leaching from agriculture (root zone and stable and storage facilities) of around 149,000 tonnes N per year. This corresponds to a reduction of around 48% of 311,000 tonnes N. After taking into account the calculation uncertainty, the nitrogen discharge reduction goal of 49% was achieved.

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[14] 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).

[15] 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).

[16] 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).

[17] 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).

These action plans have reduced the emissions of nitrous oxide in particular. 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 million tonnes CO_2 equivalents/year[19]. There are no estimates of the effect of the Action Plans I and II for the Aquatic Environment and the Action Plan for Sustainable Agriculture on carbon storage in the soil.

4.3.6.2.2 *Action Plan for the Aquatic Environment III and the Green Growth Agreement*

With the political agreement on the Action Plan for the Aquatic Environment III (APAE 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 million tonnes CO_2 equivalents/year[18].

In 2008 the APAE III was evaluated on results, adequacy of tools and economic aspects to ensure that activities and expected results are achieved. The main conclusions for a number of measures were that implementation and effect have not been as anticipated. At the midterm evaluation of the Aquatic Plan for the Environment III 2008, covering the years 2004-2007, no reductions in the production of animal manure was recorded, nor for a further decrease in the use of mineral fertilizers. Furthermore, no significant reductions in nitrogen leaching were proved for the investigated period (Waage Petersen et al., 2008).Thus, no change in the key parameters that provided reduction in the emissions of greenhouse gasses in the earlier action plans for the aquatic environment have happened so far, so it may be difficult to reach the above target.

In 2009 the Danish government launched the Green Growth Agreement (GGA) – a plan that ensures better conditions for nature and the environment while allowing agriculture to develop. The Green Growth Agreement is a long-term plan for Danish nature, environment and agriculture. The purpose of the Agreement is to ensure that

[18]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).

a high level of environmental, nature and climate protection goes hand in hand with modern and competitive agriculture and food industries.

The Green Growth Agreement contains targets with respect to discharges of nitrogen and phosphorus to the aquatic environment, protection of nature and biodiversity, development of renewable energy in the agricultural sector including biogas plant, reduction of harmful pesticides, development of the organic sector and strengthened initiatives within R&D within the agricultural and food sectors.

The initiatives incorporated in the Green Growth Agreement are expected to reduce the agricultural sector's overall emissions of greenhouse gases by about 800,000 tonnes of CO_2 annually. Of this, about 400,000 tonnes are expected to be derived from a green, market-based re-structuring of nitrogen regulation.

The opportunities for further reduction of emissions from the agricultural sector will be analysed in more detail. This analysis will be integral to a collective, cross-sectional analysis of possible instruments within the European Climate Action and Renewable Energy Package for the entire non-quota area. The analysis is expected to be presented in the spring of 2013. Based on this analysis, the government is expected to present a collective, cost-effective climate strategy for the non-quota area up to 2020.

The Green Growth Agreement also deals with the problems formerly encountered in achieving expected goals in the APAE III. The measures in the Green Growth Agreement will continue ensuring the achievement of the objective of the Nitrates Directive, with the targets on reducing the loads of nitrogen and phosphorus, as the target in APAE III is now included in the GGA target. A change from the former APAEs is the switch from a target in N leaching from the root zone to a target in N discharge to the aquatic environment. As the GGA also implements the Water Framework Directive, some measures are targeted sub-catchments and some measures are general rules.

4.3.6.2.3 *Environmental Approval Act for Livestock Holdings*

The Environmental Approval Act for Livestock Holdings was implemented on 1 January 2007, providing national minimum requirements for environmental protection (odour, ammonia, nitrate, phosphorous, landscape, etc.) when livestock holdings are established, expanded or changed. The purpose of the Act is also to ensure the use of best available techniques (BAT).

The measures covered by the Environmental Approval Act for Livestock Holdings in 2007 were:

- 300 m buffer zones around ammonia-sensitive areas where no extension of livestock farms can take place if such an extension would lead to increased ammonia deposition in natural areas vulnerable to ammonia.
- Demand for a general reduction of ammonia emissions relative to a production facility with lowest ammonia emission norm: 2007: 15%, 2008: 20%, 2009: 25%
- Demands for injection of animal slurry on black soil and grass within buffer zones (1 km from vulnerable natural areas and from 2011 in the whole country).

- Demand for fixed cover on most new containers for solid manure and slurry tanks (depending on distance to neighbours and vulnerable natural areas).
- Environmental standards and limits for nitrate-leaching to surface waters and groundwater depending on vulnerability ex. denitrification capacity and standards for phosphorous surplus depending on soil type and drainage.
- Environmental standards and limits for max. deposition of ammonia on vulnerable nature and max. odour impact on neighbours and cities.

The effect of these measures on greenhouse gas emissions has not yet been quantified.

The Environmental Approval Act for Livestock Holdings was changed in 2011, and the environmental standards for ammonia were tightened. The general reduction was increased to a reduction of 30% and max. deposition of ammonia was tightened significantly.

4.3.6.2.4 *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. The Ammonia Action Plan, which was adopted in 2001 will, together with the Action Plans 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 in sheds for cattle, pigs, poultry and fur animals.
2) Rules on covering storage facilities for solid manure and slurry tanks.
3) Ban on overall 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 have led to a reduction in emissions of nitrous oxide corresponding to 34,000 tonnes of CO_2 equivalents annually in 2010 and thereafter. A shorter period of exposure for spread manure has the greatest effect of 13,000 tonnes of CO_2 equivalents annually[20].

4.3.6.2.5 *Biogas*

Biogas from digestion of manure and organic wastes has a number of advantages when used to substitute fossil energy: reductions in emissions of greenhouse gases, better exploitation of manure as fertiliser, recycling and use of organic wastes for energy and fertiliser purposes etc.

In order to ensure renewed growth, the politically fixed subsidy on the sales price of electricity production based on biogas was adjusted by the Energy Policy Agreement of 22 March 2012. The Agreement resulted in an amendment to the Promotion of Renewable Energy Act of 27 December 2008.

The Energy Policy Agreement continued funding biogas for CHP and introduced subsidy equality so that biogas sold to the natural gas grid receives the same subsidy as biogas used at CHP plants. In addition the agreement also introduced a new subsidy when biogas is used in industrial processes or as a fuel for transport.

Finally, as part of the Danish Rural Development Programme 2007-2013, aid has been provided to investments in biogas plants in 2010 and in 2012. In 2012 support was awarded to both new and existing biogas plants to the amount of DKK 262 million.

Consequently the latest projection from the Danish Energy Agency expects an increase in the biogas production from 4 PJ in 2007 to 17 PJ in 2020. This is expected to imply a five to six fold increase in the volume of manure used for biogas generation before 2020.

The political objective in the Green Growth Agreement is to use up to 50% of livestock manure in production of green energy by 2020.

The increase is expected to result in annual emissions of methane and nitrous oxide from agriculture being additionally reduced by approx. 0.24 million tonnes of CO_2 equivalents by 2020. An additional reduction of almost 1 million tonnes of CO_2 equivalents in greenhouse gas emissions from the energy sector is expected by 2020 due to reduced CO_2 emissions from substitution of fossil fuels, primarily natural gas, with the increased production of biogas.

4.3.7 LULUCF (Land-Use, Land-Use Change and Forestry)

4.3.7.1 CO_2 – emissions and removals in LULUCF under the Climate Convention

The emission of GHGs from the LULUCF sector (Land Use, Land Use Change and Forestry) includes primarily the emission of CO_2 from land use and small amounts of N_2O from disturbance of soils not included in the agricultural sector.

The LULUCF sector is subdivided into six major categories:

- Forest
- Cropland
- Grassland
- Wetlands
- Settlements
- Other Land

Forests and forestry are important due to CO_2 sequestration and emissions as a consequence of trees growing, respiring and decomposing. Danish forests contain 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.

In the estimation of carbon pools and emissions from existing forests, afforestation and deforestation in 1990 to 2012, the information collected in relation to different forest census and inventories is combined with the satellite-based land use/land cover map for the base year 1990, 2005 and 2011. Hereby, consistent estimates of emissions from existing forests are obtained utilising as much information from the data sources as possible and providing best possible time series. From 2005 and onwards, satellite-based land use/land cover maps for 1990, 2005 and 2011 are combined with geo-referenced data from the National Forest Inventory to provide estimates of carbon storage in forests related to Articles 3.3 and 3.4 in the Kyoto Protocol.

Estimates of woody biomass carbon pools are obtained by applying species specific stem (for conifers) and total tree (for broadleaves) volume functions to individual tree measurements in the National Forest Inventory plots. Stem biomass for conifers and the total above-ground woody biomass for deciduous trees are derived by multiplying the volumes by species' specific basic densities for the wood. The estimated biomass is converted into total above-ground and below-ground biomass by multiplying with expansion factors obtained from recent studies which provided Danish biomass equations and expansion factor functions for beech and Norway spruce as representatives of deciduous and coniferous species (Skovsgaard et al. 2011; Skovsgaard and Nord-Larsen, 2012). This is a significant improvement from the standard expansion factors used previously. The quantity of carbon is calculated by multiplying by the conversion factor of 0.5 tonnes C/tonne dry matter.

Estimation of deadwood carbon pools follows the calculations stated above except that a conversion factor is applied according to the degree of decomposition of the wood.

Estimation of carbon pools in the forest floor (litter) is based on measurements of the depth of the litter layer on the National Forest Inventory plots. As peat lands are reported specifically, a maximum depth of 15 cm is used in the calculations. Forest-floor carbon for individual species is estimated by multiplication of the forest floor depth by the plot area, a species-specific density (Vesterdal & Raulund-Rasmussen, 1998) and the ground cover fraction of the individual species. Calculation of ground cover fraction is based on the proportion of basal area of the individual species and total forest-floor carbon is estimated by summation of forest-floor carbon of the different species.

For estimation of carbon pools in the mineral soil, average carbon content for different soil types (loamy, sandy and organic) were applied to the individual National Forest Inventory plots according to their soil types determined from Danish soil. The average soil carbon contents used in this analysis were obtain in a forest soil inventory in which it was documented that forest mineral soil is not an overlooked source of CO_2 emissions. In a study, analysis of time series data did not reveal any changes in forest mineral-soil carbon pools observed in 1990 and 2007-2009.

The forest area and total amounts of carbon stored in different pools of forests established before and after 1990 and forests removed after 1990 are provided in Table 4.23.

The changes in the different carbon pools are reflected in the CO_2 emissions from the forests. However, as land-use changes in forestry are also reflected in the carbon pools of other types of land use (e.g. cropland, grassland or wetland) the carbon pools provided in table 4.23 cannot be translated directly into CO_2 emissions for forestry. Reported annual CO_2 emissions from forestry in 1990 to 2011 are provided in Table 4.24.

TABLE 4.23. AREA AND CARBON POOLS IN WOODY BIOMASS AND FOREST SOILS IN FORESTS ESTABLISHED BEFORE AND AFTER 1990 AND IN DEFORESTATION.

Source: Department of Geosciences and Natural Resource Management, March 2013

Area and Carbon Pools	1990	1995	2000	2005	2007	2008	2009	2010	2011
Forests established before 1990									
Area (ha)									
Forest	543,209	543,007	542,806	542,128	541,092	540,575	540,057	539,540	539,022
Organic soil	26,494	26,485	26,475	26,442	26,391	26,366	26,341	26,315	26,290
Biomass (‘000 tonnes C)									
Above ground	29,313	30,460	31,559	30,182	30,120	31,068	31,030	31,485	32,683
Below ground	4,721	4,904	5,080	5,724	5,885	6,081	6,094	6,180	6,425
Dead wood	466	495	522	547	492	494	515	563	592
Soil (’000 tonnes C)									
Forest floor	6,710	6,595	6,474	5,583	5,541	6,024	6,046	6,569	6,831
Mineral soil	91,694	91,660	91,626	91,511	91,336	91,249	91,162	91,074	90,987
Forests established after 1990									
Area (ha)									
Forest	3,877	23,263	42,648	62,009	69,713	73,564	77,416	81,268	85,120
Organic soil	421	2,527	4,633	6,736	7,573	7,992	8,410	8,829	9,247
Biomass (’000 tonnes C)									
Above ground	-	22	95	516	800	742	788	845	888
Below ground	-	4	16	116	178	163	171	179	185
Dead wood	-	1	3	47	64	71	73	87	78
Soil (’000 tonnes C)									
Forest floor	-	3	26	248	360	346	362	383	378
Mineral soil	708	4,249	7,789	11,325	12,732	13,435	14,139	14,842	15,546
Deforestation									
Area (ha)									
Forest	40	40	40	518	518	518	518	518	518
Organic soil	2	2	2	25	25	25	25	25	25
Biomass (’000 tonnes C)									
Above ground	-2	-2	-2	-18	-18	-18	-18	-18	-19
Below ground	-0	-0	-0	-4	-4	-4	-4	-4	-4
Dead wood	-0	-0	-0	-0	-0	-0	-0	-0	-0
Soil (’000 tonnes C)									
Forest floor	-0	-0	-0	-3	-3	-3	-3	-3	-3
Mineral soil	-7	-7	-7	-87	-87	-87	-87	-87	-87

TABLE 4.24.CARBON DIOXIDE BALANCES OF FOREST MANAGEMENT (ARTICLE 3.4) AND LAND-USE CHANGE RELATED TO FOREST (ARTICLE 3.3).

Source: Department of Geosciences and Natural Resource Management, March 2013

CO_2 sequestration in Gg (negative = emissions)	1990	1995	2000	2005	2007	2008	2009	2010	2011
Art. 3.3									
Afforestation	-81.7		45.0	647.3	912.9	-300.7	210.0	319.9	71.2
Deforestation	-10.7		-11.6	-77.0	-76.4	-78.9	-78.6	-80.1	-82.8
Art. 3.4									
Forest management	-66.0		697.5	-242.3	1234.2	5923.5	163.4	4028.3	6313.6

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 forests are managed with a view to multiple-use and sustainability, and carbon sequestration is one of several objectives.

The political measure to increase carbon sequestration is the objective from the National Forest Programme (2002): "Forest landscapes should cover 20-25% of Denmark after one tree generation (80-100 years)" – and the scope and potential for natural habitats and processes should be strengthened in this effort. This measure relates to Article 3.3 of the Kyoto Protocol. Various measures have been taken towards achieving this goal as shown in Table 4.25. For instance, a government grant scheme has been established as an incentive for afforestation on private agricultural land. Also, the state itself is establishing new forests, and some private individuals are establishing forests on agricultural land without a government grant. Through rural planning and differentiated incentives, afforestation is particularly encouraged in certain priority areas in order to pursue multiple forest functions and values, including recreation and ground water protection.

Carbon sequestration in afforestation is stored in the total living biomass (incl. roots) of the trees. 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 following afforestation of cropland due to a larger supply of dead organic matter and the absence of soil preparation. Denmark reported on sequestration in litter (forest floors) developing after conversion from agriculture to forestry while mineral soil C stocks are reported as unchanged based on field measurements. Previous studies did not indicate any consistent change in mineral soil C stocks (Vesterdal et al., 2002, 2007).

The effect of afforestation on other greenhouse gases, such as nitrous oxide and methane has recently been studied in Denmark (Christiansen and Gundersen, 2011). 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. The recent projects have shown that methane uptake in soils is in fact increased following afforestation of well-drained soils, although only in oak stands, while methane uptake was unchanged in Norway spruce (Christiansen and Gundersen, 2011). In more wet afforested areas, methane may be emitted when drainage pipes stop working (Christiansen et al., 2012). Nitrous oxide emissions increased with time since afforestation in both oak and spruce stands (Christiansen and Gundersen, 2011). Increased methane and nitrous oxide emissions could to some degree counteract the positive effect of afforestation on CO_2 sequestration. However, since information is still scarce on changes in the methane and nitrous oxide emissions, analyses of the consequences of afforestation are only carried out for CO_2.

The continued growth of new forests will provide for carbon sequestration on a long-term basis. If the objective mentioned above of increasing the Danish forested area is achieved, the new forests will sequester about 250 million tonnes of CO_2 over the next approximately 120 years. Owing to the legal protection of forest land use, the sequestration in subsidised afforested land is expected to be permanent. If the objective of increasing the forest area is to be achieved, however, an enhanced rate of planting will be needed. Afforestation offers many other benefits in addition to CO_2 sequestration. Besides being valuable for outdoor 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 Danish National Forest Programme is aiming at sustainable forest management equally based on economic, ecological, environmental and social concerns. The Programme aims at long-term conversion towards a forest management regime, which increasingly supports and utilises the natural processes of the forest. For state-owned forests (about 18% of the forested area) it has been decided to introduce close-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. Furthermore, the Danish National Forest Programme is scheduled to be revised and updated in course for the upcoming 1-2 years. It is not certain what the impacts of a change in management towards more close-to-nature forestry will mean for storage of carbon in the existing forested areas in the future. Some close-to-nature forest management principles such as longer rotation and more permanent forest cover may result in more CO_2 stored in forests, while grazing and more open areas have the opposite effect. Any change in annual average increment will have an impact too, but it is not clear in which direction this may go. On the one hand a move towards a wider use of domestic tree species might impose a decline in annual increment and thereby carbon storage in forests and timber products, as compared to faster growing exotic species. On the other hand a movement towards more stable and diverse forest structures, which are less sensitive to wind falls and other natural disturbances than monocultures of exotic species, might impose an increase in total carbon storage due to reduced loss caused by natural disturbances.

Another initiative related to forestry concerns Denmark's election of Article 3.4 under the Kyoto Protocol, i.e. the sequestration of C in forests existing by 1 January 1990. Net C sequestration in forest remaining forest is the result of relatively low harvest intensity compared to increment, whereas net emissions occur when harvesting rates exceed annual increment. Net C sequestration in forest remaining forest could partly be a result of an uneven age class distribution with a relatively large proportion of young stands, where biomass is building up. Conversely, net emissions from forest remaining forest may be a result of a relatively large proportion of older stands where harvesting exceeds increment. Actual price relations as a result of changing markets influence these relations, as do natural calamities such as wind fall or fungi (such as ash dieback). Emissions from forest remaining forest are given in Table 4.23. The new National Forest Inventory has enabled reporting on dead wood and litter, while for soil C, Denmark applies the non-source principle, i.e. Denmark uses evidence from repeated sampling of forest plots sampled in 1990 and 2008-2009 and will continue this documentation in 2014-2020 that forest soils are not net sources of CO_2.

4.3.7.2 CO_2 – emissions, removals and credits from Activities under Articles 3.3 and 3.4 of the Kyoto Protocol

4.3.7.2.1 *Article 3.3*

In accordance with Article 3.3 of the Kyoto Protocol, emissions and removals from afforestation, reforestation and deforestation (ARD) activities have been included in the accounting of Removal Units (RMUs) in the 1st commitment period 2008-2012 under the Protocol. Quantitative estimates of the projected anthropogenic greenhouse gas emissions and removals from forestry activities under Article 3.3 of the Kyoto Protocol during the commitment period were included in the latest GHG projection published with Denmark's Fifth National Communication on Climate Change in 2009.

Based on the latest estimates, CO_2 emissions related to ARD activities averaged75.1 Gg for afforestation, and 80.1 Gg for deforestation for part of the commitment period (2008-2011) (*Nielsen et al., 2013*). No reforestation was recorded.

4.3.7.2.2 *Article 3.4*

In accordance with Article 3.4 of the Kyoto Protocol, emissions and removals from forest management (FM), cropland management (CM) and grazing land management (GM) activities have been elected to be included in the accounting of RMUs in the 1st commitment period 2008-2012 under the Protocol.

Forest management

Based on the latest estimates, average CO_2 removals averaged 4107.2 Gg for part of the commitment period (2008-2011) (*Nielsen et al., 2013*). The included carbon pools were above-ground and below-ground biomass, dead wood and soil. This estimate was much higher than the specified maximum of credits as removal units for Denmark at 183 Gg CO_2 (50Gg C) annually in 2008-2012.

Cropland management and grazing land management:

The government has decided to include removals of CO_2 by soils (Article 3.4 of the Kyoto Protocol) in the calculation of Denmark's climate accounts for 2008-2012, corresponding to about 1.6 million tonnes of CO_2 annually according to the latest estimates for this period.

Contributions to the Kyoto Protocol under Article 3.4 concern changes to vegetation and soil carbon stocks. Under the Kyoto Protocol, the flows of carbon to and from biomass and soils must be stated according to a net-net principle by which the change in net emissions is calculated as the rate of change for the carbon stock in the statement period (2008-2012) less the rate of change for the carbon stock in the reference year (1990). The rate of change can be calculated in different ways; however the method must be the same in the statement period as in the reference year. For agriculture, the following potential sources of CO_2 emissions and CO_2 sequestration have been included:

1. Net change in the content of carbon in mineral soils in connection with changed land use and cultivation.

2. Net change in the soil's carbon stock in connection with drainage and cultivation of organic soils or re-establishment of wetlands.

3. Change in the carbon content of wood biomass in wind breaks and fruit farms.

4. Emissions of CO_2 from application of limestone to farm land.

5. Consumption of organic soil-improvement agents, peat and sphagnum.

One of the measures with an effect on return of carbon to the soil has been the ban on burning of straw residues on fields as shown in Table 4.25.

The ban has resulted in greater return of carbon to the soil, and therefore increased carbon storage in the soil, as well as 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 from 1990. The measure was implemented in the form of a statutory order under the Environmental Protection Act, and compliance is monitored by the local authorities.

Another measure which will increase sequestration in woody biomass is the planting of windbreaks also mentioned in Table 4.25. The objective of planting windbreaks is primarily 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]

Total from activities under Articles 3.3 and 3.4

The total amount of credits from activities under Articles 3.3 and 3.4 is estimated at 9.0 million tonnes of CO_2 for the whole period 2008-2012 or as the average per year 1.8 million tonnes of $CO_2$when a uncertainty of 0.1 million tonnes of CO_2 for the final result from 2008-2012 is taken into account. Before the latter precaution, the estimate is based on the following contributions:

0.098 Mt from afforestation under Article 3.3,

0.183 Mt from forest management under Article 3.4 and

1.6 Mt from cropland management and grassland management under Article 3.4.

In 2007, a monitoring programme for the monitoring and reporting activities under Articles 3.3 and 3.4 was decided with a total budget of DKK 72 million. The results

[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).

from this programme have been included in the annual reporting of greenhouse gas inventories under the UNFCCC and the Kyoto Protocol since April 2010.

TABLE 4.25 MEASURES WITHIN LAND-USE, LAND-USE CHANGE AND FORESTRY (LULUCF) TO LIMIT EMISSIONS BY SOURCES AND ENHANCE REMOVALS BY SINKS

Source: Ministry of Food, Agriculture and Fisheries, Danish Institute of Agricultural 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/initiative	Objective	GHG affected	Type of instrument	Status of implement-tation	Implementing entity/entities	Impact in 2001	Impact in 2010	Impact in 2020
LULUCF						million tonnes CO_2 eq.	million tonnes CO_2 eq.	Million tonnes CO_2 eq.
LU-1 (AF-3): Ban on burning straw on fields	Less air pollution	N_2O	Regulation (order)	Implemented (1989)	State and county authorities			
LU-2 (AF-5): Planting of windbreaks	Binding of CO_2	CO_2	Economic (subsidies)	Implemented (1960s)	State		-0.14	
LU-3 (AF-7): Subsidies scheme for private afforestation on agricultural land	Forest area increased by 450,000- 500,000 ha in 100 years.[1]	CO_2	Economic	Implemented (through the Forestry Act)	Danish Forest and Nature Agency	-0.021	-0.116 [2] (-0.120 for "2010")	
LU-4 (AF-8): Public afforestation (state, counties and municipalities)	Forest area increased by 450,000- 500,000 ha in 100 years.[1]	CO_2	State: regulation/ counties and municip.: voluntary	Implemented	Danish Forest and Nature Agency, counties and municipalities	-0.027	-0.069 [2] (-0.068 for "2010")	

[1] Currently, only about 1850 ha forest are planted each year (average 1990-2004), the objective requires 4,500 ha- 5,000 ha. per year. Additional private afforestation has occurred without subsidies.
[2] Calculation on the basis of actual afforestation 1990- 2004, which has been too small.

4.3.8 Waste

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. Greenhouse gas emissions from wastewater treatment include both methane (81%) and nitrous oxide (19%). Out of the total greenhouse gas emissions from the waste sector of 1.0 million tonnes CO_2 equivalents in 2011 – corresponding to 1.8% of total Danish greenhouse gas emissions – the proportion from landfills was 70%, and the proportion from wastewater and compost production almost 15% each.

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.

4.3.8.1 CH_4 (methane)

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 up 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 containing industrial gases (HFCs and SF_6), besides an objective concerning stopping landfilling combustible waste.

Nor did the former government's waste plan, Waste 21, which covers the period 1998-2004, relate directly 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 industrial 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% to be 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 million tonnes.

The former government's waste plan, the Waste Strategy 2005-08, was issued in September 2003. The Waste Strategy aimed at decoupling growth in waste amounts from economic growth. The Strategy also aimed 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 former government aimed 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 were improvement of landfills and increased collection of plastic packaging for recycling.

The first part of the Waste Strategy 2009-12 was issued in March 2009 and the second part was issued in June 2010. The recycling target for all waste is still 65%, and the target for overall waste amount sent to landfills is reduced to 6%.

The latest figures for waste in Denmark are in the Danish EPA Waste Statistics 2009. Total waste in 2009 was 13,872,000 tonnes, of which 69% was recycled, 24% incinerated, and 6% landfilled.

The waste sector's contribution to reduction of greenhouse gas emissions consists mainly in:

- reducing the landfilling of organic waste,
- utilising gas from closed as well as existing landfills,
- optimising the oxidation of gas in landfill covers,
- 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. The emission of methane from Danish landfills is calculated to have been 71,100 tonnes gross in 1990, increasing to a maximum of 76,500 tonnes in 1996, corresponding to 1.6 million tonnes of CO_2equivalents.

TABLE 4.26 MEASURES WITHIN THE WASTE SECTOR TO REDUCE EMISSIONS OF GREENHOUSE GASES.

Source (on effects): Danish EPA and Denmark's CO_2 emissions - the effort in the period 1990-2001 and the associated costs

Name of measure/initiative	**Objective**	**GHG affected**	**Type of instrument**	**Status of implement-tation**	**Implementing entity/entities**	**Estimate of impact on greenhouse gas emissions**		
Waste sector						in 2001	in "2010"	in 2020
WA-1: Obligation to send combustible waste to incineration (in practice a ban on landfilling).	Reduce the landfilling of waste; higher recycling rates; energy production and CH_4 emission reduction	CH_4	Regulation (admin.)	Implemented	State and local authorities	-0.021	-0.333	
WA-2: The waste tax	Greater recycling, least possible landfilling	CH_4	Economic	Implemented	State authorities /waste plants			
WA-3: Weight-and-volume-based packaging taxes	Waste reduction	CH_4, CO_2	Economic	Implemented	State authorities			
WA-4: Subsidy programme – Enterprise Scheme (special scheme for businesses)	Reduce environmental impacts from waste	CO_2 and CH_4	Financial	Implemented	State authorities			
WA-5: Increased recycling of waste plastic packaging	22,5%recycling of waste plastic packaging in 2008 onwards	CO_2		Implemented	State and local authorities/ enterprises and the public			
WA-6: Implementation of the EU landfill directive	More focus on gas in environmental approvals, less waste to landfills	CH_4		Implemented	State and local authorities			
WA-7: Support for (construction of facilities for) gas recovery at landfill sites	Increase CH_4 recovery at landfills	CH_4	Financial	Discontinued	State authorities			
WA-8: Subsidy programme for cleaner products	Waste reduction, pollutants out of waste	CH_4	Financial	Discontinued	State authorities			
TD-1a: Energy taxes (also on waste incineration)	To increase cost-effectiveness of waste incineration and improve the structure of tax on waste incineration	CO_2	Economic	Implemented	State authorities/ waste plants			

As a consequence of the municipal obligation to assign combustible waste to incineration, from 1 January 1997, methane emissions from the Danish landfills will fall in the years ahead. The annual average emission of methane in 2008-2012 is, thus, calculated to be 63,000 tonnes, corresponding to approx. 82% of the maximum in 1996.

According to the Danish Energy Authority's inventory Biogas, Production, Forecast and Target Figures, there were in all 25 gas plants at Danish landfills in 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[20]. The same study shows that, through optimising existing gas 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 with 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. In 2007 subsidies were given for establishing methane recovery and test pumping at 11 landfill sites. Data from these projects has not been compiled yet.

As a consequence of the new Danish landfilling strategy, only a few landfill gas plants are expected to be established in the future. 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 (total methane produced less methane recovered) from Danish landfills have been calculated at 63,600 tonnes in 1990, rising to 65,900 tonnes in 1993, and then falling steadily to 51,800 tonnes in 2012. The average annual net methane emissions in 2008-2012 correspond to about 1.1 million tonnes CO_2 equivalents.

The total quantity of waste incinerated rose from 2,216,000 tonnes in 1994 to 3,489,000 tonnes in 2006, i.e. an approximately 57% 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 the Waste Strategies, 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 of paper, cardboard, plastic, metals, etc. which means less energy consumption and thus less CO_2 emissions during production of raw materials and new products.

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 stop for disposal of combustible waste at landfills). As a result of this, large quantities of combustible waste that used to be disposed of at landfills are now either recycled or used as fuel in Danish 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.

[20]Willumsen, 2004

A tax on landfilling and incineration of waste was introduced in Denmark in 1987. Since 1993 the tax has been differentiated to reflect the political priorities of the different forms of treatment. It thus costs most to dispose of waste, less to incinerate the waste and nothing in tax to recycle waste. The waste tax has been increased several times and today (March 2013) the waste tax is DKK 375 per tonne waste disposed of at landfills 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 disposal of the waste at landfills.

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.

Under the Danish EPA’s “Programme for Cleaner Products etc.”, grants were made for projects that reduced 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 could be granted to waste projects aiming at reducing the problems in connection with disposal of waste. A total of approximately DKK 100 million for the part of the programme related to waste was allocated for the 5-year period 1999 to 2003.

In 2005 the Programme for Cleaner Products etc. was replaced by the Danish government’s “Enterprise Scheme” which refunds CO_2 taxes to business. The waste part of this programme was aimed exclusively at enterprises. A total of DKK 33 million for the five-year period 2004 to 2008was earmarked for the waste part of the scheme. The subsidies were to be used to reduce the environmental impact of waste.

The Danish EPA has also supported initiation of a development project aiming at documenting the oxidation of methane in landfill cover. 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. This bio-cover project was carried out by the Technical University of Denmark with funding from the EU LIFE Programme. The bio-cover project has established a viable methodology for documentation of the reduction of greenhouse gas emissions gained by installation of a bio-cover system on a landfill. The methodology consists of a logical order of tasks using well documented measuring technologies. The demonstration project also proved that several obstacles may occur on landfills which can prevent an efficient greenhouse gas reduction, and the project has obtained understanding of which precautions should be taken.

The most important obstacles are:
a) Ability to control point gas releases,
b) Ability to distribute the landfill gas to active parts of the bio-cover system, and
c) Ability to obtain a spatially even gas distribution to active parts of the bio-cover.

Due to the obstacles the goal of reaching a 90% reduction of the methane emission was not reached; the obtained reduction was in the 20-30% range. Future developments of bio-cover systems on other landfills should focus on overcoming the mentioned obstacles.

In 2007 methane recovery systems from 11 landfill sites – including establishment of “bio-cover” for methane oxidation in the cover layer of a landfill – were supported by this scheme.

From 2009 onwards the subsidy scheme is expected to continue, but the target areas of the Enterprise Scheme have not yet been decided and the budget for waste projects is not known yet.

As a result of the EU Packaging Directive, collection of plastic packaging waste for recycling has been increased to 22.5%, corresponding to an increase in recycling of about 11,000 tonnes plastic per year from 2008, through an amendment to the Statutory Order on Waste requiring municipalities to improve the possibilities of people and enterprises to separate and deliver plastic packaging waste for recycling.

Furthermore, new producer responsibility obligations have been introduced concerning waste electrical and electronic equipment and batteries due to new EU Directives resulting in higher collection and recycling rates of these used products. The aim is to increase recycling of metals significantly, resulting in energy savings compared to extraction and refining of virgin materials.

On the basis of the EU Landfill Directive, demands on the establishment and operation of landfills in Denmark have been tightened with Statutory Orders No. 650 of 29 June 2001 and No. 252 of 31 March 2009 on landfills. According to the new regulation, methane in landfills for mixed waste must be monitored. From landfills where significant amounts of biodegradable waste are disposed of, methane gas must be managed in an environmentally-sound way – e.g. by using the gas either to produce electricity or for heating purposes.

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. 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. However, due to higher costs related to the establishment of temporary storage capacity at landfills in comparison with the cost of transportation and incineration at incineration plants abroad with excess capacity, in particular in Germany, the most common solution for impregnated wood waste has been export for incineration.

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.

4.4 Policies and measures in accordance with Article 2, of the Kyoto Protocol

4.4.1 Denmark's climate efforts – a step on the way to sustainable development

In accordance with the government platform (October 2011) the government is elaborating a new sustainability strategy with fixed goals, time limits and associated indicators and monitoring process.

The strategy is expected in the near future and will include all three pillars of sustainable development: economic, social and environmental aspects, including elements on climate/energy.

Denmark will furthermore engage actively in the on-going UN process on the development of global Sustainable Development Goals, where energy related issues will be central in the discussions.

4.4.2 Efforts for international air transport and shipping

Denmark recognises that the international aviation and maritime transport sectors are large and rapidly growing sources of greenhouse gas emissions and have to be dealt with at international level. Given the global nature of the two sectors, Denmark believes that the international organisations for civil aviation and maritime transport – the ICAO and the IMO – should decide and implement appropriate global measures to control greenhouse gas emissions from international aviation and maritime transport at levels keeping the EU's 2-degrees-Celsius objective within reach.

Denmark welcomes that in 2008 the EU adopted a directive whereby emissions of CO_2 from aviation are included in the EU emission trading scheme as of 2012 and believes that such a scheme may serve as inspiration for a future global solution for emissions from aviation. In this context Denmark would like the ICAO to show demonstrable progress in tackling the challenge of GHG emissions.

Regarding emissions from the international maritime sector, Denmark acknowledges the efforts by the IMO to make progress on the issue by agreeing on a compulsory Energy Efficiency Design Index (EEDI) for new ships which by 2025 will reduce the CO_2 emissions for new ships by 30% compared a ship of today's standard.

Within the IMO Denmark has also proposed the creation of a marked based instrument in the context of an International GHG Fund. The basic idea of such a fund is a specific GHG contribution linked to the purchase of bunker fuel. This contribution is channelled to a compensation fund, where the majority of the revenues are allocated to offset and climate-change-related purposes in the Least Developed Countries (LDCs).

4.4.3 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 the 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 climate. The existing strong Danish focus on the special vulnerability of developing countries to climate change underlines this (see section 7.2).

4.4.4 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, 4.2 and 4.3.

4.5 POLICIES AND MEASURES NO LONGER IN PLACE

Table 4.27 presents the national CO_2 allowance scheme, as well as other measures that have been discontinued and changed in the energy sector.

Regarding transport there have been no fundamental changes in the portfolio of measures since *Denmark's Fifth National Communication* to the Climate Convention in 2009, apart from the allocation of DKK 27.5 billion to improve train transport.

As mentioned in Table 4.21 the enterprise scheme on HFCs initiated in 2005 ceased by the end of 2011.

Regarding waste the government has revoked the waste tax on incineration and instead introduced an energy tax related to the energy content of the waste and a CO_2 tax on emissions from waste incineration, which are expected to give an incentive to increase recycling of waste plastic. Also, as stated in Table 4.26, the subsidy programme for gas recovery at landfills and the subsidy programme for cleaner products have been discontinued.

TABLE 4.27 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 measure/initiative	Objective	GHG affected	Type of instrument	Status of implement-tation	Implementing entity/entities	Estimate of impact on greenhouse gas emissions
The energy sector						Million tonnes CO_2
EN-7: National CO_2-allowance scheme for electricity producers	EU CO_2 allowance 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 enterprises	NE
EN-8a: Subsidy to electricity generation (RE)	Price supple-ment for environment friendly elec[2]	(CO_2)	Economic (financial)	Reorganised 1/1 2005	State authorities, energy producers	NE[1]
EN-8b: Subsidies for electricity generation (wind turbines)	Price supple-ment for environment friendly elec[2]	(CO_2)	Economic (financial)	Reorganised 1/1 2005	State authorities, energy producers	NE[1]
EN-9: Priority for electricity from CHP plants	Price supple-ment for environment friendly	(CO_2)	Economic (financial)	Reorganised 1/1 2005	State authorities, energy producers	NE[1]
EN-10: Requirement for offshore wind turbines	Tenders for offshore turbines[3]	(CO_2)	Regulatory (admin.), economic (financial)	Replaced by tenders	State authorities, energy producers	NE[1]
EN-11: 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 authorities, interest organisations, energy producers, state authorities	NE[1]
EN-12: Renewable energy Island	(Finished as state initiative)	CO_2	Economic (financial), R&D	Continued locally, see www.veo.dk	Consumers, supply companies, interest organisations, local/ regional authorities, research institutions, state authorities	NE[1]
EN-13: Construction subsidy for renewable energy	(Scheme discontinued)		Economic (financial)		State authorities, enterprises	NE[1]
EN-14: Subsidy for investment in energy savings by industry	(Scheme discontinued)	CO_2	Economic (financial)	Scheme discontinued end of 2001	State authorities, enterprises	NE[1]
EN-15: Subsidy for conversion of old housing to coal CHP	(Scheme discontinued)		Economic (financial)		State authorities, enterprises	NE[1]
EN-16: Subsidy to promote connection to coal CHP	(Scheme discontinued)		Economic (financial)		State authorities, enterprises	NE[1]
EN-17: State subsidy for energy savings measures in housing for pensioners	(Scheme discontinued)	CO_2	Economic (financial)	Scheme discontinued end of 2003	Local and state authorities, consumers	NE[1]

[1] Effects of some elements of these measures implemented in 1990-2001 are included in the Effort Analysis described in Annex B.

[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 have been established, each of 200 MW, one at Horns Rev (Horns Rev 2), and one at Rødsand (Rødsand 2). These offshore wind farms have been in operation since 2008/2009. In accordance with the energy policy agreement from February 2008 an additional offshore wind farm has been built at Anholt. This 400 MW wind farm started to operate in September 2013. In

accordance with the energy policy agreement from March 2012 tenders will be put out in 2013-15 for two additional offshore wind farms, one at Horns Rev (Horns Rev 3: 400 MW) in the North Sea and one at Krieger's Flak in the Baltic Sea (600 MW), with expected commissioning in the period 2017-20 beginning with the expansion at Horns Rev.

[4] The energy policy agreement of 29 March 2004 introduced a scrapping scheme where an extra price supplement is granted to new land-based wind turbines, provided that the owner has a scrapping certificate for a turbine with output of 450 kW or less, scrapped in the period from 15/12 2004 to 15/12 2009. The supplement was granted for brand new wind turbines linked to the grid from 1/1 2005 to 31/12 2009.

4.6 Policies and measures in Greenland

High basic energy demands and the expected emergence of an industrial sector indicate that Greenland's energy consumption is unlikely to decrease over the coming years. Nevertheless, government policies aim at reducing energy consumption, where possible, and to improve efficiency in existing energy production and supply.

During the last decades it has been a consistent priority to expand the use of renewable energy and today approximately 50% of the national energy supply is based on hydropower. Concurrently, potentials for wind energy, solar energy and hydrogen-based energy production are being explored on a smaller scale with possibilities for future expansion.

Policies and measures targeting energy production and energy consumption have multiple purposes. In addition to emission reductions, the shift to renewable energy sources is associated with a decreasing dependence on imported fossil fuels and positive effects on the local and regional environment. Improving the efficiency of the current energy production and supply system is cost-reducing and at the same time contributes to reducing GHG emissions. Energy-saving policies, acts and measures are therefore often designed to address a wider range of priorities; of which the reduction of GHG emissions remains predominant.

4.6.1 Policies and acts

A number of energy policies and acts which consider challenges, benefits and initiatives associated with reducing emissions and improving energy efficiency have been introduced:

The Energy Plan 2010

The plan was introduced in 1995 and was the first of its kind. Earlier energy policy guidelines focused on energy security and on the expansion and development of hydropower plants as the primary source of energy. The Energy Plan provided a review of the energy sector and included a plan of action for future development of the energy sector.

The Energy Supply Act

Energy supply legislation was first introduced in 1997, when Parliament passed the Energy Supply Act covering the supply of electricity, heating and fuel. In accordance with the Act, the supply of energy must be managed to promote energy saving and be economically sound. It must further improve efficiency of the production and supply system while introducing an environmentally cleaner production of energy.

The Energy Strategy and Plan of Action 2008-2015

The Strategy was issued in 2007 and focused on the challenges of climate change and on the need for industrial development. The primary focus is on continued investments in hydropower, complemented by growing research in the potential for alternative renewable sources of energy.

Analysis on reduction of GHG emissions 2008-2012

In autumn 2009 the Parliament adopted an analysis on the reduction of greenhouse gas emissions for the Kyoto Protocol period. The analysis presents emission inventories for the period 2008-2012 and discusses possible measures and reduction potentials in energy production and supply. Recommendations include further assessments of costs for implementation of suggested measures, the establishment of a programme for energy coaches, and an analysis of possible economic incentives for reduced energy consumption.

Economic incentives for fuel-efficient behaviour

The Greenlandic Parliament has furthermore passed three acts that create economic incentives for fuel-efficient behaviour:

- Act on Environmental Taxes for Products used in Energy Production is Greenland's first environmental tax on fossil fuels. The Act came into force in January 2011 and constitutes a direct tax of DKK 0.10 per litre of the retail price on most fossil fuels, regardless of end-use, creating an incentive to both reduce fossil fuel consumption and to invest in new and cleaner technologies within the private and public sectors.

- An increase in motor vehicle taxes, primarily targeting heavy vehicles. The Act came into effect in 2013.

- A general tax exemption for vehicles fuelled by electricity (EVs) or hydrogen. The tax exemption came into effect in 2010 and will remain in place until 1 January 2014.

4.6.2 Past and on-going measures

Hydropower for electricity and heating

The development of hydropower has been central to the national energy supply since the 1970s. Throughout the 1970s and 1980s, systematic studies of possible hydropower potentials were carried out. The 1986 Energy Policy Guidelines stated that hydropower should be a bearing element of the future energy supply system in Greenland.

The first hydropower facility was opened in 1993 and since then the use of hydropower has gradually expanded. With the introduction of the fifth hydropower plant in 2013, the total capacity of the hydropower plants in Greenland amounts to 91 MW, covering around 50% of total supply. In 2014 the five hydropower plants will produce enough energy to save more than 67 million litres of oil, cutting greenhouse gas emissions by more than 174.7 Gg annually, which equals approximately 23% of the total greenhouse gas emissions in 2011 in Greenland.

Residual heat from energy production at the hydropower plants is in some places used for district heating. Surplus electricity production is likewise used for district heating and constitutes an efficient way of making use of energy that would otherwise go to waste. In Nuuk, the capital, the heating supply depends almost entirely on this kind of district heating. A couple of times a year, when the demand peaks, there is no surplus electricity production and temporary use of oil boilers ensures a continuous and steady heating supply. The most recent hydropower plant in Ilulissat will have district heating facilities installed by the end of 2013, which are expected to meet the total energy demand of the town.

In this way, hydropower constitutes a significant resource in improving the efficiency of existing energy production and reducing emissions of greenhouse gases in Greenland. While no new hydropower plants are planned for the coming years, initiatives and efforts to improve efficiency of existing production continue.

Waste Incineration Facilities

Waste management in Greenland is challenged by the vast distances and hence depends on local waste management schemes. In six major cities, incineration plants are in use. Much of the residual heat from these facilities is used for district heating and, in combination with hydropower-based heating, contributes to an energy-efficient heating system. The incineration of waste replaces fuel for heating and reduces emissions of methane that would otherwise occur, if waste was deposited at landfill sites.

In smaller towns and settlements, 46 small-scale incineration facilities have been established. The primary objective with these facilities is to provide an alternative method of waste disposal compared with open landfills in small communities. A current project carried out by the government, is investigating the potentials for improved use of residual heat from waste incineration plants. The project will contribute to the formulation of a strategy for incineration solutions in Nuuk as well as in smaller towns and settlements.

The project has determined that the best solution from an environmental and socio-economic perspective is to move towards centralisation of the country's waste management.

The aim is that all waste incineration will take place in three larger towns – Nuuk, Qaqortoq and Sisimiut – by 2024. Residual heat from waste incineration can complement existing energy sources in an efficient manner in Qaqortoq and Sisimiut, while large-scale advantages in Nuuk make it worth concentrating here.

Sector Programme for Renovation with Environmental and Energy Effects in Greenland 2000-2003

The objective of the Sector Programme was to ensure that efforts in the renovation of buildings and supply plants would increasingly take into account environmental and energy-saving aspects.

Projects carried out under the Programme included renovation of combined electricity and heat production plants (CHP plants) and supply grids along with renovation of buildings. It also included a revision of the existing building regulations, the preparation of a new energy plan and initiatives for behaviour-regulating measures.

In 2003, an evaluation of the Sector Programme was carried out, estimating a reduction in CO_2 emissions of more than 3,900 tonnes annually. Calculations were based on information from energy statistics provided by the Danish Energy Authority as well as estimates of reductions in the consumption of both electricity and oil.

The Transport Sector

The transport sector is considered a key sector, despite the fact that Greenland has no roads connecting towns and settlements. Even though the market for electric vehicles (EVs) is limited in Greenland, EVs have reached a technological stage of development, where they in some cases can become a realistic alternative to diesel vehicles.

The analysis, *Electric Vehicles as a Realistic Alternative in Nuuk*, from 2013 identifies barriers to the introduction of EVs in Nuuk and presents a number of recommendations for improving conditions for EVs in Nuuk. Surplus capacity from hydropower energy production that is now used for heating purposes can be used even more efficiently for charging EVs.

The initiative to push forward the introduction of EVs in Nuuk is backed up by several actors represented in a working group on EVs hosted by CSR Greenland; an organisation established in 2010 which promotes the benefits of responsible business and sustainable development in Greenland. The working group on EVs includes representatives from the municipality and the government, local businesses and interested citizens.

Other Initiatives

In 2013 the Ministry of Housing, Nature and Environment launched a national campaign to raise awareness of the effects of GHG emissions. The campaign was published in a number of local newspapers and in one national paper and encouraged energy-saving behaviour.

The Ministry of Housing, Nature and Environment supports the research in and development of new initiatives within the renewable energy sector. The Ministry has a DKK 1.5 million programme for research in and development of renewable energy technologies in Greenland.

The programme was designed to support research in hydrogen energy, but today has been expanded to include financial support for a wider range of projects within the field of energy and climate change adaptation. The projects supported under the programme are small-scale, but bring knowledge and practical experience to entrepreneurs and other interested actors in Greenland. As examples, solar panels have been established to supply a folk high school with energy, and in one settlement a micro-hydropower plant has been introduced to supplement energy production from a CHP plant. The programme has furthermore supported pilot projects on wind energy and geothermal energy. All projects provide good experience and useful lessons for entrepreneurs and they contribute to the generation of new knowledge about the opportunities for expanding the use of renewable sources in Greenland.

4.7 Policies and measures on Faroe Islands

The Climate Convention was ratified by the Realm, and therefore it also applies for the Faroe Islands. When ratifying the Kyoto Protocol the Danish government took a territorial reservation for the Faroe Islands.

In the spring 2008 the Faroese Government started a process formulating a Climate Strategy, and in the autumn 2008 a catalogue of potential options to reduce emissions of greenhouse gases was published.

In December 2009 the Faroese Climate Policy was adopted by the Faroese Parliament. The policy was adopted by all the political parties in the Parliament. The national target is to reduce the domestic emissions of greenhouse gases by at least 20% in the period 2010 to 2020 compared with the level of emissions in 2005.

Renewable energy was less than 5% of total energy supply in the Faroe Islands in 2012. However, there is unexploited potential, especially in wind and wave power.

Oil consumption has increased since 1990, with a slight drop up to 1994. In 2012 hydropower was 24% of electricity production. Electricity supply in the Faroe Islands is carried out by the supply company SEV, which is owned by the Faroese municipalities jointly. The Faroe Islands work with DCE - Danish Centre for Environment and Energy, Aarhus University on the annual inventory of greenhouse emissions for the Climate Convention. In the latest inventory of April 2013, total greenhouse gas emissions from the Faroe Islands in 2011 were calculated at 0.736 million tonnes CO_2 equivalents. It is vital that the statistics are prepared and the cooperation 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.

5 Projections and the total effect of policies and measures

– and supplementarity relating to Kyoto Protocol mechanisms

5 Projections and the total effect of policies and measures

- and supplementarity relating to Kyoto Protocol mechanisms

5.1 PROJECTIONS

5.1.1 Introduction and overall effect of policies and measures

In September 2012, the latest baseline scenario with a projection of Denmark's future greenhouse gas emissions 2011-2035 was published by the Danish Energy Agency (*DEA 2012*)[21]. A full documentation report in English was published in March 2013 by DCE, the Danish Centre for Environment and Energy at Aarhus University (*Nielsen et al., February 2013*)[22].

The purpose of the baseline scenario – the so-called "with measures" projection - is to get an assessment of how energy consumption and emissions of greenhouse gases will evolve in the future if no new policies are introduced. This is often referred to as a "frozen policy" scenario or a "business-as-usual" scenario. The actual development will continue to be influenced by new political initiatives, and the scenario is not considered as a long-term forecast, but rather as a calculation that, on the basis of some given assumptions, we can identify the challenges which future climate policy must address.

The baseline scenario is based on a number of general economic assumptions (the output of industries, private consumption, fuel prices etc.), a number of specific assumptions on technology (what are the costs of different types of plants, what is the efficiency etc.) and assumptions about how the energy market players will act with pure market conditions.

Scenarios of this nature will always be subject to many key and uncertain assumptions. A different development than the assumed may therefore move the result in both directions. The baseline scenario includes the effects of already adopted, but not necessarily implemented, measures.

All elements of the Energy Agreement of March 2012 are included in the baseline scenario. This includes the agreement on new offshore wind farms.

In addition, the baseline scenario includes previously agreed actions from, for example, the 2008 energy agreement, the 2009 tax reform and the review of this reform in 2010.

The results of the projections are very dependent on these assumptions. The assessment of the effect of specific political initiatives also influences the result. For

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[21] DEA 2012: Danmarks Energifremskrivning 2012, Danish Energy Agency, September 2012 (http://www.ens.dk/sites/ens.dk/files/info/tal-kort/fremskrivninger-analyser-modeller/fremskrivninger/danmarks_energifremskrivning_2012_endelig_v1.2.pdf) (in Danish)

[22] Nielsen et al., 2013: Projection of greenhouse gases 2011-2035. Nielsen, O-K., Plejdrup, M.S., Winther, M., Hjelgaard, K., Nielsen, M., Hoffmann, L., Fauser, P., Mikkelsen, M.H., Albrektsen, R., Gyldenkærne, S. & Thomsen, M. 2013. Aarhus University, DCE – Danish Centre for Environment and Energy, 180 pp. Scientific Report from DCE – Danish Centre for Environment and Energy No. 48 (http://www2.dmu.dk/Pub/SR48.pdf)

example: Planning aspects regarding expansion of wind power or biogas or assessments of the impact of energy savings initiatives.

The projection goes up to 2035, and its findings are obviously very uncertain.

Based on baseline scenario projections of activity data from sectors withe greenhouse gas emissions, e.g. energy consumption in the energy sector, number of livestock in the agricultural sector etc., projections of greenhouse gas emissions are calculated.

The main sector categories in the greenhouse gas projections are the same as those defined in the IPCC guidelines for greenhouse gas inventories:

- Energy (Fuel Combustion, including Transport, and Fugitive Emissions from Fuels)
- Industrial Processes
- Solvent and Other Product Use
- Agriculture
- LULUCF (Land-Use, Land-Use Change and Forestry)
- Waste

However the sector category "Solvent and Other Product Use" is shown together with "Industrial Processes" in this chapter, both becuase it is a minor source of greenhouse gas emissions and to be consistent with Chapter 4...

The energy-related CO_2 emissions account for the vast majority of Denmark's total emissions of greenhouse gases.

A major part of the energy-related CO_2 emissions falls under the EU Emissions Trading System (EU ETS), not least electric utilities. Changes in these emissions do not directly influence Denmark's compliance with reduction commitments under the Kyoto Protocol, since the final result for Denmark's accounting of emissions and credits under the Kyoto Protocol is determined by the quota for Danish installations covered by the EU ETS. In case of emissions above the quota, the responsible entities under the EU ETS have to buy and surrender extra quotas or credits to cover this excess of emissions. This means that the excess of emissions are covered by an equivalent amount of emission reductions elsewhere.

Table 5.1 and Figure 5.1 show Denmark's emission of greenhouse gases from Denmark's base year (i.e. without Greenland) under the 1st commitment period under the Kyoto Protocol ("KP BY") to 2035 for the main IPCC sector categories mentioned above together with total greenhouse gas emissions with and without LULUCF. Figures for emissions in the period 1990-2011 are from the National Inventory Report (NIR) submitted under the UNFCCC and the Kyoto Protocol in April 2013, and figures for emissions in the period 2012-2035 are from the September 2012 baseline or "with measures" projection scenario published in English in *Nielsen et al.* in February 2013. In general, both in this chapter and in Annex E, the projections for 2011 have been replaced by the later inventory data for 2011.

The full set of tables with the results from the September 2012 baseline scenario is included in Annex E1.

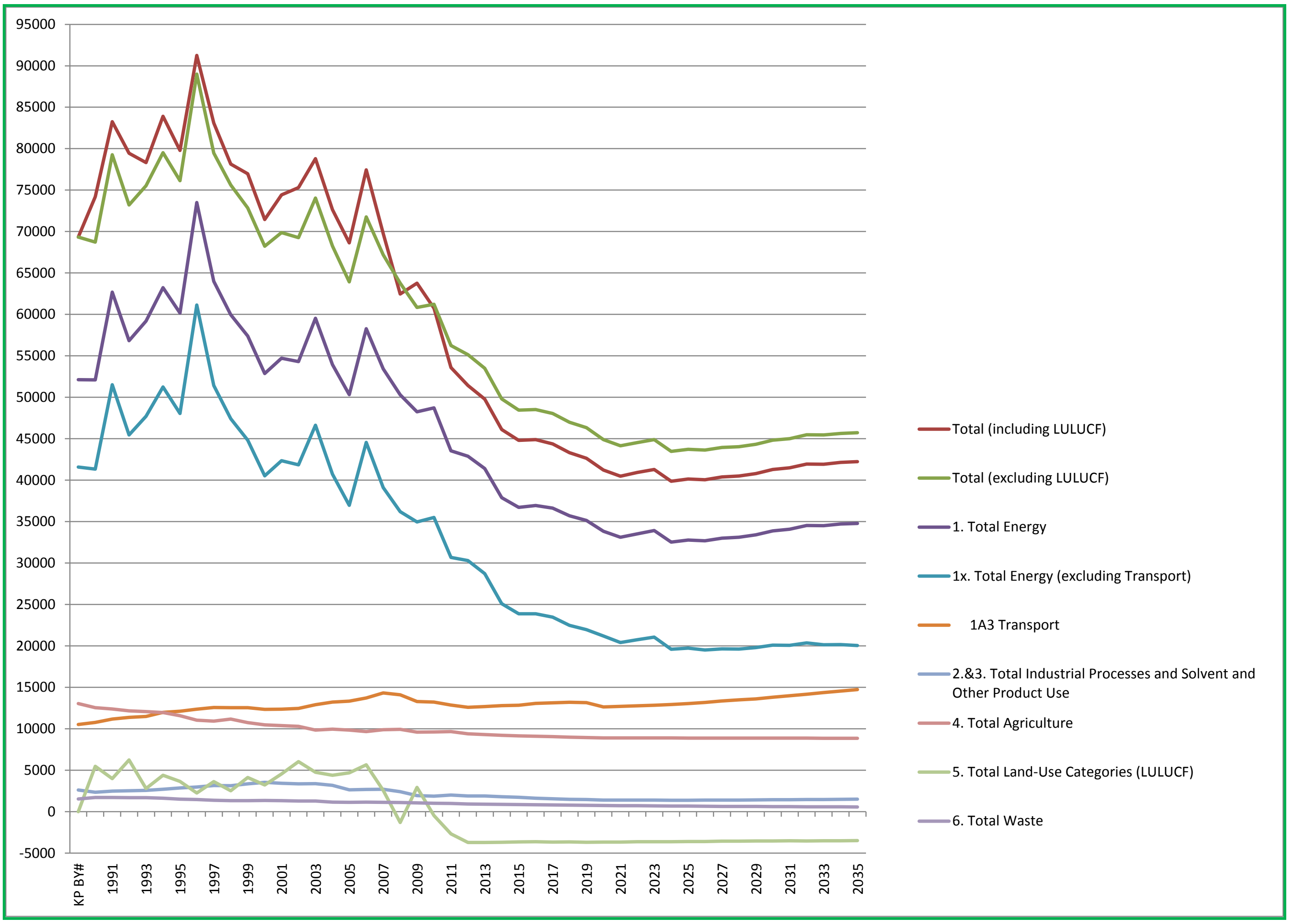
TABLE 5.1 GREENHOUSE GAS EMISSIONS IN DENMARK (I.E. WITHOUT EMISSIONS IN GREENLAND AND FAROE ISLANDS) IN CO2 EQUIVALENTS FOR MAIN IPCC SECTORS – INCLUDING ENERGY WITH AND WITHOUT TRANSPORT, 1990-2011 ARE OBSERVED.

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035: Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.

GHG emissions and projections (Gg CO_2 equivalents)	KP BY#	1990	1995	2000	2005	2010	2008-12	2013-20	2015	2020	2025	2030	2035
Total (including LULUCF)	69323	74193	79790	71453	68630	60743	59794	51545	51667	48128	46895	47915	48799
Total (excluding LULUCF)	69323	68720	76141	68235	63934	61217	59442	48320	48463	44898	43733	44822	45731
1. Total Energy	52121	52111	60165	52875	50317	48717	46742	36784	36721	33836	32784	33891	34787
1x. Total Energy (excluding Transport)	41592	41333	48042	40520	36978	35494	33530	23839	23870	21195	19742	20089	20041
3 Transport	10529	10778	12124	12355	13339	13223	13212	12945	12850	12641	13042	13802	14746
2.&3. Total Industrial Processes and Solvent and Other Product Use	2607	2356	2863	3537	2630	1872	2029	1626	1731	1409	1388	1441	1512
4. Total Agriculture	13048	12545	11592	10471	9852	9614	9645	9088	9156	8903	8889	8876	8859
5. Total Land-Use Categories (LULUCF)	0	5473	3649	3218	4695	-474	-1044	-3668	-3649	-3671	-3599	-3526	-3495
6. Total Waste	1547	1709	1521	1351	1135	1015	1026	823	854	749	671	615	574

FIGURE 5.1 GREENHOUSE GAS EMISSIONS IN DENMARK (I.E. WITHOUT EMISSIONS IN GREENLAND AND FAROE ISLANDS) IN CO2 EQUIVALENTS FOR MAIN IPCC SECTORS – INCLUDING ENERGY WITH AND WITHOUT TRANSPORT, 1990-2011 ARE OBSERVED.

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035: Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.



5.1.1.1 *Progress towards the target for 2008-2012*

According to the Kyoto Protocol, Denmark's total greenhouse gas emissions may not exceed 54.8 million tonnes of CO_2 equivalent on average for the period 2008-2012. The baseline scenario shows that the Kyoto targets are met. Table 5.2 shows the estimate of the average annual greenhouse gas emissions from the September 2012 baseline scenario compared with expectations as the basis for the allocation plan in 2007.

TABLE 5.2: KYOTO ACCOUNT WITH ADOPTED MEASURES, MILLION TONNES CO2 EQUIVALENT

Source: Danish Energy Agency, September 2012

Kyoto-account with adopted measures (Average emissions 2008-2012, million tonnes CO_2 equivalent.)	**NAPII (2007)**	**September 2012**
Kyoto objective	**54.8**	**54.8**
Allocated emission allowances in the ETS sectors	24.5	24.5*
Expected emissions in the Non-ETS sectors	36.8	35.2
Credits from sinks**	-2.3	-1.8
Base year compensation***	-1.0	-1.0
Remaining requirements to adopted measures******	**3.2**	**2.2**

** Including allocated government allowances auctioned in 2013*

***DCE estimate*

**** Assigned amount units allocated to Denmark as the base year compensation under the EU burden sharing of the joint reduction target under the Kyoto Protocol pursuant to the European Commission's decision of 15 December 2010 (2010/778/EU).*

***** This requirement is covered by Kyoto units from the state portfolio, including the national JI and CDM program.*

The progress towards the 2008-2012 target under the Kyoto Protocol is also shown in Figure 5.2.

5.1.1.2 *Progress towards the targets for 2013-2020*

The reduction in the use of fossil fuels means that energy-related CO_2 will be reduced significantly towards 2020. The baseline scenario also shows a decline in other greenhouse gases. The baseline scenario includes the total effect of the policies and measures described in Chapter 4.

Progress towards the EU non-ETS target for 2013-2020

The result from the baseline scenario shows that Denmark is in accordance with the non-ETS reductions target path for Denmark under the Effort Sharing Decision (ESD) adopted in the EU with the EU climate and energy package. Under the ESD Denmark is committed to a reduction of greenhouse gas emissions in non-ETS sectors in the period 2013-2020, rising to 20 % by 2020 relative to 2005.

From Figure 5.2 it can be seen that the projection of total greenhouse gas emissions in the non-ETS sectors is clearly below Denmark’s reduction target path for 2013-2020 under the EU Effort Sharing Decision (ESD). A total overachievement of approximately 16 million tonnes of CO_2 eq. is expected for the period 2013-2020 or on average approximately 2 million tonnes of CO_2 eq. per year.

However, both the energy scenario and projections of non-energy related emissions are subject to uncertainty, which means that total emissions may develop differently than described above. For the non-ETS emissions, it is particularly worth noting that the agriculture and transport sector as a whole accounts for more than 70 per cent of emissions.

Progress towards the government's domestic target for 2020

As mentioned in Chapter 4, the Danish government has increased its ambition and set a domestic goal of a 40 per cent reduction in Denmark's greenhouse gas emissions by 2020 compared with the base year under the Kyoto Protocol. In the assessment of the achievement of this domestic goal, credits from the CO_2-sink activities under articles 3.3 and 3.4 of the Kyoto Protocol, as well as adjustment for electricity trade in 2020 will be taken into account.

The Energy Agreement from March 2012 has brought Denmark a long way towards realising the domestic target of a 40% reduction by 2020 compared with 1990. This is illustrated in Figure 5.2. However, significant additional efforts will be needed to reach the domestic target. Furthermore the target should preferably contribute towards structural changes in 2035 and 2050.

Calculated on the basis of the adjusted energy consumption and a preliminary recalculated base year under the 2nd commitment period of the Kyoto Protocol, the August 2013 interim update of the September 2012 baseline scenario, described in Boxes 5.1 and 5.2 below, shows that, without further climate mitigation measures, total greenhouse gas emissions in 2020 are expected to be around 46.4 mill. tonnes CO_2 equivalents. Based on the central estimate for emissions in 2020, a reduction in the region of 4 mill. tonnes CO_2 equivalents annually is also expected in 2020. However, the projection is sensitive to a number of parameters.

The energy area is particularly sensitive to changes in allowance prices. The central estimate for emissions in 2020 has therefore been calculated assuming an allowances price of EUR 9.6 per tonne. Sensitivity analysis of the allowances price indicates that if the allowances price doubles in 2020 to EUR 19.2 per tonne, Danish emissions will fall about 1.2 mill. tonnes. An allowances price of EUR 19.2 per tonne or more is not unrealistic, provided it is possible to gather support for a tightening of the European emission trading system. For example, the allowances price in 2008 was EUR 30 per tonne.

On the other hand a further drop in the price cannot be ruled out, if the problems with the emission trading system are not resolved. Therefore, a sensitivity calculation with an allowances price of EUR 0 per tonne has been made. This calculation shows that emissions could increase by about 0.2 mill tonnes compared with the central estimate[23].

The calculations show that a higher allowance price will reduce Danish emissions significantly, while a lower allowance price will only increase emissions slightly[24]. This is illustrated in Table 5.3 that shows the historical emissions from 1990 and

[23] This asymmetric effect of changes in allowances prices is because the assumed price of EUR 9.6 per tonne in 2020 is so low that use of biomass in electricity and district heating production can more or less only be expected if this gives tax advantages for heating production, although there may still be some biomass use for electricity production. Note that the sensitivity assumes otherwise unchanged fuel prices and that it will be possible to observe similar effects for variations in fuel prices, especially in the relative prices between coal and biomass.

[24] Within the EU ETS area, carbon emissions are determined by the total allowance allocation. A higher or lower allowance price will therefore not affect the total carbon emissions at EU level.

expected emissions in 2020 with three different assumed allowances prices, and the related shortfall to the 40% reduction target.

TABLE 5.3: SHORTFALL TO MEETING THE DANISH GOVERNMENT'S DOMESTIC TARGET OF A 40% REDUCTION BY 2020 COMPARED WITH 1990

Source: The Danish Climate Policy Plan, August 2013

Emissions in base year 1990/95[1]	**Domestic target for emissions in 2020 with 40% reduction**	**Expected contribution from CO_2 uptake in soil and forests**[2]	**Maximum emissions in 2020 including expected uptake in soil and forests**	**Expected emissions in 2020 for low, middle and high allowances price**[1]		**Shortfall including contribution from CO_2 uptake in soil and forests for low, middle & high allowances price**[3]
				EU Allowances price 2020	Total greenhouse gas emissions[3]	
Million tonnes CO_2 equivalents	Million tonnes CO_2 equivalents	Million tonnes CO_2 equivalents	Million tonnes CO_2 equivalents	EUR/t CO_2	Million tonnes CO_2 equivalents	Million tonnes CO_2 equivalents
67.2	40.3	Approx. 1.9	Approx. 42.2	0	46.4	4.2
				9.6	46.2	4.0
				19.2	45.0	2.8

Note 1: Historical base year and future 2020 emissions have been updated for this Climate Policy Plan, see boxes 5.1 and 5.2.
Note 2: Uptake in soil and forests, assuming no new initiatives.
Note 3. When calculating whether the 40% target has been met, emissions will be adjusted for electricity trading.

In addition to the great uncertainty regarding the size of the shortfall, especially in relation to the allowances price and general economic trends, there is also uncertainty regarding future energy prices, technological developments, changes in the carbon balance in the soil and forests, future consumer behaviour, the effect of initiatives or targets already decided, as well as the effect of submitted but not yet adopted proposals in the EU, etc. The overall effect of these uncertainties could pull both towards and away from meeting the target. Thus it is uncertain in which direction some of the parameters will develop.

Furthermore, the final resolution of a number of issues concerning the base year and emission inventories in 2015-2016 could also affect the estimated distance to the domestic target. These issues include recalculations of the time series in 2015 due to a decision at international level to implement a scientific update of the IPCC guidelines for greenhouse gas inventories (the 2006 IPCC guidelines). Moreover a number of revised factors for global warming potentials (GWPs) will also be implemented due to new scientific knowledge (published in 2007 in IPCCs 4th assessment report on climate change).

Box 5.1 shows a number of preliminary estimates for 2020 of the consequences of the updated inventory guidelines and updated GWPs that are to be implemented in the reporting of greenhouse gas inventories under the Climate Convention and the Kyoto Protocol as of 2015. As can be seen, the effect in Denmark of these scientifically based improvements of greenhouse gas inventories will predominantly be in the agricultural sector.

An interim update of the baseline projection for the year 2020 was made in August 2013 in connection with the publication of the government's Climate Policy Plan. In this update, the effect of changes in the electric heating tariff in the 2013 Finance Act, the solar panel agreement in autumn 2012, as well as the effect of the Growth Plan DK and the significant drop in the price of CO_2 allowances on the European emission trading market were taken into account as described in Box 5.2. Finally, the preliminary estimated effects of new GWPs and inventory guidelines as described in Box 5.1 were also taken into account.

BOX 5.1 PRELIMINARY ESTIMATES OF GREENHOUSE GAS EMISSIONS IN 2020 WITH THE EFFECTS OF THE UPDATED INVENTORY GUIDELINES AND UPDATED GWPS TO BE USED IN INTERNATIONAL REPORTING AS OF 2015.

Estimated effect on total greenhouse gas emissions in 2020

Preliminary recalculations of the greenhouse projections for 2020 show an increase of approx. 0.7 million tonnes CO_2 equivalent in total emissions from the application of new global warming potentials (GWPs).

However, this increase is counterbalanced by a decrease of approx. 1.1 million tonnes CO_2 equivalent in total emissions from the application of new inventory guidelines.

The overall effect of these scientifically based improvements of the greenhouse gas inventories is therefore expected to be a total decrease of emissions in 2020 corresponding to approx. 0.4 million tonnes CO_2 equivalent. This decrease is primarily the result of a decrease in the estimate of greenhouse gas emissions from agriculture corresponding to approx. 0.5 million tonnes CO_2 equivalent (cf. below) and an increase in the estimate of greenhouse gas emissions from waste corresponding to approx. 0.1 million tonnes CO_2 equivalent.

It should be noted that also base year emissions will change with recalculations to be carried out in 2015 with the application of new global warming potentials (GWPs) and inventory guidelines. The emission reduction efforts by Denmark needed for the achievement of reduction targets in 2013-2020 will therefore not necessarily be lowered with the estimated decreases in emissions.

Estimated effect on greenhouse gas emissions in agriculture in 2020

In the preliminary estimate of the effect of application of new inventory guidelines, only the changes regarding inventories for agriculture are taken into account, since the changes in the new guidelines primarily affect greenhouse gas emissions in the agricultural sector in Denmark. The overall decrease in the estimated greenhouse gas emissions in the agricultural sector in Denmark comprises different trends in different activities within the agricultural sector of which the following will have the biggest impact:

- An increase in methane emissions from enteric fermentation due to an increase in the Ym factor (methane conversion factor in per cent of gross energy in feed converted to methane) for dairy cattle and heifers in the new guidelines.
- An increase in methane emissions from manure management due to increase of $MCF_{(S,k)}$ (methane conversion factors in per cent for each manure management system S by climate region k) for all solid and deep litter manure housing systems.
- An increase of nitrous oxide emissions from manure management due to the increased emission factor for liquid manure, which is partly counterbalanced by a decrease in the emission factor for solid manure.
- A general decrease in the EF for nitrogen from 1.25 per cent to 1.0 per cent, which will decrease emissions from nitrous oxide sources.
- A decrease in the EF for leached N from 1.94 per cent to 0.75 per cent, which will contribute with the largest decrease in nitrous oxide emissions from agriculture.

In agriculture the effect of the moving from the 1996 GL to the 2006 GL is an increase of 0.4 million. tonnes CO_2 equivalents for methane and a decrease of 1.5 million tonnes CO_2 equivalents for nitrous oxide. This is expected to lead to an estimated decrease in agricultural total greenhouse gas emission of 1.1 million tonnes CO_2 equivalents in 2020.

When the effect of the changes in GWPs for the emissions in agriculture (an increase of 0.6 million tonnes CO_2 equivalents) is also taken into account, the total change in greenhouse gas emission from agriculture is estimated at a decrease of approx. 0.5 million tonnes CO_2 equivalents in 2020.

Box 5.2 The August 2013 interim update of the greenhouse gas projection for 2020

The projection of future greenhouse gas emissions in 2020 was updated in August 2013 in connection with the government's Climate Policy Plan taking into consideration a number of developments that have taken place since the last baseline energy projection in September 2012.

These developments include the change in the electric heating tariff in the 2013 Finance Act, the solar panel agreement in autumn 2012, as well as the effects of the Growth Plan DK. The projection has also been adjusted for a significant drop in the price of CO_2 allowances on the European emission trading market.

This drop in the price of allowances has led to adjustment of the allowance price estimate for 2020 from EUR 22 per allowance, as assumed in the baseline projection, to EUR 9.6 per allowance in 2020.

All else being equal, this will increase emissions from Danish electricity production with approx. 1.7 – 1.8 million tonnes CO_2 in 2020.

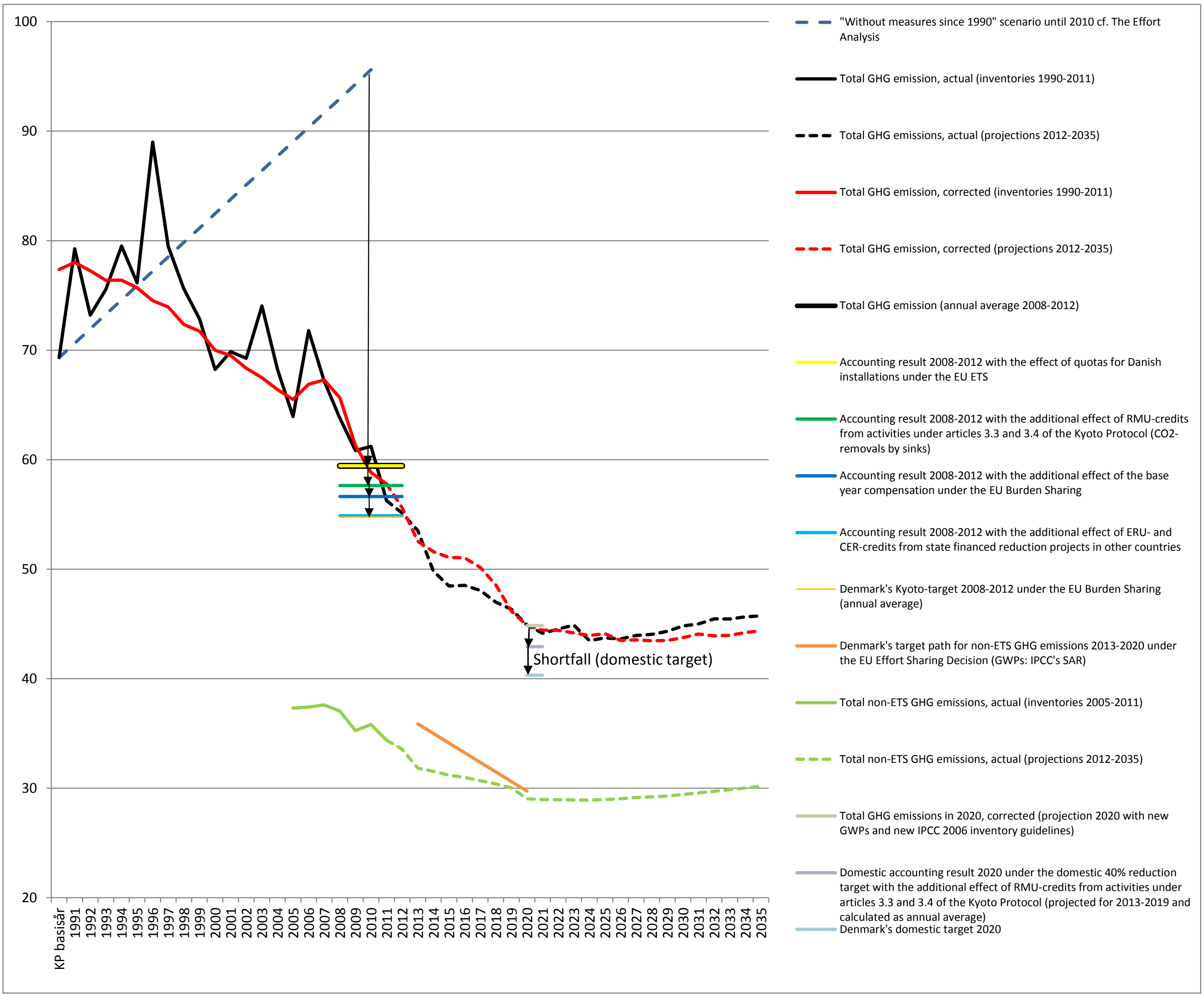
Also taking into account the expected decrease of approx. 0.4 million tonnes CO_2 equivalents in total emissions in 2020 from the effect of the scientifically based improvements of the greenhouse gas inventories mentioned in Box 5.1, the combined effect is estimated at an increase of 1.3 – 1.4 million tonnes CO_2 equivalents in 2020.

However, neither the effect of this interim update nor the effects of new GWPs and inventory guidelines are included in the "with measures" projection described in greater detail in this chapter. That is, the projection data for 2012-2035 listed in this chapter are from the September 2012 baseline scenario and the documentation report in English from February 2013 - except for the distance to the domestic target mentioned above in this section and in Figure 5.2, where progress towards the domestic 2020 target is shown.

Figure 5.2 shows the historic and projected developments in total greenhouse gas emissions together with the effects of quotas under the EU ETS, credits from forest and agricultural activities under articles 3.3 and 3.4 of the Kyoto Protocol, base-year compensation under the EU Burden Sharing Agreement and credits from JI- and CDM-projects counting towards reaching the 2008-2012 target under the Kyoto Protocol. The estimate for 2010 in the "without measures" scenario from the Effort Analysis described in Annex B1 is included in Figure 5.2. Figure 5.2 also shows the projection of total greenhouse gas emissions in the non-ETS sectors and Denmark's reduction target path 2013-2020 under the EU Effort Sharing Decision (ESD) based on current global warming potentials (GWPs) and current inventory guidelines (the 1996 IPCC GL). For 2020, the preliminary projection of total greenhouse gas emissions based the the new GWPs and new inventory guidelines (the 2006 IPCC GL), to be applied from 2015 in the reporting of inventories, is shown in Figure 5.2 corrected for electricity trade. For 2020, figure 5.2 also shows the estimated effect of sinks-credits from activities under articles 3.3 and 3.4 of the Kyoto Protocol calculated in accordance with how progress towards the domestic 40 per cent target should be assessed and the resulting shortfall if no new measures are implemented.

FIGURE 5.2: HISTORIC AND PROJECTED PROGRESS TOWARDS DENMARK'S 21 PER CENT REDUCTION TARGET 2008-2012 UNDER THE EU BURDEN SHARING OF THE EU TARGET UNDER THE KYOTO PROTOCOL (KP), TOWARDS DENMARK'S NON-ETS 20 PER CENT REDUCTION TARGET 2020 AND TARGET PATH 2013-2020 UNDER EU EFFORT SHARING DECISION (EU-ESD) AND TOWARDS DENMARK'S DOMESTIC 40 PER CENT REDUCTION TARGET (DK). THE PROJECTIONS SHOWN IN RELATION TO THE KP- AND EU-ESD TARGETS ARE THE "WITH MEASURES" PROJECTION FROM SEPTEMBER 2012. IN RELATION TO THE DK TARGET THE PROJECTION SHOWN FOR 2020 IS BASED ON THE AUGUST 2013 INTERIM UPDATE TAKING INTO ACCOUNT NEW GWPS AND NEW INVENTORY GUIDELINES. THE RESULT OF THE "WITHOUT MEASURES SINCE 1990" PROJECTION FOR 2010 IN THE EFFORT ANALYSIS IS ALSO SHOWN.

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035: Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al., DCE, February 2013.



5.1.2 Energy (Fuel Combustion, including Transport, and Fugitive Emissions from Fuels)

This section decribes the projection of the total emissions of CO_2, CH_4 and N_2O from combustion of fuels and from fugitive emissions from fuels. The projections of combustion of fuels include all fuel-consuming sectors. A more detailed description of the approach used in the energy projection is included in Annex E2.

5.1.2.1 Methods

Based on a projection of the development in energy consumption in the period 2011-2035, projected emissions of CO_2, CH_4 and N_2O from combustion of fuels have been calculated by multiplying the fuels' related 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[25].

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 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 so called Convergence Programme by the Danish Ministry of Finance, published in May 2012.

The projection of electricity and heat production is based on the Danish Energy Agency's RAMSES model, using as the basis the demand for electricity and district heating 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, therefore a separate (bottom-up) projection has been made of this production.

The projection of emissions from other sectors (primarily from extraction of oil and gas as well from as oil refineries) is based on data on expansion plans and ad-hoc assumptions. For these sectors the projections include both fuel combustion emissions and fugitive emissions.

The projection of of emissions from road transport is carried out within EMMA. Projection of rail transport and domestic ferries and freighters is based on a report on the transport sector's energy consumption and emissions, Danish Road Directorate, 2002[26], whereas domestic air transport is based on the study "European energy and transport – trends to 2030" from 2003.

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[25] Environmental satellite models for ADAM, NERI Technical Report no. 148, DMU 1995.
[26] 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)

The basis for the emissions projections is the official Danish national fuel consumption projections from the DEA (2012). These activity data are used in combination with sector-specific emission factors derived from emission models developed at DCE (the former NERI) for road transport, aviation, railways, sea transport and working machinery. More in-depth documentation can be seen in Nielsen et al. (2013).

5.1.2.2 Assumptions and key parameters

In general, the projection is based on the policies implemented or adopted before April 2012, including the Agreement on Danish Energy Policy from March 2012. The projection is based on energy consumption in 2011. The basic assumption is that energy consumption in the future will equal the 2011 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 2011 (including new initiatives) are included specifically when calculating the projection. Therefore, the projection should be regarded as a ”with measures” projection.

The IEA price assumptions for fossil fuels (World Energy Outlook – New Policy scenario, 2011) have been applied. Prices of biomass are based on an analysis prepared by an external consultant in spring 2011. District-heating prices are based on production costs, while the price of electricity, as mentioned above, has been calculated on the basis of marginal production costs.

Other assumptions behind the energy projection are economic growth of about 1.0-2.4 per cent p.a. and prices of CO_2 allowances of about EUR 21.6 per tonne in 2020.

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 has been 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.

In Table 5.4 a number of key assumptions for the projections are shown.

TABLE 5.4 GROWTH ASSUMPTIONS[1]

Source: Danish Energy Agency

	Units	2011	2015	2020	2025	2030	2035
Gross Domestic Product	€ 2005 constant prices prices	208,230	223,131	248,817	265,829	283,700	301,661
Gross domestic product growth rate [1]	Per cent Annual growth rate	1.0%	2.4%	1.7%	1.3%	1.7%	1.8%
Population	1000 pers.	5569.99	5642.88	5736.52	5833.97	5923.12	5993.58
Population growth rate	Per cent p.a.	0.8%	2.2%	3.9%	5.6%	7.2%	8.5%
International coal prices	2010 prices, €/GJ	3.5	3.1	3.1	3.1	3.2	3.2
International oil prices	2010 prices, €/GJ	12.9	13.0	13.4	14.0	14.5	14.8
International gas prices	2010 prices, €/GJ	7.1	7.5	7.9	8.4	8.8	9.2
Carbon price	2010 prices, €/t CO_2	12.4	12.2	21.7	25.3	28.9	32.5

[1] The growth rates are from *The Danish Finance Ministry (Convergence Programme, May 2012)*

5.1.2.3 Results

Figure 5.3 (gross and final) and Table 5.5 (final) show the development of total energy consumption with these assumptions.

FIGURE 5.3 GROSS ENERGY CONSUMPTION 1990-2030, 1990-2011 ARE OBSERVED

Source: Danish Energy Agency

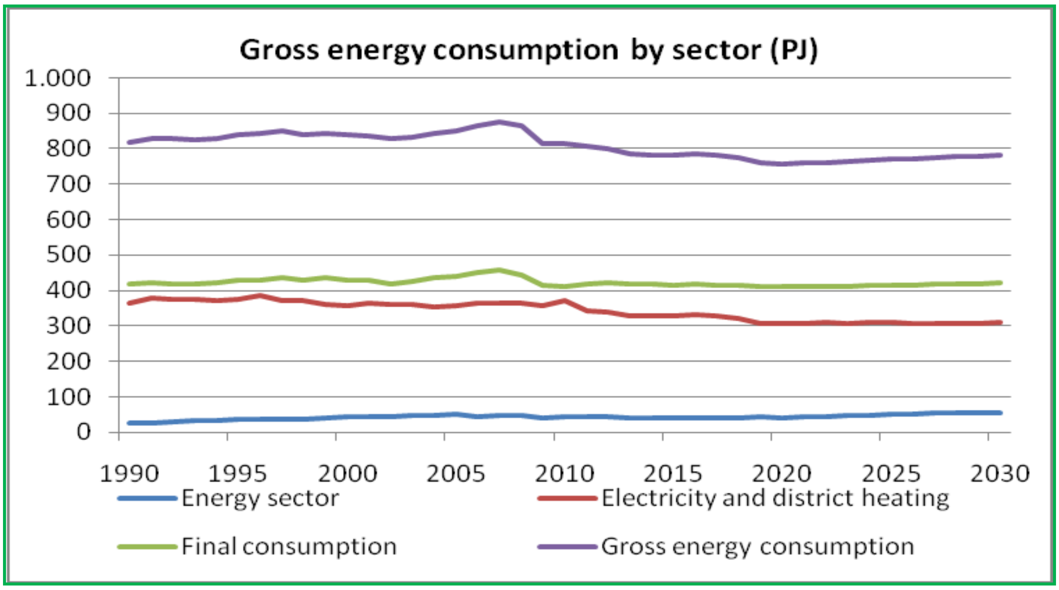


TABLE 5.5 FINAL ENERGY CONSUMPTION 1990-2035, 1990 IS OBSERVED

Source: Danish Energy Agency

PJ	**1990**	**2015**	**2020**	**2025**	**2030**	**2035**
Non Energy purposes	13	12	12	12	12	12
Transport incl. International air transport	170	219	229	236	245	259
Agriculture	33	31.6	34.6	34.6	33.8	33.4
Industry and Building	126	137	135	134	132	132
Commerce and service	77	81	79	79	78	77
Domestic sector	184	187	176	179	181	184
Total	**604**	**636**	**632**	**641**	**649**	**664**

Gross energy consumption

Gross energy consumption expresses the total input of primary energy to the Danish energy system. The input of primary energy to the Danish energy system is a combination of fuels and fuel-free energy such as wind, solar and geothermal energy. Furthermore, the calculation of the gross energy consumption makes a correction regarding primary energy related to electricity exports or imports. Also energy for space heating is adjusted due to the variations compared to a normal climatic year. Unlike the final energy consumption, energy input to electricity and heat production is included in the gross energy consumption, as well as distribution losses. In addition, the energy consumption for extracting and refining oil and gas, and the consumption of oil products for non-energy purposes are included.

Efficiency improvements in final energy consumption in the transformation sector and the energy sector provide reductions in gross energy consumption. For example, plants transform approximately 40 per cent of the fuel energy into electricity, while the remaining approximately 60 per cent is lost when it is not used for district heating. However, only the production of electricity from wind turbines counts in gross energy consumption. Expansion of wind power will contribute to a reduction in gross energy consumption, and, all other things being equal, lower power consumption (and heat consumption) has a greater impact on gross energy than on final energy consumption. Figure 5.3 shows the scenario for gross energy consumption as well as the scenario for gross energy consumption by sector.

From 1990 to 2007, gross energy consumption increased by 7 per cent while final energy consumption increased by 13 per cent. The economic crisis led to a large decline in gross energy consumption, which by 2009 fell below its level in 1990.

This decrease was in large part due to the decrease in final energy consumption. Since then, gross energy consumption has fallen by a further 8 PJ to 807 PJ in 2011, despite the fact that the final energy consumption in the same period rose 7 PJ. This decoupling of gross energy consumption and final energy consumption is mainly due to the increasing non-fuel power generation, e.g. electricity from wind turbines, as wind power is not associated with conversion loss.

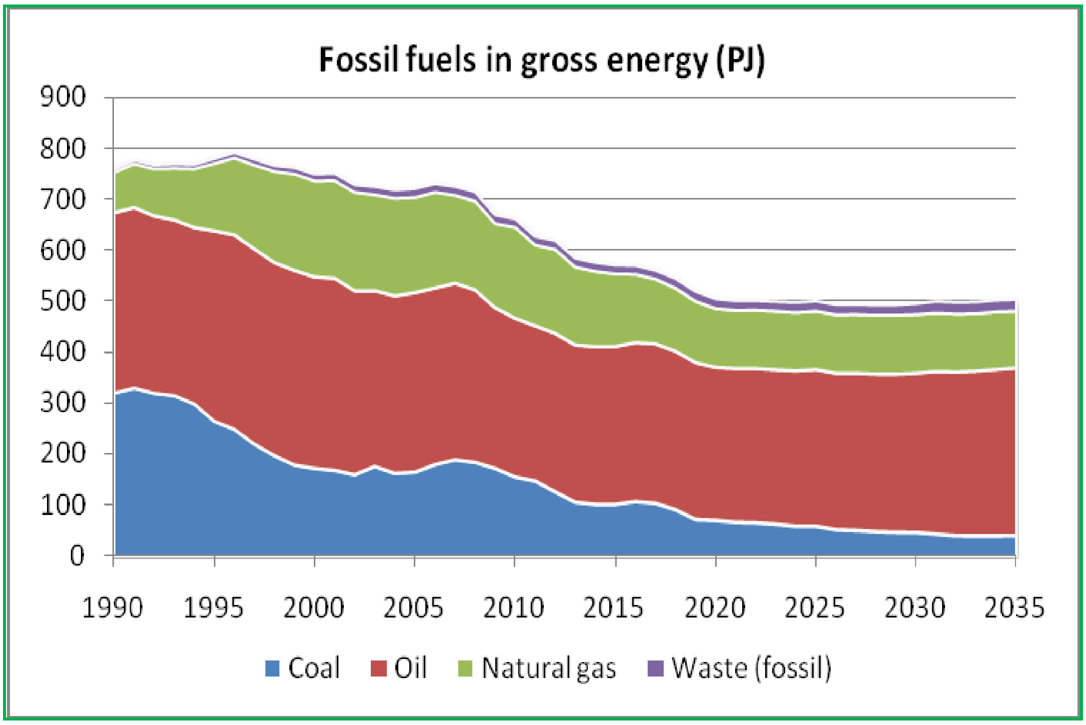
In the baseline scenario, final energy consumption declines by 1 per cent by 2020, while gross energy consumption decreases by about 6 per cent. The decrease in gross energy consumption in this period is, to a great extent, attributable to a decrease in energy consumption for the production of electricity and district heating. This decrease is mainly driven by the rapid expansion of wind power in the form of offshore wind farms at Anholt, Horns Rev 3 and Kriegers flak and an increase in coastal wind turbines. After 2020, gross energy consumption will increase, partly driven by the energy sector.

The Energy Agreement of February 2008 contains objectives for gross energy consumption in 2011 and 2020. Energy statistics show that the objective of a 2% reduction by 2011 compared with 2006 has been reached, and the projection shows that the goal of a 4% reduction in 2020 compared with 2006 has been reached.

Fossil fuels consumption

The Danish government has set targets for the phasing out of fossil fuel use. The use of coal for electricity production and district heating is to be phased out by 2030, while the use of fossil fuels for the production of electricity and heat is to be phased out by 2035. The overarching goal of the Danish government is to make Denmark independent of fossil fuels (coal, oil and gas) in 2050. In particular, the consumption of coal and gas can fluctuate significantly from year to year due to differences in electricity exchange with neighbouring countries. In order to assess a trend in the development separated from these 'random' fluctuations, Figure 5.4 illustrates the consumption of fossil fuels adjusted for electricity exchange. In Figure 5.4 the development of total energy consumption is broken down by fuels. This determines the size of CO_2 emissions because the fuels have very different emission factors.

FIGURE 5.4 GROSS ENERGY CONSUMPTION 1990-2035, 1990-2011 ARE OBSERVED
Source: Danish Energy Agency



The consumption of fossil fuels decreases over the scenario period. Up to 2020, consumption decreases by approximately 20 per cent compared with 2011, and by 2030 it falls by approximately 21 per cent. In the period up to 2020 fossil fuel consumption is reduced by approximately 125 PJ. The largest factors behind the decrease are coal and natural gas, which reduced by 53 per cent and 28 per cent, respectively. This is largely due to substitution with biomass and a higher share of wind power in electricity and heat production. In the period after 2020 there will be a further reduction in the consumption of coal, so that it will be reduced to approximately 45 PJ in 2030, and a decrease of approximately 69 per cent compared with 2011.

The majority of the reduction in fossil fuel consumption is attributable to the portion of energy consumption that is linked to households and industries, including the production of electricity and district heating. When looking at these sectors, the consumption of fossil fuels declines over the scenario period. In the period up to 2020, consumption of coal, oil and natural gas declines about 35 per cent relative to 2011, by 2030 the decline is approximately 50 per cent.

There are a number of uncertainties associated with the fuel consumption in the scenario. Among other things, the decline in consumption of fossil fuels is sensitive to changes in the assumed fuel prices and the resulting difference between the price of biomass on the one hand and the prices of coal and CO_2 allowances on the other hand. Also fluctuating amounts of rain and wind in the Nordic countries is important, as such variation in particular affects coal consumption upwards or downwards. The trend in gas prices relative to coal prices is also important with regard to the decentralized CHP power generation in the future and thus the consumption of natural gas compared with the consumption of coal.

Renewable energy & RE shares

The calculation of the consumption of renewable energy includes solar, wind and hydropower, solid biomass, waste of non-fossil origin, liquid biofuels, biogas, ambient heat, geothermal energy and solar energy.

From 1990 to 2011, the consumption of renewable energy in the Danish energy system more than tripled, and it is now approximately 175 PJ annually. Most of this is biomass, but wind power also provides an important contribution, particularly when taking into account that the included wind energy is converted directly to electricity without conversion losses, while the use of biomass is associated with a conversion loss.

Towards 2020, the consumption of renewable energy increases by approximately 45 per cent relative to 2011, by 2030 renewable energy will increase by almost 70 per cent, see Figure 5.5.

In the period up to 2020, consumption of renewable energy increases by approximately 80 PJ. The major contributions to this increase come from the expansion of wind power. In addition, the increased use of solid biomass in power stations, increased use of liquid biofuels for transport, increased production and use of biogas and an increased use of ambient heat for heat pumps and geothermal heating have contributed as well. The increase from 2020 and onward is primarily due to increased production and use of biogas and increased use of ambient heat in heat pumps.

In the EU climate and energy package, Denmark's renewable energy share of the expanding final energy consumption in 2020 will be at least 30 per cent. With the assumptions of the baseline scenario, a renewable energy share of 35.9 per cent is achieved. In addition to the goal of 30 per cent RE in 2020, in accordance with EU package, Denmark will follow an expansion with annual targets for renewable energy share. As shown in Figure 5.6, the EU targets are overachieved in all years. RE share is due to biomass use in the supply sector particularly sensitive to developments in biomass price relative to the price of coal (including CO_2 price). Figure 5.6 compares the projection of renewable energy in gross final energy consumption with the EU targets for renewable energy by 2020.

The EU package also includes a separate target for renewable energy share in the transport sector, which in 2020 must be 10 per cent. In the baseline scenario, 10.4 per cent is reached. Phasing in of biofuels for road transport is included, so that biofuels represent approximately 5.75 per cent in the years 2012-2019 and about 10.0 per cent from 2020 and onwards of total fuel consumption for road transport. There are no anticipated calculations of second generation biofuels. A modest trend in the number of electric vehicles is also expected: green electricity will be weighted by a factor of 2 ½ when calculating the renewable energy share for this type of vehicle. The contribution of renewable electricity for rail transport is somewhat larger than that for road transport.

FIGURE 5.5: RENEWABLE ENERGY IN GROSS ENERGY CONSUMPTION (PJ)
Source: Danish Energy Agency, September 2012.

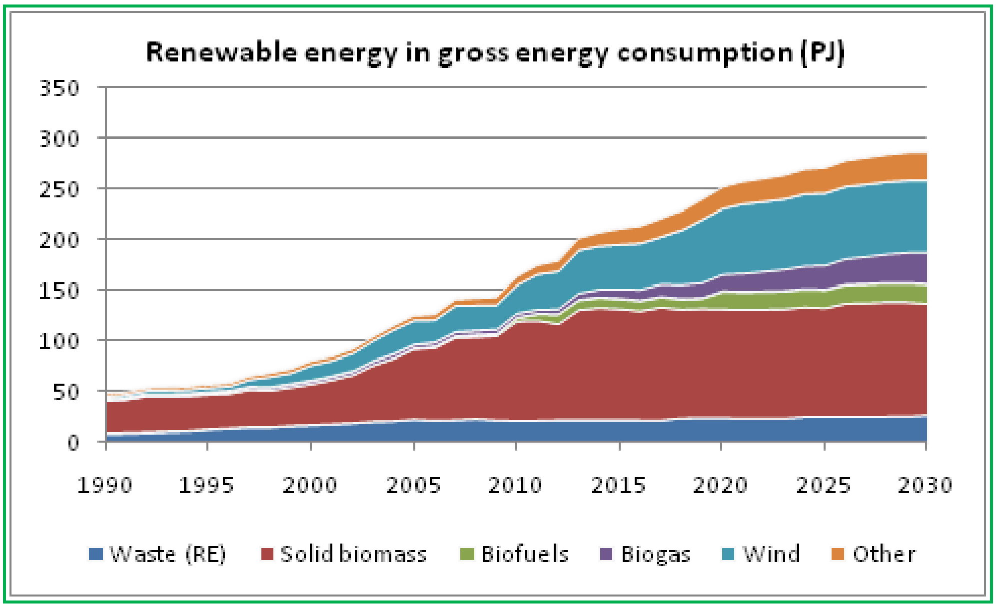
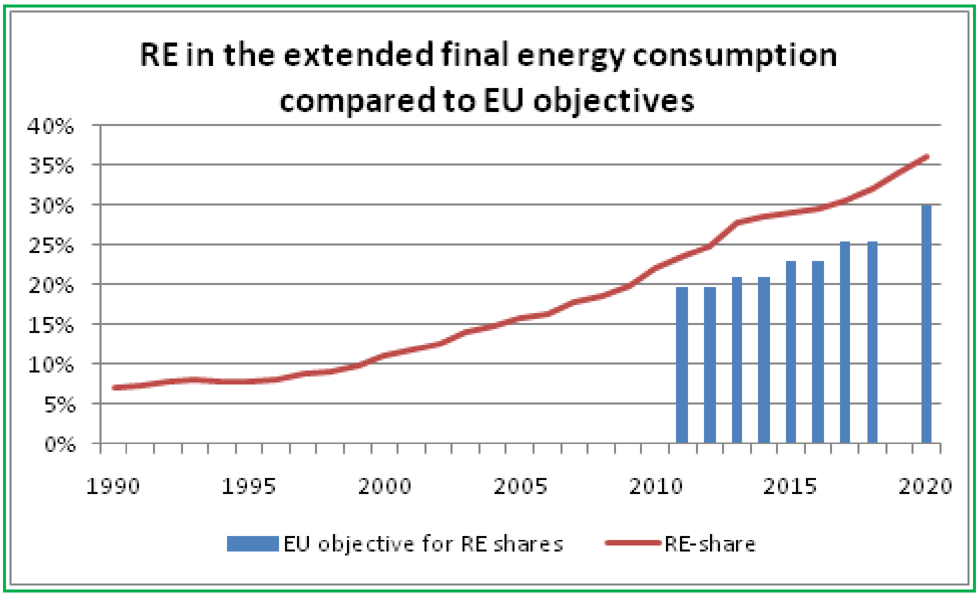


FIGURE 5.6: RE IN THE EXTENDED FINAL ENERGY CONSUMPTION COMPARED WITH EU OBJECTIVE (PER CENT)
Source: Danish Energy Agency, September 2012.



Emissions of energy-related CO_2

In energy statistics, energy-related CO_2 emissions from Denmark's gross energy consumption is calculated (the total input of primary energy to the energy system), including both the actual and corrected consumption, where the corrected consumption is corrected for electricity trade. At the same time gross energy from fuels used in Denmark is calculated.

In the international greenhouse gas inventories, emissions from combustion are defined as emissions from fuels sold in Denmark, and therefore include emissions that relate to cross-border trade with petroleum products (gasoline, gas-/diesel and petroleum coke). Also, emissions from flaring is included, but not emissions from international aviation.

The actual energy-related CO_2 emissions are sensitive to changes in electricity exchange and are therefore difficult to use to assess the trend of development. CO_2 emissions associated with the electricity exchange will also predominantly be covered by the European Union Emission Trading Scheme (EU ETS). By correcting emissions for electricity trading, the fluctuations caused by climate fluctuations (particularly precipitation in the Nordic countries) and temporary capacity factors (e.g. extraordinary outage times for nuclear power) are eliminated. The development in corrected emissions better reflect the trend in emissions related to the Danish energy consumption.

In the period of the scenario, actual and corrected emissions are relatively close to one another. However, in the period 2014-2018 a tendency appears where Denmark is a net importer of electricity, and therefore the actual emissions in this period are less than the corrected emissions. These imports are very sensitive in relation to external factors such as rainfall in Norway and Sweden and operational stability in nuclear power plants. Variations in these factors contribute significantly to the historical fluctuations in actual emissions, but less in the projection since the projection is based on a normal year.

The corrected emissions decline in the scenario period, and decrease by approximately 24 per cent from 2011 to 2020 as a result of the substitution of fossil fuels with CO_2-neutral renewable energy, as previously described due to the changes in gross energy consumption. After 2020, CO_2 emissions are roughly constant.

The results of the projections of total greenhouse gas emissions from energy, including transport 2012-2035, are shown in Table 5.6 and Figure 5.7 together with the corresponding historic emission inventories for 1990-2011. 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.

TABLE 5.6 PROJECTION OF GREENHOUSE GAS EMISSIONS IN CO2 EQUIVALENTS FOR ENERGY INCLUDING TRANSPORT – AND EXCLUDING TRANSPORT , 1990-2011 ARE OBSERVED.

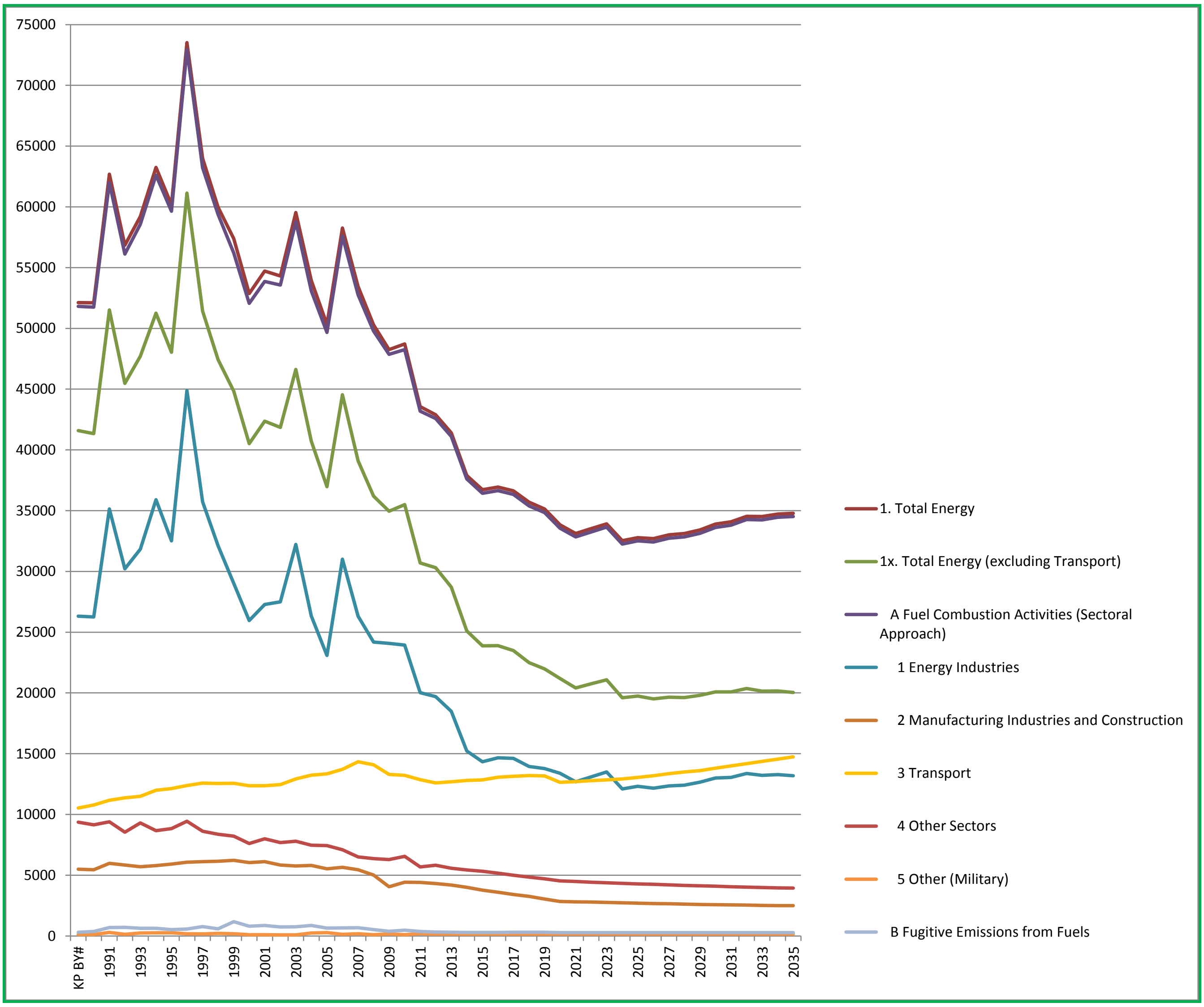
Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.

GHG emissions and projections (Gg CO2 equivalents)	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
1. Total Energy	**52121**	**52111**	**60165**	**52875**	**50317**	**48717**	**42898**	**46742**	**36784**	**36721**	**33836**	**32784**	**33891**	**34787**
A Fuel Combustion Activities (Sectoral Approach)	**51817**	**51742**	**59644**	**52067**	**49663**	**48247**	**42579**	**46330**	**36490**	**36434**	**33554**	**32507**	**33618**	**34514**
1 Energy Industries	**26315**	**26246**	**32514**	**25959**	**23085**	**23936**	**19701**	**22388**	**14803**	**14333**	**13383**	**12318**	**12994**	**13186**
a Public Electricity and Heat Production	24861	24786	30371	23479	20513	21580	17337	19964	12569	12171	11093	9559	9884	10100
b Petroleum Refining	908	908	1388	1001	939	855	901	910	901	901	901	901	901	901
c Manufacture of Solid Fuels and Other Energy Industries	546	552	756	1480	1632	1501	1463	1513	1332	1261	1389	1858	2209	2185
2 Manufacturing Industries and Construction	**5493**	**5446**	**5910**	**6035**	**5521**	**4422**	**4318**	**4441**	**3513**	**3776**	**2841**	**2703**	**2576**	**2493**
3 Transport	**10529**	**10778**	**12124**	**12355**	**13339**	**13223**	**12590**	**13212**	**12945**	**12850**	**12641**	**13042**	**13802**	**14746**
a Civil Aviation	246	246	202	157	138	158	147	155	151	149	155	156	153	153
b Road Transportation	9418	9421	10750	11369	12371	12216	11664	12230	12015	11922	11707	12107	12869	13813
c Railways	300	300	306	230	234	244	107	215	107	107	107	107	107	107
d Navigation	566	811	867	600	597	604	672	613	672	672	672	672	672	672
e Other Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other non-specified	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Other Sectors	**9359**	**9152**	**8841**	**7606**	**7444**	**6558**	**5815**	**6143**	**5074**	**5320**	**4534**	**4288**	**4091**	**3934**
a Commercial/Institutional	1419	1499	1247	1014	1144	1081	944	1020	858	880	799	766	730	698
b Residential	5208	5109	5108	4159	3843	3234	2969	2977	2322	2507	1891	1684	1522	1389
c Agriculture/Forestry/Fisheries	2732	2545	2486	2433	2457	2243	1902	2146	1894	1933	1844	1838	1839	1847
5 Other	**120**	**120**	**254**	**112**	**274**	**108**	**155**	**146**	**155**	**155**	**155**	**155**	**155**	**155**
B Fugitive Emissions from Fuels	**304**	**369**	**522**	**808**	**653**	**470**	**319**	**412**	**294**	**286**	**283**	**277**	**273**	**273**
1 Solid Fuels	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2 Oil and Natural Gas	**304**	**369**	**522**	**808**	**653**	**470**	**319**	**412**	**294**	**286**	**283**	**277**	**273**	**273**
a Oil	32	35	54	82	106	111	105	113	102	99	102	97	99	99
b Natural Gas	6	9	18	8	8	4	5	5	4	5	4	4	4	4
c Venting and Flaring	267	325	451	718	539	355	209	295	188	183	177	177	170	170
d. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (not included above):														
International Bunkers	**4904**	**4820**	**6963**	**6627**	**5001**	**4552**	**4945**	**4711**	**5211**	**5083**	**5479**	**5592**	**5383**	**5383**
Aviation	1755	1755	1888	2376	2602	2447	2645	2526	2912	2783	3179	3292	3083	3083
Marine	3149	3065	5076	4251	2400	2105	2300	2185	2300	2300	2300	2300	2300	2300
Multilateral Operations	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CO2 Emissions from Biomass	**4641**	**4662**	**5725**	**6899**	**10728**	**14902**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
1x. Total Energy (excluding Transport)	**41592**	**41333**	**48042**	**40520**	**36978**	**35494**	**30308**	**33530**	**23839**	**23870**	**21195**	**19742**	**20089**	**20041**
3 Transport	**10529**	**10778**	**12124**	**12355**	**13339**	**13223**	**12590**	**13212**	**12945**	**12850**	**12641**	**13042**	**13802**	**14746**
1. Total Energy	**52121**	**338**	**740**	**1380**	**1377**	**1211**	**1005**	**1143**	**620**	**756**	**319**	**260**	**246**	**246**

Note: For 2008-2012 and 2013-2020 the annual averages are shown.

FIGURE 5.7 PROJECTION OF GREENHOUSE GAS EMISSIONS IN CO2 EQUIVALENTS FOR ENERGY INCLUDING TRANSPORT – AND EXCLUDING TRANSPORT , 1990-2011 ARE OBSERVED.

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.



5.1.2.4 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 tachygraphy data is also uncertain.

For the above reasons it is important to stress that the projection should only be used as 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.

The energy projection's sensitivity to changes in biomass fuel prices is shown in Figures 5.8 and 5.9. The sensitivity to changes in CO_2 quota prices is shown in Table 5.7 and the sensitivity to changes in wind conditions is shown in Table 5.8.

FIGURE 5.8: CORRELATION BETWEEN BIOMASS FUEL PRICE AND FUEL CONSUMPTION IN ELECTRICITY AND DISTRICT HEAT PRODUCTION (PJ)

Source: Danish Energy Agency, September 2012.

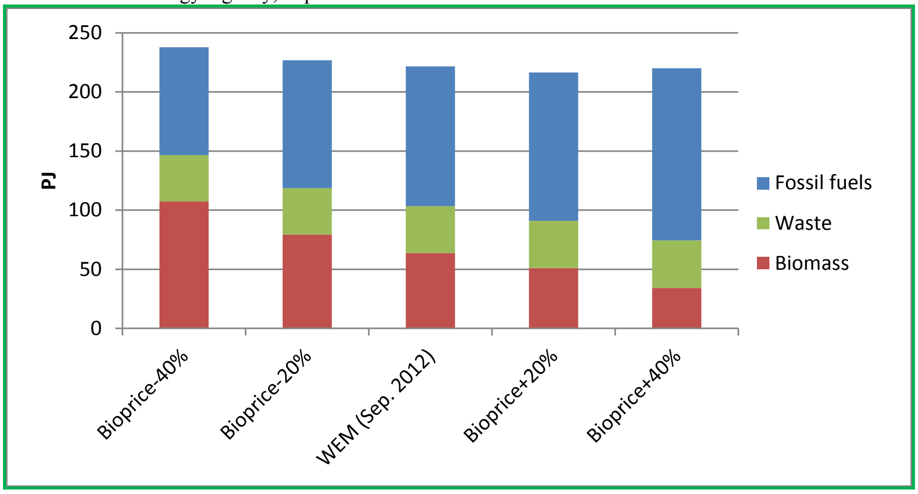


FIGURE 5.9: CHANGE IN ELECTRICITY AND DISTRICT HEAT PRODUCTION IN 2020 BASED ON RENEWABLE ENERGY SOURCES AND THE PERCENTAGE OF RENEWABLE ENERGY IN RELATION TO THE EXTENDED FINAL ENERGY CONSUMPTION IF THE BIOMASS FUEL PRICE IS CHANGED FROM THE CENTRAL PRICE ASSUMPTION

Source: Danish Energy Agency, September 2012.

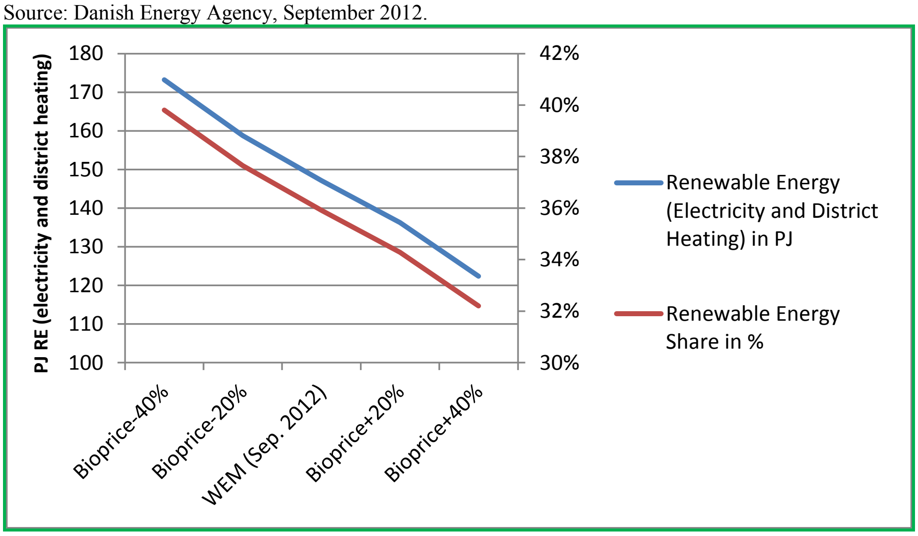


TABLE 5.7: SENSITIVITY ANALYSIS OF DIFFERENT PARAMETERS IN 2020 IF THE CO2 QUOTA PRICE IS CHANGED FROM THE CENTRAL PRICE ASSUMPTION (ONLY FOR SECTORS PRODUCING ELECTRICITY AND DISTRICT HEATING)

Source: Danish Energy Agency, September 2012.

	Quota price +100%	Quota price +50%	Quota price -50%	Quota price -100%
Renewable energy percentage[1] (per cent point)	+ 1.1	+ 0.7	- 1.3	- 1.6
Consumption of biomass and waste (PJ)	+ 9.9	+ 4.5	- 9.9	- 12.1
Consumption of natural gas (PJ)	+ 5.6	+ 3.2	- 1.1	- 1.0
Consumption of coal (PJ)	- 18.8	- 8.9	+ 9.9	+ 19.9
CO_2 emissions, adjusted for electricity trade (million tonnes)	- 1.5	- 0.7	+ 1.2	+ 1.4

[1] Calculated in accordance with methodology to be used in relation to the EU target on renewable energy

TABLE 5.8: SENSITIVITY ANALYSIS OF DIFFERENT PARAMETERS IN 2020 IF 2020 IS A BETTER PR WORSE WIND YEAR THAN ASSUMED IN THE PROJECTION

Source: Danish Energy Agency, September 2012.

	Wind - 10%	Wind + 10%
Danish wind power (TWh)	- 1.82	+ 1.82
Electricity price (øre/kWh)	+ 3.1	- 2.9
Electricity import (TWh)	+ 0.61	- 0.72
Renewable energy percentage[1] (percentage point)	- 0.9	+ 0.9
CO_2 emissions, adjusted for electricity trade (million tonnes)	+ 1.18	- 1.19

[1] Calculated in accordance with methodology to be used in relation to the EU target on renewable energy

5.1.3 Industrial Processes (including Solvent and Other Product Use)

In addition to the emissions of greenhouse gases related to energy consumption by industry included in section 5.1.2, greenhouse gases are also emitted from a number of industrial processes. These include emissions from the production of cement, lime, bricks/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 insulation gases. The use of solvents and certain other products is a minor source of greenhouse gas emissions. The projections of these emissions are included here.

5.1.3.1 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 their expected future production, partly for commercial reasons and partly because 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.

5.1.3.2 Assumptions and key parameters

The fluorinated gases (F-gases) comprise HFCs, PFCs and SF_6. None of the F-gases are produced in Denmark. The emission of these gases is therefore associated with their use alone.

An account of the annual consumption and emission of F-gases has been prepared by a consultant on behalf of the Danish Environmental Protection Agency (DEPA) (Poulsen & Werge, 2012). In this connection, projections to 2020 have also been prepared. Annual reports that contain both consumption and emission data are available. In Nielsen et al. (2013) this projection has been extended to 2035.

The projections of the F-gas emissions are based on implemented and adopted policies and measures, described in Chapter 4, including a statutory order on the phasing out of certain industrial gases, including 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, the projections are in general based on energy and production value projections related to specific sectors. From these value projections, extrapolation factors have been calculated and applied. The methodologies used within the different sub-sectors are described in *Nielsen et al. (2013)*.

5.1.3.3 Results

Results of projections of greenhouse gas emissions from industrial processes, including emissions of F-gases and from solvents and other product use, appear in Table 5.9 and Figure 5.10 together with the inventory data reported in April 2013.

TABLE 5.9 PROJECTIONS OF EMISSIONS FROM INDUSTRIAL PROCESSES AND SOLVENT AND OTHER PRODUCT USE, 1990-2011 ARE OBSERVED.

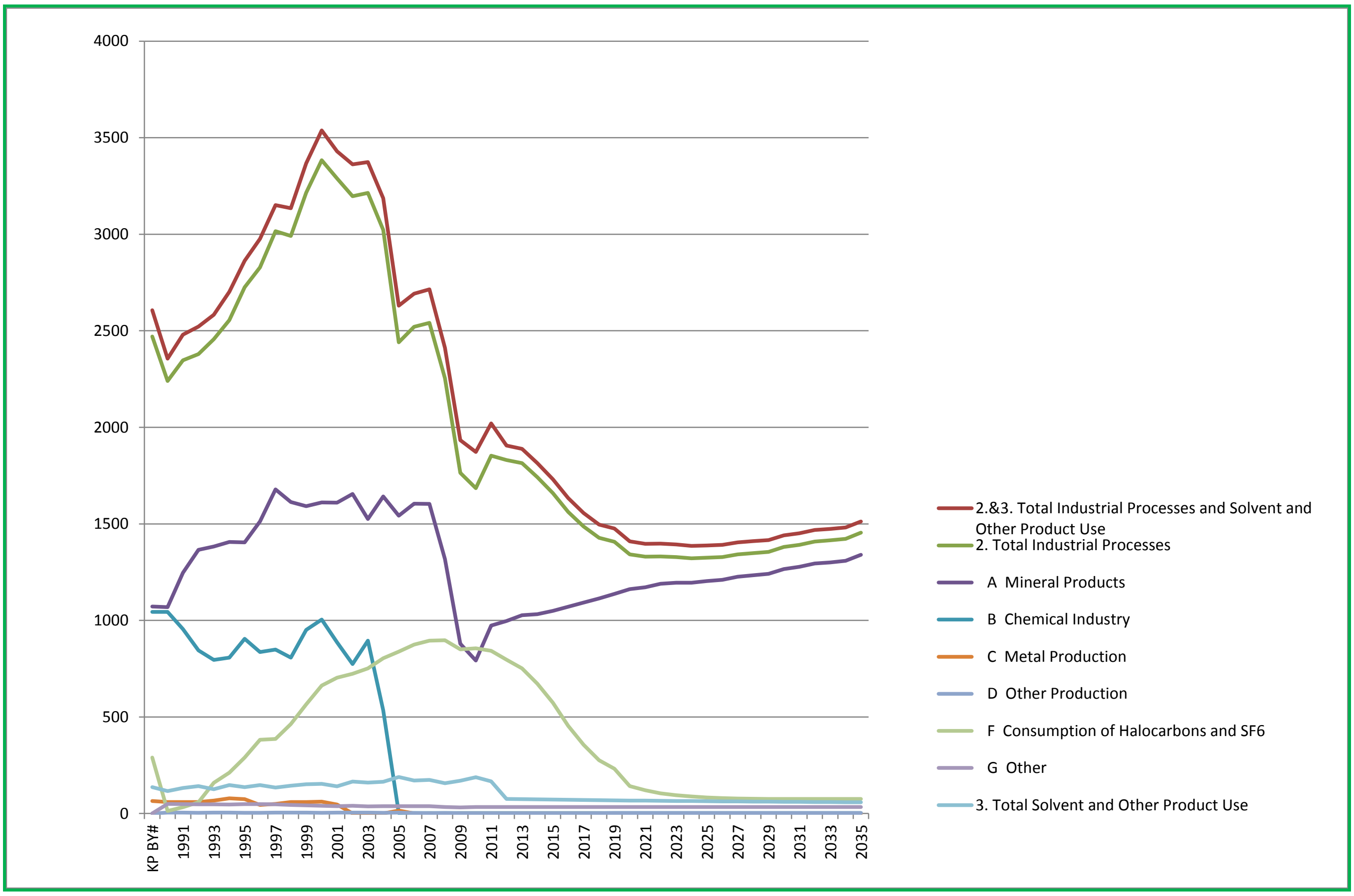
Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.

GHG emissions and projections (Gg CO2 equivalents)	KP BY[#]	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
2. Total Industrial Processes	2470	2240	2726	3384	2441	1685	1831	1877	1555	1660	1342	1325	1380	1454
A Mineral Products	1072	1069	1404	1611	1542	792	998	992	1085	1049	1162	1203	1266	1340
B Chemical Industry	1044	1044	905	1004	3	2	2	2	2	2	3	3	3	3
C Metal Production	64	60	74	62	16	0	0	0	0	0	0	0	0	0
D Other Production	0	4	4	4	4	2	2	2	2	2	2	2	3	3
E Production of Halocarbons and SF6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Consumption of Halocarbons and SF6	290	13	290	663	838	856	796	848	432	573	142	83	75	76
G Other	0	50	49	40	38	33	33	33	33	33	33	33	33	33
3. Total Solvent and Other Product Use	137	116	137	154	189	187	75	151	70	72	67	64	61	58
2.&3. Total Industrial Processes and Solvent and Other Product Use	2607	2356	2863	3537	2630	1872	1906	2029	1626	1731	1409	1388	1441	1512

Note: For 2008-2012 and 2013-2020 the annual averages are shown.

FIGURE 5.10 PROJECTIONS OF EMISSIONS FROM INDUSTRIAL PROCESSES AND SOLVENT AND OTHER PRODUCT USE, 1990-2011 ARE OBSERVED.

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.



5.1.3.4 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 the production of nitric acid in Denmark – with the same technology as was used 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 million 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 million tonnes CO_2 equivalents per year in 2008-2012.

5.1.4 Agriculture

The emission of greenhouse gases from the agricultural sector includes the emission of methane (CH_4) and nitrous oxide (N_2O). Emissions are mainly related to livestock production and include CH_4 emissions from enteric fermentation and manure management and N_2O emissions from manure management and agricultural soils. Furthermore, minor CH_4 and N_2O emissions are estimated from the burning of straw on fields. The effect of lower emissions from biogas-treated slurry is also taken into account.

In this projection, the latest official reporting from Denmark includes emissions until 2011. Thus, the projection comprises an assessment of greenhouse gas emissions from the agricultural sector from 2012 to 2035.

It must be noted that CO_2 removals/emissions from agricultural soils are not included in the agricultural sector. According to the IPCC guidelines this removal/emission should be included in the LULUCF sector (Land-Use, Land-Use Change and Forestry). The same comment applies to emissions related to agricultural machinery (tractors, harvesters and other non-road machinery); these emissions are included in the energy sector.

The most recent projected greenhouse gas emissions from the agricultural sectors (*Nielsen et al., 2013*) are provided in Table 5.9 and Figure 5.11.

5.1.4.1 Methods

The projection of greenhouse gas emissions is regularly updated in line with new scientific knowledge, which also includes changes in the historical emission inventory. Therefore, some deviations are apparent in comparison with the projection scenarios published in previous reports. The projection of greenhouse gases published in *Nielsen et al. (2013)* replaces the latest basic projection published in NERI Technical Report No. 841 (*Nielsen et al., 2011*).

The expectations to the future framework conditions for the agricultural production include establishment of ammonia-reducing technologies. Increasing demands to reduce unintended environmental effects of livestock production has led to more legislation in connection with approvals and establishment of new animal housing. This projection includes several objectives formulated in the Agreement on Green Growth (2009 and 2010), such as expansion of the biogas production and the establishment of non-cultivated areas along water streams and lakes. Furthermore implementation of technologies to achieve reductions in N-loss to the aquatic environment has been taken into account. The most important assumptions are expected change in number of produced animals, change in nitrogen excretion as a consequence of efficiency for dairy cattle and sows and expected changes in housing systems for livestock.

The emission of greenhouse gases has decreased from 12.46 million tonnes CO_2 equivalents in 1990 to 9.52 million tonnes CO_2 equivalents in 2010, which corresponds to a 24 per cent reduction. Based on the given assumptions, the projected emission is expected to decrease by a further 8 per cent in 2035, corresponding to 8.86 million tonnes CO_2 equivalents. The decreased emission is mainly a result of a decrease in emissions from manure management and N_2O emissions from synthetic fertiliser (included in direct soil emission).

The decreased emission from synthetic fertiliser is due to a reduction in agricultural area and implementation of ammonia reduction technology. Reduction of ammonia emissions in animal housing leads to higher nitrogen content in manure resulting in less need for synthetic fertiliser.

The decrease in both CH_4 and N_2O emissions from manure management is in particular due to the increasing amount of biogas-treated slurry.

5.1.4.2 Assumptions and key parameters

The main part of greenhouse gas emissions is related to livestock production and particularly the production of pigs and dairy cattle. All other livestock categories have a minor effect of the total emission and therefore, until 2035, the population has been kept at a level equivalent to average production conditions in 2006-2010.

The given assumptions for cattle and pig production have been discussed with the Knowledge Centre for Agriculture.

More details on the assumptions regarding developments in livestock, technology, agricultural area, use of synthetic fertiliser, nitrogen leaching and field burning of agricultural residues are given in Nielsen et al. (2013).

5.1.4.3 Results

The results of the September 2012 baseline projection scenario regarding greenhouse gas emissions from agriculture are provided in Table 5.10 and Figure 5.11.

As it can be seen from Table 5.10, the CH_4 emission is nearly unchanged from 2011 to 2035. The decreased emission from manure compensates for an increase in emission from enteric fermentation. This is a consequence of higher feed intake for dairy cattle to obtain a higher milk yield.

The expected development for N_2O emission, given in million tonnes CO_2 equivalents, is a decrease from 5.41 in 2011 to 4.73 in 2035, which leads to a 14 per cent reduction. This fall is mainly driven by the decrease in emissions from manure and the decrease in the use of fertiliser. Furthermore, emission reductions are also affected by a decrease in N leaching and a decrease in the total area of cultivated organic soils.

TABLE 5.10. PROJECTED TOTAL GREENHOUSE GAS EMISSION FROM DIFFERENT ACTIVITIES IN THE AGRICULTURAL SECTOR. 1990-2011 ARE OBSERVED.

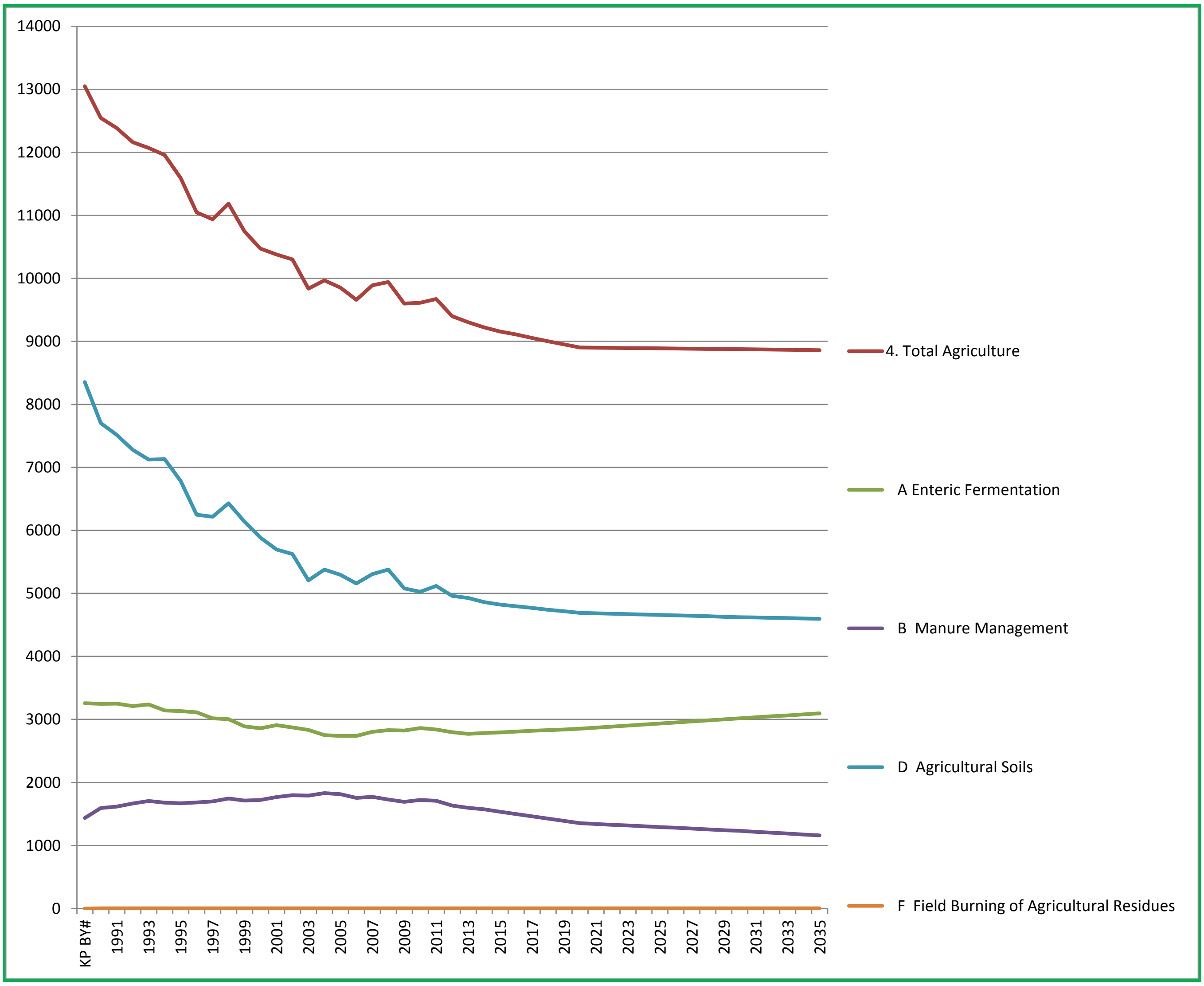
Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.

GHG emissions and projections (Gg CO2 equivalents)	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
4. Total Agriculture	**13048**	**12545**	**11592**	**10471**	**9852**	**9614**	**9399**	**9645**	**9088**	**9156**	**8903**	**8889**	**8876**	**8859**
A Enteric Fermentation	**3259**	**3247**	**3134**	**2861**	**2737**	**2862**	**2798**	**2831**	**2813**	**2795**	**2853**	**2935**	**3017**	**3098**
B Manure Management	**1437**	**1593**	**1669**	**1722**	**1816**	**1723**	**1635**	**1698**	**1480**	**1536**	**1354**	**1293**	**1232**	**1161**
C Rice Cultivation	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
D Agricultural Soils	**8352**	**7702**	**6787**	**5885**	**5295**	**5026**	**4962**	**5113**	**4791**	**4822**	**4692**	**4657**	**4624**	**4597**
E Prescribed Burning of Savannas	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
F Field Burning of Agricultural Residues	**0**	**3**	**3**	**4**	**4**	**3**	**4**	**3**	**4**	**4**	**4**	**4**	**4**	**4**
G Other	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: For 2008-2012 and 2013-2020 the annual averages are shown.

FIGURE 5.11. PROJECTED TOTAL GREENHOUSE GAS EMISSION FROM DIFFERENT ACTIVITIES IN THE AGRICULTURAL SECTOR. 1990-2011 ARE OBSERVED.

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.



5.1.4.4 Sensitivity analyses and scenario calculations

Some of the objectives from the political Agreement on Green Growth from 2009 have not been taken into account in the September 2012 projection. The projection includes expansion of biogas production and establishment of 50 000 ha non-cultivated area along water streams and lakes because these objectives have already been implemented in the regulation in the form of legislation and a subsidy scheme. The remaining objectives in the political Agreement on Green Growth have not been implemented yet in the regulation. Furthermore the effects of some of the objectives might be overestimated. Therefore, in Nielsen et al. (2013), the combined effect of the following elements has been estimated:

- Establishment of 30 000 ha non-cultivated area along water streams instead of 50 000 ha
- Establishment of 10 000 ha wetlands, and
- Implementation of 140 000 ha fields with catch crop.

The results from the calculation of the effects of these additional elements appear in Table 5.11. As can be seen, it is expected that the elements that are not included in the projection will increase the GHG emissions by 16 Gg CO2 equivalents per year compared with the September 2012 baseline scenario projection.

TABLE 5.11 EXPECTED CHANGE IN EMISSIONS OF NITROUS OXIDE FROM AGRICULTURE 2015 – 2035 IF FURTHER MEASURES FROM GREEN GROWTH ARE INCLUDED

Source: Nielsen et al. (2013)

Emissions of greenhouse gases from agriculture	2015	2020	2035
	Million tonnes CO_2 equivalents		
1. September 2012 baseline scenario	9.156	8.903	8.859
2. Projection with further measures from Green Growth	9.172	8.919	8.875

5.1.5 LULUCF

The emission of GHGs from the LULUCF sector (Land Use, Land Use Change and Forestry) includes also in the projection primarily the emission of CO_2 from land use and small amounts of N_2O from disturbance of soils not included in the agricultural sector.

The projections are made on best available knowledge on the past development in the land use in Denmark and expectations for the future. The methodologies for estimation of emissions by sources and removals by sinks for the different sectors Forest, Cropland, Grassland, Wetlands, Settlements and Other Land, are described in greater detail in Chapter 7 of Nielsen et al. (2012).

Approximately two thirds of the total Danish land area is cultivated and 14 per cent is forest. Intensive cultivation and large numbers of animals exert high pressure on the landscape, and regulations have been adopted to reduce this pressure. The adopted policy aims at doubling the forested area within the next 80-100 years, at restoring former wetlands and establishing protected national parks. In Denmark almost all natural habitats and all forests are protected. Therefore only limited conversion from forest or wetlands into cropland or grassland has occurred and is expected to occur in the future. It can be noted that most forest areas in Denmark are planted forests or managed forests, and have not been not reported as natural forests in the sense of virgin/original forests. This is due to the land use history of Denmark.

Figure 5.12 shows the land use in 1990, 2010 and the expected land use in 2035. A decrease in cropland is expected. The conversion is mainly from Cropland to Forest, Grassland and Settlements. It should be noted that the definition of the LULUCF-sectors differs slightly from the normal Danish land use definitions and the shown distribution will therefore differ from other national statistics (e.g. the National Forest Inventory applies a sample-based area estimate that differs slightly from the LULUCF matrix, but within the aimed uncertainty).

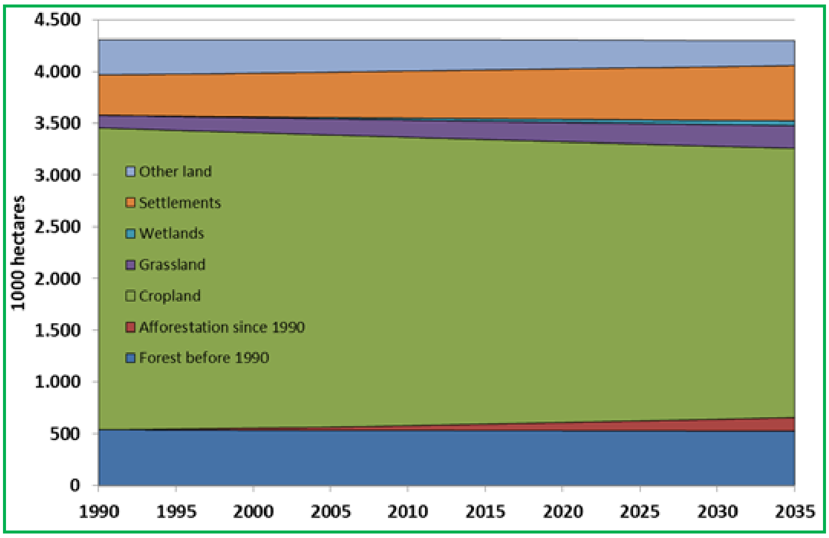
Land use conversions impact whether a category is a sink or a source. In the following, emissions by sources are given as positive values (+) and removals by sinks are given as negative values (-).

Under the Kyoto protocol, Denmark has selected Forest Management, Cropland Management and Grazing Land Management under article 3.4 to meet its reduction commitments in addition to the obligatory Afforestation, Reforestation and

Deforestation under article 3.3. Since land, which is converted from one category to another (e.g. from Cropland to Settlements), cannot be omitted from the reporting obligation under the Kyoto Protocol, the actual estimates in each category reported under the Convention, may not be the same as those accounted for under the Kyoto Protocol, see Section 5.1.5.5.

FIGURE 5.12 LAND AREA USE 1990-2035.

Source: Nielsen et al. (2013)



5.1.5.1 Methods

Other methodologies are applied when projecting emissions by sources and removals by sinks for the categories Forest, Cropland, Grassland, Wetlands, Settlements and Other Land. In general the methodologies used in the projections follow the methodologies used for the estimations of the historic greenhouse gas inventories for these categories. Further details about the methodologies used are available in *Nielsen et al. (2013)*.

5.1.5.2 Assumptions and key parameters

For the categories Forest, Cropland, Grassland, Wetlands, Settlements and Other Land also different assumptions and key parameters are used.

For example for Forest, one of the main assumptions is that the Danish forest policy target to double the forest area from 1980 to 2080 will be maintained.

For Cropland, the decrease over the last 20 years, primarily due to urbanisation and afforestation, is assumed to continue in the future.

Further details about the assumptions and key parameters for the different categories are available in *Nielsen et al. (2013)*.

5.1.5.3 Results

The total emission from the LULUCF is shown in Table 5.12 and Figure 5.13. For these categories an overall emission of around 3,300 Gg CO_2 equivalents per year in 2012 is assumed, decreasing to 3,100 Gg CO_2 equivalents per year in 2035.

TABLE 5.12 PROJECTIONS OF GREENHOUSE GAS EMISSIONS* FROM THE LULUCF SECTOR IN GG CO2 EQUIVALENTS PER YEAR. 1990-2010 ARE OBSERVED.

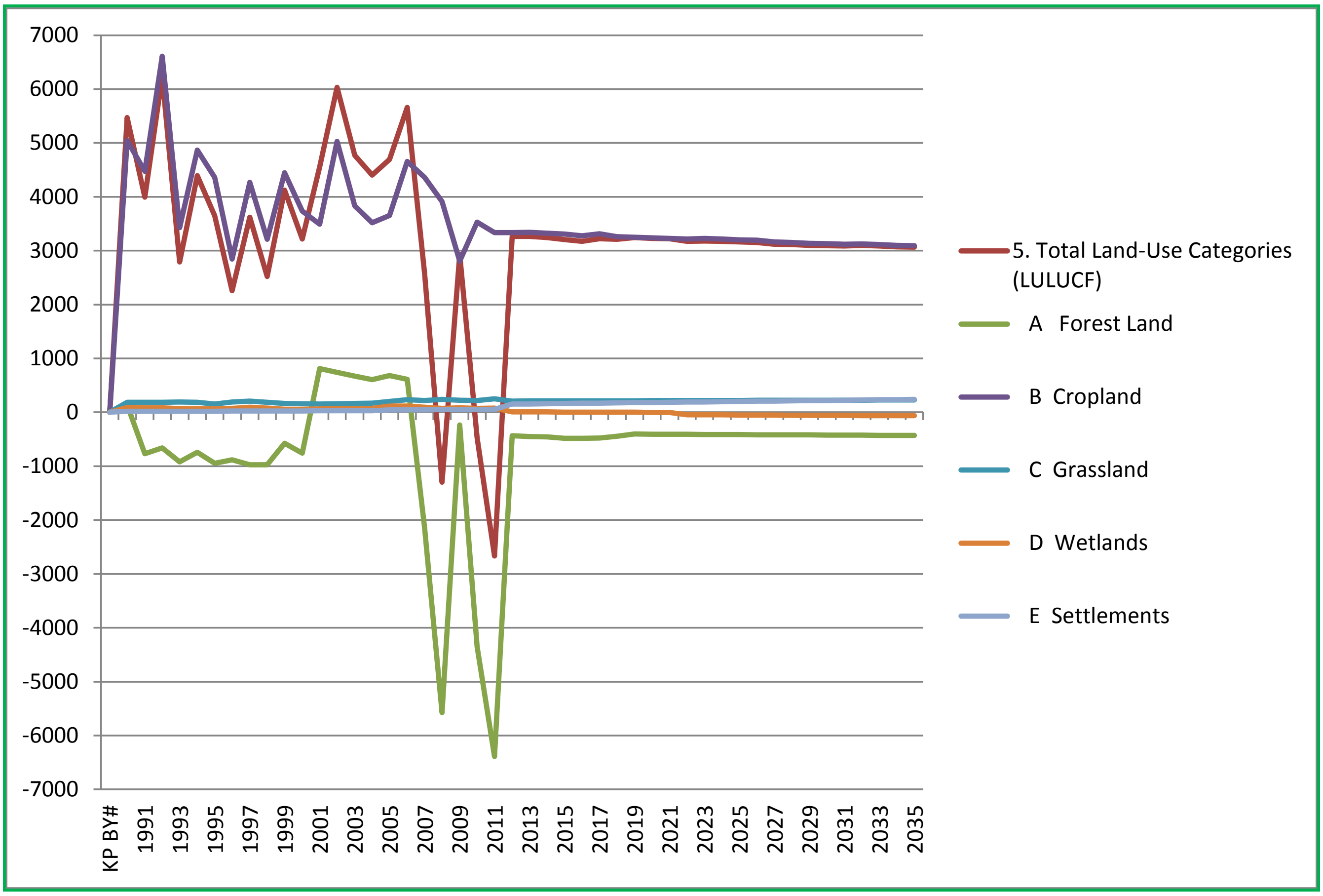
Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035: Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.

GHG emissions and projections (Gg CO_2 equivalents)	KP BY#	1990	1995	2000	2005	2010	2008-12	2013-20	2015	2020	2025	2030	2035
5. Total Land-Use Categories (LULUCF)	**0**	**5473**	**3649**	**3218**	**4695**	**-474**	**352**	**3224**	**3204**	**3230**	**3162**	**3093**	**3067**
A Forest Land	0	136	-947	-757	680	-4350	-3396	-451	-485	-406	-414	-422	-430
B Cropland	**0**	**5047**	**4362**	**3733**	**3654**	**3530**	**3384**	**3289**	**3309**	**3238**	**3203**	**3128**	**3093**
C Grassland	**0**	**183**	**152**	**159**	**203**	**217**	**228**	**214**	**212**	**216**	**220**	**225**	**229**
D Wetlands	**0**	**91**	**61**	**56**	**115**	**75**	**64**	**3**	**5**	**-1**	**-49**	**-58**	**-63**
E Settlements	**0**	**16**	**21**	**27**	**44**	**54**	**73**	**169**	**164**	**183**	**202**	**221**	**240**
F Other Land	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
G Other (please specify)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Notes: For 2008-2012 and 2013-2020 the annual averages are shown. Emissions by sources are given as positive values (+) and removals by sinks are given as negative values (-). # Under the Kyoto Protocol, separate rules regarding the LULUCF sector apply in accordance with articles 3.3 and 3.4 of the protocol.

FIGURE 5.13 PROJECTIONS OF GREENHOUSE GAS EMISSIONS* FROM THE LULUCF SECTOR IN GG CO2 EQUIVALENTS PER YEAR. 1990-2010 ARE OBSERVED.

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.



Danish forests are expected to constitute an overall sink of around 400 Gg CO_2 equivalents per year in the future. Utilisation of the organic soils for agricultural purposes is responsible for an emission of approximately 3 million tonnes CO_2 emissions per year (3,000 Gg). A total of 55 per cent of this derives from utilisation of organic soils, 43 per cent from mineral soils and 10 per cent from liming of agricultural soils. Conversion of organic soils from annual crops to permanent grassland will reduce this emission substantially but will not remove the emission totally unless conversion includes a raised water table to prevent degradation of the organic matter in the dry grasslands.

Another important loss factor is the conversion of cropland to other land use except forestry. The reason for this is that the current carbon stock for annual crops is defined as when the maximum carbon stock is in the field. Conversion of Cropland that has a high amount of carbon in living biomass to other categories with a lower amount of living biomass, e.g. urban areas, will therefore cause an overall loss of carbon.

The main driver for the increase in the emission is primarily an expected increase in the loss of carbon from agricultural soils. Increasing the input of organic matter into the agricultural soils to compensate for this loss seems very difficult as only 10-15 per cent of the annual input of organic matter will add to the Soil Organic Carbon, and the remaining organic matter will very rapidly be degraded and return to the air as CO_2.

Cultivation of energy crops will only have a marginal effect on the emissions in the LULCUF sector as only small amounts of carbon will be stored temporarily in the energy crops before the crop is harvested. The major effect of growing energy crops is the substitution in the energy sector.

The increased area with afforestation will also increase the carbon stock in these areas in the future. The former Forest & Landscape, Copenhagen University, has in their projection until 2019 assumed carbon sequestration in afforested areas of approx. 600 Gg CO_2 per year increasing to approx. 800 Gg CO_2 per year in 2035. Including the expected sink in the afforested areas will reduce the overall loss by approx. 2,000 Gg CO_2 equivalents from now and to 2035 (Johannset et al. 2011[27]).

5.1.5.4 Sensitivity analyses and scenario calculations

Full sensitivity analyses have not been carried out.

5.1.5.5 Projection of accounting quantities under Articles 3.3 and 3.4 of the Kyoto Protocol

In addition to the obligatory inclusion of Afforestation/Reforestation and Deforestation (article 3.3) Denmark has elected to use Forest Management, Cropland Management and Grazing land Management under article 3.4 to meet its reduction commitment. Even though the reduction commitment is based on the national inventory to UNFCCC, there are several differences. The major differences are that for Cropland Management and Grazing land Management the reduction is estimated based on the net-net principle. Furthermore, a land area elected for any activity in 1990 cannot leave the commitment and shall therefore be accounted for in the future. This means that land converted from Cropland to e.g. Settlements must still be

[27] Vivian Kvist Johannsen, Thomas Nord-Larsen and Kjell Suadicani (2011): Submission of information on forest management reference levels by Denmark. Forest & Landscape Working Papers No. 58-2011, 34 pp. Forest & Landscape Denmark, Hørsholm.

accounted for in the reduction commitment in the first and all subsequent commitment periods.

For Forest Management there is a maximum amount of 183 Gg CO_2 per year in the first commitment period 2008-2010 (the cap), in total 916.67 Gg CO_2 for the whole period, which can be included in the accounting of Removal Units (RMUs) towards reaching the Danish reduction commitment. Any excedance of this amount will not add to the Danish reduction commitment. There is no cap on Afforestation/Reforestation, Cropland Management and Grazing land Management.

The first commitment period is from 2008 to 2012. Table 5.13 shows the projected estimates for the different categories as conservative estimates. In table 5.14 the net-net accounting principle for Cropland Management and Grazing land Management is taken into account.

For the first commitment period (2008-2012), a total sink of 2,421.3 Gg CO_2 equivalents to 484.3 Gg CO_2 is projected from afforestation/reforestation under article 3.3 per year. In the period 2013-2020 a total sink of 5,881.8 Gg CO_2 equivalents to an average of 735.2 Gg CO_2 is projected per year. In 2035 an annual sink of 845.7 Gg CO_2 is estimated.

Deforestation due to conversion to settlements and infrastructure is estimated to be around 85 Gg CO_2 per year in the future.

Forest Management shows a very high variability, which will be reduced when further measurements in the National Forest Inventory have been made in the coming years. The current data shows that there will be a carbon sequestration in Forest Management of 9,347.0 Gg CO_2 equivalents in the first commitment period. As mentioned is there a cap of 916.67 Gg CO_2 equivalents or approximately 10 per cent of the current sink estimate.

For the second commitment period, 2013-2020, a Forest Management Reference Level (FMRL) has been estimated for the period 2013-2020 (http://unfccc.int/resource/docs/2011/tar/dnk01.pdf). The Danish FMRL has been settled to be a net average source of 409 Gg CO_2 equivalents per year assuming a first order decay of Harvested Wood Product (HWP) or 333.7 assuming an instantaneous oxidation of HWP. As the FMRL is based on a projection of the development of Danish forests until 2020, forest areas will not add further accounting quantities to the Danish reduction commitments unless further initiatives are made in Danish forest areas that existed before 1990. Currently there is no knowledge of new initiatives.

Cropland Management and Grazing land Management is projected to contribute to the Danish reduction commitment with 1,400 Gg CO_2 equivalents per year or 7,000 Gg CO_2 equivalents in total for the first commitment period. Cropland and Grassland will still be net sources of CO_2 but due to an increased incorporation of plant debris, animal manure, a reduced area with organic soil under cultivation and establishment of wetlands, the change in the agricultural activities will contribute positively to further Danish reduction commitments.

TABLE 5.13 PROJECTED EMISSION ESTIMATES* FOR ARTICLES 3.3 AND 3.4 ACTIVITIES IN GG CO2 EQUIVALENTS PER YEAR. 1990-2010 ARE OBSERVED.

Source: Nielsen et al. (2013)

	1990	2000	2008	2009	2010	2011	2012	2015	2020	2025	2030	2035
Afforestation/Reforestation (3.3/AR)	8.4	-316.5	-313.6	-542.1	-22.6	-907.4	-635.7	-651.6	-821.2	-829.3	-837.5	-845.7
Deforestation (a) (3.3/D)	300.4	263.0	38.2	38.6	39.4	40.9	82.2	83.0	84.1	85.8	87.5	89.1
Forest Management (b) (3.4/FM)	-832.1	2245.0	-691.6	-3048.4	-5677.3	-125.3	195.6	162.5	378.8	378.7	378.6	378.5
Cropland Management (3.4/CM)	4650.4	3461.5	3577.8	2488.5	3278.9	3472.7	3424.4	3409.7	3355.5	3336.1	3276.7	3257.3
Grassland Management (3.4/GM)	205.1	189.5	175.3	173.4	171.3	172.4	173.7	176.2	180.3	184.5	188.6	192.8

* Emissions by sources are given as positive values (+) and removals by sinks are given as negative values (-).
(a) N_2O emission associated with deforestation is reported under Cropland in the convention reporting but for clarification in the accounting under KP given here under Deforestation.
(b) In the first commitment period (2008-2012), there is a cap (a maximum) on the amount stored in forest remaining forest that can be included in the Danish reduction commitment. The Danish cap for 2008-2012 is 916.7 Gg CO_2. For the second commitment period (2013-2020), a Forest Management Reference Level (FMRL) has been made of 282-573 Gg CO_2 per year in the period 2013-2020. See text for further explanation.

TABLE 5.14 PROJECTED ACCOUNTING ESTIMATES 2008 TO 2020 FOR AFFORESTATION, REFORESTATION, DEFORESTATION UNDER ART. 3.3. AND FOREST MANAGEMENT (FM), CROPLAND MANAGEMENT (CM) AND GRASSLAND MANAGEMENT (GM) UNDER ART. 3.4 OF THE KYOTO-PROTOCOL AND HARVESTED WOOD PRODUCT (HWP) IN GG CO2 EQUIVALENTS PER YEAR. 1990-2010 ARE OBSERVED.

Source: Nielsen et al. (2013)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
3.3: AR	-313.6	-542.1	-22.6	-907.4	-635.7	-633.7	-635.3	-651.6	-645.9	-838.2	-836.2	-819.5	-821.2
3.3: D[a]	38.2	38.6	39.4	40.9	82.2	82.4	82.7	83.0	83.3	83.6	83.7	83.9	84.1
3.3: Total	-275.3	-503.5	16.9	-866.5	-553.6	-551.3	-552.6	-568.7	-562.7	-754.7	-752.5	-735.6	-737.1
3.4: FM	-691.6	-3048.4	-5677.3	-125.3	195.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HWP	NO	NO	NO	NO	NO	102.0	108.0	119.0	118.0	120.0	125.0	119.0	121.0
3.4: CM	-1072.6	-2161.9	-1365.9	-1178.6	-1226.1	-1214.3	-1228.2	-1240.7	-1272.4	-1228.4	-1278.8	-1285.4	-1295.0
3.4: GM	-29.8	-31.7	-33.8	-32.6	-31.4	-30.6	-29.8	-28.9	-28.1	-27.3	-26.4	-25.6	-24.8
3.4: CM+GM	-1102.4	-2193.7	-1399.7	-1211.2	-1257.5	-1244.8	-1257.9	-1269.7	-1300.5	-1255.6	-1305.2	-1311.0	-1319.7
3.4: Total incl. HWP	-1794.0	-5242.1	-7077.0	-1336.5	-1061.9	-1244.8	-1257.9	-1269.7	-1300.5	-1255.6	-1305.2	-1311.0	-1319.7
3.3 and 3.4: Total incl. HWP	-2069.3	-5745.5	-7060.1	-2203.0	-1615.5	-1796.1	-1810.5	-1838.3	-1863.2	-2010.3	-2057.7	-2046.7	-2056.8

* Emissions by sources are given as positive values (+) and removals by sinks are given as negative values (-).
Note: N_2O emission associated with deforestation is reported under Cropland in the convention reporting, but for clarification reasons in the accounting under KP stated here it is reported under Deforestation.

5.1.6 Waste

Greenhouse gas emissions under this sector include methane (CH_4) from landfills and methane and nitrous oxide (N_2O) from wastewater treatment. In the historic greenhouse gas inventories, minor sources are included, e.g. human cremation, animal cremation, sludge spreading, biogas production, other combustion, accidental building fires, accidental vehicle fires and compost production. For completeness these sources are included in the projections also. Further information on the projection of emissions from these minor sources is available in *Nielsen et al. (2013).*

5.1.6.1 Methods

Landfills

The CRF source category 6.A, "Solid waste disposal sites", gives rise to CH_4 emissions.

CH_4 emissions are calculated by means of a first order decay (FOD) emissions model, where activity data is based on annual data for the amount of waste deposited, and where emissions factors, which are the amounts of CH_4 emitted per amount of waste deposited, result from model assumptions about the decay of waste and release of CH_4 as described in Nielsen et al., 2012.

In connection with ISAG reporting, projections of quantities of waste produced are carried out using the model FRIDA (FRemskrivning af Isag DAta – Projection of ISAG Data) (Andersen & Larsen, 2006). The model is a further development of the model described in the report from DEPA (Andersen et al., 1998) and is based on data from the information system for waste, ISAG, and the macroeconomic model, ADAM, assuming proportionality between the amounts of waste generated and the waste generating economic activity. Projection of the development in the amount of waste produced is based on the Ministry of Finance's projection of the economic development from December 2008 (Danish Government, 2008).

Wastewater

Methane emissions from the municipal and private wastewater treatment plants (WWTP) are divided into contributions from 1) the sewer system, primarily settling tanks and biological N and P removal processes, 2) an-aerobic treatment processes in closed systems with biogas extraction and combustion for energy production and 3) septic tanks. For a detailed description of the model equations and input parameters (process-specific emissions factors and activity data), see Nielsen et al., 2012.

Both direct and indirect N_2O emissions from wastewater treatment processes are calculated based on country-specific and process-specific emission factors (Nielsen et al., 2012) and the amount of nitrogen in the influent and effluent wastewater, respectively. The influent total N was verified to correlate with population and therefore projected according to population projections.

5.1.6.2 Assumptions and key parameters

Landfills

The represented projection of emissions from solid waste disposal sites is based on total deposited amounts estimated that are based on the economic projection from 2008 (Andersen, 2010) even though a more updated economic survey (Danish Government, 2010) is available and accordingly an updated primary waste projection report published by the Danish EPA in August 2010 (DEPA, 2010). The estimated total amounts of generated waste do not differ significantly in the period 2010-2030 when comparing the projected amounts of primary waste production estimated from the economic projection models based on 2008 and 2009 data, respectively (Andersen, 2010; DEPA, 2010). Furthermore, the FRIDA 2009 report (Andersen, 2010) includes, for the first time, projection estimates of the total amounts of deposited waste taking into account the Danish waste strategy plans (Andersen, 2010); these were used as input data for the landfill emission model.

The amount of recovered methane was estimated based on information from the Danish Energy statistics and a correlation analysis between historical data on the annual generated and collected amounts of methane.

The content of degradable organic matter within each fraction as well as the degradation rate and oxidation in top layers was set equal to the model input parameter values of the FOD model as described in Nielsen et al., 2012.

The emission projection uses the same CH_4 emission model used for calculation of the historic emissions.

The annual waste statistics include the amount of waste sent to landfill, whereas projected waste data (Andersen, 2010) have been used for the years 2010-2035, as presented in Table 5.15.

TABLE 5.15 HISTORICAL AND PROJECTED AMOUNTS OF DEPOSITED WASTE AT DANISH LANDFILL SITES [‘000 TONNES].

Source: Nielsen et al., 2013

	1990	1995	2000	2005	2010*	2015	2020	2025	2030	2035
Deposited waste (’000 tonnes)	3174	1978	1469	948	910	1034	1043	1080	1110	1160

* For 2010 the annual average 2008-2012 is shown.

Wastewater

For the calculation of CH_4 emissions, the fraction of wet-weight sewage sludge treated anaerobically is set at a constant corresponding to the 2009 level of 34 per cent. From the influent TOW data and the amount of sludge treated anaerobically, the gross emission is derived. The fugitive emission from anaerobic processes, all with energy production, equals 1 per cent of gross methane emissions (*Nielsen et al., 2012*). Methane emission projections are provided in Table 5.16.

Implied emission factors for N_2O emissions are calculated as average emissions for the period 2005-2010 assuming constant industrial influent N load. The population statistics have been used for projecting emissions from WWTPs. The emission projection for the total N_2O emission is provided in Table 5.16.

5.1.6.3 Results

The projection of methane emissions from landfills and methane, and nitrous gas emissions from wastewater handling is shown Table 5.16 and Figure 5.14.

TABLE 5.16 PROJECTIONS OF GREENHOUSE GAS EMISSIONS FROM LANDFILLS AND WASTEWATER HANDLING. 1990-2011 ARE OBSERVED.

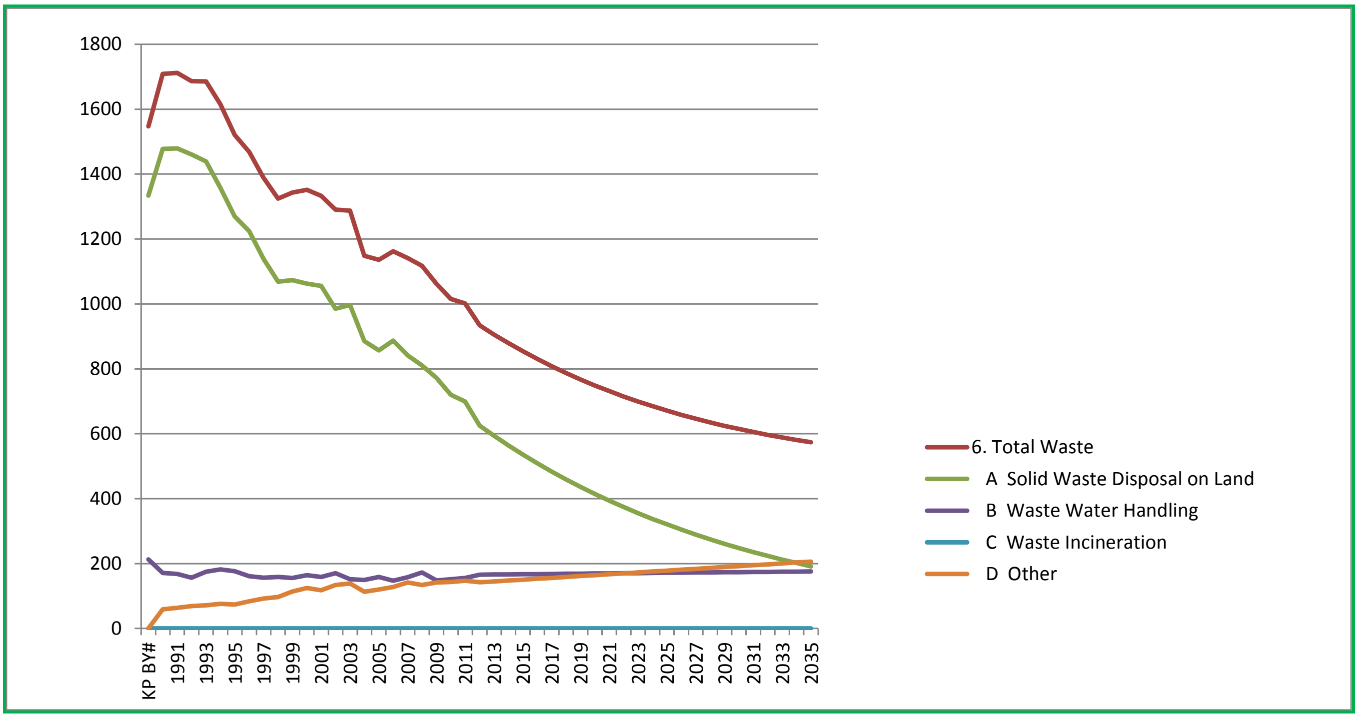
Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.

GHG emissions and projections (Gg CO2 equivalents)	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
6. Total Waste	1547	1709	1521	1351	1135	1015	934	1026	823	854	749	671	615	574
A Solid Waste Disposal on Land	1334	1478	1270	1062	856	720	625	725	500	536	415	321	248	192
B Waste Water Handling	213	171	177	164	159	152	166	159	168	167	169	172	174	176
C Waste Incineration	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Other	0	60	74	125	120	143	143	142	155	151	164	178	192	206

Note: For 2008-2012 and 2013-2020 the annual averages are shown.

FIGURE 5.14 PROJECTIONS OF GREENHOUSE GAS EMISSIONS FROM LANDFILLS AND WASTEWATER HANDLING. 1990-2011 ARE OBSERVED.

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.



5.1.6.4 Sensitivity analyses and scenario calculations

Sensitivity analyses have not been carried out for the waste sector.

5.2 ASSESSMENT OF AGGREGATE EFFECTS OF POLICIES AND MEASURES

The total effect of policies and measures is described in section 5.1.1.

In this section further information on the total effect of policies and measures on a gas by gas basis is given.

5.2.1 Carbon dioxide, CO_2

Figure 5.15 shows the expected development in CO_2 emissions in Denmark's main IPCC sector categories. A more detailed projection in IPCC source and sector categories is contained in annex E1.

The total CO_2 emission without land-use, land-use change and forestry (LULUCF) was 52,853 Gg in 1990 and 43,890 Gg in 2011. In comparison, for the period 2008-2012, it has been calculated that the average annual CO_2 emissions will be 47,035 Gg CO_2.

The biggest source of CO_2 emissions in Denmark is combustion of fossil fuels, including electricity and heat production and transport.

Emissions of CO_2 from electricity production have varied considerably in the period 1990-2011 due to great variations in exports/imports of electricity.

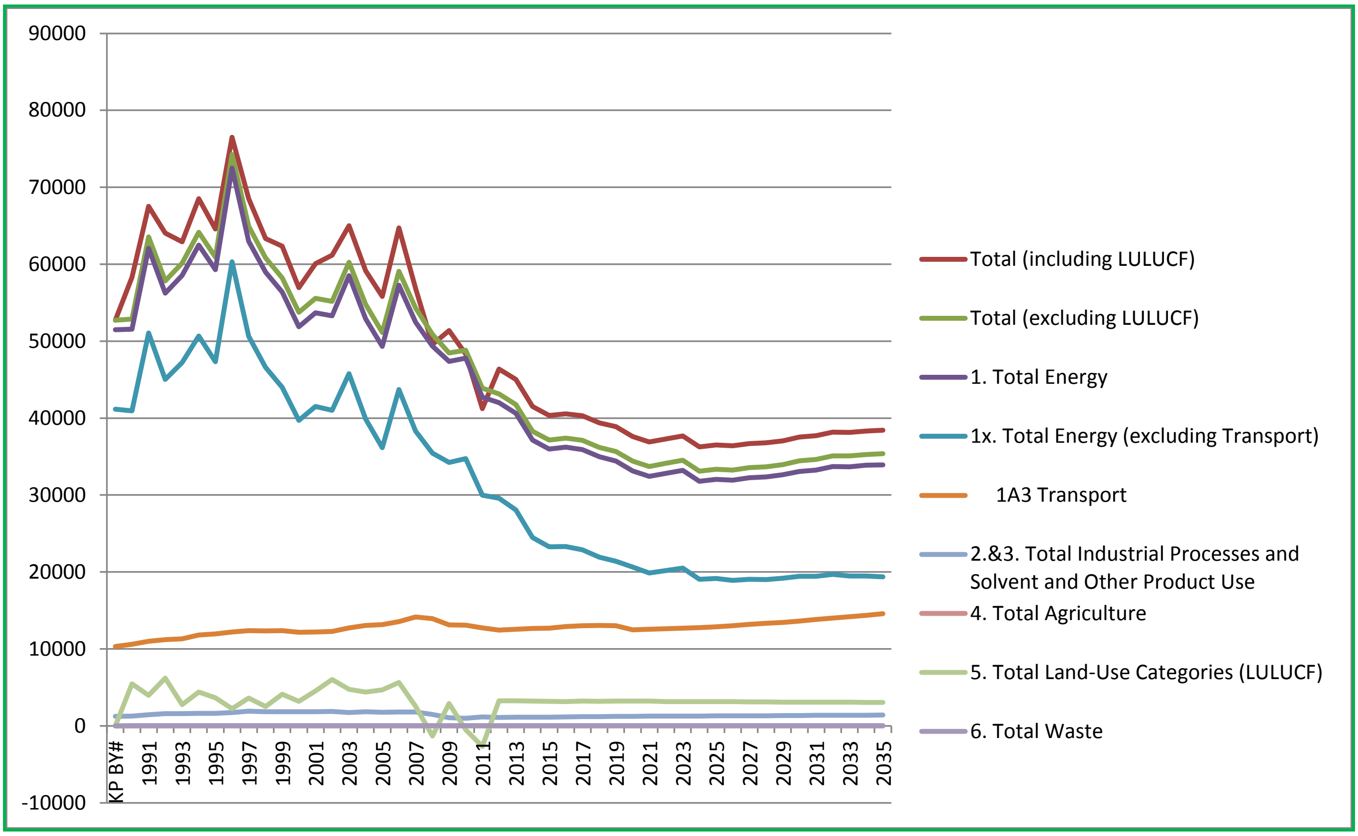
The transport sector has had the biggest increase in CO_2 emissions since 1990, and the emissions are expected to continue rising for the whole of the projection period. CO_2 emissions from the transport sector were 10,619 Gg of CO_2 in 1990 and had risen to a peak of 14,161 Gg of CO_2 in 2007, and therafter decreased to12,716 Gg of CO_2 in 2011. From 2012 the projection shows a slight increase until 2018, which will be repeated until 2035 following a brief return to the 2011 level in 2019-2020.

The total net emissions in the Land-Use Categories (LULUCF) sector have fluctuated in historic data due to inter-annual variations in the harvest both in Forest Land and in Cropland – for example related to inter-annual variations in climate and world market prices. In 2008, 2010 and 2011 the net result was removals (negative emissions in Figure 5.15). In the projections similar inter-annual variations cannot be projected and the projected total is rather stable. Trends in the projection of emissions and removals by the sub-categories in the LULUCF sector are different for the different sub-sectors. For Forest Land an almost constant annual net removal just under 0.5 million tonnes CO_2 is projected. In the Cropland sector, a slight decrease in CO_2 emissions after a peak in 2013 is projected. Grassland, Wetlands and Settlements are sub-categories with minor emissions and removals. Towards the end of the projection period (2035), slight decreases in emissions from Grassland and Settlements can be seen, while Wetlands show a minor increase in net removals.

It should be noted that only specific parts of the LULUCF emissions and removals estimated in accordance with the rules under the UNFCCC are to be taken into account under the Kyoto Protocol in accordance with Articles 3.3 and 3.4 of the protocol. This is further described in Section 5.1.5.5 above.

FIGURE 5.15 PROJECTIONS OF DENMARK'S CO2 EMISSIONS IN 2012 - 2035 AND EMISSIONS OBSERVED IN 1990-2011

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.



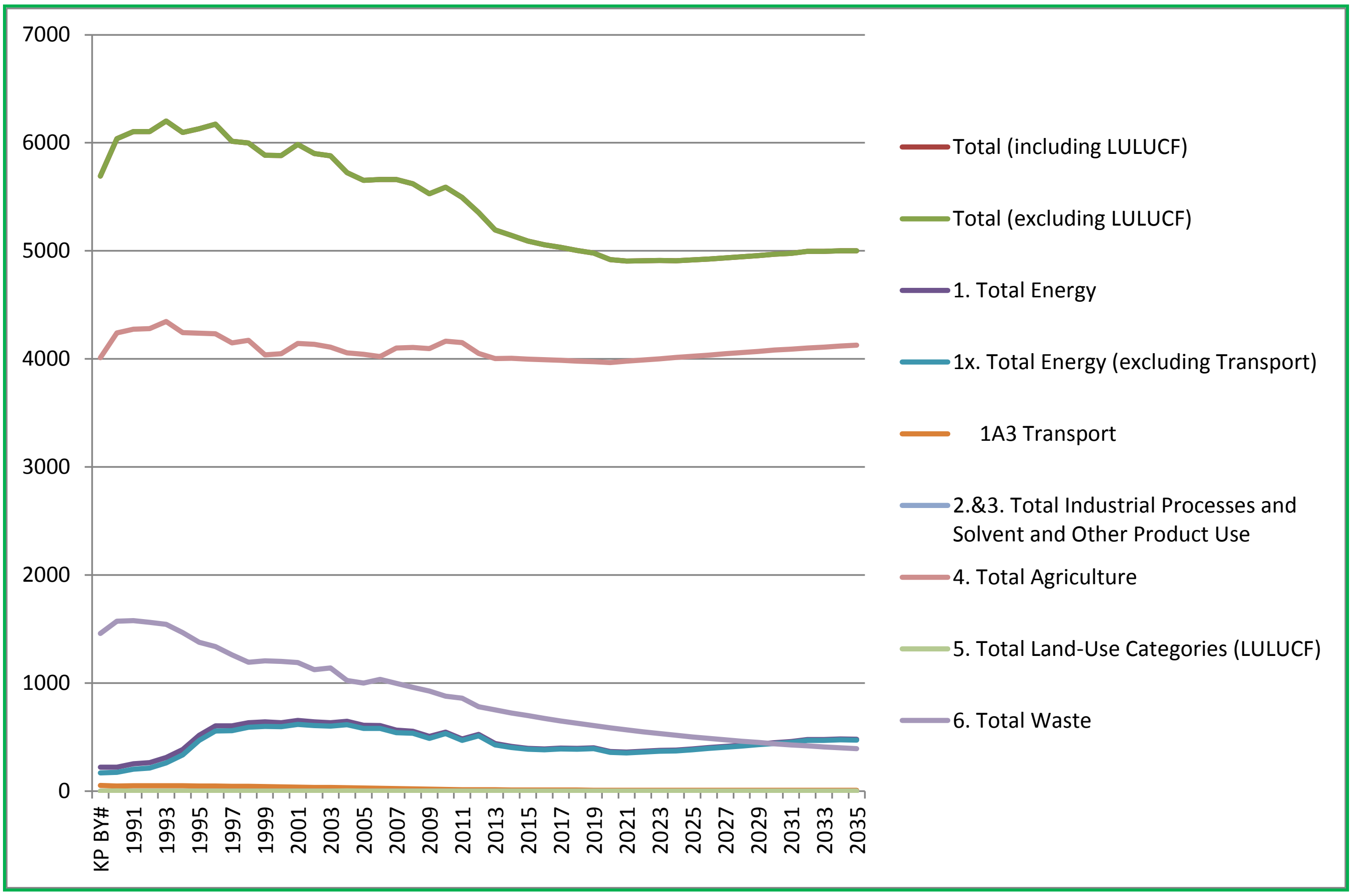
5.2.2 Methane (CH_4)

Most of the methane emissions come from farm animals' digestive systems (enteric fermentation). The projections are shown in Figure 5.16. The very small changes in emissions from agriculture from 1990 to 2035 are primarily due to very little changes in cattle stocks. The next largest source of methane is landfills, from which emissions were reduced from 1990 to 2011 and will continue to decrease in the projection period primarily due to the decrease in formation of methane in old landfills after the ban on landfilling of combustable waste in 1997. Methane emissions from the energy sector have, however, increased considerably until 1999 due to an increase in the use of gas-driven motors. This increase was followed by a stabilisation which seems to continue in the projection period.

Altogether total methane emissions decreased from 6,038 Gg of CO_2 equivalents in 1990 to 5,493 Gg of CO_2 equivalents in 2011, whereas the baseline projection for 2012-2035 shows a further decrease until 2021 followed by a slight increase until it reaches 5,001 Gg of CO_2 equivalents in 2035.

FIGURE 5.16 PROJECTIONS OF DENMARK'S METHANE EMISSIONS IN GG CO2 EQUIVALENTS 2012 – 2035, EMISSIONS IN 1990-2011 ARE OBSERVED

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.

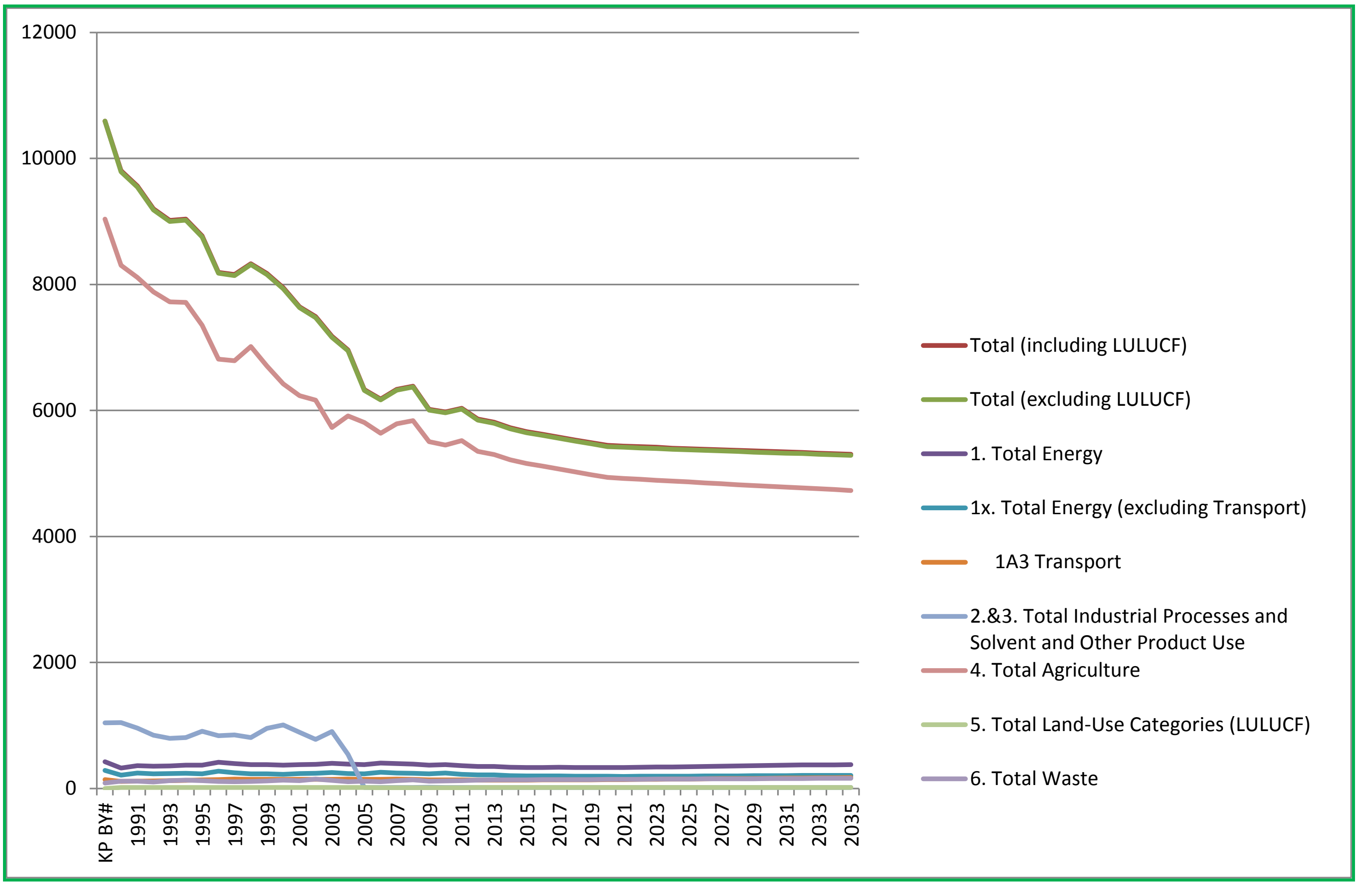


5.2.3 Nitrous oxide, N_2O

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. The projections are shown in Figure 5.17. The main reason for the reduction in total nitrous oxide emissions from 9,803 Gg CO_2 equivalents in 1990 to 6,034 Gg CO_2 equivalents in 2011 is a combination of the Action Plans for the Aquatic Environment I and II and the Action Plan for Sustainable Agriculture. The baseline projection for 2012-35 shows a further decrease until an emission of 5,303 Gg CO_2 equivalents is reached in 2035. Another substantial reduction is due to the fact that Denmark ceased to produce nitrous acid in 2004, as shown under Industrial Processes in Figure 5.17. Contributions from the other sector categories are minor and in general they show no particular trends.

FIGURE 5.17 PROJECTIONS OF DENMARK'S NITROUS OXIDE EMISSIONS IN 2008-25, EMISSIONS IN 1990-2007 ARE OBSERVED

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.



5.2.4 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, or F-gases, HFCs, PFCs and SF_6. Total emission of these gases corresponded to 326 Gg CO_2 equivalents in 1995 and seems to have peaked in 2008 with 897 Gg CO_2 equivalents.

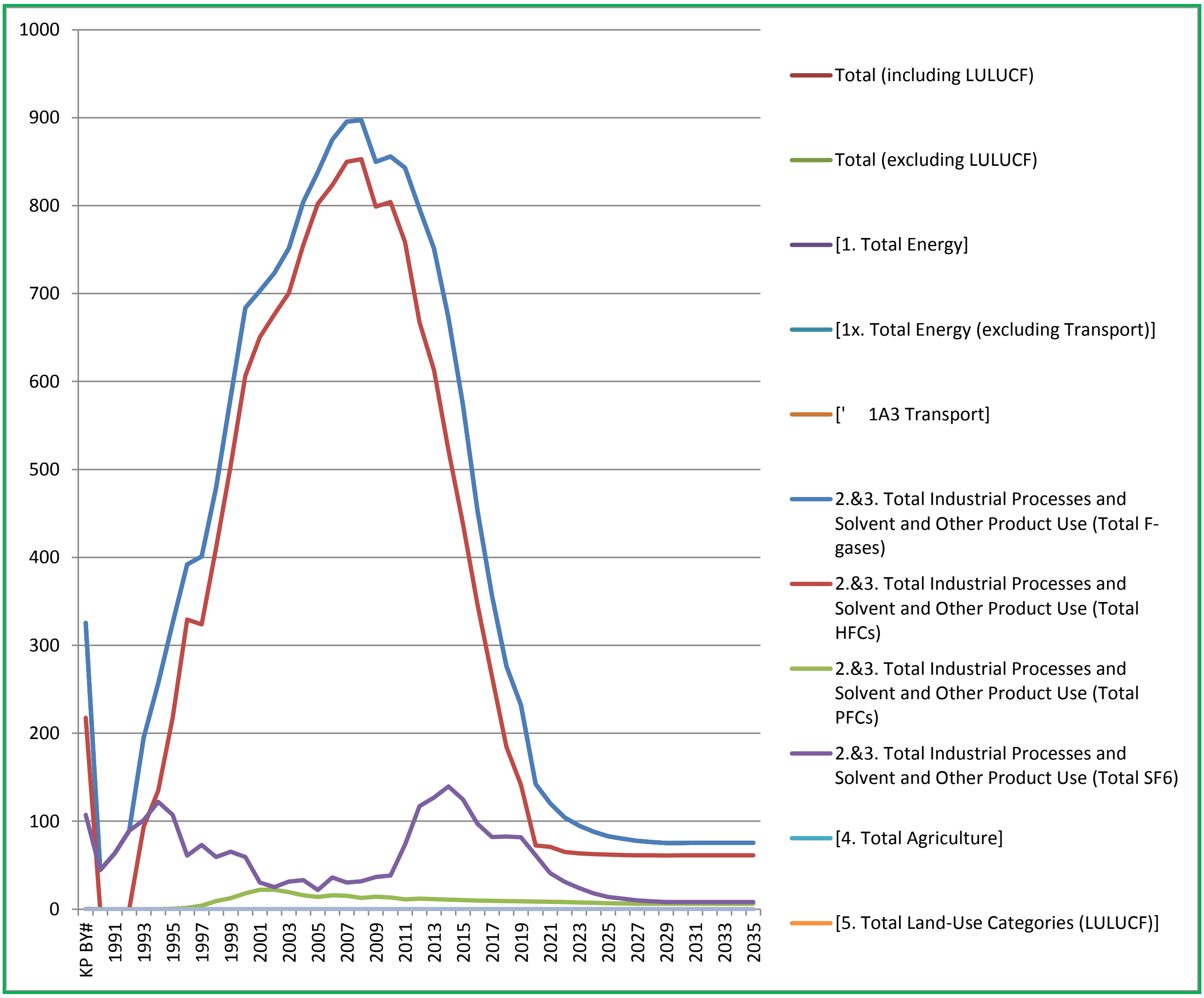
The decrease in the rate of increase until 2008 is primarily due to taxes and regulations introduced concerning the use of new installations/products.

In the baseline projection of total F-gas emissions, emissions are expected to decrease rapidly until 2021, after which only minor and slow further reductiona are expected until a level of 76 Gg CO_2 equivalents is reached in 2035.

As can be seen from Figure 5.18, the trends for the three individual types of F-gas are very different due the different uses of these gases. With HFCs being the major contributor, the trend for HFC emissions follows the trend for total F-gas emissions closely.

FIGURE 5.18 PROJECTIONS OF DENMARK'S INDUSTRIAL GREENHOUSE GAS EMISSIONS (THE F-GASES) IN GG IN 2012-35, EMISSIONS IN 1990-2011 ARE OBSERVED

Source: 1990-2011: The National Inventory Report (NIR), DCE, April 2013.
2012-2035 : Projections of greenhouse gas emissions 2012 to 2035, Nielsen et al. (2013), DCE, February 2013.



5.2.5 Denmark's total greenhouse gas emissions and removals

Figure 5.1 shows the base year and projections of Denmark's total greenhouse gas emissions and removals. The overall trend and effect of policies and measures is commented on in section 5.1.1. Further details concerning IPCC source and sector categories are contained in Annex E1.

5.2.6 Projections without measures

According to the guidelines for national reporting, projections in National Communications could also include 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 *Effort Analysis* are described in Annex B.

Note that the analysis has been prepared on the basis of a previous projection which includes the effect of measures described in Denmark's Third National Communication as the analysis was started in 2003.

As stated in Annex B in the *Efforts Analysis,* it has been estimated that average Danish emissions of greenhouse gases in 2008-2012 would have been 95.6 million tonnes CO_2 equivalents– i.e. about 15.6 million tonnes CO_2 equivalents greater than the previous projection with measures, if the measures initiated in the period 1990-2001 had not been initiated.

In addition, as indicated in Annex C, it has been estimated that average Danish emissions of greenhouse gases in 2008-2012 would have been around 1 million tonnes CO_2 equivalents per year greater, if the selected and analysed measures initiated after 2001 had not been initiated. However, it should be noted that the analysis described in Annex C only contains an evaluation of the effects of certain climate change mitigation measures implemented after 2001 and that the analysed measures have been selected by the National Audit Office. This analysis is therefore not a complete analysis of all measures implemented after 2001. Furthermore it should be noted that within the nine measures selected by the National Audit Office it has been impossible to carry out an analysis for two of them. For one of them, the ex-ante estimate has been included in the total estimate because the result of the ex-post analysis is pending.

5.2.7 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 policies and measures that are planned but still not implemented are included.

As described in Chapter 4, the Danish government's Climate Policy Plan from August 2013 contains a strategy on how additional policies and measures should be determined for the purpose of achieving the domestic 40 per cent reduction target in 2020 most efficiently.

Although a catalogue of potential additional measures was published in parallel with the Climate Policy Plan, the government has not yet decided on which of the measures in the catalogue should go into the planning with a view to be adopted and implemented.
Therefore it is not possible to distinguish between which measures will have a realistic chance of being adopted and which will not. And the former is the criteria for measures in the planning stage to be included in a "with additional measures" projection. Thus, a "with additional measures" projection scenario cannot be made until the government has decided which of the measures - in the catalogue or among the additional measures suggested by the business community or civil society in connection with the dialogue that the government has initiated with the Climate Policy Plan - should be pursued.

Depending on the progress in this dialogue, the planned 2014 update of the baseline scenario will either take the effects of adopted additional measures into account in the "with measures" baseline scenario or take the effects of planned additional measures with a realistic chance of being adopted into account in a "with additional measures" scenario.

In Annex E3, the ex-ante estimated greenhouse gas reduction effects of the 78 potential additional measures contained in the above-mentioned catalogue are shown together with the estimated socio-economic marginal costs expressed as a CO_2 shadow price. These results are used for the construction of the MAC-curve shown in Figure 4.7.

5.3 SUPPLEMENTARITY RELATING TO MECHANISMS UNDER ARTICLES 6, 12 AND 17 OF THE KYOTO PROTOCOL

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...".

The National Allocation Plan

The European Commission approved the Danish National Allocation Plan (NAP) in 2007. The NAP contains a detailed plan for the reduction efforts and ensures that Denmark reaches its goal for the Kyoto Protocol period 2008 – 2012. In the NAP, the gap between the emission target and emissions under business as usual amounted to 13 million tonnes annually. Of this gap, 5.2 million tonnes are covered by efforts in the emission trading sector, while the remaining 7.8 million tonnes are covered by efforts in the non-emission trading sector using various instruments, including the use of CDM-credits, sinks and additional domestic efforts. The NAP also ensures that Denmark honours the supplementarity principle.

5.4 METHODOLOGY USED FOR THE PRESENTED GREENHOUSE GAS EMISSION PROJECTIONS

The methodologies used for the presented greenhouse gas emission projections are described for the relevant sectors in section 5.1.2-5.1.7.

In Annex E4, a comparison of the latest reported greenhouse gas inventory with the "with measures" projections of Denmark's total greenhouse gas emissions included in Denmark's first to sixth national communication is shown. As can been seen, no clear conclusion can be drawn from a plot of the "raw" projection data reported over the period 1995-2013. However, if the data are normalised to take into account the improvements made in inventory reporting over the same period, and if inter-annual variations in temperature and electricity trade, the latter being sensitive to inter-annual variations in precipitation in Norway and Sweden due to these countries' hydropower based production of electricity for the Nordic electricity market, is also taken into account, relatively good correlation between the projections until 2005 in NC1 (1994) and until 2010 in NC2 (1997) and the later actual development can be seen. A closer look into the detailed level of sectors and source categories, however, reveals major differences, but outliers in both directions seem to even out each other in the total due to the relatively high number of separately projected sub-categories. The projections for 2011 in the NC3 (2003), NC4 (2005) and NC5 (2009) show significant deviations from the 2011 inventory data reported in April 2013.

5.5 Greenland and the Faroe Islands

5.5.1 Greenland

Total greenhouse gas emissions in Greenland in 1990, 1995, and 2005 to 2011 are shown in table 5.17.

Table 5.17 Total greenhouse gas emissions (Gg Co2 equivalents) in 1990, 1995, 2005-2011

Source: Statistics Greenland (2013) GHG Inventory for Greenland 2012-2025.

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
GHG (Gg CO_2 Equivalents)	659.4	568.4	705.1	683.7	701.9	693.2	720.5	630.4	717.6	763.8

Greenland is likely to experience significant industrial growth over the coming years, which will impact on future emission levels. Possible sources of new emissions include:

- Further growth in the mining industry with the establishment of a number of new mines
- Establishment of an aluminium smelter (mainly based on hydropower)
- Continuation of oil and gas explorations
- Exploitation of gas and oil

Eight scenarios have been developed to exhibit the different possible developments in total GHG-emission levels depending on varying degrees of new growth in the minerals and hydrocarbon industry. Three scenarios are based on no new exploitation of minerals, oil and gas, but with different emission developments using current emissions as a baseline. Five scenarios are based on different combinations of possible, new projects in the oil and mineral industry. The different scenarios are associated with different projected emission levels. It must be stressed that none of the projects that are included in the scenarios have yet been granted exploitation licenses, and projected emissions are hence subject to a significant degree of uncertainty. They have been included in order to display the full range of possible emission developments and the significant variations in emissions depending on which, if any, projects will be realised.

The five scenarios that include new projects in the minerals and hydrocarbon industry are summarised in Table 5.18.

TABLE 5.18 OVERVIEW OF CATEGORIES SUMMARISING DIFFERENT SCENARIOS FOR GROWTH IN THE OIL AND MINERALS INDUSTRY

Source: Greenland Government and Statistics Greenland (2013) *GHG Inventory for Greenland 2012-2025.*

	Annual GHG Emissions (in Gg CO_2 Equivalents) per Project	**Projects**
Category 1 oil and mineral projects	0< - 100	Kringlerne, Fiskenæsset, Maarmorilik and a number of seismic investigations
Category 2 oil and mineral projects	100-250	Citronen Fjord, Skærgården, Malmbjerg and several oil exploration drillings
Category 3 oil and mineral projects	250-500	Kvanefjeld (mining of uranium)
Category 4 oil and mineral projects	500-1000	The Isukasia iron mine, Aluminium smelter by Maniitsoq
Category 5 oil and mineral projects	1000<	Exploitation of oil and gas corresponding to the Danish level in 2009

Table 5.19 below presents inventories for the period 2012-2025 based on the eight different scenarios. The three first scenarios include no new minerals and hydrocarbon projects, while the five scenarios below have incorporated different levels of new growth in the minerals and hydrocarbon industry corresponding to the five categories listed above.

Without any new projects in the minerals and hydrocarbon industry, the average annual GHG emissions will be in the range 586-654 Gg CO_2 equivalents. This is less than the expected average annual emissions in the period 2008-2012, which is estimated to be 696 Gg CO_2 equivalents. With new projects in the minerals and hydrocarbon industry, the average annual GHG emissions will be in the range 688-2,531 Gg CO_2 equivalents.

It should be stressed that all scenarios are characterized by a significant degree of uncertainty as they depend on which, if any, projects will be carried out over the coming years.

TABLE 5.19 GREENHOUSE GAS INVENTORIES (IN GG CO_2-EQUIVALENTS) FOR THE PERIOD 2012-2025 BASED ON EIGHT DIFFERENT SCENARIOS

Source: Statistics Greenland, 2013: *GHG Inventory for Greenland 2012-2025*.

Scenarios	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	***2013 -2025***
	Gg CO2 equivalents														
No new projects in the minerals and hydrocarbon industry and 1 % annual reduction in GHG emissions	648	622	615	609	603	597	591	585	579	574	568	562	557	551	586
No new projects in the minerals and hydrocarbon industry and Status Quo development of GHG emissions	648	622	622	622	622	622	622	622	622	622	622	622	622	622	622
No new projects in the minerals and hydrocarbon industry and 1-2 % annual increase in GHG emissions*	648	622	620	626	633	639	646	653	660	667	674	681	688	696	654
Above(*) + Category 1 projects in the minerals and hydrocarbon industry **	648	642	673	659	666	672	679	686	693	700	707	714	721	729	688
Above(**) + Category 2 projects in the minerals and hydrocarbon industry ***	648	651	832	1,318	1,436	1,310	1,317	1,473	1,705	1,712	1,569	1,576	1,584	1,591	1,390
Above(***) + Category 3 projects in the minerals and hydrocarbon industry ****	648	651	832	1,318	1,436	1,346	1,353	1,510	2,205	2,212	2,069	2,076	2,084	2,091	1,630
Above(****) + Category 4 projects in the minerals and hydrocarbon industry *****	648	691	872	1,403	2,030	1,941	1,948	2,104	3,367	3,374	3,231	3,238	3,246	3,253	2,361
Above(*****) + Category 5 projects in the minerals and hydrocarbon industry	648	691	872	1,403	2,030	1,941	1,948	2,104	3,367	3,374	3,231	3,238	3,246	5,453	2,531

5.5.2 The Faroe Islands

As mentioned in Section 4.6, a national target to reduce the domestic emissions of greenhouse gases by at least 20 per cent in the period 2010 to 2020 compared with the level of emissions in 2005 was adopted by the Faroese Parliament in December 2009.

Faroe Islands' total greenhouse gas emissions from 1990, 1995, 2000, 2005 and 2010 to 2012 are presented in table 5.20 below.

TABLE 5.20 THE FAROE ISLANDS' TOTAL GREENHOUSE GAS EMISSIONS CALCULATED AS CO_2 EQUIVALENT EMISSIONS IN GG ('000 TONNES) IN 1990, 1995, 2000, 2005 AND 2010-2012

Source: Umhvørvisstovan – Faroese Environment Agency and DCE (2013) .

	1990	1995	2000	2005	2010	2011	2012
Total GHG emissions in Gg	**708**	**579**	**709**	**778**	**845**	**736**	**798**
Index (1990=100)	100	82	100	110	119	104	113

6 Vulnerability assessment, climate change impacts and adaptation measures

Foto: Finn Majergaard

6 Vulnerability assessment, climate change impacts and adaptation measures

6.1 EXPECTED IMPACTS OF CLIMATE CHANGE

6.1.1 Climate in the future

The climate is changing, and in all likelihood we will see more changes in the future. In the long term, the future climate is strongly dependent on the future emissions of greenhouse gasses and other substances that influence the climate. The development in greenhouse gas emissions is especially dependent on three factors: demographic development, the rate and spread of implementation of energy-efficient technologies, particularly in the energy and transportation sectors, and the socio-economic development in general. The changing climate with rising temperatures, changing precipitation patterns, an increase in extreme weather events and rising sea levels will have a broad impact on ecosystems and society in general.

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 of such events.

6.1.2 Climate trends in Denmark

6.1.2.1 The latest developments

Since the Ice Age, Denmark has had a temperate maritime climate. This climate, with wet winters and cool summers, is now changing. The latest statistics[28] from the Danish Meteorological Institute (DMI) show that the mean temperature is now above 8.5°C (1991-2012), an increase of about 1.5°C since the end of the 19th century. This increase is about double the increase of the global mean temperature for the same period. Today the average winter temperature in Denmark is often above 2ºC, and the average summer temperature is about 16ºC.

The annual precipitation measured in Denmark is now about 750 mm (1991-2012). Precipitation has increased by about 15% – or 100 mm – since the first recordings were begun in 1874. Precipitation is greatest in the western and southern part of Jutland, with almost 1000 mm annual precipitation, and least precipitation is measured in the eastern parts of Denmark (Zealand and the other eastern islands), where about 600 mm of precipitation is recorded annually. In general wet areas experience the greatest increase in precipitation. Correspondingly, precipitation has increased most in western Jutland, by about 20% in the past 85 years.

The Danish climate has become more maritime in the 20th century. On average, cloud cover has increased by about 5 percent since observations began in 1874. With the clouds, more precipitation has come, there are fewer days with snow cover, and

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[28] Cappelen, 2013b

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.

6.1.2.2 Projected climate changes in Denmark

On the basis of the most recent Danish and European scenario calculations, DMI has estimated the expected climate change in Denmark focusing on 2050[29]. The assessment of future climate change is based on the scenarios used by the Intergovernmental Panel on Climate Change (IPCC), and changes are expected to increase towards the end of this century.

Climate simulations and understanding of associated uncertainties are constantly being improved. The report from DMI presents the latest results based on European studies where a number of climate simulations were performed with several regional climate models (ENSEMBLES project). Projection of future climate change based on an ensemble of climate models is more robust than estimates based on a single model.

Global sea-level rise depends on melting of snow and ice on land and thermal expansion of the ocean. The amount of melting ice is associated with great uncertainties. The calculated sea-level rise for Denmark is based on the current best estimate from DMI and from studies carried out by GEUS.

For specific planning, assessment and risk analysis of climate adaptation, it is important to consider the full range estimate as indicated by the uncertainty interval in the report, instead of simply considering the best estimate.

All changes quoted below for the climate in Denmark are in relation to the reference period 1961-1990, unless otherwise stated:

- **Temperature**: Future global warming will lead to warming in Denmark in line with the trend already observed. By 2050 temperatures are expected to increase by around 0.9 °C in the summer and 1.5 °C in the winter. Towards 2100 temperatures are expected to increase 1.5-2.6 °C in the summer and 2.3-3.8 °C in the winter, depending on the emission scenario.

- **Precipitation**: Global warming increases the water content in the atmosphere, leading to increased global precipitation. For Denmark, this is also the case. Towards 2100 there is a tendency towards increased precipitation with the largest increase of 17-27% in the winter season, depending on the emission scenario. Most of the expected increase in winter precipitation is likely to occur witin the next 50 years. For spring and autumn, precipitation is also expected to increase, whereas the situation for summer

[29] Olesen et al. 2012: Future Climate Change in Denmark (in Danish); Mapping Climate Change – Barriers and opportunities for action, Task Force on Climate Adaptation 2012, http://klimatilpasning.dk/media/590078/mapping_climate_change.pdf

precepitation is more uncertain. Summer precipitation is expected to increase in Northern Scandinavia and decrease in Central, Eastern and Southern Europe, and Denmark will likely be on the border between these to zones, making predictions of future overall summer precipitation in Denmark rather uncertain, but the summer precipitation will be characterized by longer dry spells and more heavy precipitation events.

- **Wind**: Mean wind is expected to experience only minor changes towards the end of the century, whereas extreme wind conditions will likely occur more frequently, especially in the autumn.

- **Sea level**: The sea level is rising at all Danish coastlines, except in the northern Jutland. Further sea-level rises are expected in the future due to climate change. By 2050 the sea level is expected to rise by 0.3 ± 0.2 m compared to today. The uncertainty is largely due to the contribution from melting glaciers and ice sheets. Towards the year 2100, the sea level around Denmark is expected to increase by 0.8 ± 0.6 m, and max. 1.5 m when compared with the level today. In the northern part of the country, the sea-level rise will be partly compensated for by land uplift.

- **Extreme events and other climate parameters**: Computer models show that an increased green-house effect results in changes in frequency, intensity and duration of extreme weather events.

  Denmark will experience an increase in the frequency and duration of heat waves. Summers will be characterised by longer dry spells and an increase in heavy precipitation events. The occurrence of days with sub-zero temperatures will decrease dramatically, while the length of the growing season will increase.

  The increase in sea level will give rise to increased storm-surge height. In Esbjerg on the west coast of Jutland, a storm surge event of 4.35 m, which today has a 400-year recurrence interval, is expected to have a recurrence interval of 10 years towards the end of the century. For Copenhagen a 400-year storm-surge event of 1.7 m today is expected to occur every 1-2 years towards the end of the century.

6.1.3 Mapping the impacts of climate change in Denmark

The impacts of possible climate change in Denmark have been evaluated several times, most recently in the 2012 report by the Task Force on Climate Change Adaptation: Mapping climate change – barriers and opportunities for action[30].

A review of the significance of climate change up to 2050 for the individual sectors and industries shows that Danish society may experience both positive and negative impacts.

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[30] http://en.klimatilpasning.dk/media/600858/130206_mapping_climate_change_final.pdf

The positive impacts will relate primarily to the higher temperatures that will result. in, e.g a longer growing season and increased productivity for forestry and agriculture. Milder winters will moreover reduce energy consumption and construction costs, as well as the costs of winter-weather preparedness and road salt.

The negative impacts of climate change will relate primarily to more frequent extreme rainfall, elevated sea levels and more powerful storms, which can lead to flooding and damage to infrastructure and buildings as well as erosion along coasts.

In the following sections the impacts in individual sectors and industries are further described.

6.1.3.1 Construction and housing

Climate change will have both positive and negative impacts for buildings. These include primarily:

- More extreme rainfall events will lead to more flooding:
  The most important challenge will probably come from increased precipitation. Heavy rainfall may lead to more basements being flooded by intruding rainwater and sewage water. Houses and buildings with entrances at terrain level may also be exposed. A gradually rising sea level and more frequent storm-surge events in combination with heavy precipitation may put low-lying and coastal urban areas at risk, see the section on water.

- Greater air humidity and less frequent sub-zero temperatures are significant for the wear on buildings:
  Milder winters with greater humidity may affect buildings and reduce the life span of individual building components. This can be mitigated though greater focus on management and maintenance. However, less frequent sub-zero temperatures may help reduce the wear and tear on buildings.

- More powerful storms and changes in snowfall may damage buildings:
  Powerful storms may pose a risk of damage to buildings, including damage to roof constructions from storms and greater snow load. The latter will often be manageable through roof snow removal. In addition to this, there will probably be a need for increased maintenance and, in some situations, reinforcement of the building.

- Less demand for heating during winter, but risk of poorer indoor climate:
  Milder winters may in general entail a reduced demand for heating. At the same time more humid winters may result in a more humid indoor climate providing better conditions for house dust mites and increasing the risk of mould, see the section on human health. A more humid climate may also result in greater demand for maintenance of building envelopes.

- Greater risk of overheating:
  Large window sections facing south, and longer periods with warm weather in the summertime may pose a risk of overheating in buildings, which will have to be addressed when designing highly insulated buildings. The problem has already been addressed in the building regulations' provisions on energy efficiency classes 2015 and 2050, which stipulate requirements on maximum indoor temperature.

- Changes in productivity in the construction industry:
  A more humid climate, in particular during winter, may mean longer drying times and may pose the risk of damage to building materials, all of which may affect parts of the construction industry. However, the industry can prepare for this by using and further developing methods and materials which reduce the significance of the climate during the construction phase. Climate change could also result in fewer bad-weather days due to milder winters (fewer days with sub-zero temperatures). This will help enhance productivity in the industry.

6.1.3.2 Coasts and ports

Based on future projections of climate change, key consequences for Danish coasts and ports will include:

- Higher storm-surge water levels will increase erosion and coastal recession:
  This is the implication of the general increase in sea level and the fact that the coasts are being impacted by higher waves during more frequent and more powerful storms, which will lead to increased erosion and recession of the coastline relative to today. The flatter the coastal part of the seabed, the greater the erosion. Erosion will be most pronounced for the west coast of Jutland and less pronounced for other Danish coasts. Built-up areas in low-lying coastal areas will be at risk from higher storm-surge water levels and more frequent flooding. Furthermore, houses and other buildings near the coast will be at risk from erosion.

- More frequent flooding of low-lying coastal areas:
  Low-lying land not protected by dykes will be exposed to more frequent flooding. At the same time, the risk of water breaching existing dykes will increase. Urban developments at the mouth of rivers, e.g. in fjords, may come under double pressure: from rising sea levels as well as from increased precipitation and run-off from the catchment area.

- More powerful storm surges will make activity at ports more difficult:
  With more powerful storm surges, key areas will be flooded more frequently and this means interruption in port activities and also poses a greater risk of damage to buildings. The same applies to ferry landings. At the same time, more intense storms will pose a greater risk of ships breaking their moorings and causing damage to cranes and other equipment at the port.

- More powerful storm surges put port infrastructure under pressure:
  The port protection that protects the basin itself will be affected to an increasing extent by the waves, and protection will be less effective during high storm surges. In ports where fairways and/or port basins are dredged, the need for dredging will often grow because higher waves will lead to greater sanding.

6.1.3.3 Transport

Based on future projections of climate change, the key consequences for different parts of the transport area in Denmark will be as described in the sections below.

6.1.3.3.1 *Road network*

- Higher temperatures reduce construction costs:
  Higher temperatures during winter will mean that periods with heavy frost will be shorter or will all together disappear. This will provide the opportunity to reduce the thickness of the bottom-most layers of roadbeds, frost protection, and thus the amount of raw materials needed.

- Higher temperatures reduce the need for winter-weather preparedness and salt application:
  Higher temperatures allow for savings on winter-weather preparedness and road salt; this leads to both financial and environmental benefits.

- Temperature increases can have both positive and negative impacts on the roadbed:
  Fewer occurences of sub-zero temperatures may serve to improve the life span of the asphalt. When temperatures fall below zero, this exerts a wear on the road surface which results in loss of stone and cracks. However, asphalt surfacing becomes softer at higher temperatures and its carrying capacity and friction decreases. This problem may be managed by using alternative binding agents. For the underlying gravel and sand layers of the roadbed, the increases in temperature will have a limited but positive effect on the life span.

- Greater water volumes are a challenge for the road network:
  Increased precipitation and rising groundwater level, leading to more flooding events, will be a problem for traffic safety and passability. This will place greater demand on road drainage systems and monitoring of the road network. Flooding not only reduces the carrying capacity of roads, it also shortens their efficient life span. Similarly, increased precipitation amounts may cause road banks to become unstable thereby leading to the risk of landslide.

- Greater water volumes will challenge bridge design:
  For bridges and tunnels, there is a greater risk of reduced carrying capacity of foundations, supporting walls and sheet piles due to higher groundwater levels, regardless of whether this is due to higher sea-water levels or increased rainfall. For constructions founded on sand in particular this may become a problem.

- More frequent storms will pose a challenge for road sign portals:
  More powerful storms will expose road sign portals to greater force.

6.1.3.3.2 *Permanent links*

- Rising water levels and precipitation may affect Danish permanent links:
  For the permanent links cross the Great Belt and the Sound an increase in precipitation will mean a greater amount of surface water which will have to be pumped up from surface drainage systems in tunnels and roads. This in turn means there may be a greater demand for pumping capacity. A rising water level and more powerful storms may combine to enhance the risk of flooding of tunnels and lead to longer periods of interruption. More powerful storms may also mean that bridges will have to be closed down temporarily more often.

6.1.3.3.3 *Rail network*

- Increased water amounts will enhance the risk of flooding and landslides:
  Flooding events and rises in groundwater level will enhance the risk of landslides and embankment failures. A rise in the mean sea level could pose a problem for rail services where embankment and slope drainage systems divert the water into nearby watercourses that are affected by the rise in sea level. Damming up of water in the watercourse could affect the water level in trenches.

- More powerful storms could lead to breakdowns of overhead wires and fallen trees:
  On electrified railway lines, powerful storms and greater wind speeds may lead to greater frequency of breakdowns of overhead wires and to more incidents with trees falling across the tracks. This may result in interrupted train services with consequences for traffic and for the economy.

6.1.3.4 Water

Based on climate projections for the future, the key consequences for water are described in the sections below.

6.1.3.4.1 *Wastewater and flooding*

- More precipitation will increase the pressure on the sewerage system:
  More frequent events with extreme precipitation could mean that the capacity of sewers is exceeded more often, leading to greater risk of overflow events and subsequent flooding of terrain, buildings and basements, which, in turn, poses a risk to human health. More overflow events will also lead to greater strain on vulnerable aquatic areas from pollution. Furthermore, an increased seal level will deteriorate the drainage capacity of drains close to the coast, as reduced water flow in the sewerage system may lead to local flooding events.

- More precipitation means that vulnerable areas will be at higher risk of flooding:
  Increased precipitation will affect watercourses and low-lying land, resulting in a higher risk of local flooding events. At the same time, the increase of groundwater recharge could also mean more frequent flooding from wastewater.

6.1.3.4.2 *Groundwater and water supply*

- More precipitation means higher annual groundwater recharge:
  The increase in annual precipitation will increase groundwater recharge, and this will increase the size of the groundwater resource available for water recovery. However, seasonal variations mean that this will primarily be in the winter and there are regional variations between east and west Denmark. In the summer there will be less flow into lakes and rivers. Increased groundwater recharge in the upper strata could give more local flooding problems.

- Long periods of drought may bring water supply under pressure:
  Ever longer periods of drought are expected in the summer periods and these will put more pressure on the water supply, especially in areas which are already affected by water catchment for larger cities and to irrigate fields.

Therefore, in exposed areas it is likely that groundwater extraction will be adjusted to maintain water flow in watercourses.

- Higher temperatures mean more bacteria in drinking water:
  Higher temperatures may mean a slightly higher content of bacteria and amoeba in drinking water compared with current levels. Today it can already be difficult for some waterworks to comply with the recommended requirements for the temperature of drinking water of max. 12°C at the tap.

- Higher sea levels may add saltwater to the groundwater:
  Higher sea levels will move the current freshwater boundaries further inland. Locally, this could cause problems with saltwater infiltration into coastal extraction wells and create a need for new wells. The problem is especially serious for smaller islands.

6.1.3.5 Agriculture

The most important effects of climate change for agriculture are as follows:

- Increases in temperature will be favourable for many crops:
  Crops such as grass, sugar beets and maize will benefit from increases in temperature as the length of the growing season determines the yield. Even now there is a change in Denmark towards growing more maize. A longer growing season for grass fields may also mean longer grazing periods.

- More CO_2 means increased yields:
  More CO_2 in the atmosphere will increase yields. If the CO_2 concentration doubles, the yield is likely to increase by around 20% for most crops.

- Higher temperatures extend the production season for vegetables and fruit:
  For field vegetables and fruit, higher temperatures, especially in the spring and autumn, will mean an extended production season with a clear market advantage. There will also be possibilities for new crops, for example more Danish wine may be produced.

- Higher overall yields for agriculture may give more nitrogen and phosphorus run-off:
  Increasing yields involves a greater need for fertilizer use. Furthermore, higher temperatures and winter precipitation will increase the risk of nitrogen and phosphorus leaching and run-off into the aquatic environment.

- Rising temperatures mean lower yields for annual crops:
  Temperature increase will reduce the length of the active growing period for annual crops such as cereal and rape, and thereby reduce the yield as the crops will mature earlier. Increases in temperature may also lead to significant variations in yields.

- Increased winter precipitation and increasing water levels mean poorer agricultural exploitation:
  Increased winter precipitation and rising water levels in some areas will lead to flooding or to groundwater levels which are so high that security of cultivation will be difficult to maintain. This may be particularly relevant along a number

of fjords and watercourses, but there may also be problems for other drained areas with poor drops to watercourses in the event of greater precipitation intensity.

- Longer periods of drought increase the need for irrigation and watering:
  Longer periods of drought during the summer mean a greater need to water crops artificially, especially on sandy soil. Higher temperatures also increase evaporation, but much of this effect is countered by less evaporation from plants due to higher concentrations of CO_2 in the atmosphere. Changing crop types to more maize will also increase the need for irrigation and artificial watering. More artificial watering may have an effect on summer flows in water courses.

- Higher temperatures strengthen some species of weed:
  Some weed species will benefit from a warmer climate, e.g. cockspur and green bristle grass, both of which are relatively new species in Denmark. These species are considered some of the most aggressive globally, but so far they have not been a serious problem in Denmark.

- Higher temperatures could result in more disease:
  It is very hard to give a clear-cut description of the developments in plant diseases, but the overall assessment is that higher temperatures in the future will be more favourable for a number of plant diseases, which therefore will become more widespread.

- Rising temperatures change conditions for exotic diseases in animals:
  Rising temperatures could change conditions for the incidence of animal diseases which are currently regarded as 'exotic' in Denmark. Vector-borne diseases are an example of this, as small changes in temperatures and humidity can enable ticks and mosquitoes to establish themselves in new locations. The vector-borne disease known as blue-tongue was considered an exotic disease some years ago. In just a few years it has spread to most EU countries with consequent comprehensive vaccination programmes.

6.1.3.6 Forestry

The most important impacts for forestry are as follows:

- Rising temperatures mean longer growing seasons and larger biomass production:
  Higher temperatures and higher CO_2 content in the atmosphere may cause greater plant growth and thus greater inland biomass production. Because of the warmer climate, the growing season for trees will also be lengthened.

- Increased storm intensity affects wood production and biodiversity:
  Increased storm intensity (5-10%), as well as increased storm risk, may lead to more trees being blown down (especially conifers which comprise about one-half of the Danish forest area) and more frequent forest storm damage. This can affect wood production and cause a loss in biodiversity in forests, if forest storm damage occurs in large, cohesive areas.

- Drought stress and storms affect forest trees:

Forest trees are vulnerable to climate change (drought stress and storms). This also increases their vulnerability to harmful diseases and pests. Pests and diseases can attack trees more easily, weakening the wood and rotting or drying it out.

- Higher summer temperatures increase the risk of more forest fires:
  As a result of the warmer climate, there is a risk of more forest fires, which are already widespread in southern Europe.

- Rising temperatures change the species composition of forests:
  Tree species have different ways of dealing with climate change. Norway spruce, which covers about 17% of Danish forest land, is threatened by temperature increases as the species cannot cope very well with mild winters and summer droughts (other, non-indigenous conifer species such as Sitka spruce will cope with increases in temperature better). In contrast, deciduous forests will have better conditions as a result of rising temperatures.

6.1.3.7 Fisheries

The most important effects for fisheries are as follows:

- Rising sea temperatures impact fish stocks:
  Fish are generally adapted to a single temperature interval and rising temperatures will mean a general change in the composition of stocks in Danish waters and thereby also in the resource base for fishing. Stocks which have their southern limit in Danish waters will be affected negatively, while stocks preferring higher temperatures will generally be affected positively. Therefore it is likely that there will be an increase in species preferring warmer waters (e.g. sardine and brisling/sprats) and species preferring colder waters will retreat (e.g. cod in the North Sea).

- Climate change affects species composition:
  Rising sea temperatures and other climate-related changes will affect the species composition throughout the marine ecosystem and thus change food-chains, including the supply of food for fish and fish predators. It is currently unclear whether these changes will make fish populations and ecosystems more or less vulnerable to anthropogenic impacts on the ecosystem such as fishing and eutrophication, and therefore how the fisheries sector will be affected.

- Rising sea temperatures and increased precipitation may cause oxygen depletion:
  Rising sea temperatures, for example in the Baltic Sea and in coastal areas, could lead to more and more serious problems with oxygen depletion, which can cause poorer living conditions for cod, for example. Similarly, increased precipitation and run-off from watercourses could increase run-off of nutrient salts and the risk of oxygen depletion (hypoxia). These factors will also affect fishing.

- Rising sea temperatures encourage disease-promoting bacteria:
  Rising sea temperatures can underpin the incidence of new disease-promoting bacteria and toxic algae, which can threaten fish and shellfish stocks as well as food safety.

- Rising sea temperatures can affect production conditions:
  Rising sea temperatures could accelerate the occurrence of populations of invasive species which may lead to significant changes in ecosystems and thus affect production conditions and therefore fisheries for a number of fish and shellfish species. Similarly, trout production is very sensitive to increases in temperature, and marine rainbow trout farming may be threatened.

- Rising sea temperatures enable alternative farming methods:
  Increases in winter temperatures in particular enable the application of alternative farming methods and farming of other species.

- Increases in precipitation and run-off from watercourses lead to a drop in salt concentration in the Danish Belts and in the Baltic Sea:
  Populations of a number of important fish species in Danish coastal waters are demonstrating local adaptation to the existing salt gradient from the Baltic Sea out to the North Sea. Changes in salt concentration may mean changes in the geographical and temporal distribution of the fisheries resources.

- Strong winds and precipitation affect the development of marine aquaculture:
  More frequent weather events with strong winds and precipitation may impact the possibilities to develop marine aquaculture and may periodically obstruct shellfish harvests in coastal areas because of discharges of untreated wastewater and consequential problems for food safety.

- Drops in pH impact production of a number of organisms:
  Drops in pH levels (acidification) as a result of increasing carbon concentration can affect the production of a number of organisms, including fish and shellfish, because of reduced calcium formation.

- Cumulative effects of climate change:
  There may be cumulative effects from climate change in relation to other anthropogenic impacts. This means that even though the impact of climate change in relation to an organism or ecosystem may be small, the impact may become significant because of other pressures such as increased nitrogen.

6.1.3.8 Energy

Effects for the energy sector are primarily likely to be as follows:

- Milder winters mean less energy consumption:
  With higher average temperature and milder winters, energy needs in the winter will drop. The difference in energy consumption between mild and cold winters is about 20%. However, warmer summers will also mean more needs for cooling, but the effect of this is expected to be less than the effect of milder winters.

- Weather extremes may affect energy-producing facilities:
  More extreme weather with more powerful storms may lead to a need to secure installations against changed weather conditions. The effects are limited, however, as wind turbines have been secured against high wind speeds and the vulnerable electricity supply grid will more or less be buried underground. In

high winds, wind turbines are cut off which means electricity production will also stop.

- More wind gives more output from wind turbines:
  With stronger winds there is a potential for better exploitation of wind turbines for greater electricity generation. The expected increase in average speeds of 1-2%, however, will only lead to limited additional production with no significant effect on the economy.

- Changed import/export patterns give lower electricity prices:
  Changed precipitation patterns in Sweden and Norway will mean production of more hydropower. Higher temperatures in Norway and Sweden will also reduce electricity consumption for heating in these countries. Both these factors will reduce electricity prices in Denmark.

- Possibility for more biomass production:
  Higher temperatures and higher CO_2 content in the atmosphere may cause greater plant growth and thus greater domestic biomass production. Biomass production can be incorporated in electricity and heating supply and can replace fossil fuels as well as increase security of supply.

6.1.3.9 Tourism

The most important impacts for tourism are as follows:

- Denmark will be an attractive holiday destination for a larger part of the year:
  At the moment, 75% of all tourists visit Denmark in the summer, i.e. June, July and August. With a warmer climate, it is likely that the Danish tourist season will extend towards the whole year, and Denmark will be even more attractive in the high season. An analysis by Deutsche Bank highlights Denmark, with its wide beaches, as the country in northern Europe with the best conditions to meet the future European demand for sun and sand.

- The Mediterranean will be too hot, and this will make Denmark more attractive:
  Although the Mediterranean is currently is the most popular region for tourists in Europe, with a very hot and dry climate, it is expected that, especially in high summer, the Mediterranean will attract fewer tourists. More days of heat waves will increase the probability that it will be so hot that tourists from primarily the north-western part of Europe will seek alternative holiday destinations, and as a replacement for Cyprus, Greece, Malta and Spain, Deutsche Bank[31] points to Denmark amongst other destinations in the temperate zone as an attractive country for summer holidays.

- The current coastal holiday areas will be less attractive because of higher sea levels:
  In the medium term, sea-level rises will make a number of current holiday areas along the coast, with holiday centres, holiday houses and camp sites, unusable or less attractive.

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[31] http://en.klimatilpasning.dk/media/600858/130206_mapping_climate_change_final.pdf

- Larger investment in climate protection as a result of heavy downpours:
  The heavy downpours expected in the summer will affect many of the outdoor activities and attractions tourists often demand in Denmark. These also include the large amusement parks such as Tivoli, Dyrehavsbakken, Bonbonland and Fårup Sommerland, which will have to invest in facilities to manage increased amounts of rain.

6.1.3.10 Nature

The most important impacts for Danish nature are described in the following sections.

6.1.3.10.1 *Aquatic environment*

- More precipitation may increase the nutrient load on the aquatic environment:
  Increases in precipitation and changed rainfall patterns are expected to cause more nutrient enrichment in the aquatic environment. In combination with rising temperatures, this will result in greater algae growth, poorer light conditions, more oxygen depletion and possibly consequential fish death.

- More precipitation means increased hydraulic impact of watercourses:
  Increases in precipitation will also mean greater water flow in watercourses and higher sea levels in coastal areas, which may have an impact on animal and plant life.

- Warmer climate can change the species composition:
  Rising temperatures can lead to changes in the biological structure in the aquatic environment - with generally changed species composition and more invasive species.

- Warmer climate leads to increased substance conversion:
  Increases in temperature also mean changed substance conversion in the aquatic environment in which the biological activity/conversion will increase because of increased temperatures.

- More CO_2 in the air causes acidification of the sea:
  The content of CO_2 in water is in a chemical balance with the content in the air. When the content of CO_2 in the air increases, so does the content in water and this causes acidification of the water with potentially large impacts on aquatic ecosystems.

6.1.3.10.2 *Nature and landscapes*

- Higher temperatures and increases in the air's content of CO_2 will enhance biomass production:
  Rising temperatures provide for a longer growing season. At the same time, increased contents of CO_2 in the atmosphere lead to more favourable growth conditions. In combination, these factors provide for enhanced biomass production in Danish nature.

- Higher storm-surge water levels will probably lead to the loss of habitats along the coasts:
  A higher sea level and more powerful storms could cause coastal erosion and recession, which will reduce and in other ways affect Danish coastal habitats. These problems, however, will be limited up until 2050.

- More frequent and more intense rainfall will lead to more flooding of low-lying land areas:
  Not only along coasts but also in low-lying areas, such as river valleys and meadows, and habitats and the biodiversity living there may come under pressure from more flooding events. There will also be pressure from the lack of opportunity to spread to other habitats and not enough time to adapt to new conditions.

- A warmer climate will alter the species composition:
  More non-native species will be able to exploit a warmer climate to expand their natural habitat to include Denmark, affecting the existing ecosystem and very likely supplanting current species. This applies to all types of ecosystems: terrestrial, freshwater as well as marine ecosystems.

6.1.3.11 Health

The greatest health-related impact is expected to occur during the last part of the period up to the year 2100 when climate change is presumed to be greatest. Noticeable consequences may however occur earlier, e.g. in connection with extreme weather events with heatwaves or flooding.

- Heatstroke and dehydration during heatwaves:
  Heathwaves can lead to e.g. heatstroke and dehydration which at worst may be life-threatening. People in the northern parts of the world are less used to coping with high temperatures than people who live further south. The elderly, patients in hospitals and individuals suffering from certain diseases are at high risk. Infants and young children will also require extra attention.

- Positive as well as negative impacts of staying outdoors:
  The human body creates Vitamin D after only short exposure to the sun, however too much sun exposure can cause skin cancer and melanomacancer. Spending more time outdoors can have positive effects, e.g. in the form of more outdoor physical activity, fewer problems with indoor climate and less disease transmission in kindergartens etc. However, it may also cause more symptoms in people with pollen allergies and possibly also lead to more people becoming allergic to pollen.

- Infections and similar when temperatures increase and in connection with flooding:
  Flooding of built-up areas has been documented to increase the risk of infections in connection with e.g. work to clear up basements flooded by polluted wastewater. There is a risk of health problems if the building is damp and possibly also mould infested. Flooding which affects the access to or the functioning of important institutions in society may also affect human health. For example, flooding may cause delays in the treatment of patients. Temperature increases and increased risk of extreme weather events will

increase the risk of food- and water-borne infections. Outbreaks of a number of tick-borne diseases like inflammation of the brain and Lyme disease will also be a risk. In the long term, there will also be risk of insect-borne diseases that are restricted to tropical or subtropical areas today. After longer periods with warm seawater, an increased concentration of certain marine bacteria will comprise an infection risk for fishermen and swimmers, and there may be more incidents of algal blooms and dangerous jellyfish.

- More powerful storms and extreme weather events can increase the risk of injury:
  More powerful storms, cloudbursts and more frequent lightning bolts: Experience reveals that a greater number of injuries can be linked to e.g. an increase in outdoor activity and more outdoor work in the building and construction industry.

- Milder winters with lower mortality and less damage:
  Milder winters may lead to fewer cold-related diseases and deaths and fewer injuries from ice and snow.

- Warmer summers and more precipitation enhance the risk of damp and mould:
  The combination of warmer summers and more humid autumns and winters, as well as a greater occurrence of cloudbursts, may enhance the risk of damage to buildings from damp and mould and lead to greater nuisance from house dust mites in homes. Damage from damp and mould in buildings can cause health problems and exacerbate asthma and hay fever. Respiratory irritation may increase the risk of respiratory infection. Furthermore, the existence of a greater number of house dust mites may lead to an increase in symptoms (asthma and hay fever) and intensified preventive treatment. Moreover more people are likely to develop allergies.

- A longer growing season will mean a greater risk of pollen allergies etc.:
  With a longer pollen season, higher pollen counts and more mould spores in outdoor air, many people will experience more symptoms (asthma and hay fever) and will need intensified preventive treatment. Furthermore, more people are likely to develop allergies (hay fever and asthma). Very allergenic pollen species, such as ragweed, have already found a habitat in Denmark.

- A warmer climate will mean less outdoor air pollution:
  A warmer climate could also mean there will be less need for heating and thus less pollution from heating sources.

6.1.3.12 Cross-sectoral areas

There will be direct physical climate change impacts in the three next cross-sectoral areas: emergency preparedness, insurance and spatial planning. These cross-sectoral areas, however, are characterised by providing services to the other areas that are especially vulnerable to changes in climate.

Spatial planning is about land use, which is extremely reliant on physical and climatic conditions, and, as such, spatial planning is vital in cross-sectoral preventive efforts within climate-change adaptation.

Emergency preparedness is about reducing the extent of the damage from extreme weather events, whereas the insurance industry provides compensation to those who have suffered damage. Both of these cross-sectoral areas are vital in mitigating the negative impacts of extreme weather events in the other sectors and industries.

6.1.3.12.1 *Emergency preparedness*

The scope of the assignments of the Danish fire and rescue service will rely widely on what other sectors do to prevent climate-change impacts, e.g. in terms of land use, the design and dimensioning of buildings, sewerage and roads, coastal management and coastal protection, and human behaviour. The task of the Danish fire and rescue service is therefore to manage other remaining risks for society.

Climate change is not expected directly to entail new tasks for the Danish fire and rescue service. A more likely trend seems to be the more frequent occurrence and greater intensity of events for which a response is required. The Danish fire and rescue service is responsible for limiting and mitigating damage and injury to people, property and the environment. These responsibilities are assessed on an ongoing basis against the need for developments in terms of equipment and manpower, including training.

6.1.3.12.2 *Important effects of climate change*

Climate change could demand a greater number, as well as more resource-demanding, emergency responses and assistance from municipal as well as national fire and rescue services.

Responses to storm and water damage include efforts to fortify and identify vulnerable buildings and infrastructure, prevent flooding with sand bags and pump water away from low-lying land areas. Other responses include assisting in establishing an emergency power supply. Moreover, an important task is to protect the environment when e.g. sewers are at risk of flowing over with sewage water, or when industrial areas have been flooded, tank systems have leaked, etc. In situations when flooding leads to contamination of drinking water, the Danish fire and rescue service can assist with the distribution of clean drinking water.

There is moreover a series of rescue assignments related to serious road accidents and other accidents involving personal injury, e.g. during storm or cloudburst events. In the event of particularly intense storms, snow storms and flooding, it may also be necessary to rescue and provide housing and food relief for those in need (e.g. when public transport, roads and bridges have been closed down and similar).

More frequent and longer-lasting periods with drought in summer may lead to greater risk of forest fires. This may result in a greater number of and more comprehensive tasks for the Danish fire and rescue service, including fire guarding, emergency drinking water supplies, fire extinction and fire-damping operations. Furthermore, an increase in maximum day temperatures during summer could lead to heatwaves of an intensity, scope and duration which may require the Danish fire and rescue service to assist in home-nursing efforts and in the public health emergency response.

Traditionally, the national fire and rescue service has been deployed abroad in the event of natural disasters, including, in particular, floods. The national fire and rescue service could therefore be assigned more international response tasks due to more extensive and more extreme climate-related events.
The government's report on emergency preparedness (May 2010) stressess that in future the Danish fire and rescue service must be prepared to mitigate the follow-on effects of several climate-related events such as hurricanes/storms, heavy precipitation, cloudbursts, storm surges, and extreme water levels. On the basis of experience from climate-related events since 2007, it is likely that equipment to tackle such events will continue to be in demand in the future. The size of the investments required depends e.g. on whether there are enough preventive measures in other sectors, as well as on future organisation and coordination of the rescue preparedness services at local and central-government levels. The closer the collaboration and coordination of equipment procurement and resource use across local and central-government levels, the better and more cost-effectively the effects of climate change can be managed.

6.1.3.12.3 *Insurance*
The most important impacts for the insurance industry are as follows:

- *Unpredictable weather reduces the possibility for addressing risks:*
  When weather and climate change impacts are less predictable, the insurance companies, in turn, have less possibilities for predicting damages and thus also for addressing the risks. As a consequence, the companies will try to minimise the uncertainty through measures like the ones mentioned below.

- *Higher reinsurance premiums:*
  Danish insurance companies are typically re-insured in large international reinsurance companies that also insure against financial losses from earthquakes, tropical storms and other large natural disasters, and to some extent also acts of terrorism. An increase in the intensity of cloudbursts and other extreme weather events in Denmark will lead to an increase in the costs of reinsurance. For example, the international reinsurance company Swiss Re has announced that the cloudburst that hit Copenhagen in July 2011 will lead to higher reinsurance premiums. These higher premiums will very likely trickle down to Danish insurance customers.

- *Targeted changes in premium and coverage:*
  For both citizens and enterprises, climate change will entail a risk of higher premiums, lower coverage or the introduction of special terms for taking out insurance. Differentiated premiums (so-called "micro tariffing") might be used more extensively, which means premiums will be determined based on where buildings are located (are they located where the risk flooding is particularly large or small?), the special characteristics and technical design of buildings, as well as their history of damages. This will entail that particularly exposed properties may be at greater risk (e.g. if the sewer system is under-dimensioned or if the property is in a low-lying area, and if potential damages cannot be prevented through ordinary preventive measures such as backflow blockers) and therefore cannot be insured or can only be insured against paying extremely high insurance premiums. This, in turn, may affect loan opportunities. Owners of such properties will have a hard time selling their

property. In the city of Odense, the local water utility company ultimately had to buy seven houses.

6.1.3.12.4 *Spatial planning*
Climate change is a challenge for both new and existing designation of land. The municipalities need the right knowledge to incorporate climate change in their spatial planning.

The municipal councils are responsible for spatial planning in municipalities. The municipal development plan is an overall plan for land use in the individual municipality. The municipal development plans must not conflict with overall planning and governmental interests. Furthermore, local development plans in the municipality must be in accordance with the overall municipal development plan and with any national planning directives that relate specifically to the area in question.

In addition to the legally binding provisions (national planning directives), the Minister for the Environment can influence the municipalities' planning through political statements in the national planning report, and through an report on national interests in municipal planning published every four years for use in the municipalities' revision of their municipal development plans.

Furthermore, the Minister for the Environment has specific powers to intervene in local planning to ensure national interests. These powers include, in particular, power to object to proposed municipal development plans on behalf of all central-government bodies whose interests are affected by the municipal plan (i.e. the concept of national interests). Changes in or new land use, for example in connection with adaptation to climate change, could fall under the concept of national interests.

Spatial planning is an effective instrument of control which can contribute to reducing or eliminating the negative effects, as well as exploiting the positive effects, of climate change in a number of sectors and industries. A bill was submitted on 29 March 2012 which will allow municipalities to incorporate climate considerations in local development plans, and guidelines on local development plans that incorporate climate change will be prepared in connection with the 2013 municipal planning process.

6.2 Vulnerability Assessment

Vulnerability assessments have been an element in the mapping of impacts of climate change in Denmark. To some extent, this area is dealt with in section 6.1.3.

6.3 Adaptation Measures

In March 2008, the Danish government launched the first Danish strategy for adaptation to a changing climate.

Following the change in government in 2011, an action plan for a climate-proof Denmark32 was launched in December 2012 . The action plan is based on the notion that a responsible climate policy must do more than just work towards limiting climate change in the long term. It must also ensure the action necessary right now to adapt our society to a climate that is already changing.

All parts of society must contribute to climate change adaptation in Denmark. Dealing with the climate challenge requires collaboration between authorities, organisations, private enterprises and individuals, regardless of whether the project is maintenance of existing roads, coastal protection, construction, or investments in new infrastructure.

Climate change adaptation is first and foremost based on initiatives at local level and involves the local authorities, companies or individuals. The individual stakeholders know the local conditions best, and are consequently in the best position to make decisions on adaptation.

Central government itself has a responsibility as the owner of infrastructure, buildings and land. However, the principle role for central government is to establish an appropriate framework for local climate change adaptation by, for example, adapting laws and regulations, but also by ensuring coordination and providing information. A solid framework for the efforts must support the specific parties involved, so that they can address the challenge in a socio-economically appropriate manner at the right time.

Climate change adaptation measures can also contribute to the development of new innovative solutions. The government will create the basis for continued technological and knowledge development, so that Denmark will have a strong position on the global market for climate change adaptation.

A series of initiatives and changes in relevant regulations have already been implemented. As an example, an amendment to the Planning Act now makes it possible for the municipalities to include climate change adaptation directly in the local development plans from 1 June 2012. The possibility for wastewater companies to invest in climate change adaptation has been clarified with an amendment in the Water Sector Act in spring 2012.

Central to climate change adaptation efforts is a strong interaction between state and municipalities. The government and the municipalities have agreed that the municipalities will increase investments in climate change adaptation of wastewater treatment by DKK 2.5 billion. This agreement also entails that all municipalities carry out a risk assessment and prepare municipal climate change adaptations plans.

The Minister for the Environment has established a task force on climate change adaptation. The objective of this task force is to ensure up-to-date data and relevant knowledge on the Danish Portal for Climate Change Adaptation www.klimatilpasning.dk.

The portal also contains news, concrete cases about climate change adaptation and many interactive tools. A number of tools aimed at municipalities, enterprises and

[32] http://en.klimatilpasning.dk/media/590075/action_plan.pdf

individuals were made available in 2012. These tools can be used to assess risk from rising sea levels and to climate-proof buildings.

A mobile team has been established as part of the task force. This team offers guidance and facilitates collaboration between municipal authorities and other stakeholders in the field, for example with regard to preparing municipal climate change adaption plans.

Focus areas in the Action Plan for a Climate-Proof Denmark

The action plan provides an overview of the initatives that the government has either planned, or has already set in motion, to ensure that Denmark will become resilient to climate change.

The action plan presents 64 new initiatives within the following five genereal areas of initative:

- An improved framework for climate change adaptation
  The state must ensure the best possible framework for, as an example, the municipal climate change adaptation efforts, in order to ensure the most appropriate solutions.
  The action plan suggests, for example, changing and modernising relevant legislation and regulations.

- More consultancy and a new knowledge base
  There is a need for a common knowledge base and ongoing consultancy about the implications of climate change and how to adapt to climate change. The action plan describes which initiatives the government will launch in order to strengthen the knowledge base and ensure knowledge sharing.

- Strengthened collaboration and coordination
  Climate change adaptation efforts must be coordinated across authorities, the business community and individuals. Initiatives are indicated that are able to promote and ensure the necessary dialogue and cooperation amongst the primary stakeholders in the area.

- Green transition
  Climate change adaptation efforts create the opportunity for green transition through development and use of new, innovative solutions. The action plan focuses on the potential for growth in this respect.

- International climate change adaptation
  Climate change is also a challenge for our neighbouring countries. Denmark is working internationally to reduce the effects of climate change, and for an ambitious EU-climate change adaptation that will support the Danish climate change adaptation efforts.

For specific information on the 64 initiatives, see the action plan for a climate-proof Denmark[33].

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[33] http://en.klimatilpasning.dk/media/590075/action_plan.pdf

6.4 CLIMATE CHANGES AND ADAPTATION MEASURES IN GREENLAND

Climate changes

Greenland has an Arctic climate. About 80% of the land is covered by an ice sheet that is up to 3 km thick, while the ice-free land areas are limited to a coastal strip that is 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 population of 55,000 live, is low-Arctic. This part of Greenland 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 zero degrees 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 determined by sea ice from the Arctic Ocean, which hitherto has made up the pack-ice belt, often up to several hundred kilometres wide, 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 sea ice.

Projections of future climate evolution using global and regional climate models[34] for Greenland towards the end of the century compared with 1961-1990 for the A1B IPCC scenario show general temperature increases of 7-8 °C which is significantly above the increase in mean global temperature. The warming at the east coast of Greenland is expected to be as high as 12 °C. The temperature increase is largest in winter, and there will be fewer extremely cold days. Simulations show only small changes in precipitation along the west coast, while precipitation is expected to double along the east coast, and in the fiords precipitation is expected to increase three-fold. This results in earlier snow melt and reduced ice cover, especially along the east coast.

Adaptation measures

The Government of Greenland has launched a national initiative aimed at mainstreaming adaptation efforts in the management and development of various sectors. A series of assessments of how the public sector can promote adaptation to climate change was initiated in 2011. The first assessment focus on 'Opportunities for climate change adaptation in the fisheries and hunting industry' (September 2012). The assessement is conducted on the basis of existing scientific assesments and local knowledge. The assessment report draws up a range of conlusions pointing to the fact that climate change has both direct and indirect consequences, often resulting in significant and unpredictable impacts on the fishing and hunting sector.

[34] May, 1999; Stendel et al., 2000

Efforts and actions towards the adaptation to climate change should therefore be viewed as a continuous process to be dealt with in close cooperation with the public administration, the scientific community and the industry and various local stakeholders.

The specific assessment of the fisheries and hunting sector addresses the fact that climate changes pose a wide range of challanges to the sector, but also new opportunities are identified. The assessments identify knowlegde gaps as more scientific knowledge about the expected impacts of climate change on natural ressources is needed in order to be able to develop national adaptation strategies and implement systematic approaches.

An integrated adaptation and mitigation assessment of the shipping sector is currently being completed for political deliberation in early 2014. Climate change potentially presents new economic opportunities for the shipping sector, most notably due to expected shortened shipping routes, longer navigable periods and increased access to oil and gas resources. However, there are also uncertainties and challenges connected to these opportunities. The assessment focuses on climate-change related challenges and opportunities for the shipping sector, including mitigation efforts.

Furthermore, the Government of Greenland has engaged in an Arctic Council partnership with a view to producing an integrated regional assessment of climatic and antropogenic changes in the Arctic as a tool for future adaptation plans and actions. The Project “Adaptation Actions for a Changing Arctic” (AACA) will draw on input from research and government institutions from Denmark, Greenland and Canada and will focus on the Baffin Bay/Davies Strait region.

The background for the Arctic Council decision to make such an integrated assessment is the observation that the Arctic has experienced substantial climate changes, and over the past decades Arctic climate change and the effects thereof have accelerated. This has led to profound effects and impacts on the physical, chemical and biological conditions of the Arctic and is expected to lead to fundamental changes across the Arctic.

6.5 Climate changes on the Faroe Islands

The Faroe Islands have an extremely maritime climate, where the differences between summer and winter are relatively small. Projections with global climate models show the following general changes for the climate on the Faroe Islands in the period 2071-2100 in relation to the period 1961-1990:[35]

- A rise of around 3ºC 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.

[35] May, 1999; Stendel et al., 2000

6.6 ASSESSMENT OF THE SIGNIFICANCE OF CLIMATE CHANGE FOR THE WHOLE ARCTIC

The Arctic Crysospere (Snow and Ice) is a critically important component of the earth system, affecting the energy balance, atmospheric and ocean circulation, freshwater distribution and storage, sea level as well as the storage and release of large quantities of greenhouse gasses. Further, changes in the arctic cryosphere impact ecosystems, the economy, infrastructure, health, and indigenous and non-indigenous livelihoods, culture and identity.

Using the Arctic Climate Impact Assessment[36] 2005 as a benchmark, the Arctic Council in 2011 published its results of as synthesis of recent climate change and changes in Snow, Water, Ice and Permafrost in the Arctic (SWIPA[37]).

The SWIPA report is a comprehensive 542-page report documenting dramatic change in all major components of the Arctic cryosphere. The report substantiates the findings of the 2005 Arctic Climate Impact Assessment but also documents accelerated changes in major components of the Arctic cryosphere.

Evidence of feedback mechanisms between the cryosphere and other parts of the climate systems are identified as contributing factors to enhanced Arctic warming, while the growing importance of Arctic land-based ice as a contributor to global sea-level rise is quantified. Cryospheric changes will result in multifaceted and cascading effects for people within and beyond the Arctic, presenting both challenges and opportunities.

The SWIPA work was chaired by the Kingdom of Denmark and concluded under the Kingdom of Denmark's chairmanship of the Arctic Council. Scientist of the realm had leading roles in SWIPA.

Valuable contibutions to the understanding of Arctic climate change and effects thereof were based on long term observations and studies as well as other research efforts.

Since 1996 an integrated climate and climate-effect measurement programme has been operating at the high Arctic research station Zackenberg in north-east Greenland. In 2007 this was complemented by a similar program at Kobbefjord close to Nuuk in south-west Greenland. Aproximately 1500 parameters are followed at these site stations.

The programme for Monitoring of the Greenland Ice Sheet (PROMICE) carried out by the National Geological Survey of Denmark and Greenland provides real time data measuerments from the marginal ice and has operated for more than 5 years.

A center for Ice and Climate was established in 2007 as part of the University of Copenhagen. Here research from among other things ice-core drillings has contributed significantly to knowledge of past and present climate dynamics and the dynamics of the Greenland Ice Sheet.

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[36] ACIA, 2005. Arctic Climate Impact Assessment. Cambridge University Press, 1024 p.

[37] AMAP, 2011: Snow, Water, Ice and Permafrsot in the Arctic (SWIPA): Climate Change and the Cryosphere. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway, xii + 538 pp.

The Greenland Climate Research Centre (GCRC) is concerned with the expected impacts of climate change on Arctic marine, limnic and terrestrial environments and on Greenlandic society, including adaptation and prevention strategies. The centre was established in 2009.

A centre for the study of Permafrost, CENPERM, under the University of Copenhagen was established in 2012.

Major institutions in Arctic climate-related reseach and data gathering within the Kingdom of Denmark include: the Danish Meteorological Institute, the University of Copenhagen, the University of Aarhus, the University of Aalborg, the Danish Technical University, theUniversity of Southern Denmark, the National Geological Survey of Denmark and Greenland, the National Museum of Denmark, the Faroe Marine Research Institute, the Greenland Institute of Natural Resources and the Greenland Climate Research Centre.

7

Financial resources and transfer of technology

– including information under Articles 10 and 11 of the Kyoto Protocol

Foto: Klaus Holsting

7 Financial resources and transfer of technology - including information under Articles 10 and 11 of the Kyoto Protocol

7.1 DANISH DEVELOPMENT POLICY, COOPERATION AND PROVISION OF NEW AND ADDITIONAL FINANCIAL RESOURCES

7.1.1 Danish development cooperation

Danish development cooperation policy is an integrated part of Danish foreign and security policy and hence part of Denmark's global engagement. The development policy priorities guiding the development cooperation in 2011 are expressed in the 2010 Strategy for Denmark's Development Cooperation, "Freedom from Poverty – Freedom to Change". A change of government happened in Denmark in October 2011 and a new strategy for Denmark's development cooperation "The Right to a Better Life" was launched in 2012.

The objective of Denmark's development cooperation is to combat poverty and promote human rights, democracy, sustainable development, peace and stability in conformity with the United Nations Charter, the Universal Declaration of Human Rights, and the United Nations conventions on human rights.

Denmark is an active and committed partner in promoting global development and living up to our commitments to the world's poorest. Fighting poverty requires years of solid economic growth. Therefore lasting economic growth is key to lasting poverty reduction, but it is not in itself sufficient. Denmark wishes to promote sustainable and inclusive economic growth and increased employment, and this will remain a fundamental element in Denmark's development cooperation. Through efforts to combat poverty and promote human rights and growth, Denmark's development cooperation aims to support the creation of societies that ensure the individual's rights and that promote equality, including access to decent employment, education, health and to social protection. Denmark will work to create better coherence between policies that impact developing countries through national efforts and through EU and international organisations including the UN, the WTO, OECD, the multilateral development banks and the International Monetary Fund.

Denmark will concentrate its development cooperation on four strategic priority areas which are interconnected and which will enable Denmark to make its contribution to combating poverty and to promoting human rights:

- Human rights and democracy
- Green growth
- Social progress
- Stability and protection

In 2000, world leaders agreed on eight global development goals, the UN Millennium Development Goals (MDGs), one of which includes the target of halving global poverty by 2015. We are now well on track towards achieving this as well as several other global development goals, and Denmark's development cooperation has contributed to this progress. However, much has happened since 2000. New global challenges and opportunities have emerged and far too many people continue to live in extreme poverty. The strategy will serve as a platform for Denmark's contribution to realising the goals which will be set by the international community for global and sustainable development after 2015. Accordingly, we will engage where needs are greatest and where we can contribute to lifting most people out of poverty and in order to create global justice. To this end, we will make use of all instruments at our disposal – foreign policy, security policy, development policy and commercial policy – and work for a stronger interaction among them. We will also enter into strategic partnerships, not least with the UN and the international financial institutions, whose global role in the normative and economic fields is crucial to fighting poverty, promoting human rights and creating sustainable, inclusive growth.

Since 1978, Denmark has been among the countries that meet the UN target of providing at least 0.7 per cent of GNI to development assistance. Our ambitions even go beyond that. In 2011 Danish development assistance amounted to about DKK 15.728 bn., corresponding to 0.85% of GNI (ref. Danida annual report 2011). Assistance is primarily funded through section 06(3) of the Danish Finance Act. Denmark will continue to be amongst those countries that grant 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 to be significantly above the UN target of 0.7% of GNI.

7.1.2 Environment and Climate

Pressure on natural resources in developing countries is mounting due to population growth, unsustainable consumption patterns, production systems and climate change. The consequences are degradation of natural resources and loss of biological diversity as well as intensified competition and potential conflict over access to energy, water, land and food. Denmark supports efforts in the areas of environment, natural resources, adaptation to and prevention of climate change and access to sustainable energy in a great number of developing countries. Denmark is also active in a large number of international fora and institutions working with global environment, energy and climate issues.

Sustainable global development requires the ability to link protection of the environment, the climate and nature with economic growth, poverty reduction and social development. Denmark is working to achieve this under the heading of "green economy". Green economy implies that we show consideration for the protection of natural resources, reduction of CO2 emissions alongside considerations of economic development and poverty reduction in developing countries. For example, Denmark's efforts to promote growth and employment in many countries also have a green aspect.

Green growth should be understood as an integral part of sustainable growth which promotes general economic growth and development in a manner that enables the environment today and in future to deliver the resources and environmental services on which our welfare depends.

Under the priority area with the heading Green Growth Denmark will:

- Support developing countries in fighting poverty and creating sustainable development through green growth, increased earnings and more jobs, especially for the youth.
- Support green growth based on sustainable management and use of natural resources.
- Contribute to strengthening international and national framework conditions for green growth and enhance coherence with environmental protection.
- Promote innovative technological and financial solutions in the areas of agriculture, forestry, environment, energy, water and climate.
- Promote resource-efficient food production capable of feeding a growing population sustainably and effectively.
- Contribute to increasing developing countries' access to sustainable energy and increase efforts towards more sustainable and resource-efficient management and use of energy and water.
- Promote poor men and women's participation and improved access to water, land, knowledge and finance.

Climate focused activities will be an important and integrated element in Danish development cooperation, and should contribute to green growth, job creation and promote climate adapted agricultural production. Denmark wants to be a leading development partner with regard to climate change and work for increased international prioritisation of climate finance.

Climate change will force governments to strengthen the requirements for climate mitigation and climate adaptation across all sectors. Hence, climate interventions will be a significant and integral element of Danish development cooperation, which contributes to green growth, job creation and promotes the introduction of climate-adapted agricultural methods. There will be a need for increasing international climate finance, which must be used on climate adaptation in the poorest and most vulnerable countries, and on reducing emissions of greenhouse gasses in the fastest-growing economies among the developing countries.

This will provide a holistic approach to the issue of climate change, in which adaptation efforts in the poorest countries are complemented by mitigation efforts in emerging economies. Denmark will strive to be among the leading development partners in the area of climate change and will work to promote stronger international prioritisation of increased climate finance. Climate change affects the poor the hardest. Climate adaptation makes a positive contribution to socio-economic development, and Denmark will support the integration of climate adaptation measures into national development strategies. At the same time, we will work to strengthen the capacity of poor and vulnerable groups to adapt, handle risk and withstand the impact of climate-related natural disasters.

Through both multilateral and bilateral assistance, Denmark is working to increase the access of the developing countries to sustainable energy, the implementation of energy efficiencies and the spread of climate-friendly energy technologies. This is accomplished by, for example, support for building up local knowledge and capacity, policy development, strategies and favourable framework conditions, technical assistance and market development and concrete investment opportunities and by strengthening local businesses in the developing countries. Denmark seeks to strike a balance between funding for adaptation and mitigation purposes.

In accordance with the UNFCCC reporting guidelines, Denmark is required to provide details of measures taken to implement its commitments under Article 4, paragraphs 3, 4 and 5, of the Convention. This includes: indicating what "new and additional" financial resources have been provided under Article 4, paragraph 3, and how these resources have been determined as such; reporting on the assistance provided to developing country Parties that are particularly vulnerable to the adverse effects of climate change for the purpose of assisting them in meeting the costs of adaptation to those adverse effects; and providing information on financial contributions made to the Global Environment Facility (GEF) and other multilateral funds, as well as on financial contributions made through bilateral and regional channels. Denmark is also required to report information on steps taken by governments to promote the transfer of environmentally sound technologies and to support the development and enhancement of endogenous capacities and technologies of developing countries. This 6th National Communication seeks to meet the requirements for reporting.

7.1.3 New and additional assistance funds

The statistics presented in this 6th National Communication concern the years 2009-2012. Some statistics for 2012 may not be available yet. Statistics from 2008 and before are presented in earlier National Communications. All the figures presented are in DKK. DKK 1 = USD 0.174 (June 2013).

According to the reporting requirements, Annex II parties shall clarify how they have determined if resources are new and additional. When the terminology "new and additional" was used in Article 4.3 of the UNFCCC, the intent was to ensure that no development assistance funds would be diverted by Annex II developed country Parties to meet their obligations under the Convention. There is still not any agreement on a definition of new and additional. The Danish development assistance related to the UNFCCC is not diverted away from other priorities and is contained in the Danish ODA beyond the UN target of 0.7 per cent of GNI.

A substantial part of the Danish development assistance relating to the UNFCCC is financed through the Danish Climate Envelope. With the Copenhagen Accord agreed at COP15 in Copenhagen in 2009, the developed countries committed themselves to providing USD 30 billion for the period 2010-2012 as start-up funding for developing countries for climate adaptation, emission mitigation, capacity building, technology, and forests. The Climate Envelope represents the Danish contribution and amounts to DKK 1.2 billion. The funds were allocated with respectively DKK 300 million in 2010, DKK 400 million in 2011, and DKK 500 million in 2012. The Danish Government has allocated DKK 500 million (EUR 67 million) to the Climate Envelope in 2013 with the aim of assisting developing countries with the transition to low carbon economies and preparing to enter into a new global climate agreement. Denmark is thereby increasing its international climate finance contribution with 25 pct. compared with the average annual level of the "Fast Start Finance" from 2010 – 2012.

7.1.3.1 Bilateral efforts

By far the majority of the Danish engagement is focused on priority countries. The priority countries are the countries where Denmark is present with a long-term engagement that carries both political and financial weight. Denmark began 2012 with 25 priority countries, five of which are currently being phased out. By focusing on bilateral assistance, the goal is to have a greater impact within the Government's development policy priorities in the group of priority countries.

The majority of Danish development assistance, corresponding to roughly two-thirds of all bilateral assistance, went again to Africa in 2011. This is where the development need is greatest, particularly in fragile states such as South Sudan, Somalia and Zimbabwe.

Danish bilateral development assistance is decentralised, and the relevant Danish representations abroad have primary responsibility for development cooperation in the partner countries. Denmark has a broad network in many countries: national and local government authorities, international agencies, civil society organisations, private companies, the research environment and other relevant actors. In the vast majority of cases, the government authorities are important partners.

Danish environmental efforts in developing countries are organised in close, binding cooperation with cooperation countries. Efforts aim at promoting sustainable development, including adaptation efforts 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 water sources - e.g. by tree planting and by building up the capacity for sustainable management.

In the energy area, Denmark provides support for sustainable energy supply - e.g. supporting poor women who plant trees for fuel. This tree-planting initiative 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 that are experiencing increasing economic activity, assistance is aimed at helping these 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.

There is no internationally agreed definition of which developing country parties are "particularly vulnerable", nor is it likely that such a definition will be agreed in the foreseeable future. In the following, all developing countries receiving UNFCCC related support from Denmark are treated as being particularly vulnerable. This is reasonable because Danish climate financial support focuses on climate activities in the poorest and most vulnerable countries that are most severely affected by climate change as well as mitigation activities in the so-called emerging economies with rising emissions and large mitigation potentials.

The Danish bilateral development assistance in support of the UNFCCC is summarised below in Table 7.1.

TABLE 7.1 DISBURSED DANISH TOTAL BILATERAL DEVELOPMENT ASSISTANCE AND ASSISTANCE IN SUPPORT OF UNFCCC 2009-2012 (DKK MILL.)
Source: Danish Ministry of Foreign Affairs

	2009	2010	2011[1)]	2012
Bilateral development assistance	8,707	9,591	9,988	9,736
Bilateral development assistance with principal objective relating to UNFCCC	274	443	240	909
Bilateral development assistance with significant objective relating to UNFCCC	1,226	2,418	1,240	1,944

1) Following OECD guidelines some activities that previously were reported as bilateral will from 2011 onwards be reported as multilateral and vice versa.

There is no internationally agreed methodology for assessing the exact share of aid activity expenditure that contributes to climate change adaptation or mitigation. Donors instead report on the basis of a set of agreed definitions and reporting instructions which result in the best approximations that can be found within a reasonable effort. Assistance supporting the implementation of the UNFCCC is tracked using the so-called "Rio markers" which have been established by the OECD-DAC in close collaboration with the Secretariat of the UNFCCC. All Danish funded aid activities are screened and marked as either targeting the UNFCCC as a "principal objective", a "significant objective" or not targeting. For a definition of OECD/DAC Rio markers on assistance targeting the UNFCC, see http://www.oecd.org/dataoecd/17/15/46782000.pdf for Mitigation and http://www.oecd.org/dataoecd/1/45/45303527.pdf for Adaptation.

The sectors given in the UNFCCC reporting format are not identical to the sector selection/definition in Danish development assistance. Where sectors overlap with the format, information has been utilised directly from PDB (Project Data Base containing all factual data of activities financed by Danida). The sector "environment" is not part of the table, however each of the environment grants have been assessed and thereafter allocated to the most appropriate sector in the table. The compilation and synthesis of the fifth national communications (FCCC/SBI/2011/INF.1/Add.2) has shown that Annex I parties often report data under other categories that are different from those specified in the guidelines for the preparation of national communications. The sectors listed in the following tables are those listed in the recent synthesis report rather than those listed in the original guidelines from 1999. Only bilateral funding assigned with the Rio-marker "2" for climate change adaptation or climate change mitigation as the principal objective is listed in the tables. The actual Danish contributions in support of the UNFCCC are much higher as most of the bilateral assistance is for larger programmes where climate change mitigation or adaptation is a significant objective without being the principal objective.

The Danish bilateral and regional financial contributions during 2009-2012 with a principal objective related to the UNFCCC are summarised and presented by country/region and sector in Tables 7.2a-7.2d.

TABLE 7.2A DANISH BILATERAL AND REGIONAL FINANCIAL CONTRIBUTIONS WITH A PRINCIPAL OBJECTIVE RELATED TO THE IMPLEMENTATION OF UNFCCC, 2009 (DKK MILL.).

Source: Danish Ministry of Foreign Affairs

	Mitigation						Adaptation								
Sector Recipients country/ region	Energy	Transport	Forestry	Agriculture	Waste	Industry	Capacity- building	Other mitigation	Capacity- building	Coastal zone management	Other vulnerability assessment	Land-use planning	Rural development	Water mgt, supply and sanitation	Other adaptation
Bangladesh										4					
Bhutan									5						
Cambodia									2						
Central Am.									5						
China	102														
Ghana									5						
Interregional							3								
Kenya								1	4						
Mali							1		1						
Mozambique															2
Nepal									1						
South Africa	14														
Uganda	4						3		3						
Vietnam	200														
Total	**320**						**7**	**1**	**26**						**2**

The principal objective for all these contributions is related to the UNFCCC (Rio marker score “2”). Contributions with the principal objective relating to both Mitigation and Adaptation are counted with 50 % under each.

TABLE 7.2B DANISH BILATERAL AND REGIONAL FINANCIAL CONTRIBUTIONS WITH A PRINCIPAL OBJECTIVE RELATED TO THE IMPLEMENTATION OF UNFCCC, 2010 (DKK MILL.).
Source: Danish Ministry of Foreign Affairs

	Mitigation								Adaptation							
Sector Recipients country/ region	Energy	Transport	Forestry	Agriculture	Waste	Industry	Capacity- building	Other mitigation	Capacity- building	Coastal zone management	Other vulnerability assessment	Land-use planning	Rural development	Water mgt, supply and sanitation	Other adaptation
Asia									5						
Bangladesh									1			3			
China	2														
Indonesia	3		3												
Interregional	6		69				178								
Kenya	100											1			
Maldives									5						
Nicaragua	2														
South Africa	2				2										
Vietnam									2						
Total	**115**		**72**		**2**		**178**		**13**			**4**			

The principal objective for all these contributions is related to the UNFCCC (Rio marker score "2"). Contributions with the principal objective relating to both Mitigation and Adaptation are counted with 50 % under each.

TABLE 7.2C DANISH BILATERAL AND REGIONAL FINANCIAL CONTRIBUTIONS WITH A PRINCIPAL OBJECTIVE RELATED TO THE IMPLEMENTATION OF UNFCCC, 2011 (DKK MILL.).
Source: Danish Ministry of Foreign Affairs

	Mitigation								Adaptation							
Sector Recipients country/ region	Energy	Transport	Forestry	Agriculture	Waste	Industry	Capacity- building	Other mitigation	Capacity- building	Coastal zone management	Other vulnerability assessment	Land-use planning	Rural development	Water mgt, supply and sanitation	Other adaptation
Ghana														5	
Indonesia			50												
Interregional													20		
Kenya						50									
Maldives									50						
Uganda									5						
Ukraine	39														
Vietnam	4								1						
Total	**43**		**50**			**50**			**56**				**20**	**5**	

The principal objective for all these contributions is related to the UNFCCC (Rio marker score "2"). Contributions with the principal objective relating to both Mitigation and Adaptation are counted with 50 % under each.

TABLE 7.2D DANISH BILATERAL AND REGIONAL FINANCIAL CONTRIBUTIONS WITH APRINCIPAL OBJECTIVE RELATED TO THE IMPLEMENTATION OF UNFCCC, 2012 (DKK MILL.).
Source: Danish Ministry of Foreign Affairs

	Mitigation								Adaptation						
Sector / Recipients country/ region	Energy	Transport	Forestry	Agriculture	Waste	Industry	Capacity- building	Other mitigation	Capacity- building	Coastal zone management	Other vulnerability assessment	Land-use planning	Rural development	Water mgt supply and sanitation	Other adaptation
Asia								13		13					
Bangladesh									1						
Chile							8								
Ethiopia									5				83		
Indonesia			270												
Interregional	21						68		31			33		25	130
Kenya	39												21		
Somalia												81			
South Africa	41														
Uganda							2		3						
Vietnam	65														
Total	**166**		**270**				**78**		**40**	**13**		**114**	**104**	**25**	**130**

The principal objective for all these contributions is related to the UNFCCC (Rio marker score "2"). Contributions with the principal objective relating to both Mitigation and Adaptation are counted with 50 % under each.

The increasingly more visible consequences of climate change underline the need for converting to a green economy. At the same time it is clear that adaptation to climate change is urgent, especially for the poorest and most vulnerable countries. It is crucial that the private sector is involved in financing the necessary climate investments. The distribution of Denmark's contributions to climate investments in the developing countries is based on these considerations. When the Climate Envelope was set up in 2008, a sum of DKK 100 million was allocated the first year, increasing gradually to DKK 500 million in 2012. The Climate Envelope is administered by the Ministry of Foreign Affairs in cooperation with the Ministry of Climate, Energy and Building within the framework of Danish development assistance. This makes sense because in practice it is extremely difficult to separate the financing of climate activities from development assistance, both of which must form part of the national development plans of the recipient country.

In the first instance, the intention of the Climate Envelope was to support the active participation of the developing countries in particular in negotiations about a new climate agreement to enhance their ownership of the negotiation process. This is in itself a precondition for obtaining a new global climate agreement that everyone will commit to implementing. In connection with the 2009 Copenhagen Agreement, the industrialised countries pledged USD 30 billion in 2010-12 for fast start of implementation of necessary climate activities. The Danish contribution to this sum amounts to DKK 1.2 billion, financed through the funds in the climate pool. Using these funds, contributions are made to a number of different multilateral and bilateral activities that support adaptation by the most vulnerable developing countries to climate change and also support initiatives to limit emissions of greenhouse gases, including promoting sustainable energy and, on a more general level, the organisation of green economic growth. As part of this, Denmark supports i.a. activities aimed at promoting climate-adapted agriculture, limiting deforestation, promoting reforestation and coastal protection and strengthening disaster prevention measures.

One element in the implementation of the Climate Envelope and the Danish Fast Start Finance has been the establishment of a Low Carbon Transition Unit (LCTU) based at the Danish Energy Agency under the Ministry of Climate, Energy and Building to assist developing and emerging economies in a low carbon transition.

Already in 2020 developing countries will account for approximately two-thirds of the world's greenhouse gas emissions. With massive growth in industrial infrastructure and building stock, it is essential that these countries choose intelligent and energy efficient solutions to avoid "lock-in" of high energy consumption and greenhouse gas emissions. Denmark has a unique position of strength in reducing energy consumption and an ambitious energy policy which can be brought into play. From June 2012 this has been done through the LCTU.

The LCTU consists of experts within the fields of energy efficiency, renewable energy, mitigation analysis as well as international greenhouse gas emission baselines. The LCTU gives high quality technical government-to-government guidance to help emerging economies with greenhouse gas emission reductions and low carbon transition in the energy sector. The LCTU works both with countries regarding general and methodological issues relevant to greenhouse gas emission reductions as well as with specific energy-related capacity building in selected emerging economies: Vietnam, South Africa and Mexico.

Annex G contains further information about the LCTU.

7.1.3.2 Multilateral efforts

Denmark is providing a significant contribution to multilateral development cooperation. For instance, in 2011 Denmark made a binding commitment regarding Danish participation in the 16th replenishment (IDA 16) of the International Development Association (IDA), which is the part of the World Bank that provides support to the poorest developing countries. Denmark has allocated funds totalling up to DKK 2.1 billion that are to be disbursed in the period 2012-16. In addition, in 2011 Denmark contributed DKK 190 million to a capital increase in the World Bank (IBRD).

Denmark is following the work of the World Bank on a new energy strategy aimed at promoting clean energy. Denmark grants a considerable amount of support through the World Bank’s energy programme, ESMAP, to increase sustainable energy capacity in a number of developing countries. Denmark also cooperates with the African Development Bank to help local energy producers to prepare their investment projects in sustainable energy and procure venture capital to finance the projects. Denmark is supporting activities in Nepal and Indonesia that aim at increasing access to energy in isolated rural districts and thus strengthen local economic and social development. Through the UNEP, the UN's environment programme, Denmark supports the Risoe Centre, which provides the developing countries with energy advisory support and which has succeeded in establishing itself as a key actor in energy consultancy. In 2013, a contribution of DKK 30 mill. was allocated to the Climate Technology Centre & Network that is hosted by the UNEP and is located in the UN City in Copenhagen.

Forest conservation is of decisive importance for the global climate. Denmark supports the UN's and the World Bank's forest programmes, the aim of which is to assist developing countries to formulate and implement national policies and efforts for the conservation and sustainable utilisation of forests with consideration for economic and social development. Denmark finds it particularly important to involve local communities and indigenous peoples who depend on the forest and who share in the proceeds from forestry. This is why Denmark also grants support to the international environmental organisation IUCN's forests programme, which seeks to safeguard the rights and participation of poor population groups.

In the future the Government will strengthen the multilateral efforts. For one thing, the world needs strong, effective international organisations that can tackle the great development challenges that exist. Over the last ten years, including in 2011, the proportion of Danish development assistance that is channelled through multilateral organisations has decreased. This is a development that the Government wishes to reverse. At the same time, Denmark will increase the use of core contributions, as opposed to the many project contributions, special contributions and initiatives in order to ensure greater responsibility and ownership.

Denmark hopes to strengthen the Global Environment Facility (GEF) both financially and organisationally. Denmark's contribution to the fifth replenishment of the GEF for the period 2010-2014 is DKK 400 million, or DKK 100 million annually. Denmark gave DKK 310 million to the fourth replenishment for the period 2006-2010. Denmark maintains a constant high support level for the Global Environmental Facility as is seen in Table 7.3.

TABLE 7.3 DANISH CONTRIBUTIONS TO THE GEF 2009-2012 (MILLION DKK).
Source: Danish Ministry of Foreign Affairs

	Contributions (millions DDK)			
	2009	2010	2011	2012
Global Environmental Facility (GEF)	62	100	100	100

The Danish financial contributions to multilateral institutions and programmes for the period 2009-2012 are summarized and presented below in Table 7.4 (multilateral institutions and programmes relevant for the implementation of the UNFCCC) and in Table 7.5 (international environmental organizations and other international NGOs relevant for the implementation of the UNFCCC).

TABLE 7.4. DANISH FINANCIAL CONTRIBUTIONS TO MULTILATERAL INSTITUTIONS AND PROGRAMMES RELEVANT FOR THE IMPLEMENTATION OF THE UNFCCC 2009-2012 (MILLION DKK).
Source: Danish Ministry of Foreign Affairs

Organization	Contributions (million DKK)			
	2009	2010	2011	2012
1. World Bank	584	622	436	658
2. WB SID DOCK	-	-	38	-
3. IFC	14	15	15	9
4. AfDB	154	174	232	291
5. AsDB	25	92	25	25
6. UNDP	331	388	363	359
7. UNDP SID DOCK	-	-	42	-
8. UNEP/ Specific programmes	40	57	25	25
9. UNFCCC/Supplementary Fund	3	1	-	3
10. UNEP/Risø	6	6	6	6
11. UNEP/DHI	4	4	4	4
12. Global Environmental Facility (GEF)	62	100	100	100
13. Global Green Growth Institute (GGGI)	-	-	90	-
14. Global Climate Partnership Fund	-	-	40	-
15. Danish Climate Investment Fund, IFU	-	-	-	100
16. Pilot Program for Climate Resilience (PPCR)	38	38	0	47
17. Scaling up enewable Energy (SREP)		61		
18. Forest Investment Program (FIP)	27	27		

TABLE 7.5. THE DANISH CONTRIBUTION TO INTERNATIONAL ENVIRONMENTAL ORGANIZATIONS AND OTHER INTERNATIONAL NGOS RELEVANT FOR THE IMPLEMENTATION OF THE UNFCCC 2009-2012 (MILLION DKK).
Source: Danish Ministry of Foreign Affairs

Organization	Contributions (million DKK)			
	2009	2010	2011	2012
1. IUCN	20	20	20	-
2. IIED	6	4	8	-
3. WWF	8	8	-	-
4. IISD	3	5	3	15
5. IWGIA	15	15	15	47
6. WRI	-	1	2	-

In 2009 the Nordic Development Fund (NDF) was transformed from being an institution providing highly concessional loans to developing countries to being a climate fund providing grants to climate activities that focus on low income countries. The grants are financed from reflows of loans from the previous NDF loans. At the end of 2012, the capital of NDF was EUR 963 mill. (about USD 1.25 bn.). Denmark's share of the capital is 23 per cent. After three years of climate change operations, at the end of 2012, NDF had approved a total of EUR135 mill. (about USD 175 mill.) for altogether 50 projects in 14 countries.

7.2 PROVISION OF FINANCIAL RESOURCES, INCLUDING FINANCIAL RESOURCES UNDER ARTICLE 11 OF THE KYOTO PROTOCOL

The provision of financial resources through bilateral and multilateral public efforts is described in section 7.1.3 above. In addition to these efforts, the provision of financial resources also takes place through the Danish private sector. Denmark has the assistance instruments and measures needed to provide assistance to developing countries through the private sector described in the following sections.

Developing countries need an enabling environment for the private sector to create economic growth and effective poverty alleviation. Thus, it is a strategic priority in Danish development cooperation to contribute to the creation of a strong private sector. For Danida, it is important that Danish businesses participate actively in this endeavour. Denmark has two different commercial instruments for providing assistance to developing countries through the private sector:

- Danida Business Finance
- Danida Business Partnerships

Danida Business Finance is modernised version of the instrument known as Mixed Credits, and Danida Business Partnerships have replaced the Business-to-Business Programme (B2B) and the Innovative Partnerships for Development (IPD) Programmes.

The Danish business community can contribute strongly to the creation of growth and employment by transferring knowledge, technology and management tools. Such transfer is expected to be done with due respect for climate change and environmental considerations, human rights, labour rights, working environment, and the fight against corruption. These principles and guidelines are encompassed in the Global Compact principles and in the ILO’s Decent Work Agenda.

7.2.1 Danida Business Finance

Danida Business Finance increases access to long-term financing by involving commercial investment players in the development of important infrastructure, especially in Africa. This is expected to lay the groundwork for economic growth in the developing countries. Danida Business Finance is also directed at minor industrial projects that have a direct job-creating potential and that cannot be financed on normal market conditions. Danida Business Finance targets key infrastructure sectors where investment will improve the climate for economic development, in particular in the private sector. The main sectors are transportation, energy, water supply and sanitation. In all areas, climate-friendly and cleaner technology is a top priority.

Over the period 2001-2012, assistance was granted to 87 projects through Danida Business Finance, with a total contract sum of DKK 9.6 billion. There is still considerable demand for Danida Business Finance. The DKK 310 million allocated to the scheme in 2012 was fully utilized.

Table 7.6 provides an overview of the statistics related to Danida Business Finance for the period 2009-2012.

TABLE 7.6 NUMBER OF PROJECTS AND TOTAL ALLOCATION OF EXPENDITURE UNDER DANIDA BUSINESS FINANCE, 2009-2012.

Source: Danish Ministry of Foreign Affairs

	2009	2010	2011	2012
Number of projects funded	6	6	0	1
Contract amount (million DKK)	282	1,819	0	310
Grant (million DKK)	140	1,105	0	197

7.2.2 Danida Business Partnerships

Danida Business Partnerships has replaced the B2B and IPD Programmes as part of the implementation of Danida's policy on "Growth and Employment". Danida Business Partnerships offer more flexibility in relation to the type of activity and the partnerships that can receive support. There is an increased focus on results and sustainability, as well as higher requirements to the competences and resources of the participating partners. On-going cooperation already approved for support under the B2B and IPD programmes continue to be administered according to the guidelines for these programmes.

The overall objective of Danida Business Partnerships is to contribute to poverty reduction, facilitate green growth and promote better working and living conditions in developing countries. The immediate objective will be pursued by creating employment, increasing competitiveness and promoting corporate sustainability in Danida partner countries. The objective will be pursued by transferring knowledge and technology from Danish to local partners such as companies, civil society organisations or local authorities.

7.2.3 Industrialisation Fund for Developing Countries

The mission of the Industrialisation Fund for Developing Countries (IFU) is to enhance global economic growth, development and more equitable income distribution through an increased global flow of socially and environmentally responsible, productive investments, making optimal use of comparative advantages. IFU invests in joint ventures in 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.

In 2011, the IFU experienced a high demand for consultancy services and financing. In total, the Fund contracted investments of DKK 510 million in project companies. All together has IFU now realised 750 investments in 85 different developing countries.

In 2012 the Government set up the Danish Climate Investment Fund (KIF) administered by IFU. The purpose of the Fund is to mobilize private capital into climate relevant investments. The Government has committed DKK 225 mill. to KIF, and IFU has committed DKK 50 mill., bringing total commitments up to DKK 275 mill.. It is expected that institutional investors will invest alongside KIF through the Fund bringing commitments up to a minimum of DKK 775 mill. at first close.

7.3 ACTIVITIES RELATED TO TRANSFER OF TECHNOLOGY

Danish support to technology transfer in relation to implementation of the UNFCCC 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. 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. The tables in Annex F contain examples of Danish assistance to technology transfer in the form of projects and programmes with both soft and hard technology.

Annex F describes three selected projects/programmes that promote practical steps to facilitate and/or finance the transfer of, or access to, environmentally-sound technologies. The selected project/programmes are:

- Sector programme for energy in Burkina Faso
- Environmental Programme in Indonesia
- Programme for sustainable energy in rural areas in Nepal

7.4 INFORMATION UNDER ARTICLE 10 OF THE KYOTO PROTOCOL

The steps taken by Denmark to promote, facilitate and finance the transfer of technology to developing countries and to build their capacity, as described in sections 7.1-7.3 above, are taken into accordance with both the UNFCCC and the Kyoto Protocol.

8

Research and systematic observation

Foto: Gorm Dybkjær/DMI

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: the World Weather Watch Programme (WWW), Global Atmosphere Watch (GAW), the Global Observing System (GOS), the Global Climate Observing System (GCOS) and the Global Ocean Observing System (GOOS). DMI also participates in the Network for the Detection of Atmospheric Composition Change (NDACC). 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. DCE – the National Centre for Environment and Energy, Aarhus University (AU) is in charge of monitoring the effects of climate change on nature and the environment.

Danish research competence concerning the physical expressions of past climate change is particularly at the Geological Survey of Denmark and Greenland (GEUS), the University of Copenhagen (KU) and Aarhus University (AU). 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 Department of Geoscience at AU have very great expertise in palaeoclimate data, and the climate group at KU is known worldwide for its ice core drilling and analyses. The departments of Bioscience and Environmental Science at AU contribute important research competence in relation to the effect of climate change on ecosystems.

DMI covers the physical world, i.e. measurement, theory and modelling of the climate system. However other institutions than those mentioned above, e.g. the University of Copenhagen, and Aarhus University and the Technical University of Denmark work with different aspects of climate research. The Ministry of Science, Technology and Innovation, the Coordination Unit for Research in Climate Change Adaptation and the Ministry of Climate and Energy, published in 2009 a Mapping of Climate Research in Denmark[38].

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 five Assessment Reports. Several researchers are actively contributing to the 5th Assessment Report (AR5) currently under publication

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[38] *The Ministry of Science, Technology and Innovation, Coordination Unit for Research in Climate Change Adaptation and the Ministry of Climate and Energy, 2009:* Mapping of Climate Research in Denmark (in Danish).

in 2013-14, including two coordinating lead authors, two lead authors and one review editor.

Danish research contributes to the four core projects under the World Climate Research Programme: the Climate and Cryosphere (CliC), Climate Variability and Predictability (CLIVAR), the Global Energy and Water Cycle Experiment (GEWEX) and Stratospheric Processes and their Role in Climate (SPARC).

The Danish Centre for Energy and Environment (DCE), the Greenland Institute of Natural Resources (GINR) and Asiaq, Greenland Survey are in charge of monitoring the effect of climate change on nature and the environment in Greenland. Greenland Ecosystem Monitoring (GEM) constitutes the main monitoring programme on ecosystems and climate change in Greenland. GEM covers marine, terrestrial, limnic, atmospheric and glacial components of different monitoring sites in Greenland, which also operate as key sites for climate research. The GINR conducts research into Arctic ecosystems and how they are affected by climatic and human impacts. The GINR also monitors the living resources and the environment in Greenland and advises the Government of Greenland and other authorities on sustainable exploitation of living resources and safeguarding the environment and biodiversity.

8.2 Research

8.2.1 Research policy and funding

Climate-related research in Denmark has grown within an already existing framework of institutional activities. Danish climate research was mapped in 2009. The mapping showed the picture of a relatively small research field with a strong international position. In an international perspective, Danish climate research has extensive publication activity compared with the rest of the world, and in addition it has significant impact in terms of the number of citations received. The mapping showed that Danish ice core research and palaeoclimatology research are particularly visible in the international context.

Denmark has not previously had a general national research programme for climate change, but in the ‘Research2020’ catalogue, a basis for the political prioritisation of strategic research in Denmark, ‘Climate and climate adaptation for the future’ is one of four subthemes under the vision of ‘A society with a green economy’. The catalogue is the result of an extensive mapping and dialogue process and focuses on the research needs within the different subthemes. A central focus for the theme on ‘Climate and climate adaptation for the future’ is the need for research that can contribute to reducing society’s sensitivity to climate change by strengthening the knowledge base for decisions on investments in climate adaptation.

The Danish Council for Strategic Research participates in the European Joint Programming Initiative ‘JPI Climate – Connecting Climate Knowledge in Europe’; an initiative to coordinate and align European research programmes within the area. A pilot call will be launched within the JPI in 2013.

Between 2009 and 2011, the Danish Council for Strategic Research awarded DKK 75 million to strategic research projects within thematic programmes of climate and climate adaptation.

The Coordination Unit for Research in Climate Change Adaptation (in Danish: Koordineringsenhed for Forskning i klimaTilpasning - KFT) has been a joint endeavour by the University of Aarhus, the Danish Meteorological Institute, the Geological Survey of Denmark and Greenland (GEUS), the University of Copenhagen and Denmark's Technical University. The coordination unit was working from 2008 to 2012 with the aim to collate and transfer knowledge within all Danish (and international) research areas that work on the issue of climate change adaptation, and to help coordinate information access at the science-policy interface. This activity necessarily builds on strong cooperation across a wide range of scientific disciplines as well as regular interaction with both the policy-makers and other stakeholders.

The main objectives of the Coordination Unit for Research in Climate Change Adaptation have been:

- to coordinate national-level research activities on adaptation to climate change;
- to facilitate research synergies and identify knowledge gaps;
- to support transfer of knowledge;
- to collate authoritative data on climate change and impacts;
- to foster national and international networks.

Key outcomes and products predicted to result from the Unit's activities have been:

- Database of researchers and on-going research activities: a key task of the secretariat is to develop and maintain a database on on-going research activities in Denmark and Europe. The database is no longer being updated and will be discontinued in 2014.
- Input to klimatilpasning.dk (a climate adaptation website): another key task of the secretariat has been to provide input in form of data, maps and research news to klimatilpasning.dk hosted by the Danish Ministry for the Environment.
- Newsletters summaries activities by the secretariat, updates on selected on-going research activities, information on key national and international developments in the area of climate adaptation research, reports on working groups and other activities initiated by the Unit, etc.

Danish climate-related research is described in detail in the following sections.

8.2.2 Climate processes and studies including palaeoclimatic studies

8.2.2.1 DMI

DMI carries out research on atmospheric and coupled atmospheric-oceanic processes, which are important in connection with global climate change. These process studies include natural atmospheric-oceanic interplay on time scales from years to decades, including main processes of importance for deep water formation in the North Atlantic. Also, DMI is developing a fully interactive ice sheet model that responds to climate variations and feeds information about the runoff from the melting processes into an Earth System Model or an ocean model to close the water circle.

Studies are performed on the downward propagation of the influence from the stratosphere on tropospheric climate. Studies have also been conducted 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 works on improving statistical methods for reconstructing past climate from proxy data from e.g. tree rings and pollen.

8.2.2.2 University of Copenhagen

The Climate and Geophysical Department at the Niels Bohr Institute at the University of Copenhagen is strongly involved in studies of climate processes in the research fields of climate, meteorology, oceanography and glaciology. The research includes development of atmosphere and earth-system models to understand the large-scale dynamics of the atmosphere, mapping the natural and anthropogenic climate change and variability, studies of how ocean processes contribute to the large climate fluctuations and evolution of the ice sheets and sea level rise. Through drilling deep ice cores through the Greenland ice sheet, palaeo-records of past temperatures, precipitation, greenhouse gas concentrations, solar irradiance, impurities and volcanic eruptions are measured and models are applied to the research subjects listed above with the objective of understanding the governing processes of past and future climate.

8.2.2.3 University of Southern Denmark

At the University of Southern Denmark, research is going on within the areas of the stability of the climate system, the role of the ocean in the climate system, as well as 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.

8.2.2.4 GEUS

GEUS works with the physical expressions of past climate change, including ecosystems' response, temperature variations, changes in precipitation and sea level change.

GEUS studies the effects of past climate change in the hydrological cycle, especially in relation to groundwater conditions and the interaction with surface water. The effects of heavy rain and higher temperature on groundwater formation and the quality of the water are addressed in relation to the environment and the drinking water supply. Also the occurrence of flooding and salt water intrusion is studied.

The study of past vegetation and landscape development in relation to climate change, including past forest and tundra fire problems, have been a key activity at GEUS. These palaeoclimatic studies contribute to the understanding of the development of the environment during changing climatic conditions.

Another research topic is past variations in the circulation of the North Atlantic ocean currents and reconstructing the surface and bottom water circulation in the Baffin Bay and the Northern Labrador Sea (The Davis Strait) off West Greenland, with special reference to sea ice and iceberg drift. Furthermore, the studies aim to link this information to regional records of wind activity and large-scale ocean and atmospheric circulation records from the North Atlantic, Nordic Seas and Fram

Strait. The aim is to obtain new knowledge about changes in Greenland's climate and recent geological history through studies of marine sedimentary sequences. Studies of palaeo-currents in the North Atlantic Sea around Greenland and the Faroe Islands are also key research activities.

GEUS also works with mass balance studies and the dynamics of the Greenland ice sheet, including its interaction with climate change and effect on changes in water level and interaction with ocean circulation variability. This includes studies of the connection between the Greenland ice sheet and the glacial earthquakes related to the main outlet glaciers, so-called ice streams, from the Greenland ice sheet. The effects of refreeze of melted ice on freshwater run-off are studied and the freshwater flux to the fjords and oceans from the ice sheet are measured and evaluated.

GEUS also works with the changes in the structure and dynamics of the sea ice that have occurred in a critical region of the Arctic Ocean North of Greenland as a result of a switch in Arctic atmospheric circulation due to the Arctic oscillation.

8.2.2.5 Aarhus University

AU 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 develop projection models.

8.2.2.6 Roskilde University, ENSPAC

The Quaternary Dating Laboratory (QUADLAB) at the Department of Environmental, Social and Spatial Change (ENSPAC), is part of an interdisciplinary project (siberia.mit.edu) working on the problem of triggering mechanisms and carbon sources for natural, deep-time, greenhouse warming events (hyperthermals).

In collaboration with GEUS, QUADLAB is carrying out $^{40}Ar/^{39}Ar$ age-based provenance studies to examine the role of the Greenland Ice Sheet in the abrupt oceanographic changes that occurred in the North Atlantic during the last glacial period. QUADLAB is also providing high-precision numerical ages on widely dispersed Quaternary ash layers that occur in the ice, marine and terrestrial paleo-climate records, helping to refine age models and the timing of past climatic events.

8.2.2.7 Greenland Institute of Natural Resources (GINR)

GINR is participating in an interdisciplinary research project using both natural and social sciences to analyse and improve our understanding of long-term climate variability in Greenland. The project is exploring the links between variations in past sea ice, climate conditions, changing environments and Arctic human societies. The links between humans, changing environments and sea ice are used to describe settlement patterns in the Godthåbsfjord. Additionally, through human responses to environmental change, socio-economic patterns may reciprocally be used, supplemented and discussed by using the perspectives of the natural sciences, e.g. by understanding sea-ice conditions and changing fjord environments. Here, emphasizing that increasingly, understanding climate change requires an interdisciplinary perspective. The project provides a detailed reconstruction of changes in climate, environment and sea-ice cover in the inner part of the Godthåbsfjord.

Climatic records covering the last 5000 years will be constructed with special focus on the past 1000 years. Investigations are based on marine geological surveys, oceanography studies, including studies of the rapid changes in relative sea level, variations in the distribution and thickness of fjord sea ice, dynamics of the tidewater glacier, KNS and the general impact of changes in ocean circulation. This will be supplemented by analysis of the cultural landscape, summarizing the changes of these parameters, to show how environmental and climate changes over time have affected the living conditions of the cultures.

The project is a collaboration between institutions such as; ASP (Arctic Science Partnership), GEUS, REMAINS (The National Museum of Greenland), SILA and Danish Middle ages & Renaissance (The National Museum of Denmark), the University of Alberta, the University of Fairbanks, CUNY (City University of New York), DMI and the Niels Bohr Institute.

8.2.3 Climate modelling and the climate of the future

8.2.3.1 DMI

With substantial support from the European Commission, DMI is working closely together with research institutions in Europe on analyses of the climatic consequences of increased greenhouse effect 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 development and employment of models for scenario calculations of the climate of the future. The models include:

- Regional dynamic ocean models for calculating changes in ocean and sea ice. The focus areas are the North Sea, the Baltic Sea and Greenland waters.

- A regional dynamic atmosphere-climate model for calculating regional/local climate change and variations. The main focus has been on Denmark, Europe, and Greenland, with applications also in Arctic regions, West Africa and India.

- Global Earth System modelling: 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 decadal to centennial time scale.

- State-of-the-art ice-sheet models coupled to regional climate models for studies of the changes of Greenland ice sheet in the past and in the future.

DMI contributes to the CMIP5 (Coupled Model Intercomparison Project, Phase 5) under the WMO's World Climate Research Programme, and the results of the simulations using the RCP (Representative Concentration Pathway) scenarios feed into the IPCC's Fifth Assessment Report..

New regional climate simulations on 8-50 km grids are carried out in connection with national, European and international projects, covering Europe in particular, but also the Arctic, Africa, North America and other areas.

With regard to regional simulations, the most important focus areas for Denmark are 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.

The scenarios from the EU projects ENSEMBLES (2004-2009) and PRUDENCE (2002-2004) are made available to all groups of researchers who are studying the effects of climate change, and to decision makers taking part in planning and implementation of adaptation to climate change. They have been used extensively by researchers from cross-cutting disciplines in Denmark and in Europe for assessments of climate-change impacts and risks. The hosting of data archives from regional climate models initiated in the EU PRUDENCE and ENSEMBLES projects continues with the ambition of becoming the central data storage for CORDEX (Coordinated Regional Climate Downscaling Experiment) under WCRP.

8.2.3.2 University of Copenhagen

Research at the Department of Geoscience and Natural Resource Management 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.

At the Niels Bohr Institute, the Climate and Geophysics researchers develop atmosphere circulation models, Earth system models and state-of-the-art ice-sheet models to predict the changes in the Arctic regions and how they will influence global and regional sea level rise. The research is done in collaboration with GEUS and DMI and is partly funded by EU framework programmes.

8.2.4 Effects of climate change

The effects of climate change on nature and ecosystems are covered by research at DMI, GEUS, the University of Copenhagen, Aarhus University, the Technical University of Denmark (Risø DTU), Greenland Institute of Natural Resources and the Danish Coastal Authority.

8.2.4.1 Aarhus University (AU)

AU 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.

AU is running the High Arctic Zackenberg Research Station, an ecosystem research and monitoring facility in Northeast Greenland (74º28’ N). In 2013 and 2014, facilities will be built also in Northern Greenland at Station Nord (81°36' N). Zackenberg is owned by the Government of Greenland and is operated by the Department of Bioscience, Aarhus University. The work at Zackenberg is coordinated through the Zackenberg Ecological Research Operations programme with the following institutions as partners: the Department of Bioscience at Aarhus University, Greenland Institute of Natural Resources, the University of Copenhagen, Asiaq - Greenland Survey and the Geological Survey of Denmark and Greenland. The station will enable increased research in high-Arctic ice and permafrost as well as the effect of climate change on the high-Arctic sea, air, geology, animals and plants.

AU 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. AU has research competences concerning tolerance limits for air pollution for particularly sensitive terrestrial ecosystems. In particular, the interaction between climate change, chemical substances and other factors is being investigated.

AU 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, AU 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.

AU is working with climate-change effects across climatic gradients, analysing, modelling and comparing climate effects at different spatial and temporal levels using an interdisciplinary approach.

The Centre for Regional Change in the Earth System, with DMI, AU, KU and GEUS as partners, is doing research in how human activities interact with natural processes.

AU is doing research in the effects of climate change on air pollution, including the importance for transport of pollutants such as POP and mercury to the Arctic.

AU is carrying out research on the effects of climate change on marine ecosystems, studying how marine Arctic as well as European ecosystems respond to climate change, in terms of both biodiversity changes and ecosystem structure and function.

AU 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 NH3 volatilisation, and greenhouse gases in relation to feeding strategies, manure handling, and soil tillage.

8.2.4.2 GEUS

GEUS has competence concerning long-term variations and effects 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 vegetation, 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.

The formation of groundwater and the effects of climate change on this important resource is being covered by GEUS in several studies. The studies of the hydrological cycle include expected changes in groundwater levels and saline intrusion in the groundwater as well as changes in river discharges and water levels.

Studies have been carried out on the effects of climate change on flooding of urban areas from rivers in Denmark as well as studies of the effects of climate change on pesticide leaching and transport in groundwater and surface water.

Studies of the permafrost in Greenland focus on the consequences of the thawing on the Arctic ecosystems and the mobilization of potentially huge amounts of carbon and nitrogen and release of greenhouse gases.

8.2.4.3 Technical University of Denmark (Risø DTU)

The Technical University of Denmark (DTU) carries out research, methodology development, capacity building and implementation of actions and strategies to reduce the vulnerability and enhance the climate resilience of developing countries.

The work is carried out in close collaboration with United Nations Environment Programme (UNEP).

To strengthen the capacity for climate risk management, DTU works with academic and public and private partners in developing countries, as well as internationally, on development and application of analytical frameworks for assessing climate change impacts and vulnerability, and to identify and evaluate response options. By developing and testing new analytical approaches, DTU has facilitated enhanced integration of information about climate change, climate variability and related costs into projects and policies.

8.2.4.4 DMI

DMI is lead partner in a project on climate change adaptation strategy in the Baltic Sea region, carrying out research on the effects of climate change, including analyses of precipitation, sea level, biodiversity and surface waves/erosion. In 2012 three impact assessment reports were published on marine biodiversity, fish stocks and infrastructure, and a report on climate-change vulnerability in the Baltic region.

DMI is working with modelling both regional and global changes of permafrost. DMI has also been involved in modelling and field studies to quantify the long-term fluxes of greenhouse gases from the Northern Russian land mass due to permafrost thawing.

DMI is working with partners in West Africa on a project on data management, analysis and processing, hydro-meteorological forecasts for the agriculture and water sectors, and climate scenarios for climate adaptation strategies. Similar projects have been carried out in Zambia and Tanzania.

8.2.4.5 University of Copenhagen (KU)

The effects of climate change on natural and managed ecosystems have strong focus at KU. The research is partly based on numerous large-scale in-situ infrastructures including long-term experiments, particularly in forests, an EU-funded infrastructure of climate change manipulation experiments and climate gradients INCREASE and a Centre of Permafrost CENPERM. Furthermore, the Department of Biology (BIO) and the Department of Geosciences and Natural Resource Management (IGN) have a number of Arctic climate manipulation experiments in Abisko, Disko and Zackenberg. The research comprises biological processes, ecosystem functioning, biodiversity, carbon and nutrient cycling and adaptation of processes and ecosystems to extreme climate conditions and moderate changes. KU has competences from both managed and natural terrestrial and aquatic ecosystems, working at scales from molecules to landscape and at different temporal scales.

IGN 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. This is performed on the basis of a wide range of ecological and climatic regions from processes in the Arctic areas (e.g. the CENPERM), Danish sites and tropical sites e.g. in Africa. In the Centre for Permafrost, CENPERM, funded by the Danish National Research Foundation, different scientific disciplines meet to investigate the biological, geographical and physical effects of permafrost thawing. CENPERM combines field experiments in Greenland, Svalbard, northern Sweden and Russia under extreme conditions with experiments under controlled conditions in our laboratories at University of Copenhagen.

The Department also carries out research on the impact on ecosystem function and structure of changed climate and potential for adaptation and mitigation based on management of forest and nature areas, changes in plant diseases and invasive species. This includes research in genetic aspects of adaptation and development. This is further supported by the cooperation, including forest monitoring performed for the Ministry of the Environment.

IGN carries out studies of the impact of recent climate change on vegetation productivity at global scale, making extensive use of Earth Observation satellite data.

The University of Copenhagen, Department of Plant and Environmental Sciences (PLEN), has significant research on the effects of climate change on the production levels of future agricultural biomass (food, feed, fibre, fuels) and the related impacts on soil quality and fertility, as well as feedback mechanisms on environmental emissions e.g. effects on soil carbon sequestration and greenhouse gas emissions. The cross-disciplinary Centre for Sustainable Agriculture and Forestry Systems (http://safor.ku.dk), hosted by PLEN, forms an umbrella organisation for many of these activities. An example of such collaborative work is the I-REDD+ EU-project on ‘Impacts of Reducing Emissions from Deforestation and Forest Degradation and Enhancing Carbon Stocks’ (http://www.i-redd.eu/) coordinated by the Department of Geosciences and Natural Resource Management and with PLEN participation.

8.2.4.6 Danish Coastal Authority

The Danish Coastal Authority (DCA) is working with projects focusing on the effect of climate change on coastal erosion and flooding and how to adapt the coastal protection in the most sustainable way. DCA is advising the planning authorities in Denmark on how to plan for climate change and has published a report “Guidelines for climate adaptation”. DCA is responsible for implementing the EU’s flooding directive in Denmark in cooperation with the Danish Nature Agency.

8.2.4.7 Roskilde University, ENSPAC

At ENSPAC, research in climate change effects is done with interdisciplinary perspectives in a variety of sectors using Earth observations, land surface hydrological modelling, stream ecological modelling and experimental and laboratory studies on ecological and biological responses to climate change. Earth observations are used to model land-surface fluxes of heat, water vapour and CO_2. In collaboration with Risø-DTU, a meso-scale regional climate model was recently applied using a high spatial resolution (3 km) nested model setup for Denmark and Europe to evaluate land-surface feedbacks on weather simulations. ENSPAC is also involved in the ECOCLIM project, funded by the Strategic Research Council (coordinated by AU), and with the development of climate and land use scenarios for assessing the terrestrial CO2 budget for Denmark.

Furthermore, ENSPAC is involved in a climate research network in Africa related to the use of Earth observations for environmental monitoring, and research is being conducted on human responses to climate variations over the last 5000 years using geophysical, geochemical and pollen analyses. Environmental biologists at ENSPAC are doing research in climate effects on the invasion of marine species.

8.2.4.8 Aalborg University

At the Aalborg University, research is being carried out on the impact of climate change on society, including regional perspectives on climate change, the impact of climate change on industrial and financial structures as well as human, political and rhetorical implications from the climate change discourse.

Furthermore, studies are being carried out on the effects of climate change on energy consumption in housing, the impact on architecture, building components and technologies as well as studies on the impact on everyday life and the indoor climate.

8.2.4.9 Greenland Institute of Natural Resources (GINR)

GINR, the Danish Centre for Energy and Environment (DCE), and Asiaq, Greenland Survey is in charge of monitoring the effect of climate change on nature and the environment in Greenland. Since 1995 Zackenberg Research Station in Northeast Greenland (ZERO) has facilitated research and monitoring in the high Arctic (NE Greenland). In 2007 a low Arctic counterpart (Kobbefjord, SW Greenland) (NERO) was established. These two stations, which are funded by the Danish Ministry of Climate and Energy through the DANCEA programme, form the basis of the Greenland Ecosystem Monitoring (GEM). The GEM collects long-term data series in order to quantify variations in biological as well as geophysical parameters in the terrestrial, aquatic and marine environments on a seasonal as well as yearly basis in relation to local, regional and global climate change.

The GEM consists of several basis programmes: ClimateBasis collects data on climatological and hydrological conditions, e.g. data from automatic weather stations. GeoBasis collects data on changes in the landscape in relation to climate, hydrology and physics, e.g. data on snow and ice and on methane and CO_2 flux from the vegetation. BioBasis collects data on biological parameters in lakes as well as on land, e.g. data on arthropods, birds, vegetation phenology, NDVI, CO_2 exchange between the vegetation and the atmosphere. MarineBasis collects data on physical, chemical as well as biological oceanographic parameters.

These monitoring programmes also provide a data and knowledge foundation for on-going national and international research projects related to climate change in Greenland.

GINR conducts annual surveys on fish and shrimp stocks in West and East Greenland offshore areas and in the Disko Bay. The monitoring programme provides unique time-series dating back several decades, thus providing knowledge on the response to natural climate variation and ongoing anthropogenic climate change.

GINR provides scientific advice for the Greenland Self-government on sustainable harvest and conservation of marine and terrestrial mammals, birds and vegetation. In this regard, a significant amount of research is conducted on the effects of climate variation, primarily sea ice dynamics, on abundance and behaviour of marine mammals and birds. Moreover, the GINR has developed methods for obtaining oceanographic data in the vicinity of glacier fronts or areas heavily influenced by sea ice by means of tagging diving mammals. Such areas are not easily accessed in traditional oceanographic surveys, but particularly interesting in a climate change context providing invaluable data for understanding the oceanographic feedback processes.

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.

8.2.5.1 Technical University of Denmark (Risø DTU)

DTU 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 United Nations Framework Convention on Climate Change and capacity and training programmes in developing countries.

In addition, DTU has research activities concerning the Kyoto Protocol's flexible mechanisms, Emission Trading (ET), Joint Implementation (JI) and Clean Development Mechanism (CDM). DTU is hosting the widely used CDMPipeline.org that provides free and easy access to global CDM statistics by gathering data and analysing the performance of the CDM.

8.2.5.2 Aarhus University

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 University of Southern Denmark, University of Copenhagen and following up cooperation established with the Centre for Social Science Research on the Environment at Aarhus University, 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 cooperation on a Masters degree in Environment and Energy Law, cf. Chapter 9.

AU's Department of Environmental Science 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 the Clean Development Mechanism and Joint Implementation. Activities include preparation of guidelines for economic assessment of adaptation to climate change.

AU carries out research on the social and economic dimensions of climate change adaptation, such as how economic analyses are used in the decision making process, economic modelling of changes in land use, research on synergies in green, sustainable cities and climate adaptation and sociology research on how private and public actors perceive and participate in climate change adaptation activities.

8.2.5.3 University of Southern Denmark

The University of Southern Denmark in Odense carries out research on climatic, ecological and anthropogenic impacts on marine environments, particularly in the North Sea, in Greenland and in the Baltic Sea.

8.2.5.4 University of Copenhagen

At the University of Copenhagen, the social science aspects (economics, sociology, anthropology etc.) of adaptation to, and mitigation of, climate change effects is an integrated aspect or a core focus of numerous research activities as well as education elements. It includes studies of how adaptation to climate change effects enters into decision making for e.g. policy makers, natural resource managers, land owners and households, using economic optimization approaches, environmental sociology as well as anthropological methods. The research addresses the behaviour of decision makers in Denmark as well as in many foreign (developing country) cases, and cases that concern a wide range of topics including e.g. biodiversity conservation under change, land owners' adaptation to changing climatic conditions and rural household livelihood and coping strategies.

Mitigation measures and regulation approaches are also topics of research, in particular for the economic discipline, but also law and others. Apart from focus on e.g. taxes, subsidies for renewable energy technologies, the ETS and similar regulation tools, there is also focus on more general issues like urban households' decisions on transport, energy consumption etc., as well as global issues like a reliable design of the REDD+ mechanism.

8.2.5.5 Roskilde University, ENSPAC

At Roskilde University, 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.

At ENSPAC, Roskilde University research includes participation in the EU project Greeco on territorial potential for a greener economy (http://www.espon.eu/main/Menu_Projects/Menu_AppliedResearch/greecoTPG.html). The development of local and regional mitigation and adaptation strategies to climate change is an important research area which is conducted in cooperation with Danish municipalities. Research also addresses public lighting strategies, transitions to energy-neutral and energy-producing buildings, transitions to public transport and energy-efficient vehicles. The implications for daily life, regional infrastructure planning and transport-related taxation is evaluated.

8.2.5.6 DMI

DMI is involved in various national and international research and networking projects for assessments of climate change impacts on the economy, energy and agriculture sectors, as well as the cost of the climate changes. In these projects, DMI develops methodology for downscaling the climate-change projections to the regions of interest, and provides expert advice for other partners of cross-cutting disciplines in the projects on applications of model projections and their uncertainties to assess the climate-change impact and risk on various sectors.

8.2.5.7 Aalborg University

At Aalborg University, focus of climate mitigation research is on how to reduce energy consumption from the built environment, especially the transition to low energy consumption housing, and the transport sector. Economic assessment on energy consumption in housing and building renovation is prioritized.

Moreover, research is being done on the relations between climate change, design strategies and sustainability of industrial products, e.g. sustainable architecture in a new climate.

8.2.6 Research and development of technologies and approaches to reduce greenhouse gas emissions and to adapt to climate change

From 2008 to 2012 Aarhus University hosted the Coordination Unit for Research in Climate Change Adaptation (KFT) at the DCE – Danish Centre of Environment and Energy in collaboration with the Danish Ministry of Climate and Energy, the University of Copenhagen, the Technical University of Denmark, the Danish Meteorological Institute, the Geological Survey of Denmark and Greenland. KFT has supplied authoritative climate data and climate-effect data as well as specific climate research results of relevance to climate adaptation. KFT has mapped climate adaptation research in Denmark in terms of both researchers and projects. Since 2013, a new network of climate-change adaptation researchers has been formed, including the former members of KFT as well as the DHI Group (an independent consulting and research organisation in the field of water environment).

Aarhus University (AU) is heavily involved in all university activities related to the environment, energy and climate-related issues. AU has broad competences within the topics: Future energy systems, Future climate and climate adaptation, and Competitive environmental technologies.

At the Technical University of Denmark (DTU), the national laboratory for sustainable energy is basing their research on sustainable energy development and sustainable urban change, with energy savings and renewable energy as central parameters.

DMI works with solar resource assessment and forecasting and is involved in a Solar-PV development and demonstration project.

8.2.7 Energy research

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.

In 2006 the government suggested that public-programme support for RD&D in energy technologies should be doubled from approx. DKK 500 million to DKK 1 billion per year in 2010. This goal has been reached and the government has continued the increased effort in the years after 2010. The funding is being administrated by several programmes, including the Energy Technology Development and Demonstration Programme (EUDP), three different PSO funds (Public Service Obligation), the programme committee on energy and environment under the Strategic Research Council under the Ministry of Education and the Advanced Technology Foundation.

EUDP focuses on development and demonstration of new energy technologies. A board, nominated by the Minister, is responsible for the allocation of funds. The Board is served by a secretariat established in the Danish Energy Agency. The overall objective of EUDP is to support the government's energy-policy objective to provide 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 focus on new efficient energy technologies. EUDP was established in 2008. Available funds in 2013 are DKK 365 million. On average, 45 percent of the activities under the Programme are financed by EUDP itself, the rest of the funding coming from other project partners.

Energy research and development and demonstration projects are supported by PSO funds (Public Service Obligation). One of these is administrated by the transmission system operator Energinet.dk. The programme is aiming at research and development in environmentally friendly power-production technology, administering in 2013 support funds amounting to DKK 130 million. Under this scheme support is given to activities relating to fuel cells and renewable energy, for instance solar cells, biomass, hydropower and wave energy.

Another programme administrated by Energinet.dk is a programme of yearly DKK 25 million for the deployment of new technologies. The programme started in 2008 and has been extended to include 2015.

The third PSO programme is administrated on behalf of the power distribution companies by the Danish power association Dansk Energi. The objective is to support research and development within energy-efficient use of electricity. In 2013, DKK 25 million are available under the scheme, which aims at the development of energy-efficient products and processes in buildings, industry etc.

Activities relating to strategic energy research were increased in 2003. The activities are administered by the Danish Council for Strategic Research under the Ministry of Science, Innovation and Higher Education, and are aimed at strengthening the knowledge base within renewable energy and environment, including support to cross-disciplinary projects that involve technical, environmental, health, social, economic and political aspects. In the year 2013, available funding for the Ministry's energy research efforts is expected to be DKK 370 million.

Furthermore, the Danish National Advanced Technology Foundation was established in 2005 under the Ministry of Science, Innovation and Higher Education with the purpose of supporting various technologies. In 2005-2013 the programme allocated 25-30 % of its annual budget to energy technology activities. The funding of projects is decided by an independent board with its own secretariat.

In October 2013, the Government reached an agreement with political parties in the parliament to create a new innovation foundation in 2014. The foundation is expected to have an annual budget of DKK 1.5 billion and will be created by amalgamating the Danish Council for Strategic Research, the Danish National Advanced Technology Foundation and the Danish Council for Technology and Innovation into one foundation.

8.2.7.1 Aarhus University

Research at Aarhus University, DCA – Danish Centre for Food and Agriculture 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.

At DCA, the world's largest biogas plant for research purposes was commissioned in 2007. It can be used by scientists and private companies - Danish and foreign - for projects in biogas production and slurry separation. The plant cost DKK 25 million to build and is being expanded on an ongoing basis. The purpose of the biogas plant is to enable researchers to study the biogas processes. The researchers have a unique opportunity to study in full scale the effect on the process of changes on factors, such as biomass composition, retention time, and temperature, on which several projects are ongoing. In addition the effects on biogas treatment of animal and green manure on the subsequent emission of nitrous oxide in the field are being studied in detail.

AU, DCA has long experience in developing dedicated energy crops with a low environmental impact and high net-emission reduction. Most promising crops are perennial crops such as willow and miscanthus, the latter utilising the C4-photosynthetic pathway, which will become increasingly effective in the warming climate. This research has paved the way for a large demonstration project in the catchment of Ringkøbing Fjord, where willow planting started in spring 2009 with the aim of a total planting of 1,500 ha. The dual purpose is to produce more bioenergi and to reduce the loss of nutrients to the fjord.

As a consequence of the Kyoto agreement, Danish authorities have requested an assessment of the carbon stock and launched a EUR 10 million soil survey. Half of this is earmarked to the survey of the organic soils. AU, DCA is participating in this initiative by mapping the extent of organic soils in Denmark using GIS and legacy soil information.

AU, Department of Environmental Science is working with the main drivers behind greenhouse-gas emissions from the energy sector, the agricultural sector, and the transport sector. The University of Copenhagen, Department of Geoscience and Natural Resource Management 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.

AU 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. The University of Copenhagen, Department of Geoscience and

Natural Resource Management contributes with inventories of emissions from forestry and changes in land-use in relation to how forests affect the forest ecosystems' carbon sinks and thus the potential binding of CO_2 in biomass and soil.

AU has models for projecting greenhouse-gas emissions, based, for instance, on projections of activities in relevant sectors, with the University of Copenhagen, Department of Geoscience and Natural Resource Management providing input on forests.

AU also has research competence in modelling the dispersal of greenhouse gases locally and regionally, with special focus on Denmark, Europe, and Greenland. The Department of Environmental Science has developed 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.

8.2.7.2 University of Copenhagen

The University of Copenhagen is involved in a number of research projects related to new technologies e.g. for renewable energy, including biofuels. Furthermore a number of projects and research areas have focus on adaption to and effects of climate change.

The University of Copenhagen is exploring the options for adaptation of cities to climate change by means of blue-green approaches and exploitation of ecosystem services. This research includes principles for redesign of the blue-green infrastructure for storage, infiltration and evaporation of stormwater runoff, for buffering of the urban heat island, and for biodiversity support, as well as the development of new technologies for treatment of stormwater runoff to high quality water for reuse purposes. The research and innovation activities further encompass description and assessment of urban planning concepts for climate-change adaptation in Denmark, China and Africa.

Another research theme at the University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), is climate-change adaption in the Danish municipalities. Main focus is on performance, drivers and barriers within the following fields: mapping of flooding threats, adaptation policies and planning, implementation and management strategies as well as attitudes and collaboration between the different sectors and stakeholders: politicians and planners from the different authorities as well as the citizens.

Numerous research projects at IGN address issues related to sustainable biomass production, both in forestry and in cooperation with other departments related to agricultural biomass production. The use of biomass, the land use and land use change (including ILUC) is an integrated part of several these projects. Topics related to conversion of biomass to energy – solid or liquid – are directly related to the processes of moving towards a bio-based society and economy.

The response of tree species to climatic change, the endurance, adjustment and tolerance of species and the resilience of forest ecosystems, as well as the expected influence on productivity and ecosystems services of forests are important research topics at the forest, nature and biomass section of the Department for Geosciences and Management of Natural Resources. The implications for development of wise management strategies, including options for sustained and increased biomass productivity and carbon pools, are an important part of the research and development activities. The carbon pools, the dynamics over time and scale are core topics in a number of research projects, including development and testing of efficient inventory and sampling methods, utilizing both field data and remote sensing.

IGN carries out research on both mitigation and adaptation in developing countries. Within the framework of an IGN-led EU-funded I-REDD project, the effects of the REDD+ mechanisms are being studied in SE Asia, and in collaboration with UNEP-DTU, possibilities of options for renewable energy are being explored in Mali. In a Danida-funded project, improved adaptation to climate change, making better use of outputs from regional climate modelling and seasonal forecasting, is being studied in West Africa, in collaboration with DMI and AGRHYMET in Niger.

The Department of Plant and Environmental Sciences (PLEN), University of Copenhagen, focuses on developing methods to reduce greenhouse gas emissions from different agricultural production systems, depending on both application of mineral and organic fertilisers, irrigation strategies and choice of crops in both temperate and tropical production systems. A special focus area in a number of research projects is agricultural and urban organic waste recycling technologies, including anaerobic digestion for biogas production and upgrading of residues for biofertilizer production in both intensive and extensive agricultural systems (e.g. http://www.reusewaste.eu, http://biochain.dk, http://www.susane.info). Advanced agroecosystem models and life cycle assessment models are being used to investigate and compare the effects on global warming potential of alternative technologies.

The UN CGIAR headquarters of Climate Change and Food Security (CCAFS, http://ccafs.cgiar.org/) is located at PLEN. A member of the Department is contributing as Coordinating Lead Author to writing the food security chapter of the IPCC AR5 report in Working Group 2, to be released in March 2014, and also sits in the Science Board of the JPI on Food Security, Agriculture and Climate. The Department also studies the food systems of cities and has developed new identity metrics to calculate GHG emissions linked to food demand and supply for 9 billion people.

Together, the PLEN and IGN departments play a key role in national and international research initiatives to develop renewable biofuels for climate-change mitigation. The research focuses on sustainable intensification of the productivity and quality of biomass for different bioenergy purposes (http://www.bio4bio.dk). These activities are combined with targeted improvement of biomass feedstocks for new energy applications (e.g. maritime fuels; http://b21st.ku.dk/) and for use in biorefineries (http://biovalue-spir.ku.dk).

8.2.7.3 GEUS

GEUS is researching impacts on the Arctic environment, and the driving forces for natural climate variations in long-term perspectives.

In cooperation with other countries, GEUS participates in EU-funded projects, in which the possibilities for finding geological storage possibilities near the European power stations and large industrial CO_2 point sources are being studied. Technical-economic models are 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.

GEUS is also participating in the international research project CO2STORE, a continuation of the SACS project, 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 at low acidity.

GEUS is investigating the possibilities of using deep-sited geothermal reservoirs for energy and heating supply. Also shallow geothermic energy supplies are being developed and exploited.

8.2.7.4 Technical University of Denmark (Risø DTU)

DTU engages in research on the linkages between the uses of cleaner energy technology and its impact on the climate and development processes. In collaboration with UNEP, DTU supports implementation of policies and strategies that provide access to cleaner and more efficient energy technologies for poor people in developing countries. DTU has developed methodologies to facilitate energy technology transfer including tools to identify and overcome political, institutional and financial barriers to increase use of these technologies.

Further, DTU carries out analysis, research and technical assistance on emerging mitigation policies, strategies and instruments, such as Nationally Appropriate Mitigation Actions (NAMAs) and works extensively with the Clean Development Mechanism (CDM). DTU provides institutional and technical capacity building in Asia, Africa and Latin America through various in-country activities.

DTU also carries our research on methodological frameworks for assessing the social and financial costs and benefits of climate-change adaptation measures at project and sector levels. The aim is to help expand the knowledge base on the costs and benefits of climate-change impacts and adaptation measures, which promote effective adaptation and increase climate resilience. In the coming years, the emphasis will be on key sectors including water, agriculture, infrastructure and energy.

DTU's activities moreover include research in linking technology transfer to underlying economic forces, as well as developing tools to assess the benefits and costs of technologies needed to adapt to climate change. This involves methodology development and technical assistance related to identification, assessment and prioritization of technologies for climate-change adaptation.

8.2.7.5 Roskilde University, ENSPAC

ENSPAC is involved in the evaluation of technical, economic and environmental aspects of biofuel production. Research focuses on energy crops and algae cultivation for transformation to bio fuels. The research is based on utilizing sewage water to increase productivity, and it examines effects on CO_2 and nutrient removal. Activities include participation in the Baltic Sea Bio-Energy Promotion Programme (EU Interreg Programme with 36 partners) and in Cluster Biofuel Denmark, which is a technology platform bridging the gap between private enterprises, universities and public authorities.

Another research theme is Climate Change and Innovation in the Building Sector, and this is being conducted in cooperation with the Technical University and many others. In this context, the energy and environmental challenges for building and renovating in the future are being addressed.

8.2.7.6 Aalborg University/SBi

The impact of climate change on the built environment, especially the influence on the safety, health and quality of the built environment, is a central area of research. At the Danish Building Research Institute (SBi) at Aalborg University, work has been done on adaptation strategies for the built environment to climate change, including safety of load-carrying structures, rainwater and wastewater management as well as indoor climate in a new climate.

Furthermore, research, analysis and case studies are being carried out in a wide range of renewable energy fields, including wind and solar energy, bioenergy and wave power. Essential contributions have been made on topics such as onshore and offshore wind turbines - cost-effectiveness, reliability of structures, power electronics, operation optimization and grid integration; bioenergy – resource efficiency, valorization of biomass, liquid and gaseous biofuels and biofuel infrastructure; wave power – power take-off mechanisms, structural reliability, grid integration; solar energy – concentrated solar platforms, photovoltaic integration from micro- to macro-scale.

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 350 automatic measuring stations in the Danish 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.

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 and climate include the GCOS (Global Climate Observing System), coordinated by the World Meteorological Organisation (WMO). For further details – see Annex H.

The Danish observation network is characterised by high average data availability, as appears in Table 8.1.

TABLE 8.1 AVERAGE DATA ACCESSIBILITY IN 2012

Source: Danish Meteorological Institute

Type	2012
Automatic weather stations, incl. Greenland and the Faroe Islands	96.2%
Satellite reception	99.6%
Weather radar	93.7%
Radio sounding, Faroe Islands and Greenland	98.7%
Storm surge stations	99.4%

The meteorological observations are stored in DMI's database, and observations from several 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 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
- Satellite data
- The ice observation service
- The measurement of pollen and spores

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 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 1 JANUARY 2013

Source: Danish Meteorological Institute

Type	DMI			Cooperation partners		
	Denmark	Greenland	Faroe Islands	Denmark	Greenland	Faroe Islands
Weather stations	50	24	4	27	18	1
Automatic precipitation intensity stations				145		
Automatic acc. precipitation stations	109	8	1			
Manual acc. precipitation stations		5	1			
Surface radiation stations	28	5	1			
Automatic sea level stations	33			53		

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. Observations from Denmark, Greenland and the Faroe Islands are also included, and are coordinated with EUCOS (European Coordinated Observation System), which is organised by EUMETNET (European Meteorological Network). As part of the SURFMAR programme, DMI has an observation agreement with four ships, which carry out systematic observations (Automated Voluntary Observing Ships) in the waters around Greenland and between Greenland and Denmark.

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.

DMI operates radio sounding stations in Tórshavn on the Faroe Islands and in Danmarkshavn, Illoqqortoormiit, Tasiilaq, Narsarsuaq, and Aasiaat in Greenland. Soundings are also received from three 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 Tórshavn.

Weather radar network

With five radars in Sindal, Virring and on Stevns, Rømø and Bornholm, Denmark's network of weather radars provides 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 so-called satellite Application Facility (SAF) for use of GPS data for weather and climate monitoring (ROM-SAF) and is also participating in SAF for oceanography and sea-ice (O&SI SAF) and the SAF for ozone and atmospheric chemistry monitoring (O3M SAF).

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 140 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 satellites and aircraft for provision of ice information to shipping. Ice maps are prepared and distributed frequently with detailed information on relevant ice conditions. All new ice maps are in vector and graphic form. Since 1999 weekly maps have been prepared showing the ice conditions all the way round Greenland. All offshore maps are based on satellite data DMI is carrying out research in sea ice modelling, satellite-based iceberg detection and in mapping the extent of sea-ice through the past centuries.

Measurements of pollen and spores

In Denmark the Danish Asthma and Allergy Association (Astma-Allergi Danmark) and DMI are responsible for the pollen project and operate two routine stations measuring allergenic pollen and spores in Copenhagen, Zealand, at the DMI (55°43´N, 12°34´E) and in Viborg, Jutland, at Viborg-Kjellerup Hospital (56°27´N, 9°24´E). The measurements started in Copenhagen in 1977 and are performed utilising Burkard traps placed 15 and 21 meters above ground level, respectively. The distance between the two stations is about 220 km. In different periods, campaign measurements have been performed at different stations in Denmark.

Trend analysis of the pollen season in Denmark shows a marked shift to an earlier season and a general increase in the pollen load – a consequence of warmer climate during the period. The IPCC has recognised pollen as a climate indicator and in Denmark the Danish Nature Agency is much aware of the possible threat of a warmer climate introducing or strengthening new invasive plants, such as ambrosia, to the Danish nature.

8.3.2 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.

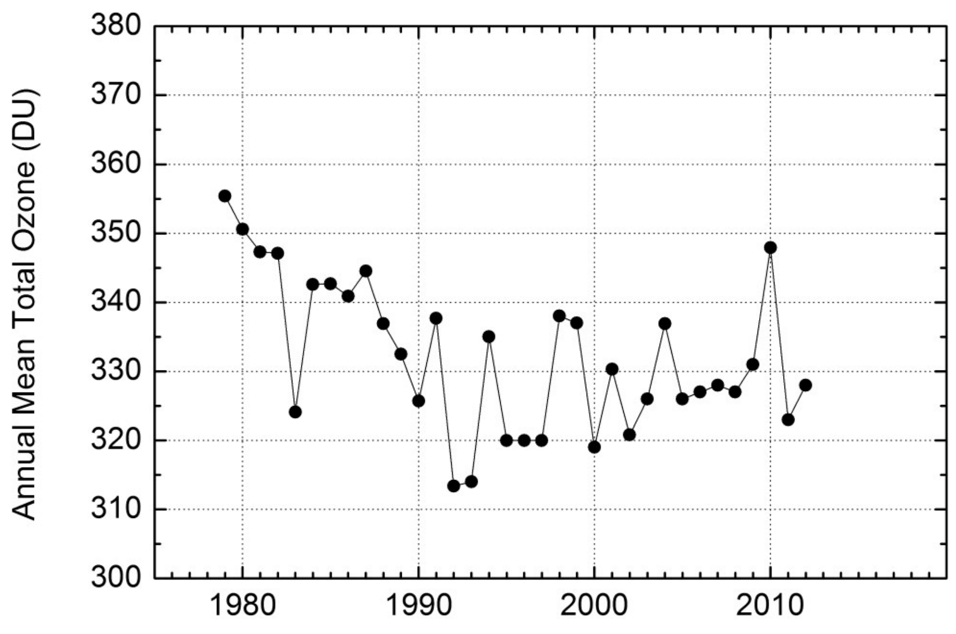
Measurements of the ozone layer and UV radiation are made at Copenhagen - see Figure 8.1 - and Kangerlussuaq (Søndre Strømfjord), using Brewer ozone spectrometers. At Pituffik (Thule) measurements are made of the ozone layer, UV radiation, global radiation, aerosols and stratospheric NO_2, using, respectively, a SAOZ spectrometer, a UV spectro-radiometer, a pyranometer and an 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 an ozone profile climatology, since 1989 DMI has been launching 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 where measurements of UV radiation are also performed.

The observatories operated by DMI in Greenland, Pituffik, Kangerlussuaq and Ittoqqortoormiit, are Arctic stations in the Network for Detection of Atmospheric Composition Change (NDACC), formerly known as 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 affect the ozone layer. DMI works with the National Center for Atmospheric Research (NCAR) in Boulder (FTIR instrument in Pituffik), with the Italian National Agency for New Technologies, Energy and the Environment (ENEA) and the Italian National Institute of Geophysics and Volcanology (INGV) (Lidar and mm-wave spectrometer in Pituffik), with the Health Protection Agency in the UK (UV radiometer in Pituffik) and with NASA (aerosol radiometer in Pituffik, Kangerlussuaq and Ittoqqortoormiit) and SRI-International, USA (Lidar in Kangerlussuaq). NDACC is supported by the International Ozone Commission (IOC), UNEP and WMO, and DMI takes part in the NDACC steering committee (http://www.ndacc.org). The stations in Pituffik, Kangerlussuaq and Ittoqqortoormiit are also part of Aeronet.

DMI's measurements are reported to the database of the Network for the Detection of Atmospheric Composition Change (NDACC) and the database of the World Ozone and UV-radiation Data Centre (WOUDC) under the WMO programme Global Atmosphere Watch and are used to validate satellite data as well as to compare with results from climate models.

FIGURE 8.1 ANNUAL MEAN THICKNESS OF THE OZONE LAYER OVER DENMARK 1979-2012 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



8.3.3 Oceanographic climate observations

DMI cooperates with the Danish Coastal Authority and local authorities to monitor the sea level at a number of Danish localities.

DMI operates a number of operational current-monitoring stations in the Danish Straits

In cooperation with the Greenland Institute for Natural Resources (GINR), DMI carries out annual oceanographic observations on 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 fish resources. In recent years this programme has been extended to include stations in fiords near Sisimiut and NUUK in order to study effects of climate change on the marine ecology.

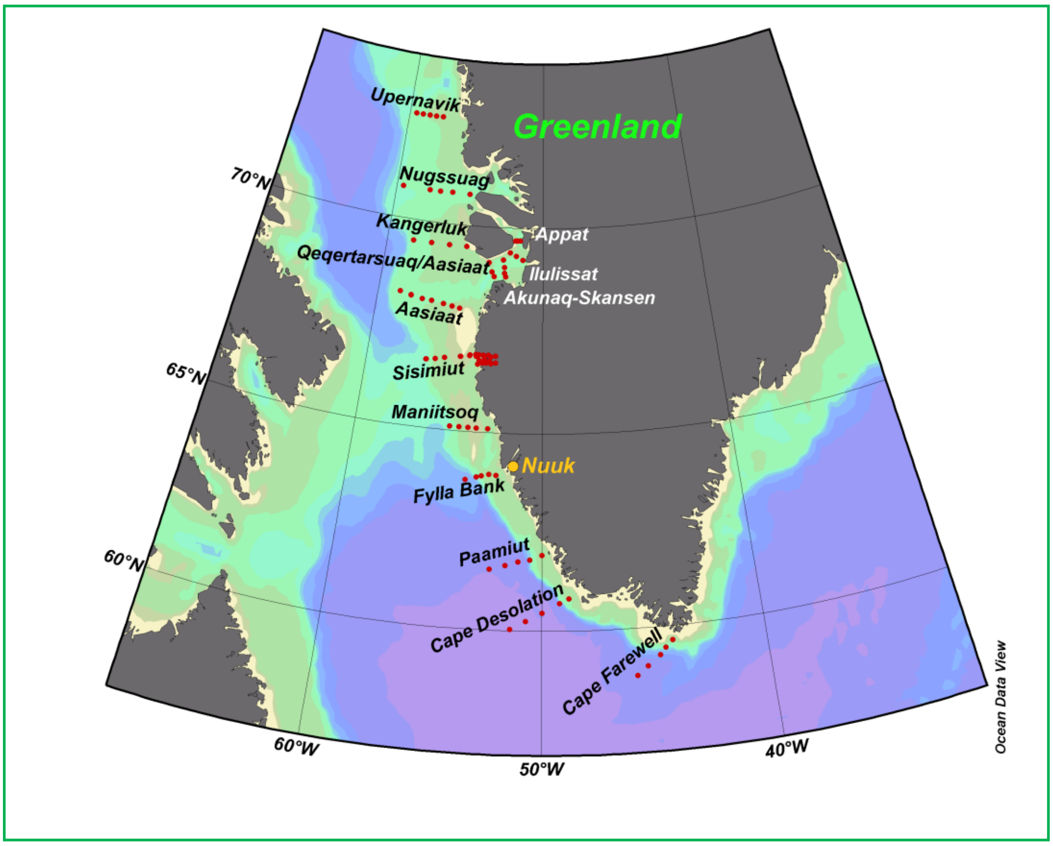
DMI also processes oceanographic data from the annual trawl cruises made by the GINR. Monitoring stations are shown in Figure 8.2.

The GINR is responsible for monitoring the living resources and the environment in Greenland and advises the Government of Greenland and other authorities on sustainable exploitation of living resources and safeguarding the environment and biodiversity. The GINR also monitors and conducts research into Arctic ecosystems and how they are affected by climatic and human impacts.

The GINR integrates research in natural, technological, and social sciences to understand the effects of natural variability and climate change on Arctic ecosystems and society. One focus area is the marine ecosystems and oceanographic conditions in the coastal waters and fjords systems in Greenland, and how these are affected by climatic forcing. Thus the GINR compiles and maintains much of the gathered data and knowledge locally in Greenland.

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 INSTITUTE OF NATURAL RESOURCES.

Source: Danish Meteorological Institute



8.3.4 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 and observations of the Greenland Inland Ice in section 8.3.5. 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 – e.g. the continuous monitoring of forests structure and function performed by the University of Copenhagen for the Ministry of Environment.

As mentioned in Section 8.2.4.10, the Greenland Institute of Natural Resources (GINR), Danish Centre for Energy and Environment (DCE), and Asiaq, Greenland Survey are in charge of monitoring the effect of climate change on nature and the environment in Greenland on the basis of the Greenland Ecosystem Monitoring (GEM). The GEM is also further described in Section 8.2.4.10.

8.3.5 Observations of the Greenland Inland Ice

GEUS has since 2007 operated the Programme for Monitoring of the Greenland Ice Sheet Margin (PROMICE), funded by the Danish Ministry of Climate, Energy and Building through the DANCEA programme. Partners are the Greenland Survey

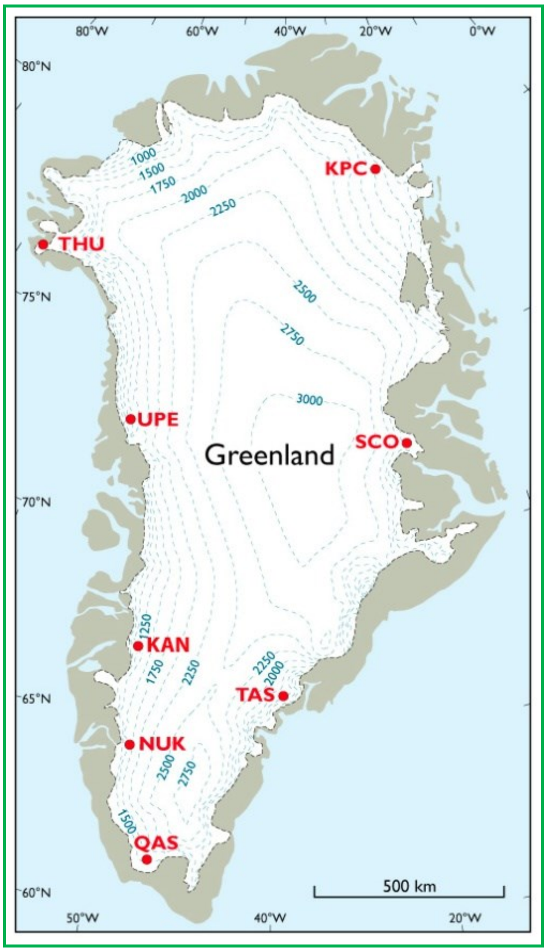
(ASIAQ) and the Danish National Space Centre at the Technical University of Denmark. The objective is to monitor the mass loss of the Greenland Ice sheet.

The monitoring programme includes:

1. An extensive network of eight automatic weather stations (AWSs) in the ice sheet surface in proximity of the ice sheet margin (see figure 8.3). The stations measure the climate parameters and the surface melt.
2. Repeated airborne surveys of the entire ice margin to obtain surface elevation and ice thickness (2007 and 2011).
3. An ongoing effort to determine ice sheet surface velocity from satellite radar data and in situ GPS.
4. Modelling of the surface melt and dynamic mass loss of the Greenland ice sheet.
5. Regular mapping of area and elevation to determine mass loss of individual glaciers and ice caps surrounding the ice sheet.
6. Maintenance of an open-access database (www.promice.org).

FIGURE 8.3 LOCATION AND IDENTIFICATION CODES OF PROMICE AUTOMATIC WEATHER STATIONS. DOTTED LINES ARE ELEVATION CONTOURS IN M ABOVE SEA LEVEL.

Source: Geological Survey of Denmark and Greenland



GEUS also operates the GlacioBasis monitoring programme of the A.P. Olsen ice cap within the GEM (Greenland Ecosystem Monitoring) framework, which is a comprehensive environmental long-term monitoring programme at Zackenberg in Northeast Greenland. The programme is funded by the Danish Ministry of the Climate, Energy and Building through the DANCEA programme.

Other programmes related to the PROMICE monitoring are:

- Participation in the worldwide effort to monitor land ice masses, Global Land Ice Measurements from Space – GLIMS. Within this framework, GEUS acts as the GLIMS Regional Centre for Greenland (RC1) and formally coordinates the GLIMS activities in Greenland through contact with regional stewards working in different parts of Greenland. GEUS actively works to submit data to the GLIMS database within PROMICE.

- Involvement in the European Space Agency (ESA) projects GlobGlacier (global ice extent), ESA Climate Change Initiative Ice Sheets (ice velocities and surface elevation changes) and CryoClim (surface types), The Nordic Centre of Excellence - Stability and Variations of Arctic Land Ice (SVALI) and the Greenland Climate Research Centre project Impact of Glaciers near the Coast (IMGLACO).

8.3.6 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.

From 2000 to 2005, in cooperation the Latvian Hydrometeorological Agency DMI developed an operational system for monitoring degree-days in Latvia. The project was supported by the Danish Energy Agency.

From 2009 to 2013 twinning activities between Danish Meteorological Institute (DMI) and Zambia Meteorological Department (ZMD) were carried out. At the initiative and support of the Royal Danish Embassy in Zambia, DMI helped ZMD to address the challenges at the ZMD in climate monitoring/modelling as well as in the dissemination of weather/climate products.

In the period 2013 to 2014 DMI will provide meteorological consultancy services for the national water sector reform studies for Gambia. The project is supported by the African Development Bank/African Water Facility.

From 2012 to 2014 DMI will participate in a climate-adaption project in West Africa to optimize the observation network, strengthen the capabilities for data management and analysis, improve processing and analysis of satellite data, improve hydro-meteorological forecasts, develop climate scenarios and update communication strategies. The project is being supported by the Danish Development Assistance Programme (Danida).

9
Education, training and public awareness

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 2011, the new government published its government platform which included new objectives for Denmark's strategy for sustainable development and Denmark's climate policy on both mitigation efforts and adaptation to a changing climate. The concrete follow-up of these objectives involves both the parliament and the public through openness about strategies, 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 change, 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 Climate, Energy and Building (www.kebmin.dk), the Danish Energy Agency (www.ens.dk), the Danish Meteorological Institute (www.dmi.dk), the Geological Survey of Denmark and Greenland (www.geus.dk) and on the websites of other relevant ministries and the institutions such as the Ministry of Finance (www.fm.dk), the Ministry of Transport (www.trm.dk), the Ministry of Food, Agriculture and Fisheries (www.fvm.dk), the Ministry of Taxation (www.skm.dk) and the Ministry of Foreign Affairs (www.um.dk).

In 2008 and 2009, numerous new initiatives on education, training and public awareness regarding climate change issues were taken with a view to support Denmark's role as host for the 15th Conference of the Parties to the UNFCCC 7-18 December 2009 in Copenhagen. Although some of these initiatives were project-based and limited in time, several of the initiatives continue now as part of the ordinary curricula in elementary schools, secondary school, high schools and at universities.

9.1 Education and postgraduate education programmes

9.1.1 Primary and lower secondary education

Information on climate change and sustainable development in general for teachers involved in primary and lower secondary education is available on several web-sites. On a web-site under the Ministry og Education a collection of relevant links can be found (http://ubu.emu.dk/).

Among the most recent and specialist dedicated web-sites targeted at elementary school are "the ice school" (http://www.isskolen.dk/) and "the new Arctic" (http://www.detnyearktis.dk/). "The ice school" offers complete e-learning materials on the Greenland ice sheet for two levels (7th-10th grade, launched in 2010, and 4th-6th grade, launched in 2011). "The new Arctic" was launched in February 2013 with web-based teaching materials for 8th-9th grade. The focus is on Arctic climate change and its regional and global importance.

An introduction to climate change through a computer game for 7th-10th grade is available at the web-site of the Danish science communication centre "Experimentarium" (https://www.experimentarium.dk/forsiden/undervisning/paa-skolen/klimamaskinen).

9.1.2 University of Copenhagen (KU)

Education in climate is an integral part of many educational programmes at the University of Copenhagen. In September 2013, an interdisciplinary two-year MSc programme, 'Climate Change, Impacts, Mitigation and Adaptation' (CCIMA) was started, covering both natural, environmental and social science aspects of climate change (http://studies.ku.dk/masters/climate-change/). The programme includes 16 courses, offered by departments from the Faculties of Science, Social Science and Health, and covering topics from geophysics to political science. All major climate change research groups at KU contribute to teaching, giving the programme a strong research base. Collaboration with other universities, such as DTU, and research organisations, such as DMI, has been established to ensure the strongest possible research basis of the programme. Students may either follow the programme, leading to a 'MSc in Climate Change', or select individual courses as part of other MSc programmes. In its first year the programme has attracted 25 students from six European countries.

Other educational programmes with focus on climate are:

- EnvEuro, a two-year Master in Environmental Science, offered by the University of Copenhagen and three other leading European universities. The MSc is focused on soil, water and biodiversity and features an introduction to environmental science, six different specialisations, and finally a Master's thesis in environmental science (http://www.enveuro.eu/).

- E-learning course in Climate Change Impacts, Adaptation and Mitigation offered by the University of Copenhagen in close cooperation with the Danish Meteorological Institute, UC Berkeley and Australian National University. Focus of the course is climate change impacts and the human response to climate change. The course has been developed by a team of teachers who are international experts within their respective disciplines, including four members of the Intergovernmental Panel on Climate Change (IPCC). Through distance learning the course can be followed from anywhere in the world and it is open for MSc students and continuing education students with a relevant BSc background in natural science, social science and economics (www.climate-change.dk).

- Global Environmental Governance (GEG) is a cross-faculty specialization, aiming to equip students with interdisciplinary skills which will assist them in dealing with global environmental governance in an international and/or national context. Focus is on the global and international levels of governance, but with a view to how these levels interact with the regional and local levels.

- Summer schools are annually offered by the University of Copenhagen within the area of climate change, and often in collaboration with other universities within IARU (http://klima.ku.dk/sommerskoler).

The universities disseminate widely the results of research, with the portals http://climate.ku.dk/ and http://climate.ku.dk/research/ as the main entry points. Here, 12 key areas of climate research are listed, including areas of study and contact persons. At the faculty/institute level, a wealth of climate activities within research and education are disseminated, e.g. the Niels Bohr Institute's activities at the website http://www.fys.ku.dk/hco/presse/Formidling2002.htm and the Faculty of Life Sciences (http://www.life.ku.dk/forskning/Klimaforskning.aspx).

9.1.3 Aarhus University (AU)

There are climate related education programmes at all the faculties. For example there are courses related to the understanding of the climate system and mechanisms of climate change, agricultural production and the impact of this on the climate, courses on tropical ecosystems, management and development, global food production and climate change, global management and manufacturing, and environmental economics and climate change. Climate regulation at UN, EU and national levels (and associated lobbyism) is a key issue in the Master in Environment and Energy Law (MEEL). The degree is offered at Aarhus University in cooperation with the University of Copenhagen and the University of Southern Denmark.

The AU Department of Education participates in the International Alliance of Leading Education Institute, which has conducted joint research on the role of education in relation to climate change and sustainable development. A new Regional Centre of Expertise on Education for Sustainable Development (RCE) under the United Nations has been established at this part of the university.

Climate change issues are highly integrated in the MSc programme on Agroenvironmental Management at Faculty of Sciences and Technology, which contains a course on Carbon Cycling and Climate Change. Climate change is also highly integrated in the SAFE PhD school and the STAiR international research education programme at AU.

Aarhus School of Business (ASB) (since 2011 under Faculty of Business and Social Sciences) at Aarhus University has set strategic focus on “sustainable growth through innovation” in research, education, communication and cooperation with the business community. More than 50 researchers are working with issues such as regulatory challenges, climate economics, strategies and business models, user behaviour, sustainable supply chain and logistics, responsible investment, CSR etc.

A BScB in Sustainability and a BScB in environmental law have been developed and an international full-time MBA with focus on sustainability and leadership was started in 2010. ASB is part of the MEEL programme mentioned above. ASB has signed up for the UN Global Compact programme and the UN Principles for Responsible Management Education (PRME) and these principles will be integrated in all programmes in future years. The project is communicated at a special webportal at www.asb.dk and a variety of dissemination and networking initiatives have been planned.

In addition Aarhus University carries out a considerable amount of public outreach, including numerous lectures at high schools and primary schools and for the general public. Courses on climate have been organised for school teachers and journalists, and AU has also presented number of papers for the general public, which may be used as teaching material.

9.1.4 Technical University of Denmark (DTU)

The climate change challenge and climate change technologies are addressed as an integrated part of a broad range of MSc and PhD programmes at DTU, which is a university with a leading force within the technical and natural sciences. In addition, DTU offers specific MSc programmes within wind energy, sustainable energy and environmental engineering.

Since 2010, DTU has organised an annual “GRØN DYST” (Green challenge) student conference and competition on sustainability, environment and climate change. More than 400 students from DTU and its international partner universities compete on a display of climate friendly technologies.

DTU is the co-founder of a number of strategic international university alliances where the partners collaborate on projects within research, innovation, and education: all characterised by a strong focus on green technology and sustainable energy

Nordic Five Tech (www.nordicfivetech.org)

The Nordic Five Tech university alliance brings together the five leading technical universities in the Nordic countries; Aalto University (Helsinki), Chalmers, (Gothenburg), DTU (Lyngby) KTH (Stockholm), and NTNU (Trondheim), featuring five Nordic universities with very strong competences within sustainable energy and environmental engineering, The alliance has developed special programmes and services for its more than 60,000 engineering students; among these six joint master programmes supported by the Nordic Council of Ministers, Programmes of particular relevance to climate change are:

- Nordic Master in Innovative Sustainable Energy Engineering
- Nordic Master in Environmental Engineering
- Nordic Master in Sustainable Urban Transitions

In addition, a PhD summer school was held in 2013 within the area of biofuels.

EuroTech Universities (www.eurotech-universities.org)

The EuroTech University Alliance brings together four of the leading technical universities in Europe: EPFL (Lausanne), DTU (Lyngby), TUM (Munich), and TU/e (Eindhoven). The mission of the alliance is to deliver technical solutions to the grand challenges of society, The alliance has strong focus on research, research education and career pathways for young researchers.

The alliance partners have established the European Graduate School for Sustainable Energy offering annual summer schools, supervision of MSc thesis work and networks for young researchers.

In 2012, the alliance launched a Green Tech pilot scheme with three joint research projects within Energy Efficient Buildings and Communities, Interface Science Photovoltaics and Wind. Cornerstones in the projects are co-supervision of co-financed PhDs and Postdocs, supervision of MSc projects, summer and winter schools.

Within the alliance, DTU offers a number of 1:1 MSc programmes. Of these, two are of particular relevance to climate change: the DTU-TUM and the DTU-EPFL 1:1 MSc programmes in Environmental Engineering.

KAIST, Korean Advanced Institute of Science and Technology

Since 2010, DTU and KAIST have collaborated on a range of joint projects within research and education.

In 2011, a joint Green Tech research centre was established – an initiative that now comprises a portfolio of MoUs for research collaboration in fields such as: Biosustainability, Integrated Water Technology, Off Shore Wind Turbine systems, Battery Research and Development, Biorefinery and Fuel cells. The projects include PhD projects and PhD student mobility.

EERA, European Energy Research Alliance

In this framework, fifteen leading European Research Institutes have taken up the challenge to found a European Energy Research Alliance (EERA). The key objective of the EERA is to accelerate the development of new energy technologies by conceiving and implementing Joint Research Programmes in support of the SET-Plan pool and integrate activities and resources, combining national and Community sources of funding and maximising complementarities and synergies

SEEIT, Sustainable Energy Education, Innovation and Technology

SEEIT is a European strategic partnership for sustainable energy education, innovation and technology, driven by the need and potential of a sustainable, low-carbon economy and inspired by the SET Plan in the formulation of its objectives and goals (Strategic Energy Technology Plan).

The members of the partnership are Aalto University, Copenhagen Business School, DTU, TU Delft, NTNU, ISE Fraunhofer, TU München, ALU Freiburg, SINTEF, Politecnico di Torino and ENEA.

The mission of the partnership is to develop new and integrated approaches to Innovation and Education in sustainable energy.

The partnership organises research workshops within areas of sustainable energy such as wind energy, photovoltaics and solar energy, and since 2012 the partnership has offered an Erasmus Mundus Wind Energy Masters, co-ordinated by TU Delft in collaboration with Oldenburg, NTNU, and DTU.

SEEIT also collaborates on e-learning (”Virtual Campus Hub” - FP7 Infrastructures) and contributes to EC level Expert Groups to develop the European Energy Education and Training initiative (SET Plan initiative).

ECRA, European Climate Research Alliance

DTU is a member of the Executive Committee of the European Climate Research Alliance which brings together leading research institutions in Europe with the aim to strengthen, expand and optimise EU climate research capabilities through the sharing of world-class national facilities in Europe and the collaborative realisation of pan-EU programmes. National and European Climate change research programmes have to be streamlined and coordinated, in order to ensure optimum use of human resources, modelling capacities, field activities, and infrastructures, maximising therefore the impact of scientific results and reinforcing the European Research Area for climate change science.

9.1.5 Roskilde University, ENSPAC

Bachelor studies in natural and social sciences, humanities and technologies at Roskilde University, ENSPAC contain climate-related components. Climate science, climate policy modules, energy production and the social dynamics behind such issues are included in the master studies in technological and socioeconomic planning (Teksma), Geography and in ENSPAC's new two-year multi-disciplinary, international master's programme in Environmental Risk. Optional courses in the fields of environment and energy with climate-related contents are available to students of these subjects.

In collaboration with other Danish PhD schools, Roskilde University, ENSPAC, organises a quarter-semester interdisciplinary PhD course on climate science and climate policy: The physical science, impact and adaptation, mitigation and institutions. Climate-change impacts are also important in relation to the GESS PhD programme, which focuses on how natural stresses (e.g., drought, temperature extremes, diseases) and stress deriving from human activities (e.g., toxic chemicals, habitat destruction) impact ecological systems, as well as in the SST PhD programme relating to questions of technology, regulation and changes in everyday practices in mobility.

9.1.6 Danish Meteorological Institute (DMI)

Members of DMI staff give lectures to high-school students, teachers, researchers and others. For instance, since 1998 staff members have been taking part in annual national events such as the Danish Science Festival and the Festival of Research, giving lectures around Denmark. 100,000 people take part in the festival’s events and activities each year. Furthermore, primary/lower secondary and upper secondary students take part in special science training programmes in the Science Festival periods. In 2012, 36% of primary schools and 58% of high-schools participated in the Danish Science Festival. For further information, visit http://www.formidling.dk/sw8773.asp and http://forsk.dk/forskningens-dogn/in-english.

DMI presents general information material on www.dmi.dk, offering both current news, basic knowledge on climate and climate-change issues and in-depth topic themes which are widely used in Danish schools.

DMI also welcomes students from the 9th and 10th grades at state schools in Denmark to participate in a short-term work experience. The programme has a duration of one week and takes place five times a year. Among other things the students learn about climate by using an interactive climate model which is a simplefied version of real climate models.

DMI participates in the education, supervision and training of PhD students in collaboration with Danish universities in areas of climate change and related issues.

9.1.7 Ministry of Education

In 2008-2009, the Ministry of Education took a series of initiatives for primary and lower secondary education, youth education programmes and tertiary education in order to put climate on the agenda. With a series of initiatives for primary and lower secondary education, youth education programmes and relevant tertiary education from 2008 to 2010, the Danish Ministry of Education undertook a special effort to encourage pupils/students, teachers and schools to put climate change on the agenda.

The initiatives were based on five key perspectives, which have been dealt with differently depending on educational programmes, the proficiency of students and teaching context:

- Knowledge perspective - what do we know about Earth's climate and factors that affect it?
- Action and behavioural perspective - what can be done to limit global warming?
- Technology and community perspective - which technologies / production forms in existence could help limit the greenhouse effect? What are the socio-economic conditions for the spread of these technologies / production forms?
- Future Perspective – future sustainable technologies, practices and dissemination
- Socio-economic perspective - issues connected to climate change, including

  a) how will climate change and efforts to improve the climate influence economic growth?

  b) security aspects of climate and energy policy.

Although the project ended in July 2010, a learning tool database and other information is still available on the dedicated web-site (www.klimaundervisning.dk).

On the EMU - Denmark's educational website portal – information and links aiming at primary and secondary school, vocational training and education and the general upper secondary programmes are provided (see http://www.emu.dk/).

On UBUportalen (www.ubuportalen.dk, published by the Danish UNESCO National Commission, in cooperation with and funded by the Ministry of Education) references, links, articles, literature suggestions, teaching examples as well as examples of how it is possible to create different types of sustainable development can be found.

9.2 Climate information

9.2.1 Ministry of Climate, Energy and Building

The websites of the Ministry of Climate, Energy and Building (www.kebmin.dk) and of the Danish Energy Agency (www.ens.dk) 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 relevant professionals.

In accordance with the political Energy Agreement from March 2012, a special effort to develop strategic energy planning and CO_2 calculation tools for Danish municipalities has been initiated by the Danish Energy Agency. The purpose of municipal strategic energy planning (SEP) is to promote a shift towards a more flexible energy system to realize the potential for energy savings and conversion to renewable energy in the most efficient way for society. It is up to the local authorities whether they will develop strategic energy plans. On the basis of previous work and new analyses carried out in 2012 and 2013, the toolbox made available for the municipalities now contains:

- Guidelines regarding mapping methods and data collections, and
- Guidelines regarding system change analyses and scenario analyses.

Furthermore, financial support from a dedicated pool, totalling DKK 19 million for the period 2013 to 2015, is being made available for municipalities to apply for in order to promote partnerships for strategic energy planning. For the purpose of exchanging experience with green transformation through partnerships, Green Cities (http://www.greencities.dk/UK/), the Carbon 20 project (http://www.carbon20.dk/carbon20InEnglish/), Local Government Denmark (the interest group and umbrella authority for Danish municipalities, http://www.kl.dk/English/) and the Danish Energy Agency held the conference; "Green change - through partnerships" in November 2013.

The next tool planned for is further development for SEP purposes of the CO_2 calculator previously developed with support from the Ministry of Climate, Energy and Building as a tool for Danish municipalities' planning of local climate-change mitigation actions.

9.2.2 Aarhus University (AU)

DCE – Danish Centre for Environment and Energy, Aarhus University prepares regular reports about environmental issues (until June 2011 under the name of NERI). NERI Technical Report No. 401 contains an evaluation of Denmark's need and possibilities for adapting to future climate change. In connection with the report, a poster with illustrations has been published. The report is featured at 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 expected climate changes in Denmark. The report shows that rational long-term planning may prevent much damage and many effects of probable climate change. In 2009, NERI published a book – no. 16 in the series "The Environment Library" - on "Greenhouse gases – sources, inventory methodologies and international commitments"(in Danish) for use in the education sector and for the public in general. This book describes in a non-technical language how greenhouse gas inventories and projections are made. In 2010 KFT (Coordination Unit for Research in Climate Change Adaptation)/NERI hosted a conference on climate change adaptation and published the conference proceedings 'Klima & Tilpasning' (http://kft.au.dk/fileadmin/www.kft.au.dk/Publikationer/KFT_konferencemagasin2010.pdf).

AU also publishes several journals for public outreach. These journals include articles on various subjects within natural science, but climate-related subjects have a dominant role and several volumes of the journals have been dedicated to climate. In addition researchers from AU publish findings of interest to the general public in various public outreach journals as well as on the internet (e.g. www.videnskab.dk).

DCA – the Danish Centre for Food and Agriculture at AU has prepared several reports on 1) greenhouse-gas emissions from agriculture and how these emissions can be reduced, and 2) impacts of climate change on Danish and European agriculture (until 2011 under the name of DJF).

In 2012, AU researcher Jørgen Olesen published the book "Life in Europe under climate change", written in collaboration with Joseph Alcamo, UNEP.

In 2012, AU took part in the Danish delegation to the Rio+20 Summit. For that purpose, a website was created containing information on sustainability research at AU (see: http://www.au.dk/en/research/globalchallenges/).

9.2.3 University of Copenhagen

Dissemination on climate from researchers at the Niels Bohr Institute (NBI) is available on the homepage http://www.isarkiv.dk/, established with support from the Ministry of Research and Education. In addition, KU hosts 50 high school classes every year for climate lessons and view of the Greenland ice cores. On the NBI home page under http://www.nbi.ku.dk/sciencexplorer/, movies on climate an ice core drilling are available and have been accessed by more than 1 million people. Researchers from NBI have been lead authors on AMAP's assessment of the Snow, Water, Ice and Permafrost in the Arctic (SWIPA, http://www.amap.no/swipa).

9.2.4 DMI

DMI disseminates knowledge on climate issues to the general public from an extensive website at www.dmi.dk, offering both current news, basic knowledge on climate and climate-change issues and in-depth topic themes. DMI also communicates through lectures and popular articles in newspapers and trade journals, through series of reports, and at theme days (Klimaforum). Furthermore, DMI holds conferences for teachers, communicators from the business community, consultants, and journalists. DMI has translated the Summary for Policymakers of the IPCC WG-I AR5 report into Danish and the translation can be obtained at www.dmi.dk. On the annual Culture Night in Copenhagen, DMI participates with outreach activities for the general public on climate change and related issues. Finally, employees at DMI often take part in radio and TV interviews, and in interviews for the printed press.

9.2.5 GEUS

GEUS participates in a number of international research projects and groups. The PROMICE monitoring is part of the AMAP, Arctic Monitoring and Assessment Programme. In collaboration with DMI and DTU Space, a new Arctic monitoring web-site "Polar Portal" was launched in June 2013 (http://polarportal.dk/en/home/). On this web-site the Danish Arctic research institutions present updated knowledge on the condition of two major components of the Arctic: The Greenland ice sheet and the sea ice. GEUS is furthermore involved in work at the following groups or organisations:

- International Arctic Science Committee-Working Group on Arctic Glaciers (IASC),
- World Glacier Monitoring Service (WGMS),
- GlobGlacier user group (ESA),
- Global Land Ice Measurements from Space (GLIMS),
- Colorado University/CIRES station network,
- GC-Net and
- WMO.

In relation to CO_2 storage GEUS participate the following networks:

- CGS Europe,
- CO2GeoNet Association,
- EERA (European Energy Research Alliance) and
- ENeRG (European Network for Research in Geo-Energy).

9.2.6 Roskilde University, ENSPAC

Roskilde University, ENSPAC, is hosting the conference "Sunrise" that combines outreach and academia by providing a space for scientists, academics, business people, NGOs and students to meet and discuss their ideas and work related to climate, change and communication. ENSPAC also regularly convenes or co-convenes international symposia on climate impacts on water resources through its organisational involvement in ICCLAS-IAHS (International Commission of the Coupled Land Surface-Atmosphere System/International Association of Hydrological Sciences).

9.2.7 University of Greenland

Ilimmarfik Institute at Ilisimatusarfik, University of Greenland, covers social sciences and humanities. The Ilimmarfik Institute is involved in a series of activities which include focus on climate change and specific courses with focus on climate change are offered at BA and MA levels.

The Climate and Society programme

The Climate and Society programme connects Ilisimatusarfik, University of Greenland, and the Greenland Climate Research Centre (GCRC) and focuses on issues of pressing current concern for society and the environment in Greenland. The Climate and Society programme carries out research and contributes to teaching at the intersection of social science, climate science and public policy.

The Climate and Society programme complements research in the natural sciences at GCRC and the work aims to improve understanding of the interconnections between climate change, the use of natural resources, non-renewable resource development, and social-ecological systems in Greenland.

Education and communication are central activities. The Climate and Society programme is a foundation for formal educational links between GCRC and Ilisimatusarfik and the Climate and Society programme is contributing to teaching of undergraduate students and supervision of graduate students at Ilisimatusarfik at both Master's and PhD level.

The Climate and Society programme employs a professor, researchers and PhD students, and the five current main projects under the Climate and Society programme are:

- Inuit Pinngortitarlu—Nuuk Fjord Monitoring and Mapping Project.
- Climate Change and Extractive Industries.
- Kalaalimernit: Greenlandic Foods, Cultural Identity and Climate Change.
- Greenlandic Communities and Living Resources.
- Climate Change, Policy and Governance.

Major Projects

Researchers at the institute are involved in the following major projects:

- HACHTAGG (Handling Arctic climate CHange - Towards A Greener Growth) is a new international project on climate change and green growth.
- SWIPA (Snow, Water, Ice, Permafrost in the Arctic) is an international and multidisciplinary Danish lead project within the frame of Arctic Council's AMAP (Arctic Monitoring and Assessment Programme).
- SLiCA (Survey of Living Conditions in the Arctic) was an international project which looked into the living conditions for Inuit and Sami including the effects of climate change.

9.2.8 Greenland Institute of Natural Resources (GINR)

GINR advises the Government of Greenland and other authorities on sustainable exploitation of living resources and safeguarding the environment and biodiversity.

GINR is managed by a Board of Governors and a Director under the Ministry of Infrastructure, Climate and the Environment in the Government of Greenland and according to Act of Greenlandic Parliament no. 6 of 8 of June 1994 on the Greenland Institute of Natural Resources GINR is obliged to:

- provide the scientific basis for an assessment of sustainable use of the living resources in and around Greenland as well as a scientific basis for protecting the environment and securing biological diversity
- advise the Greenland Government on the work of the Institute
- publish results of its research.

Results on climate issues gathered through the ongoing research and monitoring efforts are also communicated in local and international forums.

GINR are actively participating in expert networks of the Circumpolar Biodiversity Monitoring Program (CBMP), which has been endorsed by the Arctic Council and the UN Convention on Biological Diversity.

GINR also manages the marine monitoring efforts and takes part in the terrestrial/limnic monitoring efforts of the Greenland Ecosystem Monitoring (GEM). GEM is active in national and international climate forums, representing a key Danish-Greenland collaboration on Arctic climate change.

9.3 DANISH PARTICIPATION IN INTERNATIONAL CLIMATE ACTIVITIES

9.3.1 DMI

DMI participates in a number of international research projects with support primarily from the European Commission's framework research programmes. DMI is also active in the EC Earth collaboration on global climate modelling. In addition, DMI contributes to work in the IPCC. This includes climate projections for several of the IPCC's SRES and RCP emission scenarios with a coupled atmosphere ocean model system and a regional climate model. These climate projections, which are coordinated under the WCRP CMIP5 Programme, are available for impact studies in the IPCC's scenario database and in a European scenarios database hosted at DMI. Employees at DMI have also participated in the preparation of the IPCC Assessment Reports as coordinating lead authors and contributing authors and as expert reviewers. DMI is also very active in communicating the IPCC’s reports to the public through translations and popular articles/books.

9.3.2 Aarhus University (AU)

Aarhus University participates at expert level in the IPCC.

The Department of Education at AU participates in the International Alliance of Leading Education Institute. A new Regional Centre of Expertise on Education for Sustainable Development (RCE) under the United Nations has been established at this part of the university.

DCA has contributed with a lead author to the latest IPCC assessment reports. Researchers at DCA are actively involved in European and international research on:

1) quantifying greenhouse gas emissions from agriculture,
2) assessing efficiency of agricultural mitigation measures,
3) researching impacts of climate change on agriculture in Europe and in developing countries, and
4) evaluating measures and strategies for adaptation to climate change.

The results feed into the IPCC emissions inventory guidelines and the IPCC assessment reports.

DCE/Department of Environmental Science works in different ways to popularise and communicate the content of e.g. TAR, the latest research results on climate effects, etc.

AU also takes part in numerous international networks and research projects on understanding the climate system, causes for climate change, consequences for the ice sheet and ocean circulation as well as impact on ecosystems and biodiversity.

9.3.3 Roskilde University, ENSPAC

ENSPAC participates in the "Bioenergy Promotion 2: from strategies to activities" project, which is an EU project. ENSPAC also contributes to the development of international hydrological education and research programmes (UNESCO-IHP, IAHS-Panta Rhei) addressing climate change. ENSPAC also contributes to climate education in the EU project (Intelligent Europe) Schools and Universities for Climate and Energy, and it contributes to hydro-meteorological research communication by convening and co-convening international symposia on climate impacts on water resources through its organisational involvement in ICCLAS/IAHS (International Commission on the Coupled Land Surface-Atmosphere System – International Association of Hydrological Sciences).

9.3.4 Technical University of Denmark (Risø DTU)

DTU participates at expert level in the IPCC. DTU contributes to the AR5 working group 3 and is further engaged in review activities in the IPCC.

DTU is also highly involved in the content and organisational coordination of UNEP's Emissions Gap Report; involving 44 scientific groups in 17 countries. The Emissions Gap Report gives an annual, authoritative assessment of the size of the Emissions Gap: the gap between global ambition to limit temperature increase within 2 degrees and national mitigation pledges. The annual updates are a crucial reminder about the ambition necessary to mitigate catastrophic levels of climate change. The media, NGO campaigns, negotiators and national policy makers alike use the analysis to push for higher levels of ambition.

9.3.5 University of Copenhagen

The University of Copenhagen is involved in a number of projects in relation to climate change in the tropical regions, focusing on research and outreach.

The DBL-Centre for Health Research and Development of the Department of Veterinary Disease Biology (DVDB), together with the Danish Development Research Network, Danish Water Forum and the Danish Research Network for International Health and partners from Southern Africa have facilitated the establishment of the Southern Africa Climate Change Research Network (SACCNET). SACCNET, which is a South-North network including researchers and practitioners from the African SADC region and Denmark, is addressing research and knowledge sharing on the interlinkages between climate change impacts, human health, water and food security.

KU researchers have also played an important role in the work of the IPCC. This includes work under the Department for Plant and Environmental Sciences (PLEN) in the Faculty of Science as coordinating lead author for the IPCC 5th assessment for the chapter in WG2 on food security and food production systems.

PLEN also works with impact models of agricultural crops including extreme events, methods to estimate GHG emissions and combined food and energy producing systems in agriculture. Soil-water-plant-atmosphere process understanding covering microclimate, energy and gas exchange between canopy and atmosphere is applied in the development of models (The DAISY model). PLEN has several ongoing research projects of relevance such as “Innovative cleaning technologies for production of drinking water during flooding episodes (A-WATER)”, supported by the Danish Ministry of Foreign Affairs, and teaching activities in EnvEuro (European Master in Environmental Science). A new initiative is to examine the food systems and food security of large capital cities. PLEN has also played an active role in the formation of the Joint Programming Initiative (JPI) in Food Security, Agriculture and Climate (FACCE) of the EU and the UN research facility; CCAFS.

Researchers from the Niels Bohr Institute chair the climate section of the European Geophysic Union and are members of the climate board CLiC (Climate and Cryosphere; http://www.climate-cryosphere.org/).

9.3.6 Greenland Institute of Natural Resources (GINR)

GINR is part of numerous international networks and research projects in the Arctic on the effects of climate and climate change on both terrestrial and marine ecosystems.

The GINR research spans from oceanography and biogeochemistry to macroecology, and also includes the aspect of social impacts. Through cross-disciplinary and cross-institutional efforts, GINR aims to improve the understanding of the links between climatic and ecological processes in the Arctic, and the impact of climate change on the human population in Greenland, who rely very much on the natural resources.

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 about less environmentally harmful technologies.

Annexes

Annex A1 Greenhouse gas inventories 1990-2011

This Annex contains nine tables summarising the results of the latest greenhouse gas inventories for Denmark, Greenland and the Faroe Islands 1990-2011. The tables are based on the annual report under the Climate Convention and the Kyoto Protocol from April 2013 (Nielsen et al., 2013, including the CRF).

TABLE A.1 (CRF TABLE 10S1): DENMARK'S EMISSIONS AND REMOVALS OF CARBON DIOXIDE (CO_2) IN THE PERIOD 1990-2011

TABLE A.2 (CRF TABLE 10S2): DENMARK'S EMISSIONS OF METHANE (CH_4) IN THE PERIOD 1990-2011

TABLE A.3 (CRF TABLE 10S3): DENMARK'S EMISSIONS OF NITROUS OXIDE (N_2O) IN THE PERIOD 1990-2011

TABLE A.4 (CRF TABLE 10S4): DENMARK'S EMISSIONS OF INDUSTRIAL GREENHOUSE GASES (HCFS, PFCS AND SF_6) IN THE PERIOD 1990-2011

TABLE A.5 (CRF TABLE 10S5): DENMARK'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

TABLE A.6 (CRF TABLE 10S5): GREENLAND'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

TABLE A.7 (CRF TABLE 10S5): FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

TABLE A.8 (CRF TABLE 10S5): DENMARK'S AND GREENLAND'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

TABLE A.9 (CRF TABLE 10S5): DENMARK'S, GREENLAND'S AND FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

Note references in the tables:

(1) The column "Base year" is filled with estimates for the base year under the Climate Convention which is 1990. This base year is used to calculate the percentage change in the final column of this table. Denmark's and Greenland's base year under the Kyoto Protocol was fixed in 2007 on the basis of the annual inventories reported in 2006 (see Chapter 3.5) and deviates from the base year under the Convention.

(2) Net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(3) Actual emissions estimates. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

(4) In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions are reported for each relevant chemical. Note that the unit used for this row is Gg of CO_2 equivalent and appropriate notation keys have been entered in the cells for the individual chemicals.

(5) Includes net CO_2, CH_4 and N_2O from LULUCF.

The notation keys are as follows:
"NO" : Not Occurring,
"NE" : Not Estimated,
"NA" : Not Applicable,
"IE" : Included Elsewhere and
"C" : Confidential.

TABLE A.1 (CRF TABLE 10S1.1): DENMARK'S EMISSIONS AND REMOVALS OF CARBON DIOXIDE (CO_2) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**51.567,10**	**62.069,49**	**56.223,80**	**58.531,72**	**62.484,56**	**59.280,55**	**72.491,86**	**62.994,38**	**58.952,18**	**56.372,25**
A. Fuel Combustion (Sectoral Approach)	51.242,41	61.426,51	55.560,32	57.954,56	61.914,59	58.831,09	71.998,22	62.299,42	58.437,29	55.278,41
1. Energy Industries	26.146,21	35.014,99	30.086,31	31.660,62	35.655,27	32.163,16	44.420,37	35.308,50	31.666,00	28.575,96
2. Manufacturing Industries and Construction	5.384,62	5.915,11	5.777,60	5.642,38	5.738,17	5.853,06	6.007,97	6.057,87	6.077,97	6.166,70
3. Transport	10.618,70	11.002,42	11.201,23	11.321,10	11.803,39	11.940,42	12.188,72	12.381,23	12.352,77	12.373,40
4. Other Sectors	8.973,86	9.207,30	8.354,40	9.093,34	8.465,76	8.622,56	9.205,24	8.380,99	8.136,52	7.980,00
5. Other	119,01	286,69	140,79	237,13	252,01	251,89	175,92	170,83	204,03	182,35
B. Fugitive Emissions from Fuels	324,69	642,98	663,48	577,16	569,97	449,46	493,63	694,95	514,90	1.093,84
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and Natural Gas	324,69	642,98	663,48	577,16	569,97	449,46	493,63	694,95	514,90	1.093,84
2. Industrial Processes	**1.152,16**	**1.328,76**	**1.447,10**	**1.466,42**	**1.491,69**	**1.496,33**	**1.601,60**	**1.766,30**	**1.705,28**	**1.683,15**
A. Mineral Products	1.068,76	1.246,16	1.365,59	1.382,84	1.406,09	1.404,22	1.512,28	1.678,99	1.612,77	1.592,11
B. Chemical Industry	0,80	0,80	0,80	0,80	0,80	0,80	1,45	0,87	0,56	0,58
C. Metal Production	28,45	28,45	28,45	30,97	33,50	38,56	35,19	35,01	42,19	43,04
D. Other Production	4,45	4,49	4,14	4,26	4,36	3,91	3,80	4,29	4,90	4,71
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	49,71	48,86	48,12	47,55	46,95	48,84	48,89	47,15	44,85	42,72
3. Solvent and Other Product Use	115,00	131,11	140,90	124,85	145,75	134,92	145,81	133,18	141,22	147,62
4. Agriculture										
A. Enteric Fermentation										
B. Manure Management										
C. Rice Cultivation										
D. Agricultural Soils										
E. Prescribed Burning of Savannas										
F. Field Burning of Agricultural Residues										
G. Other										
5. Land Use, Land-Use Change and Forestry(2)	**5.455,98**	**3.979,54**	**6.219,37**	**2.772,86**	**4.378,48**	**3.634,14**	**2.240,78**	**3.609,14**	**2.508,83**	**4.106,90**
A. Forest Land	118,75	-782,71	-674,52	-934,32	-757,27	-961,87	-893,99	-986,39	-988,76	-587,48
B. Cropland	5.046,48	4.475,71	6.609,89	3.427,01	4.866,14	4.362,26	2.844,85	4.269,61	3.211,18	4.446,21
C. Grassland	183,42	186,80	183,96	191,87	184,34	151,91	192,96	206,96	186,29	164,63
D. Wetlands	91,21	82,55	81,80	68,97	64,89	60,40	74,45	95,39	75,47	57,84
E. Settlements	16,13	17,19	18,25	19,32	20,38	21,44	22,51	23,58	24,64	25,70
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**18,28**	**18,65**	**19,65**	**18,25**	**18,29**	**20,11**	**20,37**	**19,30**	**18,09**	**18,91**
A. Solid Waste Disposal on Land	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling										
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other	18,28	18,65	19,65	18,25	18,29	20,11	20,37	19,30	18,09	18,91
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CO_2 emissions including net CO_2 from LULUCF	**58.308,53**	**67.527,55**	**64.050,81**	**62.914,10**	**68.518,77**	**64.566,06**	**76.500,41**	**68.522,29**	**63.325,60**	**62.328,83**
Total CO_2 emissions excluding net CO_2 from LULUCF	**52.852,54**	**63.548,01**	**57.831,44**	**60.141,25**	**64.140,29**	**60.931,92**	**74.259,63**	**64.913,15**	**60.816,76**	**58.221,94**
Memo Items:										
International Bunkers	**4.741,07**	**4.304,98**	**4.490,18**	**5.872,79**	**6.561,69**	**6.843,24**	**6.696,52**	**6.336,50**	**6.495,96**	**6.343,36**
Aviation	1.736,10	1.632,12	1.693,19	1.658,84	1.817,70	1.867,05	1.971,08	2.010,44	2.158,98	2.290,07
Marine	3.004,96	2.672,87	2.796,99	4.213,95	4.744,00	4.976,19	4.725,44	4.326,06	4.336,98	4.053,30
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	4.661,98	5.056,95	5.306,98	5.521,40	5.459,35	5.725,02	6.108,18	6.323,34	6.272,29	6.598,33

TABLE A.1 (CRF TABLE 10S1.2): DENMARK'S EMISSIONS AND REMOVALS OF CARBON DIOXIDE (CO_2) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**51.872,81**	**53.690,63**	**53.284,64**	**58.503,28**	**52.914,87**	**49.331,01**	**57.254,13**	**52.485,59**	**49.355,99**	**47.371,88**
A. Fuel Combustion (Sectoral Approach)	51.152,77	52.921,15	52.637,34	57.833,54	52.163,11	48.788,15	56.721,98	51.941,57	48.963,59	47.106,54
1. Energy Industries	25.542,00	26.841,11	27.059,80	31.780,37	25.920,34	22.720,36	30.636,34	25.999,79	23.876,78	23.789,61
2. Manufacturing Industries and Construction	5.964,59	6.053,26	5.763,19	5.695,18	5.748,05	5.460,96	5.586,16	5.394,91	4.951,07	4.002,98
3. Transport	12.172,77	12.184,50	12.281,93	12.738,23	13.047,06	13.166,00	13.544,27	14.160,93	13.928,94	13.134,68
4. Other Sectors	7.362,87	7.745,41	7.443,64	7.527,78	7.208,64	7.170,03	6.828,76	6.211,08	6.099,18	6.019,28
5. Other	110,53	96,87	88,78	91,98	239,02	270,80	126,46	174,87	107,62	159,99
B. Fugitive Emissions from Fuels	720,04	769,49	647,30	669,74	751,76	542,86	532,15	544,01	392,40	265,34
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and Natural Gas	720,04	769,49	647,30	669,74	751,76	542,86	532,15	544,01	392,40	265,34
2. Industrial Processes	**1.696,32**	**1.700,81**	**1.699,64**	**1.568,16**	**1.687,10**	**1.602,94**	**1.645,96**	**1.645,40**	**1.356,88**	**914,28**
A. Mineral Products	1.611,35	1.609,87	1.654,76	1.525,58	1.642,39	1.542,30	1.604,11	1.603,58	1.317,81	879,04
B. Chemical Industry	0,65	0,83	0,55	1,05	3,01	3,01	2,18	2,16	2,40	2,13
C. Metal Production	40,73	46,68	NA,NO	NA,NO	NA,NO	15,58	NA,NO	NA,NO	NA,NO	NA,NO
D. Other Production	3,90	4,95	4,47	4,49	3,97	4,46	2,17	1,72	2,67	1,92
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	39,70	38,49	39,86	37,03	37,73	37,59	37,49	37,94	34,01	31,19
3. Solvent and Other Product Use	149,52	135,66	159,16	151,42	152,55	175,81	156,71	157,70	143,81	151,90
4. Agriculture										
A. Enteric Fermentation										
B. Manure Management										
C. Rice Cultivation										
D. Agricultural Soils										
E. Prescribed Burning of Savannas										
F. Field Burning of Agricultural Residues										
G. Other										
5. Land Use, Land-Use Change and Forestry[(2)]	**3.203,57**	**4.537,99**	**6.019,35**	**4.754,95**	**4.386,61**	**4.682,07**	**5.649,09**	**2.557,13**	**-1.311,86**	**2.919,33**
A. Forest Land	-770,88	796,25	727,53	658,78	590,00	666,74	596,45	-2.161,68	-5.584,19	-248,69
B. Cropland	3.732,93	3.493,57	5.029,13	3.833,55	3.521,01	3.654,24	4.657,20	4.358,66	3.911,41	2.806,00
C. Grassland	158,51	156,20	159,88	163,79	169,69	202,86	235,28	219,47	238,73	226,39
D. Wetlands	56,26	64,23	74,07	69,11	75,20	114,40	114,47	93,03	72,40	83,93
E. Settlements	26,75	27,74	28,73	29,72	30,70	43,83	45,68	47,64	49,79	51,70
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**18,77**	**18,61**	**18,20**	**19,52**	**17,73**	**18,20**	**18,72**	**19,29**	**21,43**	**21,01**
A. Solid Waste Disposal on Land	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling										
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other	18,77	18,61	18,20	19,52	17,73	18,20	18,72	19,29	21,43	21,01
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CO_2 emissions including net CO_2 from LULUCF	**56.940,98**	**60.083,71**	**61.180,99**	**64.997,33**	**59.158,86**	**55.810,02**	**64.724,61**	**56.865,11**	**49.566,26**	**51.378,39**
Total CO_2 emissions excluding net CO_2 from LULUCF	**53.737,41**	**55.545,72**	**55.161,65**	**60.242,38**	**54.772,25**	**51.127,96**	**59.075,52**	**54.307,98**	**50.878,12**	**48.459,07**
Memo Items:										
International Bunkers	**6.517,37**	**5.687,38**	**4.748,86**	**4.993,98**	**4.746,12**	**4.926,34**	**5.717,96**	**5.938,91**	**5.456,82**	**3.803,02**
Aviation	2.349,78	2.383,52	2.057,98	2.140,56	2.447,44	2.573,84	2.581,47	2.646,97	2.647,44	2.316,42
Marine	4.167,59	3.303,86	2.690,89	2.853,42	2.298,68	2.352,50	3.136,50	3.291,95	2.809,37	1.486,60
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	6.899,22	7.626,43	8.128,58	9.231,20	9.969,99	10.728,27	11.109,81	12.130,78	12.332,07	12.627,48

TABLE A.1 (CRF TABLE 10S1.3): DENMARK'S EMISSIONS AND REMOVALS OF CARBON DIOXIDE (CO_2) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
1. Energy	**47.790,70**	**42.710,69**	**-17,17**
A. Fuel Combustion (Sectoral Approach)	47.433,82	42.455,18	-17,15
1. Energy Industries	23.596,03	19.738,18	-24,51
2. Manufacturing Industries and Construction	4.371,62	4.361,26	-19,01
3. Transport	13.071,96	12.715,67	19,75
4. Other Sectors	6.287,17	5.447,03	-39,30
5. Other	107,05	193,03	62,19
B. Fugitive Emissions from Fuels	356,87	255,50	-21,31
1. Solid Fuels	NA,NO	NA,NO	0,00
2. Oil and Natural Gas	356,87	255,50	-21,31
2. Industrial Processes	**828,85**	**1.010,80**	**-12,27**
A. Mineral Products	792,00	973,41	-8,92
B. Chemical Industry	2,12	2,20	174,38
C. Metal Production	NA,NO	NA,NO	-100,00
D. Other Production	1,56	2,01	-54,77
E. Production of Halocarbons and SF_6			
F. Consumption of Halocarbons and SF_6			
G. Other	33,18	33,18	-33,25
3. Solvent and Other Product Use	173,02	150,62	30,98
4. Agriculture			
A. Enteric Fermentation			
B. Manure Management			
C. Rice Cultivation			
D. Agricultural Soils			
E. Prescribed Burning of Savannas			
F. Field Burning of Agricultural Residues			
G. Other			
5. Land Use, Land-Use Change and Forestry[(2)]	**-486,86**	**-2.677,73**	**-149,08**
A. Forest Land	-4.362,35	-6.398,92	-5.488,67
B. Cropland	3.530,09	3.336,87	-33,88
C. Grassland	216,60	248,02	35,22
D. Wetlands	75,02	80,36	-11,90
E. Settlements	53,78	55,94	246,87
F. Other Land	NA,NO	NA,NO	0,00
G. Other	NE	NE	0,00
6. Waste	**18,19**	**18,21**	**-0,39**
A. Solid Waste Disposal on Land	NA,NE,NO	NA,NE,NO	0,00
B. Waste-water Handling			
C. Waste Incineration	NO	NO	0,00
D. Other	18,19	18,21	-0,39
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**0,00**
Total CO_2 emissions including net CO_2 from LULUCF	**48.323,90**	**41.212,60**	**-29,32**
Total CO_2 emissions excluding net CO_2 from LULUCF	**48.810,76**	**43.890,32**	**-16,96**
Memo Items:			
International Bunkers	**4.484,42**	**4.588,33**	**-3,22**
Aviation	2.420,92	2.492,12	43,55
Marine	2.063,50	2.096,22	-30,24
Multilateral Operations	NO	NO	0,00
CO_2 Emissions from Biomass	14.901,50	14.491,93	210,85

TABLE A.2 (CRF TABLE 10S2.1): DENMARK'S EMISSIONS OF METHANE (CH_4) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	10,55	12,01	12,50	14,78	18,31	24,57	28,72	28,72	30,16	30,51
A. Fuel Combustion (Sectoral Approach)	8,48	9,44	10,04	12,09	15,32	21,18	25,41	25,16	26,65	26,56
1. Energy Industries	0,68	1,03	1,44	3,05	6,10	11,38	14,48	13,86	15,24	15,35
2. Manufacturing Industries and Construction	0,36	0,38	0,36	0,37	0,37	0,48	0,92	0,91	1,00	0,99
3. Transport	2,29	2,38	2,40	2,38	2,37	2,29	2,21	2,15	2,07	1,96
4. Other Sectors	5,15	5,63	5,83	6,28	6,48	7,03	7,79	8,22	8,32	8,25
5. Other	0,01	0,02	0,01	0,01	0,01	0,02	0,01	0,01	0,01	0,01
B. Fugitive Emissions from Fuels	2,07	2,57	2,46	2,68	2,99	3,39	3,32	3,56	3,51	3,95
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and Natural Gas	2,07	2,57	2,46	2,68	2,99	3,39	3,32	3,56	3,51	3,95
2. Industrial Processes	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
B. Chemical Industry	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C. Metal Production	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use										
4. Agriculture	**202,00**	**203,53**	**203,80**	**206,99**	**202,11**	**201,85**	**201,51**	**197,54**	**198,64**	**192,28**
A. Enteric Fermentation	154,62	154,83	152,95	154,16	149,73	149,22	148,24	143,68	143,06	137,66
B. Manure Management	47,29	48,61	50,76	52,73	52,28	52,53	53,17	53,76	55,44	54,49
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	0,09	0,09	0,09	0,09	0,09	0,10	0,10	0,11	0,14	0,13
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0,03**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
A. Forest Land	0,03	NA,NO	0,00	NA,NO	0,00	0,00	NA,NO	NA,NO	0,00	NA,NO
B. Cropland	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO
C. Grassland	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**74,93**	**75,14**	**74,38**	**73,49**	**69,82**	**65,52**	**63,74**	**60,09**	**56,83**	**57,41**
A. Solid Waste Disposal on Land	70,37	70,44	69,53	68,50	64,65	60,45	58,28	54,24	50,88	51,12
B. Waste-water Handling	3,15	3,16	3,17	3,19	3,22	3,27	3,34	3,42	3,43	3,41
C. Waste Incineration	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other	1,40	1,54	1,68	1,81	1,94	1,80	2,12	2,43	2,52	2,88
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**287,50**	**290,69**	**290,68**	**295,26**	**290,24**	**291,94**	**293,98**	**286,35**	**285,63**	**280,20**
Total CH_4 emissions excluding CH_4 from LULUCF	**287,47**	**290,69**	**290,68**	**295,26**	**290,24**	**291,94**	**293,98**	**286,35**	**285,63**	**280,20**
Memo Items:										
International Bunkers	0,09	0,09	0,09	0,12	0,13	0,14	0,14	0,13	0,14	0,13
Aviation	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04
Marine	0,06	0,06	0,06	0,09	0,10	0,11	0,10	0,10	0,10	0,09
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

TABLE A.2 (CRF TABLE 10S2.2): DENMARK'S EMISSIONS OF METHANE (CH_4) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	30,15	31,07	30,52	30,15	30,70	28,94	28,82	26,85	26,38	24,08
A. Fuel Combustion (Sectoral Approach)	26,05	26,80	26,22	25,75	25,46	23,74	22,30	20,56	20,33	18,44
1. Energy Industries	14,63	15,54	15,12	14,40	14,08	12,45	11,54	9,63	10,16	8,88
2. Manufacturing Industries and Construction	1,21	1,25	1,16	1,12	1,13	0,99	0,87	0,64	0,70	0,66
3. Transport	1,84	1,72	1,62	1,54	1,44	1,32	1,22	1,11	0,95	0,81
4. Other Sectors	8,36	8,27	8,32	8,69	8,80	8,96	8,67	9,17	8,51	8,08
5. Other	0,01	0,01	0,00	0,00	0,01	0,01	0,01	0,01	0,00	0,01
B. Fugitive Emissions from Fuels	4,10	4,27	4,30	4,40	5,23	5,21	6,51	6,29	6,06	5,65
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and Natural Gas	4,10	4,27	4,30	4,40	5,23	5,21	6,51	6,29	6,06	5,65
2. Industrial Processes	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
B. Chemical Industry	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C. Metal Production	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use										
4. Agriculture	**192,76**	**197,24**	**196,94**	**195,60**	**193,08**	**192,54**	**191,47**	**195,26**	**195,52**	**195,01**
A. Enteric Fermentation	136,25	138,61	136,75	134,91	131,09	130,33	130,47	133,57	134,78	134,42
B. Manure Management	56,39	58,50	60,09	60,56	61,85	62,07	60,85	61,57	60,63	60,45
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	0,13	0,13	0,11	0,13	0,14	0,14	0,14	0,13	0,12	0,14
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0,00**	**0,00**	**0,00**	**0,00**	**0,03**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
A. Forest Land	NA,NO	NA,NO	NA,NO	NA,NO	0,03	NA,NO	0,00	NA,NO	NA,NO	NA,NO
B. Cropland	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO
C. Grassland	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**57,16**	**56,68**	**53,53**	**54,25**	**48,75**	**47,63**	**49,27**	**47,51**	**45,72**	**44,13**
A. Solid Waste Disposal on Land	50,58	50,27	46,93	47,45	42,15	40,79	42,23	40,05	38,59	36,75
B. Waste-water Handling	3,52	3,54	3,49	3,56	3,51	3,54	3,53	3,55	3,56	3,59
C. Waste Incineration	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other	3,06	2,87	3,11	3,25	3,08	3,31	3,50	3,91	3,57	3,80
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**280,08**	**284,99**	**280,99**	**280,01**	**272,55**	**269,12**	**269,56**	**269,61**	**267,62**	**263,22**
Total CH_4 emissions excluding CH_4 from LULUCF	**280,08**	**284,99**	**280,99**	**280,01**	**272,52**	**269,12**	**269,56**	**269,61**	**267,62**	**263,22**
Memo Items:										
International Bunkers	0,14	0,09	0,07	0,08	0,07	0,07	0,09	0,09	0,08	0,05
Aviation	0,04	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
Marine	0,09	0,08	0,06	0,07	0,05	0,06	0,07	0,08	0,07	0,04
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

TABLE A.2 (CRF TABLE 10S2.3): DENMARK'S EMISSIONS OF METHANE (CH_4) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
1. Energy	26,03	23,01	118,11
A. Fuel Combustion (Sectoral Approach)	20,70	17,73	109,18
1. Energy Industries	11,08	9,32	1.276,24
2. Manufacturing Industries and Construction	0,67	0,62	69,76
3. Transport	0,73	0,64	-71,80
4. Other Sectors	8,22	7,14	38,82
5. Other	0,00	0,01	14,20
B. Fugitive Emissions from Fuels	5,33	5,28	154,64
1. Solid Fuels	NA,NO	NA,NO	0,00
2. Oil and Natural Gas	5,33	5,28	154,64
2. Industrial Processes	**IE,NA,NO**	**IE,NA,NO**	**0,00**
A. Mineral Products	IE,NA	IE,NA	0,00
B. Chemical Industry	NA,NO	NA,NO	0,00
C. Metal Production	NA,NO	NA,NO	0,00
D. Other Production			
E. Production of Halocarbons and SF_6			
F. Consumption of Halocarbons and SF_6			
G. Other	NA	NA	0,00
3. Solvent and Other Product Use			
4. Agriculture	**198,31**	**197,66**	**-2,15**
A. Enteric Fermentation	136,28	135,25	-12,52
B. Manure Management	61,93	62,30	31,74
C. Rice Cultivation	NO	NO	0,00
D. Agricultural Soils	NA,NE	NA,NE	0,00
E. Prescribed Burning of Savannas	NA	NA	0,00
F. Field Burning of Agricultural Residues	0,10	0,10	13,53
G. Other	NA	NA	0,00
5. Land Use, Land-Use Change and Forestry	**0,00**	**0,00**	**-97,59**
A. Forest Land	NA,NO	NA,NO	-100,00
B. Cropland	IE,NO	IE,NO	0,00
C. Grassland	0,00	0,00	702,13
D. Wetlands	NE,NO	NE,NO	0,00
E. Settlements	NE,NO	NE,NO	0,00
F. Other Land	NA,NO	NA,NO	0,00
G. Other	NE	NE	0,00
6. Waste	**41,79**	**40,92**	**-45,38**
A. Solid Waste Disposal on Land	34,29	33,28	-52,70
B. Waste-water Handling	3,59	3,62	14,99
C. Waste Incineration	0,00	0,00	38,56
D. Other	3,91	4,02	185,86
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**0,00**
Total CH_4 emissions including CH_4 from LULUCF	**266,13**	**261,59**	**-9,01**
Total CH_4 emissions excluding CH_4 from LULUCF	**266,13**	**261,59**	**-9,00**
Memo Items:			
International Bunkers	0,06	0,06	-34,27
Aviation	0,01	0,01	-65,47
Marine	0,05	0,05	-19,00
Multilateral Operations	NO	NO	0,00
CO_2 Emissions from Biomass			

TABLE A.3 (CRF TABLE 10S3.1): DENMARK'S EMISSIONS OF NITROUS OXIDE (N_2O) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**1,04**	**1,17**	**1,14**	**1,16**	**1,19**	**1,19**	**1,35**	**1,28**	**1,23**	**1,22**
A. Fuel Combustion (Sectoral Approach)	1,04	1,16	1,13	1,15	1,19	1,19	1,34	1,27	1,22	1,21
1. Energy Industries	0,27	0,35	0,32	0,34	0,38	0,36	0,49	0,42	0,38	0,38
2. Manufacturing Industries and Construction	0,17	0,19	0,19	0,17	0,16	0,15	0,15	0,15	0,15	0,14
3. Transport	0,36	0,37	0,39	0,40	0,42	0,44	0,46	0,47	0,47	0,47
4. Other Sectors	0,23	0,24	0,23	0,24	0,23	0,23	0,23	0,22	0,21	0,21
5. Other	0,00	0,01	0,00	0,01	0,01	0,01	0,01	0,00	0,01	0,01
B. Fugitive Emissions from Fuels	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,00	0,01
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and Natural Gas	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,00	0,01
2. Industrial Processes	**3,36**	**3,08**	**2,72**	**2,56**	**2,60**	**2,92**	**2,69**	**2,74**	**2,60**	**3,07**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
B. Chemical Industry	3,36	3,08	2,72	2,56	2,60	2,92	2,69	2,74	2,60	3,07
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01
4. Agriculture	**26,78**	**26,16**	**25,42**	**24,91**	**24,88**	**23,72**	**21,98**	**21,90**	**22,62**	**21,63**
A. Enteric Fermentation										
B. Manure Management	1,93	1,92	1,94	1,93	1,88	1,83	1,82	1,84	1,87	1,83
C. Rice Cultivation										
D. Agricultural Soils	24,85	24,24	23,48	22,98	23,00	21,89	20,16	20,05	20,74	19,79
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**
A. Forest Land	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05
B. Cropland	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C. Grassland	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Wetlands	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**0,38**	**0,37**	**0,34**	**0,40**	**0,42**	**0,40**	**0,35**	**0,35**	**0,36**	**0,38**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0,34	0,33	0,29	0,35	0,37	0,35	0,29	0,27	0,28	0,27
C. Waste Incineration	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other	0,04	0,04	0,05	0,05	0,05	0,05	0,06	0,07	0,08	0,11
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total N_2O emissions including N_2O from LULUCF	**31,62**	**30,84**	**29,67**	**29,08**	**29,15**	**28,28**	**26,43**	**26,31**	**26,87**	**26,36**
Total N_2O emissions excluding N_2O from LULUCF	**31,57**	**30,79**	**29,62**	**29,03**	**29,10**	**28,24**	**26,38**	**26,26**	**26,82**	**26,31**
Memo Items:										
International Bunkers	**0,25**	**0,22**	**0,23**	**0,32**	**0,36**	**0,38**	**0,37**	**0,34**	**0,35**	**0,34**
Aviation	0,06	0,06	0,06	0,06	0,06	0,06	0,07	0,07	0,08	0,08
Marine	0,19	0,17	0,18	0,27	0,30	0,31	0,30	0,27	0,27	0,26
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

TABLE A.3 (CRF TABLE 10S3.2): DENMARK'S EMISSIONS OF NITROUS OXIDE (N_2O) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**1,19**	**1,23**	**1,24**	**1,29**	**1,24**	**1,22**	**1,30**	**1,27**	**1,24**	**1,19**
A. Fuel Combustion (Sectoral Approach)	1,19	1,22	1,23	1,29	1,24	1,21	1,30	1,27	1,24	1,19
1. Energy Industries	0,36	0,37	0,38	0,42	0,37	0,33	0,39	0,34	0,33	0,33
2. Manufacturing Industries and Construction	0,15	0,14	0,14	0,13	0,13	0,13	0,14	0,13	0,13	0,11
3. Transport	0,46	0,46	0,46	0,47	0,48	0,47	0,47	0,48	0,47	0,44
4. Other Sectors	0,22	0,24	0,24	0,26	0,25	0,28	0,29	0,30	0,30	0,30
5. Other	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,01	0,00	0,01
B. Fugitive Emissions from Fuels	0,01	0,01	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and Natural Gas	0,01	0,01	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00
2. Industrial Processes	**3,24**	**2,86**	**2,50**	**2,89**	**1,71**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
B. Chemical Industry	3,24	2,86	2,50	2,89	1,71	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	0,01	0,02	0,02	0,03	0,04	0,04	0,05	0,05	0,04	0,06
4. Agriculture	**20,72**	**20,12**	**19,88**	**18,48**	**19,07**	**18,74**	**18,19**	**18,67**	**18,83**	**17,75**
A. Enteric Fermentation										
B. Manure Management	1,73	1,74	1,73	1,68	1,72	1,65	1,54	1,55	1,47	1,36
C. Rice Cultivation										
D. Agricultural Soils	18,98	18,37	18,14	16,80	17,35	17,08	16,64	17,12	17,35	16,38
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0,05**	**0,05**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**
A. Forest Land	0,05	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
B. Cropland	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C. Grassland	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Wetlands	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**0,43**	**0,40**	**0,48**	**0,41**	**0,34**	**0,38**	**0,35**	**0,40**	**0,44**	**0,37**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0,29	0,27	0,31	0,25	0,24	0,27	0,24	0,27	0,32	0,24
C. Waste Incineration	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other	0,13	0,13	0,16	0,17	0,10	0,10	0,11	0,13	0,12	0,13
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total N_2O emissions including N_2O from LULUCF	**25,63**	**24,66**	**24,16**	**23,15**	**22,45**	**20,42**	**19,93**	**20,43**	**20,59**	**19,41**
Total N_2O emissions excluding N_2O from LULUCF	**25,59**	**24,61**	**24,11**	**23,10**	**22,40**	**20,38**	**19,89**	**20,39**	**20,55**	**19,37**
Memo Items:										
International Bunkers	**0,34**	**0,29**	**0,24**	**0,25**	**0,23**	**0,24**	**0,29**	**0,30**	**0,27**	**0,17**
Aviation	0,08	0,08	0,07	0,07	0,08	0,09	0,09	0,09	0,09	0,08
Marine	0,26	0,21	0,17	0,18	0,14	0,15	0,20	0,21	0,18	0,09
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

TABLE A.3 (CRF TABLE 10S3.3): DENMARK'S EMISSIONS OF NITROUS OXIDE (N_2O) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
1. Energy	**1,22**	**1,16**	**11,66**
A. Fuel Combustion (Sectoral Approach)	1,22	1,16	11,78
1. Energy Industries	0,35	0,31	12,28
2. Manufacturing Industries and Construction	0,12	0,11	-33,76
3. Transport	0,44	0,44	22,00
4. Other Sectors	0,32	0,29	28,50
5. Other	0,00	0,01	77,88
B. Fugitive Emissions from Fuels	0,00	0,00	-32,79
1. Solid Fuels	NA,NO	NA,NO	0,00
2. Oil and Natural Gas	0,00	0,00	-32,79
2. Industrial Processes	**IE,NA,NO**	**IE,NA,NO**	**-100,00**
A. Mineral Products	IE,NA	IE,NA	0,00
B. Chemical Industry	NA,NO	NA,NO	-100,00
C. Metal Production	NO	NO	0,00
D. Other Production			
E. Production of Halocarbons and SF_6			
F. Consumption of Halocarbons and SF_6			
G. Other	NA	NA	0,00
3. Solvent and Other Product Use	0,05	0,05	1.360,91
4. Agriculture	**17,58**	**17,81**	**-33,50**
A. Enteric Fermentation			
B. Manure Management	1,36	1,30	-32,89
C. Rice Cultivation			
D. Agricultural Soils	16,21	16,51	-33,56
E. Prescribed Burning of Savannas	NA	NA	0,00
F. Field Burning of Agricultural Residues	0,00	0,00	13,53
G. Other	NA	NA	0,00
5. Land Use, Land-Use Change and Forestry	**0,04**	**0,04**	**-23,86**
A. Forest Land	0,04	0,04	-24,78
B. Cropland	0,00	0,00	120,84
C. Grassland	0,00	0,00	701,67
D. Wetlands	0,00	0,00	0,00
E. Settlements	NE,NO	NE,NO	0,00
F. Other Land	NA,NO	NA,NO	0,00
G. Other	NE	NE	0,00
6. Waste	**0,38**	**0,40**	**6,21**
A. Solid Waste Disposal on Land			
B. Waste-water Handling	0,25	0,26	-24,29
C. Waste Incineration	0,00	0,00	38,56
D. Other	0,14	0,14	278,79
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**0,00**
Total N_2O emissions including N_2O from LULUCF	**19,27**	**19,47**	**-38,44**
Total N_2O emissions excluding N_2O from LULUCF	**19,23**	**19,43**	**-38,47**
Memo Items:			
International Bunkers	**0,21**	**0,22**	**-12,29**
Aviation	0,08	0,09	44,95
Marine	0,13	0,13	-30,18
Multilateral Operations	NO	NO	0,00
CO_2 Emissions from Biomass			

TABLE A.4 (CRF TABLE 10S4.1): DENMARK'S EMISSIONS OF INDUSTRIAL GREENHOUSE GASES (HFCS, PFCS AND SF_6) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
Emissions of HFCs[3] - (Gg CO_2 equivalent)	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**93,93**	**134,53**	**217,73**	**329,30**	**323,75**	**411,20**	**504,04**
HFC-23	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-32	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00	0,00
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-43-10mee	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-125	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,01	0,02	0,02	0,03
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-134a	NA,NO	NA,NO	NA,NO	0,07	0,10	0,15	0,20	0,17	0,21	0,23
HFC-152a	NA,NO	NA,NO	NA,NO	0,03	0,05	0,04	0,03	0,02	0,01	0,04
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-143a	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,01	0,01	0,02	0,03
HFC-227ea	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed HFCs[4] - (Gg CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Emissions of PFCs[3] - (Gg CO_2 equivalent)	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**0,05**	**0,50**	**1,66**	**4,12**	**9,10**	**12,48**
CF_4	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_2F_6	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_3F_8	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00	0,00	0,00
C_4F_{10}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
$c\text{-}C_4F_8$	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_5F_{12}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed PFCs[4] - (Gg CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Emissions of SF6[3] - (Gg CO_2 equivalent)	**44,45**	**63,50**	**89,15**	**101,17**	**122,06**	**107,34**	**60,96**	**73,06**	**59,42**	**65,36**
SF_6	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00

TABLE A.4 (CRF TABLE 10S4.2): DENMARK'S EMISSIONS OF INDUSTRIAL GREENHOUSE GASES (HFCS, PFCS AND SF_6) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
Emissions of HFCs[3] - (Gg CO_2 equivalent)	**606,74**	**650,46**	**676,24**	**700,70**	**755,23**	**802,31**	**823,26**	**849,90**	**852,72**	**798,84**
HFC-23	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00
HFC-32	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,02	0,02	0,02
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-43-10mee	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-125	0,04	0,05	0,05	0,05	0,06	0,07	0,07	0,07	0,08	0,07
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-134a	0,25	0,27	0,28	0,27	0,29	0,29	0,29	0,29	0,29	0,25
HFC-152a	0,02	0,01	0,01	0,00	0,01	0,00	0,00	0,00	0,00	0,00
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-143a	0,04	0,04	0,04	0,05	0,05	0,06	0,06	0,07	0,07	0,06
HFC-227ea	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed HFCs[4] - (Gg CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Emissions of PFCs[3] - (Gg CO_2 equivalent)	**17,89**	**22,13**	**22,17**	**19,34**	**15,90**	**13,90**	**15,68**	**15,36**	**12,79**	**14,18**
CF_4	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00
C_2F_6	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_3F_8	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C_4F_{10}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
c-C_4F_8	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00
C_5F_{12}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed PFCs[4] - (Gg CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Emissions of SF6[3] - (Gg CO_2 equivalent)	**59,23**	**30,40**	**25,01**	**31,37**	**33,15**	**21,75**	**35,99**	**30,35**	**31,60**	**36,69**
SF_6	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

TABLE A.4 (CRF TABLE 10S4.3): DENMARK'S EMISSIONS OF INDUSTRIAL GREENHOUSE GASES (HFCS, PFCS AND SF_6) IN THE PERIOD 1990-2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
Emissions of HFCs(3) - (Gg CO_2 equivalent)	**804,18**	**758,63**	**100,00**
HFC-23	0,00	0,00	100,00
HFC-32	0,02	0,02	100,00
HFC-41	NA,NO	NA,NO	0,00
HFC-43-10mee	NA,NO	NA,NO	0,00
HFC-125	0,07	0,07	100,00
HFC-134	NA,NO	NA,NO	0,00
HFC-134a	0,27	0,26	100,00
HFC-152a	0,00	0,00	100,00
HFC-143	NA,NO	NA,NO	0,00
HFC-143a	0,06	0,06	100,00
HFC-227ea	NA,NO	NA,NO	0,00
HFC-236fa	NA,NO	NA,NO	0,00
HFC-245ca	NA,NO	NA,NO	0,00
Unspecified mix of listed HFCs(4) - (Gg CO_2 equivalent)	NA,NO	NA,NO	0,00
Emissions of PFCs(3) - (Gg CO_2 equivalent)	**13,27**	**11,06**	**100,00**
CF_4	0,00	0,00	100,00
C_2F_6	NA,NO	NA,NO	0,00
C_3F_8	0,00	0,00	100,00
C_4F_{10}	NA,NO	NA,NO	0,00
c-C_4F_8	0,00	0,00	100,00
C_5F_{12}	NA,NO	NA,NO	0,00
C_6F_{14}	NA,NO	NA,NO	0,00
Unspecified mix of listed PFCs(4) - (Gg CO_2 equivalent)	NA,NO	NA,NO	0,00
Emissions of SF6(3) - (Gg CO_2 equivalent)	**38,29**	**73,19**	**64,64**
SF_6	0,00	0,00	64,64

TABLE A.5 (CRF TABLE 10S5.1): DENMARK'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	58.308,53	67.527,55	64.050,81	62.914,10	68.518,77	64.566,06	76.500,41	68.522,29	63.325,60	62.328,83
CO_2 emissions excluding net CO_2 from LULUCF	52.852,54	63.548,01	57.831,44	60.141,25	64.140,29	60.931,92	74.259,63	64.913,15	60.816,76	58.221,94
CH_4 emissions including CH_4 from LULUCF	6.037,50	6.104,39	6.104,22	6.200,42	6.094,99	6.130,74	6.173,52	6.013,42	5.998,16	5.884,21
CH_4 emissions excluding CH_4 from LULUCF	6.036,95	6.104,39	6.104,21	6.200,42	6.094,99	6.130,73	6.173,51	6.013,41	5.998,14	5.884,21
N_2O emissions including N_2O from LULUCF	9.802,85	9.560,59	9.198,51	9.015,59	9.037,15	8.768,00	8.191,81	8.156,08	8.328,79	8.171,57
N_2O emissions excluding N_2O from LULUCF	9.786,38	9.544,76	9.182,85	9.000,12	9.021,87	8.752,90	8.176,90	8.141,35	8.314,22	8.157,21
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	93,93	134,53	217,73	329,30	323,75	411,20	504,04
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	0,05	0,50	1,66	4,12	9,10	12,48
SF_6	44,45	63,50	89,15	101,17	122,06	107,34	60,96	73,06	59,42	65,36
Total (including LULUCF)	**74.193,34**	**83.256,03**	**79.442,69**	**78.325,21**	**83.907,55**	**79.790,36**	**91.257,66**	**83.092,73**	**78.132,26**	**76.966,49**
Total (excluding LULUCF)	**68.720,33**	**79.260,66**	**73.207,66**	**75.536,89**	**79.513,79**	**76.141,12**	**89.001,96**	**79.468,85**	**75.608,84**	**72.845,23**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	52.111,32	62.684,29	56.838,29	59.200,88	63.239,21	60.165,45	73.512,02	63.992,97	59.965,44	57.391,43
2. Industrial Processes	2.239,52	2.347,10	2.379,84	2.456,45	2.554,84	2.725,75	2.827,85	3.015,46	2.991,50	3.215,23
3. Solvent and Other Product Use	116,12	132,46	142,37	126,16	147,27	137,07	147,81	134,86	143,73	152,05
4. Agriculture	12.544,75	12.385,05	12.160,81	12.068,15	11.957,05	11.592,28	11.045,84	10.937,32	11.183,61	10.743,60
5. Land Use, Land-Use Change and Forestry (5)	5.473,00	3.995,37	6.235,03	2.788,32	4.393,77	3.649,24	2.255,69	3.623,88	2.523,42	4.121,26
6. Waste	1.708,62	1.711,76	1.686,35	1.685,25	1.615,41	1.520,58	1.468,44	1.388,23	1.324,56	1.342,93
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF) (5)	**74.193,34**	**83.256,03**	**79.442,69**	**78.325,21**	**83.907,55**	**79.790,36**	**91.257,66**	**83.092,73**	**78.132,26**	**76.966,49**

TABLE A.5 (CRF TABLE 10S5.2): DENMARK’S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	56.940,98	60.083,71	61.180,99	64.997,33	59.158,86	55.810,02	64.724,61	56.865,11	49.566,26	51.378,39
CO_2 emissions excluding net CO_2 from LULUCF	53.737,41	55.545,72	55.161,65	60.242,38	54.772,25	51.127,96	59.075,52	54.307,98	50.878,12	48.459,07
CH_4 emissions including CH_4 from LULUCF	5.881,62	5.984,80	5.900,76	5.880,22	5.723,60	5.651,54	5.660,70	5.661,90	5.620,01	5.527,65
CH_4 emissions excluding CH_4 from LULUCF	5.881,62	5.984,79	5.900,74	5.880,21	5.723,02	5.651,52	5.660,67	5.661,89	5.620,00	5.527,64
N_2O emissions including N_2O from LULUCF	7.946,21	7.644,13	7.488,13	7.175,32	6.959,35	6.330,24	6.178,77	6.334,52	6.383,97	6.016,31
N_2O emissions excluding N_2O from LULUCF	7.932,03	7.630,12	7.474,30	7.161,68	6.945,44	6.316,89	6.165,61	6.321,58	6.371,21	6.003,75
HFCs	606,74	650,46	676,24	700,70	755,23	802,31	823,26	849,90	852,72	798,84
PFCs	17,89	22,13	22,17	19,34	15,90	13,90	15,68	15,36	12,79	14,18
SF_6	59,23	30,40	25,01	31,37	33,15	21,75	35,99	30,35	31,60	36,69
Total (including LULUCF)	**71.452,67**	**74.415,63**	**75.293,30**	**78.804,29**	**72.646,08**	**68.629,78**	**77.439,01**	**69.757,14**	**62.467,34**	**63.772,05**
Total (excluding LULUCF)	**68.234,91**	**69.863,62**	**69.260,11**	**74.035,69**	**68.244,98**	**63.934,33**	**71.776,74**	**67.187,05**	**63.766,44**	**60.840,16**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	52.875,16	54.723,21	54.308,76	59.537,42	53.944,15	50.316,58	58.263,56	53.443,26	50.294,95	48.246,34
2. Industrial Processes	3.383,68	3.289,11	3.197,13	3.214,23	3.022,10	2.440,91	2.520,89	2.541,01	2.253,99	1.763,99
3. Solvent and Other Product Use	153,55	140,80	165,22	159,76	164,23	189,23	170,88	173,54	157,16	169,84
4. Agriculture	10.471,27	10.377,90	10.298,67	9.836,78	9.966,39	9.852,14	9.659,30	9.887,92	9.942,81	9.598,00
5. Land Use, Land-Use Change and Forestry(5)	3.217,75	4.552,00	6.033,19	4.768,60	4.401,10	4.695,44	5.662,28	2.570,09	-1.299,09	2.931,89
6. Waste	1.351,26	1.332,61	1.290,33	1.287,49	1.148,12	1.135,48	1.162,10	1.141,32	1.117,52	1.061,99
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)(5)	**71.452,67**	**74.415,63**	**75.293,30**	**78.804,29**	**72.646,08**	**68.629,78**	**77.439,01**	**69.757,14**	**62.467,34**	**63.772,05**

TABLE A.5 (CRF TABLE 10S5.3): DENMARK'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	48.323,90	41.212,60	-29,32
CO_2 emissions excluding net CO_2 from LULUCF	48.810,76	43.890,32	-16,96
CH_4 emissions including CH_4 from LULUCF	5.588,73	5.493,45	-9,01
CH_4 emissions excluding CH_4 from LULUCF	5.588,72	5.493,44	-9,00
N_2O emissions including N_2O from LULUCF	5.974,75	6.034,35	-38,44
N_2O emissions excluding N_2O from LULUCF	5.962,20	6.021,81	-38,47
HFCs	804,18	758,63	100,00
PFCs	13,27	11,06	100,00
SF_6	38,29	73,19	64,64
Total (including LULUCF)	**60.743,12**	**53.583,27**	**-27,78**
Total (excluding LULUCF)	**61.217,42**	**56.248,45**	**-18,15**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	48.716,54	43.554,23	-16,42
2. Industrial Processes	1.684,59	1.853,68	-17,23
3. Solvent and Other Product Use	187,47	166,95	43,78
4. Agriculture	9.613,86	9.671,85	-22,90
5. Land Use, Land-Use Change and Forestry (5)	-474,30	-2.665,18	-148,70
6. Waste	1.014,96	1.001,74	-41,37
7. Other	NA	NA	0,00
Total (including LULUCF) (5)	**60.743,12**	**53.583,27**	**-27,78**

TABLE A.6 (CRF TABLE 10S5.1): GREENLAND'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	625,78	611,06	596,92	546,79	496,64	535,19	598,14	619,02	598,02	595,99
CO_2 emissions excluding net CO_2 from LULUCF	625,57	610,78	596,62	546,45	496,27	534,79	597,72	618,57	597,55	595,48
CH_4 emissions including CH_4 from LULUCF	13,11	13,21	12,64	11,94	12,39	12,94	13,23	13,84	13,46	12,74
CH_4 emissions excluding CH_4 from LULUCF	13,11	13,21	12,64	11,94	12,39	12,94	13,23	13,84	13,46	12,74
N_2O emissions including N_2O from LULUCF	20,48	20,48	20,19	19,81	19,89	20,19	21,39	20,97	21,83	21,81
N_2O emissions excluding N_2O from LULUCF	20,48	20,48	20,19	19,81	19,89	20,19	21,39	20,97	21,83	21,81
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,02	0,02	0,08	0,39	0,71	1,28
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF_6	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,04	0,00	0,00	0,00	0,00
Total (including LULUCF)	**659,36**	**644,74**	**629,75**	**578,55**	**528,93**	**568,38**	**632,84**	**654,22**	**634,03**	**631,82**
Total (excluding LULUCF)	**659,15**	**644,46**	**629,44**	**578,21**	**528,57**	**567,98**	**632,41**	**653,77**	**633,56**	**631,32**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	625,68	610,81	596,58	546,18	495,72	534,38	597,46	618,20	596,68	594,70
2. Industrial Processes	0,00	0,00	0,00	0,00	0,02	0,06	0,08	0,39	0,72	1,28
3. Solvent and Other Product Use	0,26	0,26	0,26	0,26	0,28	0,28	0,21	0,26	0,27	0,31
4. Agriculture	8,78	8,85	7,98	7,03	7,66	8,19	9,37	9,41	10,05	9,46
5. Land Use, Land-Use Change and Forestry (5)	0,21	0,28	0,31	0,34	0,37	0,39	0,42	0,45	0,48	0,50
6. Waste	24,43	24,54	24,62	24,73	24,90	25,07	25,30	25,50	25,84	25,56
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF) (5)	**659,36**	**644,74**	**629,75**	**578,55**	**528,93**	**568,38**	**632,84**	**654,22**	**634,03**	**631,82**

TABLE A.6 (CRF TABLE 10S5.2): GREENLAND'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	669,36	619,86	580,87	651,78	639,88	643,84	661,90	653,16	677,60	592,18
CO_2 emissions excluding net CO_2 from LULUCF	668,83	619,25	580,79	651,05	639,04	643,19	661,27	652,21	676,74	592,02
CH_4 emissions including CH_4 from LULUCF	12,46	12,48	12,15	12,24	12,46	12,64	12,49	12,52	12,39	12,13
CH_4 emissions excluding CH_4 from LULUCF	12,46	12,48	12,15	12,24	12,46	12,64	12,49	12,52	12,39	12,13
N_2O emissions including N_2O from LULUCF	21,45	21,42	21,11	21,35	21,51	21,71	21,91	21,50	23,98	19,56
N_2O emissions excluding N_2O from LULUCF	21,45	21,42	21,11	21,35	21,51	21,71	21,91	21,50	23,98	19,56
HFCs	1,87	2,96	3,90	4,75	5,42	5,50	5,56	6,06	6,53	6,57
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF_6	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total (including LULUCF)	**705,14**	**656,73**	**618,04**	**690,13**	**679,28**	**683,69**	**701,86**	**693,24**	**720,51**	**630,44**
Total (excluding LULUCF)	**704,61**	**656,11**	**617,95**	**689,40**	**678,44**	**683,05**	**701,24**	**692,28**	**719,65**	**630,29**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	668,67	618,80	580,23	650,86	638,97	643,07	661,37	652,22	676,91	591,66
2. Industrial Processes	1,88	2,97	3,90	4,76	5,43	5,50	5,56	6,07	6,53	6,57
3. Solvent and Other Product Use	0,25	0,22	0,23	0,31	0,28	0,33	0,23	0,22	0,22	0,34
4. Agriculture	8,84	9,06	8,67	8,80	9,30	9,70	9,54	9,16	10,79	9,29
5. Land Use, Land-Use Change and Forestry(5)	0,53	0,61	0,09	0,72	0,84	0,64	0,62	0,96	0,86	0,15
6. Waste	24,97	25,05	24,91	24,67	24,47	24,45	24,54	24,61	25,21	22,43
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)(5)	**705,14**	**656,73**	**618,04**	**690,13**	**679,28**	**683,69**	**701,86**	**693,24**	**720,51**	**630,44**

TABLE A.6 (CRF TABLE 10S5.3): GREENLAND'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	**2010**	**2011**	**Change from base to latest reported year**
	CO_2 equivalent (Gg)	**CO_2 equivalent (Gg)**	**(%)**
CO_2 emissions including net CO_2 from LULUCF	679,27	725,41	15,92
CO_2 emissions excluding net CO_2 from LULUCF	677,85	724,20	15,77
CH_4 emissions including CH_4 from LULUCF	12,36	12,26	-6,45
CH_4 emissions excluding CH_4 from LULUCF	12,36	12,26	-6,45
N_2O emissions including N_2O from LULUCF	19,16	19,01	-7,16
N_2O emissions excluding N_2O from LULUCF	19,16	19,01	-7,16
HFCs	6,77	7,14	100,00
PFCs	NA,NO	NA,NO	0,00
SF_6	0,00	0,00	100,00
Total (including LULUCF)	**717,55**	**763,83**	**15,84**
Total (excluding LULUCF)	**716,13**	**762,62**	**15,70**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**2010**	**2011**	**Change from base to latest reported year**
	CO_2 equivalent (Gg)	**CO_2 equivalent (Gg)**	**(%)**
1. Energy	677,91	724,43	15,78
2. Industrial Processes	6,78	7,15	6.592.300,53
3. Solvent and Other Product Use	0,21	0,22	-15,27
4. Agriculture	9,35	8,71	-0,78
5. Land Use, Land-Use Change and Forestry [(5)]	1,42	1,21	464,46
6. Waste	21,88	22,11	-9,51
7. Other	NA	NA	0,00
Total (including LULUCF)[(5)]	**717,55**	**763,83**	**15,84**

TABLE A.7 (CRF TABLE 10S5.1): FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	667,67	648,53	638,45	528,37	533,23	539,31	559,43	555,12	598,56	640,39
CO_2 emissions excluding net CO_2 from LULUCF	667,67	648,53	638,45	528,37	533,23	539,31	559,43	555,12	598,56	640,39
CH_4 emissions including CH_4 from LULUCF	18,33	17,61	17,77	17,84	18,74	18,82	18,72	18,74	18,60	20,33
CH_4 emissions excluding CH_4 from LULUCF	18,33	17,61	17,77	17,84	18,74	18,82	18,72	18,74	18,60	20,33
N_2O emissions including N_2O from LULUCF	22,20	21,58	21,79	20,42	20,76	20,92	20,99	21,04	21,53	21,84
N_2O emissions excluding N_2O from LULUCF	22,20	21,58	21,79	20,42	20,76	20,92	20,99	21,04	21,53	21,84
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,02	0,02	0,06	0,66	1,22	3,29
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
SF_6	NA,NE,NO	NA,NE,NO	0,12	0,13	0,14	0,15	0,16	0,18	0,19	0,09
Total (including LULUCF)	**708,20**	**687,73**	**678,14**	**566,76**	**572,89**	**579,23**	**599,36**	**595,73**	**640,10**	**685,95**
Total (excluding LULUCF)	**708,20**	**687,73**	**678,14**	**566,76**	**572,89**	**579,23**	**599,36**	**595,73**	**640,10**	**685,95**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	676,16	656,56	646,66	535,13	540,11	546,44	566,68	562,45	606,47	650,29
2. Industrial Processes	NA,NE,NO	NA,NE,NO	0,12	0,13	0,16	0,18	0,22	0,83	1,41	3,38
3. Solvent and Other Product Use	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
4. Agriculture	32,04	31,16	31,36	31,51	32,61	32,62	32,45	32,44	32,22	32,28
5. Land Use, Land-Use Change and Forestry(5)	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
6. Waste	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)(5)	**708,20**	**687,73**	**678,14**	**566,76**	**572,89**	**579,23**	**599,36**	**595,73**	**640,10**	**685,95**

TABLE A.7 (CRF TABLE 10S5.2): FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	664,33	733,98	723,76	733,71	740,20	724,19	726,48	743,94	697,03	728,56
CO_2 emissions excluding net CO_2 from LULUCF	664,33	733,98	723,76	733,71	740,20	724,19	726,48	743,94	697,03	728,56
CH_4 emissions including CH_4 from LULUCF	18,76	19,03	19,15	19,10	19,27	20,03	19,73	19,64	19,38	19,17
CH_4 emissions excluding CH_4 from LULUCF	18,76	19,03	19,15	19,10	19,27	20,03	19,73	19,64	19,38	19,17
N_2O emissions including N_2O from LULUCF	22,04	22,63	22,91	23,14	23,26	23,00	23,12	23,16	22,05	23,01
N_2O emissions excluding N_2O from LULUCF	22,04	22,63	22,91	23,14	23,26	23,00	23,12	23,16	22,05	23,01
HFCs	4,35	6,93	8,69	10,21	11,40	11,20	11,66	12,09	12,39	11,61
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
SF_6	0,08	0,08	0,09	0,08	0,19	0,15	0,14	0,13	0,16	0,21
Total (including LULUCF)	**709,56**	**782,65**	**774,61**	**786,24**	**794,32**	**778,58**	**781,13**	**798,96**	**751,01**	**782,56**
Total (excluding LULUCF)	**709,56**	**782,65**	**774,61**	**786,24**	**794,32**	**778,58**	**781,13**	**798,96**	**751,01**	**782,56**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	672,68	743,00	733,14	743,29	750,21	735,08	737,43	754,78	706,75	738,86
2. Industrial Processes	4,43	7,01	8,78	10,29	11,59	11,36	11,80	12,22	12,55	11,82
3. Solvent and Other Product Use	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
4. Agriculture	32,45	32,64	32,68	32,66	32,53	32,14	31,90	31,96	31,71	31,88
5. Land Use, Land-Use Change and Forestry (5)	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
6. Waste	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)(5)	**709,56**	**782,65**	**774,61**	**786,24**	**794,32**	**778,58**	**781,13**	**798,96**	**751,01**	**782,56**

TABLE A.7 (CRF TABLE 10S5.3): FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	790,19	684,19	2,47
CO_2 emissions excluding net CO_2 from LULUCF	790,19	684,19	2,47
CH_4 emissions including CH_4 from LULUCF	19,03	18,97	3,50
CH_4 emissions excluding CH_4 from LULUCF	19,03	18,97	3,50
N_2O emissions including N_2O from LULUCF	23,57	22,19	-0,04
N_2O emissions excluding N_2O from LULUCF	23,57	22,19	-0,04
HFCs	12,12	11,75	100,00
PFCs	NA,NE,NO	NA,NE,NO	0,00
SF_6	0,17	0,16	100,00
Total (including LULUCF)	**845,08**	**737,26**	**4,10**
Total (excluding LULUCF)	**845,08**	**737,26**	**4,10**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	801,04	693,60	2,58
2. Industrial Processes	12,29	11,91	100,00
3. Solvent and Other Product Use	NA,NE	NA,NE	0,00
4. Agriculture	31,76	31,75	-0,91
5. Land Use, Land-Use Change and Forestry (5)	NA,NE	NA,NE	0,00
6. Waste	IE,NA,NE,NO	IE,NA,NE,NO	0,00
7. Other	NA	NA	0,00
Total (including LULUCF)(5)	**845,08**	**737,26**	**4,10**

TABLE A.8 (CRF TABLE 10S5.1): DENMARK'S AND GREENLAND'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	58.934,31	68.138,60	64.647,74	63.460,89	69.015,41	65.101,25	77.098,55	69.141,31	63.923,62	62.924,82
CO_2 emissions excluding net CO_2 from LULUCF	53.478,11	64.158,79	58.428,05	60.687,70	64.636,56	61.466,71	74.857,35	65.531,72	61.414,31	58.817,42
CH_4 emissions including CH_4 from LULUCF	6.050,61	6.117,60	6.116,85	6.212,36	6.107,38	6.143,68	6.186,75	6.027,25	6.011,62	5.896,95
CH_4 emissions excluding CH_4 from LULUCF	6.050,06	6.117,60	6.116,85	6.212,36	6.107,37	6.143,68	6.186,74	6.027,25	6.011,60	5.896,95
N_2O emissions including N_2O from LULUCF	9.823,33	9.581,07	9.218,70	9.035,40	9.057,04	8.788,19	8.213,20	8.177,05	8.350,62	8.193,38
N_2O emissions excluding N_2O from LULUCF	9.806,86	9.565,23	9.203,04	9.019,93	9.041,76	8.773,09	8.198,28	8.162,32	8.336,06	8.179,02
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	93,93	134,54	217,75	329,38	324,14	411,91	505,32
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	0,05	0,50	1,66	4,12	9,10	12,48
SF_6	44,45	63,50	89,15	101,17	122,06	107,37	60,96	73,07	59,42	65,36
Total (including LULUCF)	**74.852,70**	**83.900,78**	**80.072,44**	**78.903,76**	**84.436,49**	**80.358,74**	**91.890,49**	**83.746,94**	**78.766,30**	**77.598,31**
Total (excluding LULUCF)	**69.379,48**	**79.905,12**	**73.837,10**	**76.115,10**	**80.042,35**	**76.709,10**	**89.634,38**	**80.122,62**	**76.242,40**	**73.476,55**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	52.737,00	63.295,10	57.434,87	59.747,05	63.734,93	60.699,83	74.109,48	64.611,17	60.562,12	57.986,13
2. Industrial Processes	2.239,52	2.347,10	2.379,84	2.456,45	2.554,86	2.725,81	2.827,93	3.015,86	2.992,22	3.216,51
3. Solvent and Other Product Use	116,38	132,72	142,63	126,42	147,55	137,34	148,02	135,13	144,00	152,36
4. Agriculture	12.553,53	12.393,90	12.168,79	12.075,19	11.964,71	11.600,47	11.055,21	10.946,73	11.193,66	10.753,06
5. Land Use, Land-Use Change and Forestry[(5)]	5.473,22	3.995,66	6.235,34	2.788,66	4.394,13	3.649,64	2.256,12	3.624,33	2.523,90	4.121,77
6. Waste	1.733,05	1.736,30	1.710,97	1.709,99	1.640,31	1.545,65	1.493,74	1.413,74	1.350,40	1.368,49
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[(5)]	**74.852,70**	**83.900,78**	**80.072,44**	**78.903,76**	**84.436,49**	**80.358,74**	**91.890,49**	**83.746,94**	**78.766,30**	**77.598,31**

TABLE A.8 (CRF TABLE 10S5.2): DENMARK'S AND GREENLAND'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	57.610,34	60.703,57	61.761,87	65.649,11	59.798,74	56.453,86	65.386,51	57.518,27	50.243,86	51.970,57
CO_2 emissions excluding net CO_2 from LULUCF	54.406,24	56.164,96	55.742,43	60.893,43	55.411,29	51.771,15	59.736,80	54.960,18	51.554,86	49.051,09
CH_4 emissions including CH_4 from LULUCF	5.894,08	5.997,28	5.912,91	5.892,47	5.736,06	5.664,18	5.673,19	5.674,41	5.632,40	5.539,78
CH_4 emissions excluding CH_4 from LULUCF	5.894,08	5.997,27	5.912,89	5.892,45	5.735,48	5.664,16	5.673,16	5.674,40	5.632,39	5.539,77
N_2O emissions including N_2O from LULUCF	7.967,66	7.665,55	7.509,24	7.196,67	6.980,86	6.351,95	6.200,68	6.356,02	6.407,95	6.035,87
N_2O emissions excluding N_2O from LULUCF	7.953,48	7.651,54	7.495,41	7.183,03	6.966,95	6.338,59	6.187,52	6.343,07	6.395,20	6.023,31
HFCs	608,61	653,42	680,14	705,45	760,65	807,81	828,81	855,96	859,25	805,41
PFCs	17,89	22,13	22,17	19,34	15,90	13,90	15,68	15,36	12,79	14,18
SF_6	59,23	30,40	25,01	31,38	33,15	21,76	36,00	30,35	31,60	36,69
Total (including LULUCF)	**72.157,80**	**75.072,35**	**75.911,33**	**79.494,42**	**73.325,36**	**69.313,46**	**78.140,87**	**70.450,38**	**63.187,86**	**64.402,49**
Total (excluding LULUCF)	**68.939,52**	**70.519,73**	**69.878,06**	**74.725,09**	**68.923,42**	**64.617,38**	**72.477,98**	**67.879,33**	**64.486,09**	**61.470,44**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	53.543,84	55.342,01	54.888,99	60.188,28	54.583,12	50.959,64	58.924,93	54.095,47	50.971,86	48.838,00
2. Industrial Processes	3.385,56	3.292,08	3.201,04	3.218,99	3.027,53	2.446,41	2.526,45	2.547,08	2.260,52	1.770,56
3. Solvent and Other Product Use	153,79	141,02	165,45	160,07	164,50	189,56	171,11	173,76	157,38	170,18
4. Agriculture	10.480,11	10.386,96	10.307,35	9.845,59	9.975,68	9.861,84	9.668,84	9.897,08	9.953,60	9.607,29
5. Land Use, Land-Use Change and Forestry[(5)]	3.218,29	4.552,62	6.033,27	4.769,33	4.401,94	4.696,08	5.662,90	2.571,04	-1.298,23	2.932,05
6. Waste	1.376,23	1.357,66	1.315,24	1.312,16	1.172,58	1.159,93	1.186,64	1.165,93	1.142,73	1.084,42
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[(5)]	**72.157,80**	**75.072,35**	**75.911,33**	**79.494,42**	**73.325,36**	**69.313,46**	**78.140,87**	**70.450,38**	**63.187,86**	**64.402,49**

TABLE A.8 (CRF TABLE 10S5.3): DENMARK'S AND GREENLAND'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	49.003,16	41.938,01	-28,84
CO_2 emissions excluding net CO_2 from LULUCF	49.488,61	44.614,53	-16,57
CH_4 emissions including CH_4 from LULUCF	5.601,09	5.505,71	-9,01
CH_4 emissions excluding CH_4 from LULUCF	5.601,08	5.505,70	-9,00
N_2O emissions including N_2O from LULUCF	5.993,90	6.053,36	-38,38
N_2O emissions excluding N_2O from LULUCF	5.981,35	6.040,82	-38,40
HFCs	810,95	765,78	100,00
PFCs	13,27	11,06	100,00
SF_6	38,29	73,19	64,64
Total (including LULUCF)	**61.460,67**	**54.347,10**	**-27,39**
Total (excluding LULUCF)	**61.933,55**	**57.011,07**	**-17,83**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	49.394,45	44.278,66	-16,04
2. Industrial Processes	1.691,37	1.860,82	-16,91
3. Solvent and Other Product Use	187,68	167,18	43,65
4. Agriculture	9.623,21	9.680,55	-22,89
5. Land Use, Land-Use Change and Forestry (5)	-472,88	-2.663,97	-148,67
6. Waste	1.036,84	1.023,85	-40,92
7. Other	NA	NA	0,00
Total (including LULUCF)(5)	**61.460,67**	**54.347,10**	**-27,39**

TABLE A.9 (CRF TABLE 10S5.1): DENMARK'S, GREENLAND'S AND FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	59.601,98	68.787,14	65.286,19	63.989,27	69.548,64	65.640,56	77.657,97	69.696,43	64.522,18	63.565,21
CO_2 emissions excluding net CO_2 from LULUCF	54.145,78	64.807,32	59.066,51	61.216,07	65.169,80	62.006,03	75.416,77	66.086,83	62.012,87	59.457,81
CH_4 emissions including CH_4 from LULUCF	6.068,94	6.135,21	6.134,63	6.230,20	6.126,12	6.162,50	6.205,47	6.045,99	6.030,22	5.917,29
CH_4 emissions excluding CH_4 from LULUCF	6.068,39	6.135,21	6.134,62	6.230,20	6.126,11	6.162,50	6.205,46	6.045,99	6.030,19	5.917,28
N_2O emissions including N_2O from LULUCF	9.845,53	9.602,65	9.240,49	9.055,82	9.077,80	8.809,11	8.234,19	8.198,09	8.372,16	8.215,22
N_2O emissions excluding N_2O from LULUCF	9.829,06	9.586,82	9.224,84	9.040,35	9.062,51	8.794,01	8.219,27	8.183,36	8.357,59	8.200,86
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	93,93	134,56	217,78	329,44	324,80	413,14	508,61
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,05	0,50	1,66	4,12	9,10	12,48
SF_6	44,45	63,50	89,27	101,30	122,20	107,53	61,13	73,24	59,61	65,45
Total (including LULUCF)	**75.560,90**	**84.588,50**	**80.750,58**	**79.470,52**	**85.009,37**	**80.937,97**	**92.489,85**	**84.342,67**	**79.406,40**	**78.284,26**
Total (excluding LULUCF)	**70.087,68**	**80.592,85**	**74.515,24**	**76.681,86**	**80.615,24**	**77.288,34**	**90.233,74**	**80.718,34**	**76.882,50**	**74.162,50**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	53.413,16	63.951,66	58.081,53	60.282,18	64.275,04	61.246,27	74.676,16	65.173,62	61.168,59	58.636,43
2. Industrial Processes	2.239,52	2.347,10	2.379,96	2.456,58	2.555,02	2.725,99	2.828,15	3.016,69	2.993,63	3.219,89
3. Solvent and Other Product Use	116,38	132,72	142,63	126,42	147,55	137,34	148,02	135,13	144,00	152,36
4. Agriculture	12.585,57	12.425,07	12.200,15	12.106,69	11.997,32	11.633,09	11.087,66	10.979,17	11.225,88	10.785,33
5. Land Use, Land-Use Change and Forestry[(5)]	5.473,22	3.995,66	6.235,34	2.788,66	4.394,13	3.649,64	2.256,12	3.624,33	2.523,90	4.121,77
6. Waste	1.733,05	1.736,30	1.710,97	1.709,99	1.640,31	1.545,65	1.493,74	1.413,74	1.350,40	1.368,49
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[(5)]	**75.560,90**	**84.588,50**	**80.750,58**	**79.470,52**	**85.009,37**	**80.937,97**	**92.489,85**	**84.342,67**	**79.406,40**	**78.284,26**

TABLE A.9 (CRF TABLE 10S5.2): DENMARK'S, GREENLAND'S AND FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	58.274,67	61.437,55	62.485,63	66.382,82	60.538,94	57.178,05	66.112,99	58.262,21	50.940,90	52.699,13
CO_2 emissions excluding net CO_2 from LULUCF	55.070,57	56.898,94	56.466,20	61.627,14	56.151,49	52.495,34	60.463,28	55.704,12	52.251,89	49.779,65
CH_4 emissions including CH_4 from LULUCF	5.912,84	6.016,31	5.932,06	5.911,56	5.755,33	5.684,22	5.692,92	5.694,05	5.651,79	5.558,95
CH_4 emissions excluding CH_4 from LULUCF	5.912,84	6.016,30	5.932,05	5.911,55	5.754,76	5.684,20	5.692,89	5.694,04	5.651,78	5.558,94
N_2O emissions including N_2O from LULUCF	7.989,70	7.688,18	7.532,15	7.219,82	7.004,13	6.374,95	6.223,79	6.379,18	6.430,00	6.058,88
N_2O emissions excluding N_2O from LULUCF	7.975,52	7.674,17	7.518,32	7.206,18	6.990,21	6.361,59	6.210,64	6.366,24	6.417,25	6.046,32
HFCs	612,96	660,35	688,83	715,66	772,05	819,02	840,48	868,05	871,64	817,02
PFCs	17,89	22,13	22,17	19,34	15,90	13,90	15,68	15,36	12,79	14,18
SF_6	59,31	30,48	25,10	31,45	33,33	21,91	36,14	30,48	31,76	36,90
Total (including LULUCF)	**72.867,37**	**75.855,00**	**76.685,94**	**80.280,66**	**74.119,68**	**70.092,04**	**78.922,00**	**71.249,34**	**63.938,87**	**65.185,05**
Total (excluding LULUCF)	**69.649,08**	**71.302,38**	**70.652,67**	**75.511,33**	**69.717,74**	**65.395,96**	**73.259,10**	**68.678,29**	**65.237,10**	**62.253,00**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	54.216,52	56.085,01	55.622,13	60.931,57	55.333,33	51.694,72	59.662,36	54.850,25	51.678,61	49.576,86
2. Industrial Processes	3.389,98	3.299,09	3.209,82	3.229,28	3.039,11	2.457,77	2.538,25	2.559,30	2.273,07	1.782,38
3. Solvent and Other Product Use	153,79	141,02	165,45	160,07	164,50	189,56	171,11	173,76	157,38	170,18
4. Agriculture	10.512,56	10.419,60	10.340,03	9.878,25	10.008,21	9.893,98	9.700,74	9.929,04	9.985,31	9.639,17
5. Land Use, Land-Use Change and Forestry(5)	3.218,29	4.552,62	6.033,27	4.769,33	4.401,94	4.696,08	5.662,90	2.571,04	-1.298,23	2.932,05
6. Waste	1.376,23	1.357,66	1.315,24	1.312,16	1.172,58	1.159,93	1.186,64	1.165,93	1.142,73	1.084,42
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)(5)	**72.867,37**	**75.855,00**	**76.685,94**	**80.280,66**	**74.119,68**	**70.092,04**	**78.922,00**	**71.249,34**	**63.938,87**	**65.185,05**

TABLE A.9 (CRF TABLE 10S5.3): DENMARK'S, GREENLAND'S AND FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2011

GREENHOUSE GAS EMISSIONS	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	49.793,36	42.622,19	-28,49
CO_2 emissions excluding net CO_2 from LULUCF	50.278,80	45.298,71	-16,34
CH_4 emissions including CH_4 from LULUCF	5.620,12	5.524,68	-8,97
CH_4 emissions excluding CH_4 from LULUCF	5.620,11	5.524,67	-8,96
N_2O emissions including N_2O from LULUCF	6.017,47	6.075,55	-38,29
N_2O emissions excluding N_2O from LULUCF	6.004,92	6.063,01	-38,32
HFCs	823,07	777,53	100,00
PFCs	13,27	11,06	100,00
SF_6	38,46	73,35	65,01
Total (including LULUCF)	**62.305,75**	**55.084,37**	**-27,10**
Total (excluding LULUCF)	**62.778,63**	**57.748,33**	**-17,61**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	50.195,48	44.972,27	-15,80
2. Industrial Processes	1.703,66	1.872,74	-16,38
3. Solvent and Other Product Use	187,68	167,18	43,65
4. Agriculture	9.654,97	9.712,30	-22,83
5. Land Use, Land-Use Change and Forestry (5)	-472,88	-2.663,97	-148,67
6. Waste	1.036,84	1.023,85	-40,92
7. Other	NA	NA	0,00
Total (including LULUCF)(5)	**62.305,75**	**55.084,37**	**-27,10**

Annex A2 Summary of reporting of the Supplementary information under Article 7, paragraph 2, of the Kyoto Protocol in the NC6

The table below allows identifying the Kyoto Protocol elements that are allocated in different sections of the report.

Table A2-1: Summary of reporting of the Supplementary information under Article 7, paragraph 2, of the Kyoto Protocol in the NC6.

Information reported under Article 7, paragraph 2	NC6 Chapter
National systems in accordance with Article 5, paragraph 1	3.3
National registries	3.4
Information on base year, assigned amount and total greenhouse gas emission trend under the Kyoto Protocol	3.5 and 3.6
Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17	5.3
Policies and measures in accordance with Article 2	4.3
Legislative arrangements and enforcement and administrative procedures	4.2
Information under Article 10: - Art 10a (programmes to improve the quality of local emission factors, activity data and/or models which reflect the socio-economic conditions of each Party for the preparation and periodic updating of national inventories) - Art 10b (measures to mitigate climate change and measures to facilitate adequate adaptation to climate change) - Art 10c (transfer of, or access to, environmentally sound technologies, know-how, practices and processes pertinent to climate change, in particular to developing countries) - Art 10d (maintenance and the development of systematic observation systems and development of data archives to reduce uncertainties related to the climate system etc.) - Art 10e (the development and implementation of education and training programmes)	Art. 10a: 3.3 Art. 10b: 4 and 6 Art. 10c: 7 Art. 10d: 8 Art. 10e: 9
Financial resources	7

Annex A3 Supplementary information on the allowance scheme in Denmark

This Annex consists of the following three sub-annexes:

Annex A3.1: Installations covered by the Danish National Allocation Plan 2008-12.

List including overview of installations covered by the Danish implementation of the EU ETS Directive, and the size of the quota allocated to each installation for the period 2008-12.

Annex A3.2: Information on Denmark's KP 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
9. Test procedures

Annex A3.3: 2012 KP Reports contains 2012 data on:

1. Public Information on Account Information
2. Public Information on Legal Entities

Annex A.3.1

Annex A.3.1: Installations covered by the Danish National Allocation Plan 2008-12.

ID	Permit Identifier	Name of installation	Allocation 2008	Allocation 2009	Allocation 2010	Allocation 2011	Allocation 2012
2	33269315-1003039578-1832-20041001	BrÃ¸ndby Strand Fjernvarmecentral	502	501	501	501	501
3	10046769-1010771680-0293-20041001	Viborg Kraftvarme A/S	674	674	674	674	674
4	10046769-1010771699-0295-20041001	Viborg Kraftvarme A/S	978	975	975	975	975
5	10046769-1003740497-1069-20041001	Viborg Kraftvarme A/S	145079	145077	145077	145077	145077
6	64942212-1009120080-0992-20041001	Lygten VarmevÃ¦rk	502	499	499	499	499
7	64942212-1004416316-0994-20041001	Ã˜stre Varmecentral	929	925	925	925	925
8	64942212-1010415213-0995-20041001	Sundholm Varmecentral	4862	4860	4860	4860	4860
9	10411912-1002895495-0161-20041001	Hinnerup Fjernvarme	636	633	633	633	633
10	10419034-1000073954-0945-20041001	BrÃ¦dstrup TotalenergianlÃ¦g A/S	18282	18282	18282	18282	18282
11	10663210-1002899982-0102-20041001	Farum Fjernvarme, stavnsholtcentralen	2736	2732	2732	2732	2732
12	10663210-1002899994-0103-20041001	Farum Fjernvarme, Rugmarkencentralen	1597	1594	1594	1594	1594
13	11135617-1000187343-0024-20041001	Maribo VarmevÃ¦rk	0	0	0	0	0
14	11899412-1000295548-0575-20041001	VÃ¦rlÃ¸se VarmevÃ¦rk	712	712	712	712	712
15	11931316-1003272783-0298-20041001	IshÃ¸j Kommunes Varmeforsyning	229	228	228	228	228
16	12015607-1003359737-0452-20041001	Silkeborg Varme A/S - VarmevÃ¦rket Kejlstrupvej	1477	1476	1476	1476	1476
17	12015607-1010671732-0453-20041001	Silkeborg Varme A/S - FjernvarmevÃ¦rket Hostrupsgad	2903	2902	2902	2902	2902
18	12787111-1000445617-0026-20041001	OksbÃ¸l VarmevÃ¦rk	13287	13283	13283	13283	13283
19	13551472-1000584343-0249-20041001	BrÃ¸rup Fjernvarme	10831	10830	10830	10830	10830
20	15763515-1000974476-0338-20041001	Lem VarmevÃ¦rk	14107	14106	14106	14106	14106
22	16130990-1010513924-0586-20041001	Lyngvej Central	1159	1156	1156	1156	1156
23	16130990-1010513894-0587-20041001	Svendborgvej Central	2333	2333	2333	2333	2333
24	16130990-1010513908-0588-20041001	Borgmester JÃ¸rgensensvej Central	321	320	320	320	320
25	16130990-1010513932-0974-20041001	HÃ¸jvang Varmecentral	182	181	181	181	181
26	16130990-1010513975-1638-20041001	GasvÃ¦rksvej Varmecentral	8695	8691	8691	8691	8691
27	16276111-1001070704-0499-20041001	StÃ¸vring VarmevÃ¦rk	22046	22042	22042	22042	22042
28	16634972-1001133672-0987-20041001	Bjerringbro KraftvarmevÃ¦rk (motor 1-4)	36754	36750	36750	36750	36750
29	16838314-1001169236-0381-20041001	NÃ¸rre-Aaby KraftvarmevÃ¦rk A.M.B.A.	8773	8769	8769	8769	8769
30	17000888-1001201570-0265-20041001	Jetsmark EnergivÃ¦rk A.m.b.a.	15672	15668	15668	15668	15668
31	17010131-1010738926-0313-20041001	Kolding VarmevÃ¦rk Syd	1800	1800	1800	1800	1800
32	17010131-1010738888-0315-20041001	Kolding VarmevÃ¦rk Dampcentralen	602	598	598	598	598
33	17010131-1010738896-0317-20041001	Kolding VarmevÃ¦rk Skovparken	127	126	126	126	126
34	17010131-1010738934-0321-20041001	Kolding VarmevÃ¦rk Strandhuse	1900	1900	1900	1900	1900
35	17010131-1010738977-1632-20041001	Fredericia VarmevÃ¦rk, ErritsÃ¸	2170	2170	2170	2170	2170
36	17010131-1010738993-1635-20041001	NÃ¸rremarkens Kedelcentral	206	203	203	203	203
37	17010131-1010739000-1636-20041001	SÃ¸ndermarkens Kedelcentral	241	241	241	241	241
38	17256319-1001252921-0052-20041001	Bjerringbro VarmevÃ¦rk	1170	1168	1168	1168	1168
39	17310747-1001263648-1063-20041001	SÃ¸nderborg Kraftvarme I/S	72627	72624	72624	72624	72624
40	18155141-1001441676-0786-20041001	JÃ¦gerspris Kraftvarme.	15427	15427	15427	15427	15427
42	18936674-1000605248-0269-20041001	AvedÃ¸revÃ¦rket	1763673	1763671	1763671	1763671	1763671
43	18936674-1004258440-0270-20041001	DTU KraftvarmevÃ¦rk	88580	88576	88576	88576	88576

ID	Permit Identifier	Name of installation	Allocation 2008	Allocation 2009	Allocation 2010	Allocation 2011	Allocation 2012
44	18936674-1004267619-0271-20041001	HelsingÃ¸r KraftvarmevÃ¦rk	115228	115225	115225	115225	115225
45	18936674-1004267632-0272-20041001	HillerÃ¸d KraftvarmevÃ¦rk	201864	201862	201862	201862	201862
47	18936674-1007920594-0274-20041001	KyndbyvÃ¦rket	34389	34386	34386	34386	34386
48	18936674-1002105572-0277-20041001	AsnÃ¦svÃ¦rket	1765318	1765314	1765314	1765314	1765314
49	18936674-1002982001-0278-20041001	StigsnÃ¦svÃ¦rket	389526	389524	389524	389524	389524
50	18936674-1004267723-0279-20041001	Slagelse KraftvarmevÃ¦rk	0	0	0	0	0
51	18936674-1003922902-0280-20041001	MasnedÃ¸vÃ¦rket	306	302	302	302	
52	18936674-1003253755-0330-20041001	AmagervÃ¦rket	1250995	1250992	1250992	1250992	1250992
53	18936674-1003256274-0331-20041001	H.C. Ã˜rstedsvÃ¦rket	318976	318974	318974	318974	318974
54	18936674-1003253883-0332-20041001	SvanemÃ¸llevÃ¦rket	332663	332659	332659	332659	332659
55	18936674-1004267711-0426-20041001	Ringsted KraftvarmevÃ¦rk	30380	30376	30376	30376	30376
56	18936674-1010717341-0736-20041001	KÃ¸ge KraftvarmevÃ¦rk	3125	3123	3123	3123	3123
57	18936674-1005231580-1494-20041001	Maribo-SakskÃ¸bing KraftvarmevÃ¦rk	79	77	77	77	77
58	19201414-1001510235-0346-20041001	LÃ¸gstÃ¸r FjernvarmevÃ¦rk.	11059	11055	11055	11055	11055
59	19739112-1002997847-0967-20041001	SakskÃ¸bing Fjernvarme	246	246	246	246	246
60	19854418-1003317001-0407-20041001	Otterup Kommunale Fjernvarmeforsyning	275	273	273	273	273
61	25580230-1010775449-0124-20041001	Frederikssund KraftvarmevÃ¦rk	34400	34398	34398	34398	34398
62	25580230-1010775414-1731-20041001	DTU Kedelcentral	2868	2864	2864	2864	2864
63	20245417-1001521893-0038-20041001	Ã˜stervrÃ¥ VarmevÃ¦rk	6528	6525	6525	6525	6525
64	21445711-1001535455-1068-20041001	SmÃ¸rum Kraftvarme.	20561	20559	20559	20559	20559
65	22113410-1003007911-0505-20041001	Svendborg Fjernvarmecentral	2717	2716	2716	2716	2716
66	22113410-1003007923-0506-20041001	Svendborg Fjernvarmecentral	1505	1504	1504	1504	1504
67	22703714-1003010765-0088-20041001	Ebeltoft FjernvarmevÃ¦rk	0	0	60	60	60
68	25453506-1004368727-1042-20041001	Silkeborg KraftvarmevÃ¦rk	226802	226802	226802	226802	226802
69	DK-10153158-1005171544-0251-20041001	Vattenfald, FynsvÃ¦rket	1331051	1331048	1331048	1331048	1331048
70	10153158-1003065199-0257-20041001	GrenÃ¥ KraftvarmevÃ¦rk	78752	78749	78749	78749	78749
71	10153158-1003065217-0259-20041001	DONG Energy Generation A/S, StudstrupvÃ¦rket	1574675	1574675	1574675	1574675	1574675
72	10153158-1003050386-0282-20041001	DONG Energy Generation A/S, SkÃ¦rbÃ¦kvÃ¦rket	653087	653085	653085	653085	653085
73	10153158-1008477988-0288-20041001	DONG Energy Generation A/S, HerningvÃ¦rket	176939	176936	176936	176936	176936
74	25460715-1010337603-0290-20041001	RingkÃ¸bing VÃ¦rket	18570	18568	18568	18568	18568
75	25460715-1010337646-0291-20041001	DONG Energy Generation A/S, Skjern KraftvarmevÃ¦rk	22568	22565	22565	22565	22565
76	10153158-1002980617-0520-20041001	DONG Energy Generation A/S, EnstedvÃ¦rket	1397043	1397041	1397041	1397041	1397041
77	25460715-1003043318-0635-20041001	Elsam Kraft A/S, Frederikshavn KraftvarmevÃ¦rk	42889	42889	42889	42889	42889
78	10153158-1005247303-0636-20041001	Elsam Kraft A/S, NordjyllandsvÃ¦rket	1103702	1103698	1103698	1103698	1103698
79	25460715-1003043343-0637-20041001	Hirtshals KraftvarmevÃ¦rk	20213	20209	20209	20209	20209
80	10153158-1008477821-0990-20041001	DONG Energy Generation, EsbjergvÃ¦rket	1051489	1051487	1051487	1051487	1051487
81	25481984-1007759963-0415-20041001	Verdo Produktion A/S	192097	192096	192096	192096	192096
82	25481984-1009623945-0416-20041001	Energi Randers Produktion A/S	1154	1152	1152	1152	1152
83	25481984-1009623953-0960-20041001	Energi Randers Produktion A/S	341	341	341	341	341
84	25481984-1009257612-1490-20041001	Verdo Produktion A/S	3369	3365	3365	3365	3365
85	25495977-1007775284-0289-20041001	MÃ¥bjergvÃ¦rket A/S	8028	8027	8027	8027	8027
86	25496086-1007775373-0283-20041001	Horsens KraftvarmevÃ¦rk	44477	44475	44475	44475	44475
87	25525795-1010757467-0154-20041001	KVV GrÃ¸nningen/Central 2	18960	18957	18957	18957	18957
88	25525795-1007789161-0988-20041001	KVV TÃ¥rnvej	34344	34344	34344	34344	34344

ID	Permit Identifier	Name of installation	Allocation 2008	Allocation 2009	Allocation 2010	Allocation 2011	Allocation 2012
89	25535456-1003314105-0365-20041001	Nyborg Forsyning og Service	432	432	432	432	432
90	25673840-1003294517-0326-20041001	KorsÃ¸r Varme A/S	19710	19706	19706	19706	19706
91	25798929-1008145764-0040-20041001	Ã˜stkraft	54250	54250	54250	54250	54250
92	25809807-1010775309-0192-20041001	EnergiGruppen Jylland, Holstebrovej	2414	2410	2410	2410	2410
93	25809807-1010775341-0193-20041001	EnergiGruppen Jylland, Nord	1676	1675	1675	3675	3675
94	25809807-1010775392-1244-20041001	EnergiGruppen Jylland, Vest	31	29	29	29	29
95	26704065-1010775961-0216-20041001	Vestforsyning Varme A/S Central H	1644	1643	1643	1643	1643
96	26704065-1010775988-0217-20041001	Vestforsyning Varme A/S Central nord	397	393	393	393	393
97	26704065-1010776046-0218-20041001	Vestforsyning Varme A/S Central EllebÃ¦k	1277	1275	1275	1275	1275
98	26704065-1010776011-0219-20041001	Vestforsyning Varme A/S Central Vest	957	953	953	953	953
99	26704065-1010776003-0220-20041001	Vestforsyning Varme A/S Central Ã˜st	2484	2483	2483	2483	2483
100	26721059-1003311702-0129-20041001	FFV Varme A/S	22598	22596	22596	22596	22596
101	28032617-1010752325-0571-20041001	Vojens Fjernvarme	20790	20786	20786	20786	20786
102	29808228-1003267160-0010-20041001	Albertslund VarmevÃ¦rk	1639	1637	1637	1637	1637
103	30992512-1003030685-0529-20041001	Thisted Varmeforsyning	1204	1200	1200	1200	1200
104	31220912-1001672876-0567-20041001	Vinderup VarmevÃ¦rk	14259	14258	14258	14258	14258
105	31242711-1001673227-0565-20041001	VidebÃ¦k energiforsyning	200	198	198	198	198
106	31242711-1010767063-0566-20041001	VidebÃ¦k Energiforsyning	17767	17766	17766	17766	17766
107	32476813-1003037642-0423-20041001	Ringe Fjernvarmeselskab	14681	14677	14677	14677	14677
108	33016719-1001698824-0536-20041001	Tranbjerg VarmevÃ¦rk, KedelanlÃ¦g Jegstrupvej	96	92	92	92	92
109	33507410-1001705973-0459-20041001	Skagen VarmevÃ¦rk	1361	1360	1360	1360	1360
110	33507410-1010581539-1449-20041001	Skagen KraftvarmevÃ¦rk	23264	23261	23261	23261	23261
111	34681228-1001723737-0207-20041001	Hjallerup Fjernvarmeselskab	14752	14751	14751	14751	14751
112	35209115-1010757157-0388-20041001	VC Bellinge	718	714	714	714	714
113	35209115-1010757165-0389-20041001	VC BilledskÃ¦rvej	2216	2215	2215	2215	2215
114	35209115-1010757211-0390-20041001	VC Bolbro	1324	1321	1321	1321	1321
115	35209115-1010757807-0392-20041001	VC Centrum	2004	2004	2004	2004	2004
116	35209115-1010757866-0393-20041001	VC Dyrup	365	365	365	365	365
117	35209115-1010757815-0395-20041001	VC Dalum	991	991	991	991	991
118	35209115-1010757904-0398-20041001	Fjernvarme Fyn A/S VC Korup	689	686	686	686	686
119	35209115-1010757955-0400-20041001	VC NÃ¦sby	833	833	833	833	833
120	35209115-1010757998-0402-20041001	Odense Kommune VC PÃ¥rup	1185	1182	1182	1182	1182
121	35209115-1010758005-0403-20041001	VC Sanderum	827	825	825	825	825
122	35209115-1010758021-0405-20041001	VC SydÃ¸st	844	842	842	842	842
123	35209115-1010758048-0406-20041001	VC Vollsmose	1062	1061	1061	1061	1061
124	35478116-1003045929-0104-20041001	Fredericia Fjernvarme – danmarksgade	207	206	206	206	206
125	35478116-1003045930-0105-20041001	Fredericia Fjernvarme-venusvej	115	112	112	112	112
126	35602313-1009505527-0511-20041001	SÃ¸nderborg Fjernvarme	124	122	122	122	122
127	35602313-1003046196-0515-20041001	SÃ¸nderborg Fjernvarme	960	958	958	958	958
128	35607919-1010774108-0556-20041001	Varmecentral SÃ¸ndermarken	615	614	614	614	614
129	35607919-1010774116-0557-20041001	Varmecentral Toften	3173	3170	3170	3170	3170
130	36152710-1010792963-0577-20041001	Aabenraa Fjernvarme	1008	1004	1004	1004	1004
131	36152710-1010792955-0578-20041001	Aabenraa Fjernvarme	296	296	296	296	296
132	36152710-1010792947-0580-20041001	Aabenraa Fjernvarme	284	280	280	280	280

ID	Permit Identifier	Name of installation	Allocation 2008	Allocation 2009	Allocation 2010	Allocation 2011	Allocation 2012
133	36154012-1001742170-0443-20041001	RÃ¸dekro Fjernvarmecentral	716	713	713	713	713
134	36421312-1001745454-0545-20041001	TÃ¸nder Fjernvarmeselskab Amba	986	983	983	983	983
135	36892412-1001749941-0339-20041001	Lemvig VarmevÃ¦rk	1629	1625	1625	1625	1625
137	37251518-1001753730-0246-20041001	Billund VarmevÃ¦rk II	22136	22133	22133	22133	22133
138	37560219-1003054010-0425-20041001	Rindum VÃ¦rket	22312	22310	22310	22310	22310
139	37683310-1001758574-0296-20041001	Vildbjerg VarmevÃ¦rk A.m.b.a	17685	17682	17682	17682	17682
140	37809217-1001759685-0063-20041001	Brovst Fjernvarme	12999	12999	12999	12999	12999
141	37949019-1001761239-0461-20041001	Skanderborg Fjernvarme	372	372	372	372	372
142	39877511-1010774698-0095-20041001	Hedelund Spidslastcentral	453	451	451	451	451
143	39877511-1010774701-0097-20041001	Hjerting VarmevÃ¦rk	132	128	128	128	128
144	39877511-1010774728-0098-20041001	Spangsbjerg-Gjesing Varmecentral	1390	1388	1388	1388	1388
145	39877511-1010774736-0099-20041001	SÃ¦dding VarmevÃ¦rk	1496	1496	1496	1496	1496
146	40734511-1003302364-0361-20041001	Nakskov Fjernvarme	0	0	0	0	0
147	40893113-1001802909-0523-20041001	Tarm VarmevÃ¦rk A.m.b.a.	0	0	0	0	0
148	41429615-1001810468-0215-20041001	Hobro VarmevÃ¦rk	1213	1213	1213	1213	
149	41529911-1001812204-0188-20041001	Hedensted Fjernvarme	9852	9852	9852	9852	9852
150	41540214-1003064635-0080-20041001	DagnÃ¦s-BÃ¦kkelund VarmevÃ¦rk	144	143	143	143	143
151	42162019-1003287705-0430-20041001	Roskilde Forsyning Hovedcentralen	2277	2276	2276	2276	2276
152	42162019-1003288415-0432-20041001	Roskilde forsyning, Lillevang	1365	1361	1361	1361	1361
153	43005154-1003322971-0156-20041001	GrÃ¥sten Varme A/S	13289	13288	13288	13288	13288
154	43774417-1003079965-0152-20041001	GrenÃ¥ VarmevÃ¦rk	358	356	356	356	356
155	43774417-1003079977-0939-20041001	Bredstrup VarmevÃ¦rk	206	206	206	206	206
156	44424010-1001852238-0357-20041001	Andelsselskabet MÃ¸lholm VarmevÃ¦rk	73	72	72	72	72
157	44492350-1001853489-0673-20041001	Hundige FjernvarmevÃ¦rk A.m.b.a.	421	420	420	420	420
158	44835010-1003297590-0301-20041001	Jyderup VarmevÃ¦rk	13320	13318	13318	13318	13318
159	44887118-1010701992-0203-20041001	Frederiksgade Varmecentral	2020	2019	2019	2019	2019
160	44887118-1009303940-0204-20041001	UllerÃ¸d Varmecentral	650	649	649	649	649
161	44887118-1010702034-0205-20041001	Kgs. VÃ¦nge Varmecentral	480	476	476	476	476
162	44887118-1010702018-0206-20041001	Elmegaarden Varmecentral	528	524	524	524	524
163	25161513-1003083171-0017-20041001	Ikast El- og VarmevÃ¦rk	1948	1944	1944	1944	1944
164	46917928-1001888952-0025-20041001	NykÃ¸bing S. VarmevÃ¦rk	18521	18520	18520	18520	18520
165	46953614-1003312485-0308-20041001	Kerteminde Kommunale Varmeforsyning	542	540	540	540	540
166	50530213-1001950220-0385-20041001	NÃ¸rresundby Fjernvarmeforsyning	243	0	0	0	0
167	52080312-1009740313-1070-20041001	BrÃ¸nderslev Varme A/S	61480	61479	61479	61479	61479
168	54802013-1008705484-1409-20041001	Svendborg KraftvarmevÃ¦rk	36306	36803	36803	36803	36803
169	55133018-1009490503-0258-20041001	AVA, KedelanlÃ¦g 794 Ã…rhusvÃ¦rket	752	750	750	750	750
170	55133018-1010680383-0591-20041001	AVA Risskov Varmecentral	212	212	212	212	212
171	55133018-1010680359-0597-20041001	AVA, kedelanlÃ¦g 793 Jens Juuls Vej	2460	2459	2459	2459	2459
172	55133018-1010680375-0598-20041001	AVA, Viby Varmecentral	171	167	167	167	167
173	55133018-1010680367-0604-20041001	AVA, KedelanlÃ¦g 792 Gjellerup	675	674	674	674	674
174	55946817-1002041931-0554-20041001	Vamdrup Fjernvarme I.m.b.a	9048	9048	9048	9048	9048
175	57205628-1010706714-0419-20041001	Ribe Fjernvarmecentral	1512	1509	1509	1509	1509
176	57205628-1002058838-0420-20041001	Ribe KraftvarmevÃ¦rk	23905	23902	23902	23902	23902
177	57494115-1002063337-0372-20041001	NykÃ¸bing Mors FjernvarmevÃ¦rk	17848	17845	17845	17845	17845

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178	58061212-1003123407-0169-20041001	Haderslev Fjernvarme	4212	4212	4212	4212	4212
179	58061212-1003123419-0170-20041001	Haderslev Fjernvarme	13448	13446	13446	13446	13446
180	58176613-1002075632-0247-20041001	Brande Fjernvarme A.m.b.a.	15233	15229	15229	15229	15229
182	59352318-1002097051-0062-20041001	Broager Fjernvarmeselskab	10599	10599	10599	10599	10599
183	59426915-1002097944-0457-20041001	Sindal Varmeforsyning	13758	13754	13754	13754	13754
184	60247412-1002110216-0304-20041001	Kjellerup Fjernvarme	0	0	0	129	172
185	61877215-1003147413-0002-20041001	Assens fjernvarme Amba	0	0	0	0	0
186	63446319-1002170663-0050-20041001	Bramming Fjernvarme Amba	30416	30414	30414	30414	30414
187	63690619-1002175112-0533-20041001	Toftlund Fjernvarmecentral	12694	12691	12691	12691	12691
188	64429418-1002189756-0509-20041001	SÃ¦by VarmevÃ¦rk	33049	33047	33047	33047	33047
189	64463411-1002190406-0543-20041001	Taars VarmevÃ¦rk Amba	8721	8721	8721	8721	8721
190	64502018-1010657128-0190-20041001	Forsyning HelsingÃ¸r Varme A/S	593	589	589	1293	1239
191	64502018-1003280037-0191-20041001	Forsyning HelsingÃ¸r Varme A/s	1818	1814	1814	2518	2464
192	64544616-1003156575-0209-20041001	HjÃ¸rring Varmeforsyning	467	467	467	467	
193	64544616-1003156630-0210-20041001	HjÃ¸rring Varmeforsyning	88079	88079	88079	88079	88079
194	64544616-1003156587-0214-20041001	HjÃ¸rring Varmeforsyning	1053	1050	1050	1050	1050
195	64771728-1002195366-0574-20041001	VrÃ¥ VarmevÃ¦rk	7650	7650	7650	7650	7650
196	65120119-1010748883-0146-20041001	Glostrup Kommunale Varmeforsyning	107	103	103		
197	66166228-1003161700-0227-20041001	Horsens VarmevÃ¦rk	2587	2583	2583	2583	2583
198	66166228-1003161712-0228-20041001	Horsens VarmevÃ¦rk	339	336	336	336	336
199	67750411-1002257575-0172-20041001	Hadsten VarmevÃ¦rk	239	238	238	238	238
200	67892615-1003312783-0335-20041001	Langeskov Fjernvarme	260	256	256	256	256
201	67932218-1002261339-0033-20041001	Vejle Fjernvarme A.m.b.a.	702	702	702	702	702
202	68326214-1003169877-0463-20041001	I/S Skive Fjernvarme	36338	36336	36336	36336	36336
203	68326214-1003169890-0464-20041001	I/S Skive Fjernvarme	594	593	593	593	593
204	27736904-1010782941-0475-20041001	SK-Varme A/S	893	890	890	890	890
205	27736904-1010782917-0478-20041001	SK-Varme A/S	764	764	764	764	764
206	69330428-1002294343-0970-20041001	SolrÃ¸d FjernvarmevÃ¦rk a.m.b.a.	505	502	502	502	502
207	69914128-1002309201-0991-20041001	Hvide Sande Fjernvarme	18134	18130	18130	18130	18130
208	69995713-1003173770-0373-20041001	NÃ¦stved VarmevÃ¦rk	208	205	205	205	205
209	69995713-1003173800-0376-20041001	NÃ¦stved VarmevÃ¦rk	1184	1183	1183	1183	1183
210	70097117-1009059608-0125-20041001	FrederiksvÃ¦rk Kommunale VarmevÃ¦rker	2357	2357	2357	2357	2357
211	70921219-1004013689-0572-20041001	BÃ¸dkervÃ¦nget Varmecentral	937	934	934	934	934
212	74132111-1010668456-0073-20041001	CTR, Nybrovej Centralen	1438	1434	1434	1434	1434
213	74132111-1010668464-0074-20041001	CTR, Spidslastcentral Phistersvej	1955	1954	1954	1954	1954
215	74132111-1003253834-0121-20041001	Frederiksberg Varmecentral	12925	12921	12921	12921	12921
216	74132111-1010668480-0646-20041001	HÃ¸je Gladsaxe Varmecentral	3307	3304	3304	3304	3304
217	74132111-1010668499-1351-20041001	Gladsaxe SpidslastanlÃ¦g	1866	1862	1862	1862	1862
218	74132111-1010668502-1551-20041001	CTR, Utterslev Varmecentral	548	545	545	545	545
219	65278316-1010642945-0250-20041001	NÃ¦stved KraftvarmevÃ¦rk	24418	24414	24414	24414	24414
220	28709714-1003023952-0547-20041001	TÃ¸rring KraftvarmevÃ¦rk	11841	11838	11838	11838	11838
221	42125814-1001820693-1826-20041001	Lystrup Fjernvarme, KedelanlÃ¦g Houmarken	57	54	54	54	54
222	64707612-1010771745-0370-20041001	Guldborgsund Varme ApS	1331	1331	1331	1331	1331
223	64707612-1010771737-0371-20041001	NykÃ¸bing F. Kommunale Varmeforsyning	5083	5083	5083	5083	5083

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224	39901811-1001789264-1841-20041001	Holme LundshÃ¸j Fjernvarme, KedelanlÃ¦g Holme Byvej	13	9	9	9	9
225	36294515-1001743992-1057-20041001	Gram Fjernvarme AMBA	12337	12333	12333	12333	12333
226	29096716-1001640777-0238-20041001	HÃ¸ng VarmevÃ¦rk	607	607	607	607	607
227	64704710-1003157078-0386-20041001	Odder VarmevÃ¦rk	402	400	400	400	400
228	50187128-1001944117-1825-20041001	Svogerslev Fjernvarmecentral	620	618	618	618	618
229	13057117-1002933753-1824-20041001	HTF GasvÃ¦rksvej	109	108	108	108	108
230	14250905-1000707406-1833-20041001	Fjernvarmedistrib. AvedÃ¸re Stationsby	396	396	396	396	396
231	23179652-1010749189-0122-20041001	Frederikshavn Kommunale Varmeforsyning	2691	2687	2687	2687	2687
232	23179652-1010749219-0123-20041001	Frederikshavn Kommunale Varmeforsyning	2442	2441	2441	2441	2441
233	76343616-1003191352-1828-20041001	Hvidovre Midt	622	622	622	622	622
234	64831712-1002196453-0053-20041001	Bogense Forsyningsselskab	13116	13115	13115	13115	13115
235	33269315-1003039608-1830-20041001	BrÃ¸ndbyÃ¸ster Fjernvarmecentral	743	742	742	742	742
236	33269315-1003039566-1831-20041001	BrÃ¸ndbyvester Fjernvarmecentral	988	985	985	985	985
237	13545812-1000583372-1847-20041001	Middelfart Fjernvarme, Hovedcentral	1244	1242	1242	1242	1242
240	25227832-1003308258-1855-20041001	RÃ¸nne Varme A/S	99	95	95	95	95
241	10866111-1003387416-0285-20041001	I/S VestforbrÃ¦nding	913	909	909	909	909
242	10866111-1010800834-1857-20041001	HedegÃ¥rdens varmecentral, I/S VestforbrÃ¦nding	137	133	133	133	133
243	22340417-1001545710-1827-20041001	Fjernvarmecentralen AvedÃ¸re Holme	3322	3321	3321	3321	3321
244	10246415-1010232089-1713-20041001	Colas, Glostrup	1646	1642	1642	1642	1642
245	10246415-1010232100-1714-20041001	Colas, HerfÃ¸lge	1127	1126	1126		
246	10246415-1010232070-1715-20041001	Colas, Horsens	1562	1561	1561	1561	1561
247	10246415-1002889095-1716-20041001	Colas, Vinderup	1236	1232	1232	1232	1232
248	10092922-1002313890-1729-20041001	NLMK DanSteel A/S	66369	66369	66369	66369	66369
249	27210538-1009932840-1752-20041001	Nybro GasbehandlingsanlÃ¦g	19898	19895	19895	19895	19895
250	25917979-1008304072-1742-20041001	KraftvarmevÃ¦rk	24109	24105	24105	24105	24105
251	16189006-1003259066-1705-20041001	Amtssygehuset i Glostrup	8800	8800	8800	8800	8800
252	69894011-1003173381-1745-20041001	NCC Roads A/S, Odense	4493	4491	4491	4491	4491
254	69894011-1002981273-1747-20041001	NCC Roads A/S, Herlev	2190	2187	2187	2187	2187
255	69894011-1003173228-1748-20041001	NCC Roads A/S, Ejby	2601	2601	2601	2601	2601
257	69894011-1003173307-1854-20041001	NCC Roads Trige	2659	2655	2655	2655	2655
258	24247279-1001614949-1753-20041001	Nybro TÃ¸rreri A.m.b.A.	15798	15796	15796	15796	15796
259	26447038-1003084051-1759-20041001	Palsgaard A/S	5967	5967	5967	5967	5967
260	11757278-1000270481-0928-20041001	A/S Knud Jepsen	12805	12803	12803	12803	12803
261	19146847-1003102851-1084-20041001	Alfred Pedersen og SÃ¸n	26458	26454	26454	26454	26454
262	16932108-1001187219-1088-20041001	Kronborg Aps.	10714	10712	10712	10712	10712
263	27496636-1010285905-0783-20041001	Gartneriet MasnedÃ¸ A/S	27389	27389	27389	27389	27389
264	15692995-1000961770-0922-20041001	Varpelev Tomater A/S	20982	20982	20982	20982	20982
265	17030744-1002986147-1704-20041001	Akzo Nobel Salt A/S	17184	17181	17181	17181	17181
266	37322318-1003052766-1720-20041001	Damolin Fur A/S	9236	9236	9236	9236	9236
267	37322318-1003064271-1721-20041001	Damolin Mors A/S	23690	23686	23686	23686	23686
268	21643939-1003174352-1725-20041001	Danish Crown Ringsted	8585	8581	8581	8581	8581
269	21643939-1010316592-1796-20041001	Danish Crown Horsens	11934	11934	11934	11934	11934
270	45613410-1003084683-1717-20041001	Daka Proteins LÃ¸sning	18028	18024	18024	18024	18024
271	45613410-1003174303-1718-20041001	Daka Bio-industries Ortved	15094	15094	15094	15094	15094

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272	45613410-1003084713-1719-20041001	Daka Bio-industries Randers	15991	15987	15987	15987	15987
273	14003606-1002950285-1783-20041001	Tulip Food Company Vejle	5272	5271	5271	5271	5271
274	53686214-1002006832-0116-20041001	Fiskernes Fiskeindustri	50054	50052	50052	50052	50052
275	10830281-1000138566-1737-20041001	Hanstholms Fiskemelsfabrik A/S	13082	13082	13082	13082	13082
276	14981918-1003043173-1781-20041001	TripleNine Fish Protein	45227	45227	45227	45227	45227
277	14981918-1000839411-1782-20041001	Triplenine Fish Protein, Esbjerg	43572	43570	43570	43570	43570
278	15672099-1000958332-0754-20041001	Aarhus United Denmark A/S	98702	98702	98702	98702	98702
279	87469816-1003024807-0926-20041001	Arla Foods Energy A/S Akafa	31982	31982	31982	31982	31982
280	87469816-1001971408-1091-20041001	Arla Foods Energy A/S Danmark Protein	37538	37538	37538	37538	37538
281	87469816-1003029585-1101-20041001	Arla Foods Energy A/S Arinco	40884	40883	40883	40883	40883
282	87469816-1003024856-1102-20041001	Arla Foods Energy A/S HOCO	38484	38480	38480	38480	38480
284	17919679-1001873142-1722-20041001	DangrÃ¸nt Ribe	10745	10745	10745	10745	10745
285	17919679-1003064829-1723-20041001	DangrÃ¸nt RingkÃ¸bing	17171	17168	17168	17168	17168
287	11350356-1003073438-0500-20041001	Nordic Sugar, NykÃ¸bing Sukkerfabrik	83926	83925	83925	83925	83925
288	11350356-1003073359-0740-20041001	Nordic Sugar, Nakskov Sukkerfabrik	107293	107292	107292	107292	107292
289	11350356-1003073426-0742-20041001	Nordic Sugar, Assens Sukkerfabrik	58883	0	0	0	0
290	11350356-1003073505-1799-20041001	Nordic Sugar, GÃ¸rlev	13814	0	0	0	0
291	21210285-1001573553-0760-20041001	CP Kelco ApS	91081	91081	91081	91081	91081
292	21409677-1003073529-1730-20041001	V&S Danmark A/S, De Danske Spritfabrikker Aalborg	7526	7525	7525	7525	7525
293	25508386-1003138695-0734-20041001	Carlsberg A/S	28105	28104	28104	28104	28104
294	25508386-1000619820-1403-20041001	Carlsberg Danmark A/S	22769	22769	22769	22769	22769
295	16993409-1001199629-1568-20041001	Danish Malting Group	29567	29563	29563	29563	29563
296	71174611-1002336930-1087-20041001	Dragsbaek Maltfabrik A/S	33991	33987	33987	33987	33987
297	43910515-1001845554-1738-20041001	Harboes Bryggeri A/S	6902	6901	6901	6901	6901
299	38454218-1001767559-1732-20041001	EGETÃ†PPER A/S	5397	5394			
300	11766110-1002911982-0364-20041001	Novopan TrÃ¦industri A/S	17162	17160	17160	17160	17160
301	20284196-1003138658-0743-20041001	Dalum Papir A/S	52024	52024	52024	52024	52024
302	20284196-1003138646-0782-20041001	Dalum Papir MaglemÃ¸lle	6005	6005	6005	6005	6005
304	83031212-1003207862-1772-20041001	Skjern Papirfabrik A/S	12153	12151	12151	12151	12151
305	63049611-1003151998-0744-20041001	BrÃ¸drene Hartmann A/S	72836	72833	72833	72833	72833
306	10373816-1002893194-0001-20041001	Shell Raffinaderiet Fredericia	433099	433096	433096	433096	433096
307	28142412-1003022853-1773-20041001	Statoil Raffinaderiet.	431357	431356	431356	431356	431356
308	21420018-1001535091-1775-20041001	Sun Chemical A/S	13711	13710	13710	13710	13710
309	10007127-1007675476-1751-20041001	Novozymes A/S	15916	15912	15912	15912	15912
311	12760043-1000441076-1396-20041001	Cheminova A/S	78507	78505	78505	78505	78505
313	24256790-1007676162-1750-20041001	Novo Nordisk A/S	4589	4587	4587	4587	4587
314	41853816-1003065230-1736-20041001	Haldor TopsÃ¸e A/S	23791	23787	23787	23787	23787
315	27364926-1001760037-1109-20041001	Roulunds Energi ApS	18330	18330	18330	18330	18330
317	18445042-1003465733-1766-20041001	Ardagh Glass Holmegaard A/S	61473	61470	61470	61470	61470
318	11933238-1000301355-1770-20041001	Saint Gobain Isover A/S	12003	9485	9485	9485	9485
319	31978017-1001683002-1702-20041001	A/S Bachmanns TeglvÃ¦rk	4941	4940	4940	4940	4940
320	42125210-1001820681-1711-20041001	Carl Matzens TeglvÃ¦rk A/S	4487	4484	4484	4484	4484
321	40294619-1001794437-1734-20041001	GrÃ¥sten TeglvÃ¦rk	6383	7995	7995	7995	7995
322	36967110-1001750470-1739-20041001	HelligsÃ¸ TeglvÃ¦rk A/S	5712	5710	5710	5710	5710

ID	Permit Identifier	Name of installation	Allocation 2008	Allocation 2009	Allocation 2010	Allocation 2011	Allocation 2012
323	67863828-1003550278-1741-20041001	HÃ¸jslev Tegl A/S	6232	6232	6232	6232	6232
324	31310113-1002934402-1743-20041001	Monier A/S- Volstrup TeglvÃ¦rk	4746	4745	4745	4745	4745
325	38016210-1001761987-1744-20041001	LUNDGÃ…RD TEGLVÃ†RK A/S	9741	9740	9740	9740	9740
326	75922019-1002474738-1749-20041001	Nordtegl A/S	3542				
328	28672012-1001634638-1761-20041001	PETERSEN TEGL EGERNSUND A/S	9703	9699	9699	9699	9699
329	33778716-1000268567-1762-20041001	PETERSMINDE TEGLVÃ†RK A/S	11503	11500	11500	11500	11500
330	23998513-1003013090-1763-20041001	Pipers TeglvÃ¦rker A/S Gandrup TeglvÃ¦rk	15521	15517	15517	15517	15517
331	23998513-1003013089-1764-20041001	PIPERS TEGLVÃ†RKER A/S HammershÃ¸j TeglvÃ¦rk	13857	13854	13854	13854	13854
332	81664315-1007655432-1780-20041001	Ydby TeglvÃ¦rk A/S	6157	6156			
333	15517077-1000937672-1784-20041001	Tychsen's TeglvÃ¦rk A/S	4105	4102	4102	4102	4102
334	48791018-1001920902-1785-20041001	Vedstaarup TeglvÃ¦rk A/S	13758	13755	13755	13755	13755
336	82753915-1002654599-1786-20041001	Vesterled TeglvÃ¦rk A/S	11607	11605	11605	11605	11605
337	45231216-1001865577-1544-20041001	Villemoes TeglvÃ¦rk	4655	4652	4652	4652	4652
338	32232515-1001687185-1788-20041001	VindÃ¸ TeglvÃ¦rk	7426	7426	7426	7426	7426
339	10502306-1002997604-1760-20041001	Pedershvile TeglvÃ¦rk	8952	8950	8950	8950	8950
340	10502306-1002997598-1765-20041001	PrÃ¸velyst TeglvÃ¦rk	9207				
341	10502306-1002896764-1789-20041001	SÃ¸nderskov TeglvÃ¦rk	4788	4784	4784	4784	4784
342	14244441-1002952999-0007-20041001	Aalborg Portland A/S	2567181	2567177	2567177	2567177	2567177
343	20882182-1005184196-1733-20041001	Faxe Kalk, OvnanlÃ¦gget Stubberup	99777	99777	99777	99777	99777
344	54050313-1003103433-1726-20041001	Knauf A/S	21037	21036	21036	21036	21036
345	27237916-1001610372-1735-20041001	Gyproc A/S	17085	17085	17085	17085	17085
346	58711713-1002086335-1727-20041001	DANSK ETERNIT A/S	0	0			
348	10977193-1002905302-1777-20041001	Tarco Vej A/S	2216	2216	2216	2216	2216
349	10977193-1002905326-1778-20041001	Tarco Vej A/S	2810	2807	2807	2807	2807
350	10977193-1002905314-1779-20041001	Tarco Vej A/S	2582	2579	2579	2579	2579
351	42391719-1003070026-1767-20041001	Rockwool A/S Doense	48867	48867	48867	48867	48867
353	42391719-1003070014-1769-20041001	Rockwool A/S, Vamdrup	58123	58119	58119	58119	58119
354	59983016-1003135246-1728-20041001	Saint-Gobain Weber A/S	53828	53827	53827	53827	53827
355	12841736-1002931142-1756-20041001	Saint-Gobain Weber A/S	53328	53328	53328	53328	53328
356	20165715-1002999115-1395-20041001	Danfoss	24865	24865	24865	24865	24865
357	45739910-1003085393-1754-20041001	ODENSE STAALSKIBSVÃ†RFT A/S	14795	14792	14792	14792	14792
358	20683341-1004449186-0753-20041001	Maricogen P/S	100716	100716	100716	100716	100716
359	73731410-1002410978-0929-20041001	FÃ¦llinggaard Varmeforsyning Aps	16165	16165	16165	16165	16165
360	11350356-1003073542-0081-20041001	Danisco Cultor 050, Grindsted	49555	49551	49551	49551	49551
361	27450431-1010437772-1798-20041001	Duferco Danish Steel	10272	10272	10272	10272	10272
362	40556311-1003309680-1755-20041001	Varmecentral Sygehuset	6063	6063	6063	6063	6063
363	15070544-1002965976-1853-20041001	Arkil A/S asfalt	1902	1898	1898	1898	1898
364	18298503-1007635792-1793-20041001	LMK Vej A/S Randers Asfaltfabrik	884	884	884	884	884
365	18298503-1007635695-1794-20041001	LMK Vej A/S Ã˜lstykke Asfaltfabrik	1465	1463	1463	1463	1463
367	16189006-1003258812-0075-20041001	Region Hovedstaden, Gentofte Hospital.	2397	2396	2396	2396	2396
368	10153158-1010839943-1858-20041001	Elsam kedler ved SCA Packaging	0	0	0	0	0
369	18143534-1003256912-1829-20041001	Hvidovre Hospital	1515	1514	1514	1514	1514
370	22757318-0000000000-1801-20041001	Dan feltet	647752	647750	647750	647750	647750
371	22757318-0000000000-1802-20041001	Gorm feltet	446895	446894	446894	446894	446894

ID	Permit Identifier	Name of installation	Allocation 2008	Allocation 2009	Allocation 2010	Allocation 2011	Allocation 2012
372	22757318-0000000000-1803-20041001	Harald feltet	37979	37977	37977	37977	37977
373	22757318-0000000000-1804-20041001	Tyra feltet	620823	620821	620821	620821	620821
374	22757318-0000000000-1806-20041001	Halfdan feltet	92484	92482	92482	92482	276117
375	73349613-0000000000-1805-20041001	Siri feltet omfattende anlÃ¦g pÃ¥ Siri platformen	226446	226445	226445	226445	226445
376	73589118-0000000000-1800-20041001	Syd Arne feltet	208086	208084	208084	208084	208084
377	18936674-1004303224-0276-20041001	Haslev KraftvarmevÃ¦rk	0	0	0	0	0
378	42760218-1001830583-0254-20041001	Helsinge Fjernvarme	26194	26194	26194	26194	26194
379	27749836-1010580397-1870-20050314	Danscan Steel	3174	3809	3809	3809	3809
380	10246415-1002889071-1877-20050322	Colas, Sundsholmen	0	0	0	0	0
381	20705833-1011336716-1891-20051103	25 MW Gasturbine	9875	9875	9875	9875	9875
382	29144850-1011767989-1893-20060206	Effektmarked DK I/S	5137	5137	5137	5137	5137
383	16622486-1003846915-1130-20060518	Hjortebjerg kraftvarme/gartneri	5138	5134	5134	5134	5134
384	18298503-1004835379-1906-20060131	Vandel Asfaltfabrik	0	0	0	0	0
385	30992512-1003030727-0525-20060710	Thisted Varmeforsyning	1000	1000	1000	1000	1000
387	74132111-1012536441-1917-20061013	KLC2	6000	6000	6000	6000	6000
388	27471870-1012476848-1892-20060825	Kratholm	7595	7595	7595	7595	7595
389	39042010-1001775537-0004-07032007	Aulum Fjernvarme a.m.b.a	291	290	290	290	290
390	39042010-1012884571-0005-07032007	Aulum Fjernvarme a.m.b.a, Kulvej 5	8603	8603	8603	8603	8603
391	29839999-1013068263-1940-20070622	Assens	0	0	0	0	0
392	29977089-1012711901-1939-20070615	Ã˜stermose BioEnergi A/S	0	0	0	0	0
393	12257899-1013486650-1946-20070802	VÃ¦kst & MiljÃ¸ v/Ulrik Dahl	0	0	0	0	0
394	30134885-1013497865-1949-20070928	Skou/Hansen I/S	0	0	0	0	0
396	68726018-1002279450-262-20071102	Nibe VarmavÃ¦rk A.m.b.a	10342	10342	10342	10342	10342
397	30082680-1013481292-1950-20071107	Flexenergi A/S	0	0	0	0	0
398	29831459-1013483740-1948-20070914	FG Wilson diesel 12 stk.	0	0	0	0	0
399	25118359-1013752164-1952-20071116	Syd Energi Salg A/S	0	0	0	0	0
400	15283343-1000895826-1969-20080401	DK Plant	0	15017	8581	8581	8581
401	29845867-1014369135-1973-20080430	Regulerkraft Ikast	0	0	0	0	0
405	25161513-1015472304-0057-20091202	Bording KraftvarmevÃ¦rk	0	0	11868	9493	9493
407	17689800-1001339596-731-20110104	Ã˜ster Toreby VarmevÃ¦rk Amba	0	0	0	600	800
408	42742511-1001830261-1346-20100312	GrÃ¦sted Fjernvarme A.m.b.a.	0	0	0	1417	1000
409	59162616-1008891660-1235-20110101	Gilleleje Fjernvarmeselskab	0	0	0	750	1000
410	43860259-1001845141-0232-20110728	Hurup Fjernvarme A.m.b.a	0	0	0	16	39
411	34078149-1017324205-2131-20120110	Vordingborg Kraftvarme	0	0	0	0	63
413	18936674-1003922902-0280-20041001	MasnedÃ¸ gasturbine	0	0	0	0	239

Annex A.3.2: Information on Denmark's KP Registry

1. Information on the registry administrator
Danish Business Authority
Dahlerups Pakhus
Langelinie Allé 17
DK-2100 København Ø
Telephone: +45 3529 1000
E-mail: co2register@erst.dk

2. Cooperation with other countries concerning the operation of the registry
Denmark does not cooperate with other countries concerning the administration of the Danish KP Registry. The Danish KP Registry has been operated in a consolidated manner by the European Commission since June 2012. The administration of the registry remains with the Danish Business Authority.

3. Standards for data exchange
The overall change to a Consolidated System of EU Registries triggered changes in the registry software and required new conformance testing. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.

During certification, the consolidated registry was notably subject to connectivity testing, connectivity reliability testing, distinctness testing and interoperability testing to demonstrate capacity and conformance to the DES. All tests were executed successfully and lead to successful certification on 1 June 2012.

4. Procedures for administration and operation of the KP registry
The procedures are described in Commission Regulation (EU) No 389/2013 of 2 May 2013 establishing a Union Registry pursuant to Directive 2003/87/EC of the European Parliament and of the Council, Decisions No 280/2004/EC and No 406/2009/EC of the European Parliament and of the Council. Further procedures are set in Executive Order No 1180 of 9 October 2013 on the EU ETS Registry and the Danish KP Registry. Denmark is in compliance with the procedures set in and pursuant to the regulation and executive order.

5. Safety standards

The overall change to a Consolidated System of EU Registries also triggered changes to security, as reflected in the updated security plan. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.

As security and safety standards are treated as confidential, no further descriptions are provided here. Relevant parties can request further information. This will then be provided to the extent possible, by the national administrators.

6. Information available to the public
Pursuant to article 109 in Commission Regulation (EU) No 389/2013 of 2 May 2013 establishing a Union Registry pursuant to Directive 2003/87/EC of the European Parliament and of the Council, Decisions No 280/2004/EC and No 406/2009/EC of the European Parliament and of the Council only the information specified in Annex XIV of the regulation is available to the public.
Publicly available information from the registry can be found at http://ec.europa.eu/environment/ets/.
General information can be found at http://www.dba.erhvervsstyrelsen.dk/eu-ets-registry-kyoto.

7. Internet address for the registry
https://ets-registry.webgate.ec.europa.eu/euregistry/DK/index.xhtml

8. Protection, maintenance and recreation of data
The overall change to a Consolidated System of EU Registries also triggered changes to data integrity measures, as reflected in the updated disaster recovery plan. The complete description of the

consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.

As the disaster recovery plan is treated as confidential, no further descriptions are provided here. Relevant parties can request further information. This will then be provided to the extent possible, by the national administrators

9. Test procedures

Before the EU ETS operations were centralized to a Consolidated System of EU Registries, a number of tests were performed on the pre-June 2012 Danish registry software and hardware infrastructure. Most notably a major penetration test was performed by Deloitte. No major issues were found during this test, but a number of small recommendations were made and solutions were implemented as needed.

Regarding CSEUR, the European Commission is responsible for test procedures and all relevant functionality tests related to operations and software/hardware updates. Furthermore, each member state has the possibility to test new releases before they are put in production.

As test procedures and results are treated as confidential, no further descriptions are provided here. Relevant parties can request further information. This will then be provided to the extent possible, by the national administrators.

Annex A3.3: 2012 KP Reports

1. Public Information on Account Information

** Please note that information on account number and information related to account representatives is not included due to confidentiality*

Account Name	KP Account Type	CP	Account Holder
Annulleringskonto for overskydende udstedelse	EXCESS_ISSUANCE_CANCELLATION_ACCOUNT	1	Erhvervsstyrelsen
Lcer Expiry	LCER REPLACEMENT ACCOUNT EXPIRY	1	Energistyrelsen
Erstatningskonto for ICER, som er ved at udløbe	LCER REPLACEMENT ACCOUNT EXPIRY	1	Erhvervsstyrelsen
LCer p 1	LCER REPLACEMENT ACCOUNT FAIL SUBMISSION CERT REP	1	Energistyrelsen
Erstatningskonto for ICER ved manglende indgivelse af certificeringsrapport	LCER REPLACEMENT ACCOUNT FAIL SUBMISSION CERT REP	1	Erhvervsstyrelsen
LCer 1	LCER REPLACEMENT ACCOUNT REVERSAL CARBON STORAGE	1	Energistyrelsen
Erstatningskonto for ICER til tilbageførsel af oplagring	LCER REPLACEMENT ACCOUNT REVERSAL CARBON STORAGE	1	Erhvervsstyrelsen
Man Can	MANDATORY CANCELLATION ACCOUNT	1	Energistyrelsen
Obligatorisk annulleringskonto	MANDATORY CANCELLATION ACCOUNT	1	Erhvervsstyrelsen
DK kvotekonto (Kyoto)	National Holding (Party)		Energistyrelsen
DK kontrolkonto (Kyoto)	National Holding (Party)		Energistyrelsen
DK auktionering	National Holding (Party)		Energistyrelsen
Verdensbanken	National Holding (Party)		Energistyrelsen
Lusakert Biogas	National Holding (Party)		Energistyrelsen
CHN 1032 Shanxian Biomass	National Holding (Party)		Energistyrelsen
Malay 0984 Lavang	National Holding (Party)		Energistyrelsen
Malay 0249 Lumut	National Holding (Party)		Energistyrelsen
Malay 0558 UP1	National Holding (Party)		Energistyrelsen
Fuel Leningrad	National Holding (Party)		Energistyrelsen
Fuel Priozersk	National Holding (Party)		Energistyrelsen
Gas Amursk	National Holding (Party)		Energistyrelsen
Wood Energy	National Holding (Party)		Energistyrelsen
Turnu-Severin	National Holding (Party)		Energistyrelsen
Energy Oradea	National Holding (Party)		Energistyrelsen
Sawdust 2000	National Holding (Party)		Energistyrelsen
Gas Târgu Mures	National Holding (Party)		Energistyrelsen
Gas Focsani	National Holding (Party)		Energistyrelsen
Holboca CET	National Holding (Party)		Energistyrelsen
Gas Zakopane	National Holding (Party)		Energistyrelsen
Mazurskie Gas	National Holding (Party)		Energistyrelsen
Zagorze Windfar	National Holding (Party)		Energistyrelsen
Minoil Flare	National Holding (Party)		Energistyrelsen
Lovochemie	National Holding (Party)		Energistyrelsen
Heating Bourgas	National Holding (Party)		Energistyrelsen
Pleven Veliko	National Holding (Party)		Energistyrelsen
Fertilizer Plan	National Holding (Party)		Energistyrelsen
Indo 4480 Musim Mas	National Holding (Party)		Energistyrelsen
Malay 1107 Kerdau	National Holding (Party)		Energistyrelsen
Malay 1108 Merotai	National Holding (Party)		Energistyrelsen
Malay 1153 UP2	National Holding (Party)		Energistyrelsen
Malay 0927 Seelong	National Holding (Party)		Energistyrelsen

Account Name	KP Account Type	CP	Account Holder
Thai 1558 SPM	National Holding (Party)		Energistyrelsen
Thai 1552 Nong Bua	National Holding (Party)		Energistyrelsen
Thai 1554 VCF	National Holding (Party)		Energistyrelsen
CHN 1694 Shenyang Daxin	National Holding (Party)		Energistyrelsen
CHN 2021 Haiyang Shandong	National Holding (Party)		Energistyrelsen
CHN 2764 Yantai Laizhou	National Holding (Party)		Energistyrelsen
ET 3501 Zafarana 8	National Holding (Party)		Energistyrelsen
Malay 2727 Pekaka	National Holding (Party)		Energistyrelsen
Malay 4516 MNI	National Holding (Party)		Energistyrelsen
Haranky Palm	National Holding (Party)		Energistyrelsen
Jugra Palm	National Holding (Party)		Energistyrelsen
The Fish River	National Holding (Party)		Energistyrelsen
Clanwilliam	National Holding (Party)		Energistyrelsen
Thai 4202 SIMA 2	National Holding (Party)		Energistyrelsen
Thai 4214 SIMA 1	National Holding (Party)		Energistyrelsen
Natural Palm	National Holding (Party)		Energistyrelsen
Fuel Switching	National Holding (Party)		Energistyrelsen
Thai 2645 SIMA 4	National Holding (Party)		Energistyrelsen
Thai 2660 SIMA 3 - PVD	National Holding (Party)		Energistyrelsen
Thai 3585 Advanced Bio Power	National Holding (Party)		Energistyrelsen
Thai 3826 Bua Yai	National Holding (Party)		Energistyrelsen
Song Giang	National Holding (Party)		Energistyrelsen
Groenland	National Holding (Party)		Energistyrelsen
Statens CDM pro	National Holding (Party)		Energistyrelsen
Allokering	National Holding (Party)		Energistyrelsen
NEW Entrant	National Holding (Party)		Energistyrelsen
DK virk.retur.	National Holding (Party)		Energistyrelsen
Lubna	National Holding (Party)		Energistyrelsen
Lubna Sosnowiec	National Holding (Party)		Energistyrelsen
ADAM Cypern	National Holding (Party)		Energistyrelsen
Poldanor	National Holding (Party)		Energistyrelsen
NEFCO TGF	National Holding (Party)		Energistyrelsen
NEFCO NeCF	National Holding (Party)		Energistyrelsen
Odessa Gas	National Holding (Party)		Energistyrelsen
NZ Permanent F	National Holding (Party)		Energistyrelsen
Buseruka	National Holding (Party)		Energistyrelsen
Biomass Tamil N	National Holding (Party)		Energistyrelsen
Burgas Gasific.	National Holding (Party)		Energistyrelsen
Expans. Zakopan	National Holding (Party)		Energistyrelsen
Raw Mat Kryvyi	National Holding (Party)		Energistyrelsen
DK basisår	National Holding (Party)		Energistyrelsen
Torrent India	National Holding (Party)		Energistyrelsen
DK PHA-overskud	National Holding (Party)		Energistyrelsen
DK PHA - B	National Holding (Party)		Energistyrelsen
CHN 3799 Fujian Putian III	National Holding (Party)		Energistyrelsen
CHN 3835 Zhejiang Zhoushan	National Holding (Party)		Energistyrelsen
CHN 3803 Hebei Z Baimiaotan	National Holding (Party)		Energistyrelsen
CHN 4462 Gansu Guazhou	National Holding (Party)		Energistyrelsen
CHN 3972 Hebei W Dishuihu	National Holding (Party)		Energistyrelsen
CHN 3971 Hebei W Yangshugou	National Holding (Party)		Energistyrelsen
Waste Heat SGIS	National Holding (Party)		Energistyrelsen
DK deposit	National Holding (Party)		Energistyrelsen

Account Name	KP Account Type	CP	Account Holder
SKM	National Holding (Party)		Energistyrelsen
514	National Holding (Party)		Energistyrelsen
Indo 1936 Listrindo	National Holding (Party)		Energistyrelsen
Grønland	National Holding (Party)		Erhvervsstyrelsen
DK kvotekonto (Kyoto)	National Holding (Party)		Erhvervsstyrelsen
DK kontrolkonto (Kyoto)	National Holding (Party)		Erhvervsstyrelsen
DK PHA-overskud	National Holding (Party)		Erhvervsstyrelsen
AAU-depotkonto	National Holding (Party)		Erhvervsstyrelsen
CER/ERU returneringskonto	National Holding (Party)		Erhvervsstyrelsen
Net Source Canc	NET SOURCE CANCELLATION ACCOUNT	1	Energistyrelsen
Nettokildeannulleringskonto	NET SOURCE CANCELLATION ACCOUNT	1	Erhvervsstyrelsen
Non compliance	NON COMPLIANCE CANCELLATION ACOUNT	1	Energistyrelsen
Annulleringskonto for manglende overholdelse	NON COMPLIANCE CANCELLATION ACOUNT	1	Erhvervsstyrelsen
Rugmarken Central:DK5	Operator Holding		Farum Fjernvarme A M B A
Borg Jørgensens	Operator Holding		Aalborg Kommune
Fredericia Esø	Operator Holding		TRE-FOR Varme A/S
Kyndbyværket:DK8	Operator Holding		Dong Energy Power A/S
Sakskøbing FV	Operator Holding		Dong Energy Power A/S
Elsam Kraft, GRV:DK10	Operator Holding		Dong Energy Power A/S
EnergiRanders P	Operator Holding		Verdo Produktion A/S
EnergiJylland V	Operator Holding		EnergiGruppen Jylland Varme A/S
Videbæk Energif	Operator Holding		Videbæk Varme A/S
KOV	Operator Holding		Fjernvarme Fyn
Aabernraa Fv	Operator Holding		Aabenraa-Rødekro Fjernvarme
Hedelund Spidsb	Operator Holding		Esbjerg Varme A/S
Grenå VarmeV	Operator Holding		grenaa varmeværk a.m.b.a.
Nørresundby FV	Operator Holding		Nørresundby Fjernvarmeforsyning A.m.b.a.
Nykøbing Mors F	Operator Holding		Nykøbing Mors Fjernvarmeværk A.m.b.a
Sæby Varme V	Operator Holding		Sæby Varmeværk amba
Langeskov KommF	Operator Holding		Kerteminde Forsyning - Varme A/S
Bødkervænget V	Operator Holding		Vordingborg fjernvarme A/S
Nykøbing Komm V	Operator Holding		Guldborgsund Varme A/S
Hvidovre Midt	Operator Holding		Hvidovre Midt Amba
Colas Glostrup	Operator Holding		Colas Danmark A/S
Danish Crown Ri	Operator Holding		Danish Crown A/S
ARLA F Protein	Operator Holding		ARLA Foods Energy A/S
CP Kelko	Operator Holding		CP Kelco ApS
Dalum P Maglem	Operator Holding		Dalum Papir A/S
Skjern Papir	Operator Holding		Skjern Papirfabrik A/S
Brdr Hartmann	Operator Holding		Brdr. Hartmann A/S
Shell Raff	Operator Holding		A/S Dansk Shell
Statoil Raff	Operator Holding		Statoil Refining Denmark A/S
Sun Chemical	Operator Holding		Sun Chemical A/S
V og S Danmark	Operator Holding		Pernod Ricard Denmark A/S
Carlsberg A/S	Operator Holding		Carlsberg Danmark A/S
Carlsberg	Operator Holding		Carlsberg Danmark A/S
Danish Malting	Operator Holding		Danish Malting Group A/S
Dragsbaek Malt	Operator Holding		Sophus Fuglsang Export-Maltfabrik
Harboes Brygger	Operator Holding		Harboes Bryggeri A/S
Novopan Træind	Operator Holding		Novopan Træindustri
Dalum Papir	Operator Holding		Dalum Papir A/S
Novozymes	Operator Holding		Novozymes AS

Account Name	KP Account Type	CP	Account Holder
Rockwool Doense	Operator Holding		Rockwool A/S
Rockwool Vamdru	Operator Holding		Rockwool A/S
Saint Gobain	Operator Holding		Saint-Gobain Weber A/S
Saint gobain We	Operator Holding		Saint-Gobain Weber A/S
Danfoss	Operator Holding		Danfoss A/S
Odense Skibsv	Operator Holding		Odense Staalskibsværft A/S
Maricogen	Operator Holding		Maricogen A/S
Fællinggaard VF	Operator Holding		Fællinggaard Varmeforsyning ApS
DuPont Nutrition Biosciences Aps	Operator Holding		DuPont Nutrition Biosciences Aps
Duferco Danish Steel:DK58	Operator Holding		Duferco Danish Steel A/S
SYV	Operator Holding		Fjernvarme Fyn
Arkil Asfalt	Operator Holding		Arkil A/S - Asfalt
Randers Asfalt	Operator Holding		Lemminkäinen A/S
Ølstykke Asfalt	Operator Holding		Lemminkäinen A/S
Gentofte Hos	Operator Holding		Gentofte Hospital
Hvidovre Hospi	Operator Holding		Hvidovre hospital
Dan:DK67	Operator Holding		Maersk Olie og Gas
Gorm:DK68	Operator Holding		Maersk Olie og Gas
Harald:DK69	Operator Holding		Maersk Olie og Gas
Tyra:DK70	Operator Holding		Maersk Olie og Gas
Halfdan:DK71	Operator Holding		Maersk Olie og Gas
Siri Feltet	Operator Holding		DONG E&P A/S
Syd arne Feltet	Operator Holding		Hess Denmark
Haslev Kraftvarmeværk:DK74	Operator Holding		Dong Energy Power A/S
Helsinge Fjernv	Operator Holding		Helsinge Fjernvarme
Cheminova	Operator Holding		Cheminova A/S
Novo Nordisk	Operator Holding		Novo Nordisk A/S
Haldor Topsøe	Operator Holding		Haldor Topsøe A/S
Roulunds Energy	Operator Holding		Roulunds Energy ApS
Ardagh Holmegaa	Operator Holding		Ardagh Glass Holmegaard A/S
Saint Gobain I	Operator Holding		Saint Gobain Isover A/S
Bachmann Tegl	Operator Holding		A/S Bachmanns Teglværk
Carl M tegl	Operator Holding		Carl Matzens teglværk
Gråsten tegl	Operator Holding		Gråsten Teglværk
Helligsø Tegl	Operator Holding		Helligsø Teglværk A/S
Højslev Tegl	Operator Holding		Højslev Teglværk A/S
Volstrup Tegl	Operator Holding		Monier A/S
Lundgård tegl	Operator Holding		Lundgaard Teglværk A/S
Egernsund tegl	Operator Holding		Petersen Tegl A/S
Petersminde T	Operator Holding		Wienerberger A/S
Aabenraa fjernv	Operator Holding		Aabenraa-Rødekro Fjernvarme
Aabenraa fv	Operator Holding		Aabenraa-Rødekro Fjernvarme
Rødekro fjernva	Operator Holding		Aabenraa-Rødekro Fjernvarme
Tønder Fjernvar	Operator Holding		Tønder Fjernvarmeselskab A.m.b.a
Lemvig varmevær	Operator Holding		Lemvig Varmeværk
Billund varmev	Operator Holding		Billund Varmeværk A.m.b.a.
Rindum værket	Operator Holding		Ringkøbing Fjernvarmeværk AmbA
Vildbjerg Varme	Operator Holding		Vildbjerg Varmeværk
Brovst Fjernvar	Operator Holding		Brovst Fjernvarnvarme
Skanderborg FV	Operator Holding		Skanderborg-Hørning Fjernvarme
Hjerting Varmev	Operator Holding		Esbjerg Varme A/S
Spangsbjerg-G V	Operator Holding		Esbjerg Varme A/S

Account Name	KP Account Type	CP	Account Holder
Sædding Varmev	Operator Holding		Esbjerg Varme A/S
Nakskov Fvarme	Operator Holding		Nakskov Fjernvarme
Tarm Varmeværk	Operator Holding		Tarm varmeværk
Hobro Varmeværk	Operator Holding		Hobro Varmeværk A.M.B.A.
Hedensted Fv	Operator Holding		Hedensted Fjernvarme
Dagnæs-Bækkel V	Operator Holding		Dagnes-Bækkelund Varmeværk AMBA
Roskilde Varme	Operator Holding		Roskilde Varme A/S
Rosklide varmeF	Operator Holding		Roskilde Varme A/S
Gråstem Kom VF	Operator Holding		Gråsten Varme A/S
Piper Gandrup T	Operator Holding		Pipers Teglværker A/S
Pipers Hammersh	Operator Holding		Pipers Teglværker A/S
Tychsen Tegl	Operator Holding		Tychsens Teglværk A/S
Vedstaarup Tegl	Operator Holding		Vedstaarup Teglværk A/S
Vesterled tegl	Operator Holding		Vesterled Teglværk A/S
Vilemoes Teglv	Operator Holding		VillemoesTeglværk A/S
Vindø Teglværk	Operator Holding		Pipers Teglværker A/S
Pedershvile Teg	Operator Holding		Wienerberger A/S
Bredstrup Varme	Operator Holding		grenaa varmeværk a.m.b.a.
Mølholm Varmev	Operator Holding		Andelsselskabet Mølholm Varmeværk
Hundige Fjernv	Operator Holding		Hundige Fjernvarme
Jyderup Varme	Operator Holding		Jyderup Varme A/S
Frederiksgade V	Operator Holding		Hillerød Varme A/S
Ullerød Varme	Operator Holding		Hillerød Varme A/S
Kgs. Vænge V C	Operator Holding		Hillerød Varme A/S
Elmegaarden Var	Operator Holding		Hillerød Varme A/S
Ikast El og var	Operator Holding		Ikast el og varmeværk
Nykøbing Sj V	Operator Holding		Nykøbing Sj. Varmeværk
Kertminde Kv	Operator Holding		Kerteminde Forsyning - Varme A/S
Brønderslev KV	Operator Holding		Brønderslev Varme A/S
Svendborg Kraft	Operator Holding		Svendborg Fjernvarme A.M.B.A.
ÅKV Århusværket	Operator Holding		AffaldVarme Århus, Teknik og Miljø, Århus Kommune
ÅKV Risskov	Operator Holding		AffaldVarme Århus, Teknik og Miljø, Århus Kommune
ÅKV Jens Juul v	Operator Holding		AffaldVarme Århus, Teknik og Miljø, Århus Kommune
ÅKV Viby	Operator Holding		AffaldVarme Århus, Teknik og Miljø, Århus Kommune
Gellerup	Operator Holding		AffaldVarme Århus, Teknik og Miljø, Århus Kommune
Vamdrup Fjernv	Operator Holding		Vamdrup Fjernvarme I.M.B.A.
Ribe Fjernv	Operator Holding		Ribe fjernvarme Amba
Ribe Kraftv	Operator Holding		Ribe fjernvarme Amba
Haderslev F	Operator Holding		Haderslev Fjernvarme amba
Haderslev fjern	Operator Holding		Haderslev Fjernvarme amba
Brande fjernv	Operator Holding		Brande fjernvarme
Broager Fjernv	Operator Holding		Broager Fjernvarmeselskab
Sindal Varmef	Operator Holding		Sindal Varmeforsyning
Kjellerup Fjern	Operator Holding		Kjellerup Fjernvarme Amba
Assens Fjernv	Operator Holding		Assens Fjernvarme
Bramming Fjernv	Operator Holding		Bramming Fjernvarme amba
Toftlund Fjernv	Operator Holding		Toftlund Fjernvarme A.m.b.a
Taars Varmeværk	Operator Holding		Tårs Varmeværk Amba
Helsingør Kom	Operator Holding		Forsyning Helsingør Varme A/S
Helsingør KV	Operator Holding		Forsyning Helsingør Varme A/S
Hjørring Vforsy	Operator Holding		Hjørring Varmeforsyning
Hjørring VF	Operator Holding		Hjørring Varmeforsyning

Account Name	KP Account Type	CP	Account Holder
Hjørring Varmef	Operator Holding		Hjørring Varmeforsyning
Vrå Varmeværk	Operator Holding		Vrå Varmeværk Amba
Horsens Varme	Operator Holding		Horsens Fjernvarme
Horsens Varmev	Operator Holding		Horsens Fjernvarme
Hadsten Varmev	Operator Holding		Hadsten Varmeværk A.m.b.a.
Vejle Fjernv	Operator Holding		Vejle Fjernvarme a.m.b.a.
I/S Skive Fjern	Operator Holding		I/S Skive Fjernvarme
Skive fjernvarm	Operator Holding		I/S Skive Fjernvarme
SK-Varme A/S	Operator Holding		SK-Varme A/S
SK-varme A/S	Operator Holding		SK-Varme A/S
Solrød FV	Operator Holding		Solrød Fjernvarmeværk
Hvide Sande V	Operator Holding		Hvide Sande Fjernvarme A.m.b.a.
Næstved Varmev	Operator Holding		Næstved Varmeværk A.m.b.a.
Næstved Varme	Operator Holding		Næstved Varmeværk A.m.b.a.
Frederiksværk V	Operator Holding		Halsnæs Kommunale Varmeforsyning
Nybrovej Centra	Operator Holding		Næstved Varmeværk A.m.b.a.
Phistersvej SC	Operator Holding		CTR I/S
Frederiksberg V	Operator Holding		CTR I/S
Høje Gladsaxe V	Operator Holding		CTR I/S
Gladsaxe Spidst	Operator Holding		CTR I/S
Utterslev Varme	Operator Holding		CTR I/S
Næstved Kraftv	Operator Holding		I/S AffaldPlus
Tørring KarftV	Operator Holding		Tørring Kraftvarmeværk
Lystrup FjernV	Operator Holding		Lystrup Fjernvarme
Nykøbing Kom V	Operator Holding		Guldborgsund Varme A/S
Holme-Lundshøj	Operator Holding		Holme-Lundshøj Fjernvarme AMBA
Operator Account:DK192	Operator Holding		Gram Fjernvarme AMBA
Høng Varmeværk	Operator Holding		Høng Varmeværk a.m.b.a.
Odder Varmeværk	Operator Holding		Odder Varmeværk A.m.b.A.
Svogerslev FV	Operator Holding		Svogerslev Fjernvarme
VEKS Høje Tåstr	Operator Holding		Høje Taastrup Fjernvarme
VEKS Advedøre	Operator Holding		Avedøre Fjernvarme
Frederikshavn K	Operator Holding		Frederikshavne Varme A/S
Frderikshavn VF	Operator Holding		Frederikshavne Varme A/S
Bogense Forsyn	Operator Holding		Bogense Forsyningsselskab
Fv Brøndby Ø	Operator Holding		Brøndby Fjernvarme amba
FV Brøndby V	Operator Holding		Brøndby Fjernvarme amba
Midelfart Fvarm	Operator Holding		Middelfart Fjernvarme a.m.b.a.
Rønne VV	Operator Holding		Rønne Varme A/S
Vestforbrænding	Operator Holding		I/S Vestforbrænding
Hedegard Varme	Operator Holding		I/S Vestforbrænding
Fjern.v Avedøre	Operator Holding		Fjernvarmecentralen Avedøre Holme
Colas Horsens	Operator Holding		Colas Danmark A/S
Colas Vinderup	Operator Holding		Colas Danmark A/S
NLMK DanSteel	Operator Holding		NLMK DanSteel A/S
Nybro Gas	Operator Holding		DONG Naturgas A/S
GEF Smørmosen	Operator Holding		Grundejerforeningen Smørmosen
GlostrupSygehus	Operator Holding		E.ON Produktion Danmark A/S
NCC Asfalt A/S	Operator Holding		NCC Roads A/S
NCC Asfalt	Operator Holding		NCC Roads A/S
NCC RoadsAsfalt	Operator Holding		NCC Roads A/S
NCC Roads Trige	Operator Holding		NCC Roads A/S

Account Name	KP Account Type	CP	Account Holder
Nybro Tørreri	Operator Holding		Nybro Tørreri A.m.b.A.
Palsgaard A/S	Operator Holding		Palsgaard A/S
Knud Jepsen A/S	Operator Holding		A/S Knud Jepsen
Alfred P og Søn	Operator Holding		Alfred Pedersen & Søn ApS
Kronborg Aps	Operator Holding		Gartneriet Kronborg
Garneri Masnedø	Operator Holding		Gartneriet Masnedø A/S
VarpelevTomater	Operator Holding		Østervang Sjælland A/S
Akzo Nobel Salt	Operator Holding		Akzo Nobel Salt A/S
Damolin Fur	Operator Holding		Damolin A/S
Damolin Mors	Operator Holding		Damolin A/S
Sønderskov Tegl	Operator Holding		Wienerberger A/S
AalborgPortland	Operator Holding		Aalborg Portland A/S
Faxe Kalk	Operator Holding		Faxe Kalk A/S
Knauf A/S	Operator Holding		Knauf A/S
Gyproc A/S	Operator Holding		Gyproc A/S
Tarco Vej	Operator Holding		Munck Asfalt A/S
TarcoVej Nyborg	Operator Holding		Munck Asfalt A/S
Tarco vej A/S	Operator Holding		Munck Asfalt A/S
DC Horsens:DK243	Operator Holding		Danish Crown A/S
Daka Løsning	Operator Holding		Daka amba
Daka Ortved	Operator Holding		Daka amba
Daka Randers	Operator Holding		Daka amba
Tulip Vejle:DK247	Operator Holding		Tulip Food Company
Fiskernes fiske	Operator Holding		Fiskernes Fiskeindustri Amba
Hanstholm fiske	Operator Holding		Hanstholm Fiskemelsfabrik A/S
Triplenine fish	Operator Holding		Tripleline Fish Protein A.m.b.a.
Triplenine	Operator Holding		Tripleline Fish Protein A.m.b.a.
Aarhus United	Operator Holding		Aarhus Karlshamn Denmark A/S
ArlaFoods Akafa	Operator Holding		ARLA Foods Energy A/S
Maribo Varme	Operator Holding		Maribo Varmeværk AMBA
værløse Varmev	Operator Holding		Værløse Varmeværk Amba
Ishøj Kom Varme	Operator Holding		Ishøj Varmeværk
Silkeborg K	Operator Holding		Silkeborg Varme A/S
Silkeborg Varme	Operator Holding		Silkeborg Varme A/S
Oksbøl Varmev	Operator Holding		Andelsselskabet Oksbøl Varmeværk
Brørup Fjernv	Operator Holding		Brørup Fjernvarme A.m.b.a.
Lem Varmev	Operator Holding		Lem varmeværk
Lyngvej Central	Operator Holding		Aalborg Kommune
Svendborg Centr	Operator Holding		Aalborg Kommune
ArlaFoodsArico	Operator Holding		ARLA Foods Energy A/S
Arla Foods HOCO	Operator Holding		ARLA Foods Energy A/S
Dangrønt Ribe	Operator Holding		Dangrønt Products A/S
Dangrønt Ringkø	Operator Holding		Dangrønt Products A/S
Nordic S Nykøb	Operator Holding		Nordic Sugar A/S
NordicS Nakskov	Operator Holding		Nordic Sugar A/S
Højvang varmec	Operator Holding		Aalborg Kommune
Gasværksvej V	Operator Holding		Aalborg Kommune
Støvring Varme	Operator Holding		Støvring Kraftvarmeværk A.m.b.a.
Bjerringbro KV	Operator Holding		Bjerringbro Varmeværk Amba
Nørre Åby KV	Operator Holding		Nørre Aaby Kraftvarmeværk
Jetsmark energi	Operator Holding		Jetsmark Energiværk
Kolding Syd	Operator Holding		TRE-FOR Varme A/S

Account Name	KP Account Type	CP	Account Holder
Kolding DampC	Operator Holding		TRE-FOR Varme A/S
Kolding Skovpar	Operator Holding		TRE-FOR Varme A/S
Kolding varmev.	Operator Holding		TRE-FOR Varme A/S
Nørremarken K	Operator Holding		TRE-FOR Varme A/S
Søndermarken K	Operator Holding		TRE-FOR Varme A/S
Bjerringbro V.V	Operator Holding		Bjerringbro Varmeværk Amba
Sønderborg KV	Operator Holding		Sønderborg Kraftvarmeværk I/S
Jægerspris Kraf	Operator Holding		Jægerspris Kraftvarme Amba
Avedøreværket:DK291	Operator Holding		Dong Energy Power A/S
DTU Kraftvarmeværk:DK292	Operator Holding		Dong Energy Power A/S
Helsingør Kraftvarmeværk:DK293	Operator Holding		Helsingør Kraftvarmeværk A/S
Hillerød Kraftvarmeværk:DK294	Operator Holding		Hillerød Kraftvarme Aps
Asnæsværket:DK295	Operator Holding		Dong Energy Power A/S
Stigsnæsværket:DK296	Operator Holding		Dong Energy Power A/S
Slagelse Kraftvarmeværk:DK297	Operator Holding		SK-Varme A/S
Masnedøværket:DK298	Operator Holding		Dong Energy Power A/S
Amagerværket:DK299	Operator Holding		Vattenfall A/S
H.C. Ørstedsværket:DK300	Operator Holding		Dong Energy Power A/S
Svanemølleværket:DK301	Operator Holding		Dong Energy Power A/S
Ringsted Kraftvarmeværk:DK302	Operator Holding		Ringsted Kraftvarmeværk
Køge Kraftvarmeværk:DK303	Operator Holding		Dong Energy Power A/S
Maribo-Sakskøbing Kraftvarmeværk:DK304	Operator Holding		REFA Energi A/S
Løgstør Fjernv	Operator Holding		Løgstør Fjernevarme A.m.b.a.
OtterupKommunal	Operator Holding		Fjernvarme Fyn
Frederikssund K	Operator Holding		E.ON Produktion Danmark A/S
DTUKedelcentral	Operator Holding		DTU keddelcentral
Øster Vrå	Operator Holding		Østervrå varmeværk
Smørum Kraftv	Operator Holding		Smørum Kraftvarme A.m.b.A
Svendborg Fjern	Operator Holding		Svendborg Fjernvarme A.M.B.A.
SvendborgFjernv	Operator Holding		Svendborg Fjernvarme A.M.B.A.
Ebeltoft Fjernv	Operator Holding		Ebeltoft Fjernvarmeværk
SilkeborgKraftv	Operator Holding		Silkeborg Varme A/S
Elsam Kraft, FYV:DK315	Operator Holding		Vattenfall A/S
DONG Energy Generation A/S, SSV:DK316	Operator Holding		Dong Energy Power A/S
DONG Energy Generation A/S, SKV:DK317	Operator Holding		Dong Energy Power A/S
DONG Energy Generation A/S, HEV:DK318	Operator Holding		Dong Energy Power A/S
Ringkøbing Værk	Operator Holding		Ringkøbing Fjernvarmeværk AmbA
DONG Engery Gen	Operator Holding		Skjern Fjernvarme amba
DONG Energy Generation A/S, ENV:DK321	Operator Holding		Dong Energy Power A/S
Frederikshavn Kraftvarmeværk:DK322	Operator Holding		Frederikshavne Varme A/S
Elsam Kraft, NJV:DK323	Operator Holding		Vattenfall A/S
HirtshalsKraftv	Operator Holding		Hirtshals Fjernvarme amba
DONG Energy Generation A/S, ESV:DK325	Operator Holding		Dong Energy Power A/S
DK34	Operator Holding		Verdo Produktion A/S
Energi Randers	Operator Holding		Verdo Produktion A/S
EnergiRandersPr	Operator Holding		Verdo Produktion A/S
Måbjergværket A/S:DK329	Operator Holding		Måbjergværket A/S
Horsens Kraftv.	Operator Holding		Horsens Kraftvarmeværk A/S
KVV Grønningen	Operator Holding		GEV Varme A/S
KVV Tårnvej	Operator Holding		GEV Varme A/S
NyborgForsyning	Operator Holding		Nyborg Forsyning & Service A/S
Korsør Varme	Operator Holding		SK-Varme A/S

Account Name	KP Account Type	CP	Account Holder
Østkraft	Operator Holding		Østkraft Production A/S
Energigruppen J	Operator Holding		EnergiGruppen Jylland Varme A/S
Energigruppen N	Operator Holding		EnergiGruppen Jylland Varme A/S
Brøndby s. fvc	Operator Holding		Brøndby Fjernvarme amba
Viborg kraftva	Operator Holding		Energi Viborg Kraftvarme A/S
Viborg kraftv	Operator Holding		Energi Viborg Kraftvarme A/S
Viborg Kraftv	Operator Holding		Energi Viborg Kraftvarme A/S
Lygten Varme	Operator Holding		HOFOR Fjernvarme P/S
Østre Varme	Operator Holding		HOFOR Fjernvarme P/S
Sundholm Varmec	Operator Holding		HOFOR Fjernvarme P/S
Hinnerup Fjernv	Operator Holding		Hinnerup Fjernvarme amba
Brændstrup T.E.	Operator Holding		Brædstrup Totalenergianlæg A/S
Stavnsholt Central:DK348	Operator Holding		Farum Fjernvarme A M B A
Central H	Operator Holding		Vestforsyning Varme A/S
Central Nord	Operator Holding		Vestforsyning Varme A/S
Cnetral Ellebæk	Operator Holding		Vestforsyning Varme A/S
Central vest	Operator Holding		Vestforsyning Varme A/S
Central Øst	Operator Holding		Vestforsyning Varme A/S
Faaborg Fjernv	Operator Holding		FFV Varme A/S
Vojens Fjernv	Operator Holding		Vojens Fjernvarme a.m.b.a.
Albertslund V.V	Operator Holding		Albertslund Varmeværk
Thisted Varmef.	Operator Holding		Thisted Varmeforsyning amba
Vinderup Varme	Operator Holding		Vinderup Varmeværk
Videbæk E. For.	Operator Holding		Videbæk Varme A/S
Ringe Fjernvarm	Operator Holding		Ringe Fjernvarmeselskab A M B A
Tranbjerg V.V	Operator Holding		Tranbjerg Varmeværk
Skagen V.Værk	Operator Holding		Skagen Varmeværk a.m.b.a.
Skagen KV	Operator Holding		Skagen Varmeværk a.m.b.a.
Hjallerup fv	Operator Holding		Hjallerup Fjernvarmeværk
VC Bellinge	Operator Holding		Fjernvarme Fyn
VC Billedskærer	Operator Holding		Fjernvarme Fyn
VC Bolbro	Operator Holding		Fjernvarme Fyn
VC Centrum	Operator Holding		Fjernvarme Fyn
VC Dyrup	Operator Holding		Fjernvarme Fyn
VC Dalum	Operator Holding		Fjernvarme Fyn
VC Næsby	Operator Holding		Fjernvarme Fyn
VC Pårup	Operator Holding		Fjernvarme Fyn
Vc Sanderum	Operator Holding		Fjernvarme Fyn
VC Sydøst	Operator Holding		Fjernvarme Fyn
VOV	Operator Holding		Fjernvarme Fyn
Fredericia fv	Operator Holding		Fredericia fjernvarme A.M.B.A.
Fredericia Fv	Operator Holding		Fredericia fjernvarme A.M.B.A.
Sønderborg Fv	Operator Holding		Sønderborg Fjernvarme A.m.b.a.
Sønderborg Fv.	Operator Holding		Sønderborg Fjernvarme A.m.b.a.
Varmec Sønderm.	Operator Holding		Varde Varmeforsyning A/S
Varmec. Toften	Operator Holding		Varde Varmeforsyning A/S
Vorskla Steel Denmark A/S	Operator Holding		Vorskla Steel Denmark A/S
Colas, Sundsholmen:DK448	Operator Holding		Colas Danmark A/S
Effektpartner:DK481	Operator Holding		Effektpartner
Effektmarked DK:DK498	Operator Holding		Effektmarked A/S
Hjortebjerg CO2 konto I:DK500	Operator Holding		Gartneriet Hjortebjerg I/S
Imkvejvandel:DK504	Operator Holding		Lemminkäinen A/S

Account Name	KP Account Type	CP	Account Holder
Thisted varmef.	Operator Holding		Thisted Varmeforsyning amba
KLC2:DK517	Operator Holding		CTR I/S
Energi Fyn Produktion A/S:DK518	Operator Holding		Energi Fyn Produktion A/S
Aulum Fjernvarme a.m.b.a:DK532	Operator Holding		Aulum fjernvarme Amba
Aulum Fjernvarme a.m.b.a:DK533	Operator Holding		Aulum fjernvarme Amba
Energi Fyn produktion A/S:DK543	Operator Holding		Energi Fyn Produktion A/S
Østermose BioEnergi A/S:DK548	Operator Holding		Østermose BioEnergi A/S
Vækst og Miljø v/Ulrik Dahl:DK550	Operator Holding		Vækst og Miljø v/Ulrik Dahl
Skou Hansen I/S	Operator Holding		Skou Hansen I/S
Nibe Varmværk A.m.b.a:DK556	Operator Holding		Nibe Varmeværk amba
Flexenergi A/S:DK661	Operator Holding		Flexenergi A/S
MPM Invest Aps	Operator Holding		MPM Invest Aps
Syd Energi Salg:DK663	Operator Holding		Energi Fyn Produktion A/S
DK plant aps	Operator Holding		DK plant aps.
401 reg. Ikast	Operator Holding		Regulerkraft Ikast Aps
Grenaa Effekt-	Operator Holding		Grenaa Effektreserve
Energi Fyn Prod	Operator Holding		Energi Fyn Produktion A/S
Regulerkraft Fr	Operator Holding		Energi Fyn Produktion A/S
Bording Kraftva	Operator Holding		Bording kraftvarmeværk
Biogen Idec	Operator Holding		Biogen Idec (Denmark) Manufacturing ApS
Fjernv.Ø Toreby	Operator Holding		Fjernvarmeforsyningen i Ø Toreby, Toreby, Sundby og Nagelsti Amba
Græsted FV	Operator Holding		Græsted Fjernvarme A.m.b.a.
Gilleleje Fv	Operator Holding		Gilleleje Fjernvarme A M B A
Hurup Fjernvarm	Operator Holding		Hurup Fjernvarme A.m.b.a
Masnedø Dong	Operator Holding		Dong Energy Power A/S
Masnedø halm	Operator Holding		Vordingborg Kraftvarme A/S
DONG Naturgas	Person Holding		DONG Naturgas A/S
DONG Energy P	Person Holding		Dong Energy Power A/S
NJ Elhandel	Person Holding		Nordjysk Elhandel A/S
EnergiMidt	Person Holding		EnergiMidt Handel A/S
GF Fasanvænget	Person Holding		Torben Frøberg
Novo Nordisk AS	Person Holding		Novo Nordisk A/S
CTR I/S 2	Person Holding		CTR I/S
KE Varme P/S	Person Holding		HOFOR Fjernvarme P/S
ÅKV	Person Holding		AffaldVarme Århus, Teknik og Miljø, Århus Kommune
CTR I/S	Person Holding		CTR I/S
Duferco DS	Person Holding		Duferco Danish Steel A/S
Vattenfall TP	Person Holding		Vattenfall A/S
DONG Energy El & Gas A/S	Person Holding		DONG Energy El & Gas A/S
Rockwool	Person Holding		Rockwool International A/S
EXIMA ApS	Person Holding		EXIMA ApS
Scanenergi A/S	Person Holding		Scanenergi A/S
DONG Naturgas2	Person Holding		DONG Naturgas A/S
ON	Person Holding		Odense Nord Aps
BF	Person Holding		Bellinge - Fangel Aps.
ÅL	Person Holding		Åsum og Langeskov Aps
L	Person Holding		Lindved Aps
Ulla Hald	Person Holding		Sunds Vand og Varme
Maersk Olie/Gas	Person Holding		Maersk Olie og Gas
Ingen CO2	Person Holding		Ingen CO2
81242500	Person Holding		Caltech Industries UG
Energie I. GmbH	Person Holding		Energie Intelligenz GmbH

Account Name	KP Account Type	CP	Account Holder
OK a.m.b.a	Person Holding		OK a.m.b.a
Dansk Shell A/S	Person Holding		Dansk Shell A/S
Energi Danmark	Person Holding		Energi Danmark
Verdo Energy	Person Holding		Verdo Energy A/S
AAEN A/S	Person Holding		AAEN RÅDGIVENDE INGENIØRER A/S
DANSKECOM	Person Holding		Danske Commodities A/S
Avadon A/S	Person Holding		Avadon A/S
Maersk Energy M	Person Holding		Maersk Energy Marketing A/S
national EU-retirement:DK4	Retirement account	0	Energistyrelsen
Tilbagetrækning CP1:DK501	Retirement account	1	Energistyrelsen
Tilbagetrækningskonto	Retirement account	1	Erhvervsstyrelsen
tCER	TCER REPLACEMENT ACCOUNT EXPIRY	1	Energistyrelsen
Erstatningskonto for tCER, som er ved at udløbe	TCER REPLACEMENT ACCOUNT EXPIRY	1	Erhvervsstyrelsen
Frivillig annulleringskonto:DK1	Voluntary cancellation	0	Energistyrelsen
Annullering CP1:DK502	Voluntary cancellation	1	Energistyrelsen
Frivillig annulleringskonto	Voluntary cancellation	1	Erhvervsstyrelsen

2. Public Information on Legal Entities

Legal Entity	Address Line 1	Address Line 2	Postal Code	City	Country
A/S Bachmanns Teglværk	Amtsvejen 23	Nybøl	6400	Sønderborg	DK
A/S Dansk Shell	c/o Finans fortroligt	Rued Langgaards Vej 6-8, 5.	2300	København S	DK
A/S Knud Jepsen	Skanderborgvej 193	Norring	8382	Hinnerup	DK
AffaldVarme Århus, Teknik og Miljø, Århus Kommune	Rådhuspladsen 2	.	8000	Aarhus C	DK
Akzo Nobel Salt A/S	Hadsundvej 17		9550	Mariager	DK
Albertslund Varmeværk	Vognporten 9		2620	Albertslund	DK
Alfred Pedersen & Søn ApS	Asssensvej 217		5250	Odense SV	DK
Andelsselskabet Mølholm Varmeværk	Mølholm Landevej 14	Mølholm	7100	Vejle	DK
Andelsselskabet Oksbøl Varmeværk	Industrivej 10		6840	Oksbøl	DK
Ardagh Glass Holmegaard A/S	Glasværksvej 52	Fensmark	4684	Holmegaard	DK
Arkil A/S - Asfalt	Tingvejen 32, Skrydstrup		6500	Vojens	DK
ARLA Foods Energy A/S	Sønderhøj 14		8260	Viby J	DK
Assens Fjernvarme	Stejlebjergvej 4		5610	Assens	DK
Aulum fjernvarme Amba	Rugbjergvej 3		7490	Aulum	DK
Avadon A/S	Bredskifte Allé 11		8210	Århus V	DK
Avedøre Fjernvarme	c/o EBO Consult	Strandmarksvej 27a	2650	Hvidovre	DK
Bellinge - Fangel Aps.	c/o Energi Fyn Holding A/S	Sanderumvej 16	5250	Odense SV	DK
Billund Varmeværk A.m.b.a.	Møllevej 9		7190	Billund	DK
Biogen Idec (Denmark) Manufacturing ApS	Biogen Idec Alle 1		3400	Hillerød	DK
Bjerringbro Varmeværk Amba	Realskolevej 18		8850	Bjerringbro	DK
Bogense Forsyningsselskab	Fynsvej 5		5400	Bogense	DK
Bording kraftvarmeværk	Europavej 2		7430	Ikast	DK
Bramming Fjernvarme amba	Grønningen 7		6740	Bramming	DK
Brande fjernvarme	Præstevænget 8		7330	Brande	DK
Brdr. Hartmann A/S	Ørnegaardsvej 18		2820	Gentofte	DK
Broager Fjernvarmeselskab	Østergade 21		6310	Broager	DK
Brovst Fjernvarnvarme	Nørremarksvej 22		9460	Brovst	DK
Brædstrup Totalenergianlæg A/S	Fjernvarmevej 2		8740	Brædstrup	DK
Brøndby Fjernvarme amba	Kirkebjerg Alle 92 A		2605	Brøndby	DK
Brønderslev Varme A/S	Virksomhedsvej 20		9700	Brønderslev	DK
Brørup Fjernvarme A.m.b.a.	Vandværksvej 5		6650	Brørup	DK

Legal Entity	Address Line 1	Address Line 2	Postal Code	City	Country
Caltech Industries UG	Office 104	2 Rosenstrasse	D-10178	Berlin	DE
Carl Matzens teglværk	Havnevej 44		6320	Egernsund	DK
Carlsberg Danmark A/S	Vesterfælledvej 100		1799	København V	DK
Cheminova A/S	Thyborønvej 78		7673	Harboøre	DK
Colas Danmark A/S	Fabriksparken 40		2600	Glostrup	DK
CP Kelco ApS	Ved Banen 16		4623	Lille Skensved	DK
CTR I/S	Stæhr Johansens Vej 38		2000	Frederiksberg	DK
Dagnes-Bækkelund Varmeværk AMBA	Glerntevej 8		8700	Horsens	DK
Daka amba	Bragesvej 18		4100	Ringsted	DK
Dalum Papir A/S	Dalumvej 116		5250	Odense SV	DK
Damolin A/S	Kønsborgvej 9		7884	Fur	DK
Danfoss A/S	Nordborgvej 81		6430	Nordborg	DK
Dangrønt Products A/S	c/o Vitalys I/S	Limfjordsvej 4	6715	Esbjerg N	DK
Danish Crown A/S	Marsvej 43		8960	Randers SOE	DK
Danish Malting Group A/S	Spirevej 5		4760	Vordingborg	DK
Dansk Shell A/S	Nærum Hovedgade 6		2850	Nærum	DK
Danske Commodities A/S	Vaerkmestergade 3, 3.sal		8000	Aarhus C	DK
DK plant aps.	Gartnerivej 5		5450	Otterup	DK
DONG E&P A/S	Agern Allé 24-26		2970	Hørsholm	DK
DONG Energy El & Gas A/S	Kraftværksvej 53	Skærbæk	7000	Fredericia	DK
Dong Energy Power A/S	Kraftværksvej 53	.	7000	Fredericia	DK
DONG Naturgas A/S	Kraftværksvej 53	Skærbæk	7000	Fredericia	DK
DTU keddelcentral	Energivej bygning 415		2800	Kgs. Lyngby	DK
Duferco Danish Steel A/S	Havnevej 47		3300	Frederiksværk	DK
DuPont Nutrition Biosciences Aps	Langebrogade 1		1001	København K.	DK
E.ON Produktion Danmark A/S	Nørrelundvej 10		2730	Herlev	DK
Ebeltoft Fjernvarmeværk	Hans Winthers Vej 9		8400	Ebeltoft	DK
Effektmarked A/S	Europavej 2		7430	Ikast	DK
Effektpartner	Estrupvej 28		6700	Esbjerg	DK
Energi Danmark	Hedeager 5		8200	Aarhus N	DK
Energi Fyn Produktion A/S	Sanderumvej 16		5250	Odense SV	DK
Energi Viborg Kraftvarme A/S	Industrivej 40		8800	Viborg	DK
Energie Intelligenz GmbH	Charlottenstrasse 68		D-10117	Berlin	DE
EnergiGruppen Jylland Varme A/S	Tietgensvej 2-4		8600	Silkeborg	DK
EnergiMidt Handel A/S	Tietgensvej 2		8600	Silkeborg	DK
Energistyrelsen	Amaliegade 44		1256	København K	DK
Energistyrelsen	Amaliegade 44		1256	København K	DK
Energistyrelsen	Amaliegade 44		1256	København K	DK
Erhvervsstyrelsen	Langelinie Allé 17		2100	København Ø	DK
Esbjerg Varme A/S	Ravnevej 10		6705	Esbjerg Ø	DK
EXIMA ApS	Langøgade 17, 2. th		2100	København Ø	DK
Farum Fjernvarme A M B A	Stavnsholtvej 33		3520	Farum	DK
Faxe Kalk A/S	Hovedgaden 13		4654	Faxe Ladeplads	DK
FFV Varme A/S	Sundvænget 5		5600	Faaborg	DK
Fiskernes Fiskeindustri Amba	Havnevagtvej 12		9990	Skagen	DK
Fjernvarme Fyn	Billedskærervej 7		5230	Odense M	DK
Fjernvarmecentralen Avedøre Holme	Nordholmen 1		2650	Hvidovre	DK
Fjernvarmeforsyningen i Ø Toreby, Toreby, Sundby og Nagelsti Amba	Agrovej 3		4800	Nykøbing F	DK
Flexenergi A/S	Højrebyvej 14		4952	Stokkemarke	DK
Forsyning Helsingør Varme A/S	Haderslevvej 25		3000	Helsingør	DK
Fredericia fjernvarme A.M.B.A.	Dalegade 38		7000	Fredericia	DK
Frederikshavne Varme A/S	Vidarsvej 1		9800	Hjørring	DK

Legal Entity	Address Line 1	Address Line 2	Postal Code	City	Country
Fællinggaard Varmeforsyning ApS	Ny Vestergade 72 A	Vejle	5672	Broby	DK
Gartneriet Hjortebjerg I/S	Hjortebjergvej 26		5471	Søndersø	DK
Gartneriet Kronborg	Bladstrupvej 302		5450	Otterup	DK
Gartneriet Masnedø A/S	Tuborgvej 48		4540	Fårevejle	DK
Gentofte Hospital	Niels Andersensvej 65		2900	Hellerup	DK
GEV Varme A/S	Tårnvej 24		7200	Grindsted	DK
Gilleleje Fjernvarme A M B A	Fiskerengen 2		3250	Gilleleje	DK
Gram Fjernvarme AMBA	Sønderbyvej 24		6510	Gram	DK
Grenaa Effektreserve	Estrupvej 28	Pb 6064 Sluppen	6700	Esbjerg	DK
grenaa varmeværk a.m.b.a.	energivej 6		8500	grenaa	DK
Grundejerforeningen Smørmosen	Smørmosevej 25 / Novo Allé 1		2880	Bagsværd	DK
Græsted Fjernvarme A.m.b.a.	Mesterbuen 8-10		3230	Græsted	DK
Gråsten Teglværk	Teglværksvej 14		6300	Gråsten	DK
Gråsten Varme A/S	Vemmingbundstrandvej 111		6310	Broager	DK
Guldborgsund Varme A/S	Gaabensevej 116		4800	Nykøbing Falster	DK
Gyproc A/S	Hareskovvej 12		4400	Kalundborg	DK
Haderslev Fjernvarme amba	Fjordagervej 15		6100	Haderslev	DK
Hadsten Varmeværk A.m.b.a.	Toftegårdsvej 30 A		8370	Hadsten	DK
Haldor Topsøe A/S	Nymøllevej 55		2800	Kongens Lyngby	DK
Halsnæs Kommunale Varmeforsyning	Undalsvej 3		3300	Frederiksværk	DK
Hanstholm Fiskemelsfabrik A/S	Nordre Strandvej 54		7730	Hanstholm	DK
Harboes Bryggeri A/S	Spegerborgvej 34		4230	Skælskør	DK
Hedensted Fjernvarme	Løsningvej 26		8722	Hedensted	DK
Helligsø Teglværk A/S	Helligsøvej 15		7760	Hurup Thy	DK
Helsinge Fjernvarme	Skovgårdsvej 4a		3200	Helsinge	DK
Helsingør Kraftvarmeværk A/S	Haderslevvej 25		3000	Helslingør	DK
Hess Denmark	Østergade 26B		1100	København K	DK
Hillerød Kraftvarme Aps	Ægirsvej 4		3400	Hillerød	DK
Hillerød Varme A/S	Ægirsvej 4		3400	Hillerød	DK
Hinnerup Fjernvarme amba	Fanøvej 15		8382	Hinnerup	DK
Hirtshals Fjernvarme amba	Søndergade 12		9850	Hirtshals	DK
Hjallerup Fjernvarmeværk	Gravensgade 18		9320	Hjallerup	DK
Hjørring Varmeforsyning	Buen 7		9800	Hjørring	DK
Hobro Varmeværk A.M.B.A.	Lupinvej 21		9500	Hobro	DK
HOFOR Fjernvarme P/S	c/o Københavns Energi	Ørestads Boulevard 35	2300	København S	DK
Holme-Lundshøj Fjernvarme AMBA	Holme Byvej 14		8270	Højbjerg	DK
Horsens Fjernvarme	Østergade 14		8700	Horsens	DK
Horsens Kraftvarmeværk A/S	Kraftværksvej 53	Skærbæk	7000	Fredericia	DK
Hundige Fjernvarme	Hundige Storcenter 4		2670	Greve	DK
Hurup Fjernvarme A.m.b.a	Nygade 22		7760	Hurup Thy	DK
Hvide Sande Fjernvarme A.m.b.a.	Numitvej 25		6960	Hvide Sande	DK
Hvidovre hospital	Andersen Nexø Vej 26		2860	Søborg	DK
Hvidovre Midt Amba	Strandmarksvej 27 A		2650	Hvidovre	DK
Høje Taastrup Fjernvarme	Malervej 7a		2630	Taastrup	DK
Højslev Teglværk A/S	Mineralvej 2		9220	Aalborg	DK
Høng Varmeværk a.m.b.a.	Banemarken 8		4270	Høng	DK
I/S AffaldPlus	Ved Fjorden 20		4700	Næstved	DK
I/S Skive Fjernvarme	Marius Jensens Vej 3		7800	Skive	DK
I/S Vestforbrænding	Ejby Mosevej 219		2600	Glostrup	DK
Ikast el og varmeværk	Europavej 2		7430	Ikast	DK
Ingen CO2	Højrisvej 19		8240	Risskov	DK
Ishøj Varmeværk	Industrivangen 34		2635	Ishøj	DK

Legal Entity	Address Line 1	Address Line 2	Postal Code	City	Country
Jetsmark Energiværk	Nørregade 81		9490	Pandrup	DK
Jyderup Varme A/S	Kalvemosevej 1		4300	Holbæk	DK
Jægerspris Kraftvarme Amba	Håndværkervej 9	Over Draaby	3630	Jægerspris	DK
Kerteminde Forsyning - Varme A/S	Kohaven 12		5300	Kerteminde	DK
Kjellerup Fjernvarme Amba	Tværgade 4		8620	Kjellerup	DK
Knauf A/S	Kløvermarksvej 6	N/A	9500	Hobro	DK
Lem varmeværk	Askevej 5		6940	Lem st	DK
Lemminkäinen A/S	Nørreskov Bakke 1		8600	Silkeborg	DK
Lemvig Varmeværk	Industrivej 10		7620	Lemvig	DK
Lindved Aps	c/o Energi Fyn Holding A/S	Sanderumvej 16	5250	Odense SV	DK
Lundgaard Teglværk A/S	Lundgårdsvej 10		7850	Stoholm Jyll	DK
Lystrup Fjernvarme	Hovmarken 2		8520	Lystrup	DK
Løgstør Fjernevarme A.m.b.a.	Blekingevej 8		9670	Løgstør	DK
Maersk Energy Marketing A/S	Esplanaden 50		1263	København K	DK
Maersk Olie og Gas	Esplanaden 50		1263	København K	DK
Maribo Varmeværk AMBA	C.E. Christiansens Vej 40		4930	Maribo	DK
Maricogen A/S	Hadsundvej 17		9550	Mariager	DK
Middelfart Fjernvarme a.m.b.a.	Hessgade 21 b		5500	Middelfart	DK
Monier A/S	Kong Christians Alle 53		9000	Aalborg	DK
MPM Invest Aps	Nørregårdsvej 9		4990	Sakskøbing	DK
Munck Asfalt A/S	Slipshavnsvej 12		5800	Nyborg	DK
Måbjergværket A/S	Kraftværksvej 53	Skærbæk	7000	Fredericia	DK
Nakskov Fjernvarme	Nørrevold 2		4900	Nakskov	DK
NCC Roads A/S	Fuglesangsallé 16		6600	Vejen	DK
Nibe Varmeværk amba	Hobrovej 46		9240	Nibe	DK
NLMK DanSteel A/S	Havnevej 33		3300	Frederiksværk	DK
Nordic Sugar A/S	Langebrogade 1		1411	København K	DK
Nordjysk Elhandel A/S	Skelagervej 1		9000	Aalborg	DK
Novo Nordisk A/S	Novo Alle 1		2880	Bagsværd	DK
Novo Nordisk A/S	Novo Allé		2880	Bagsværd	DK
Novopan Træindustri	Fabriksvej 2	Pindstrup	8550	Ryomgård	DK
Novozymes AS	Krogshøjvej 36		2880	Bagsværd	DK
Nyborg Forsyning & Service A/S	Gasværksvej 2		5800	Nyborg	DK
Nybro Tørreri A.m.b.A.	Nybrovej 167		6851	Janderup	DK
Nykøbing Mors Fjernvarmeværk A.m.b.a	Kjærgaardsvej 20		7900	Nykøbing Mors	DK
Nykøbing Sj. Varmeværk	Billesvej 8-10		4500	Nykøbing Sj	DK
Næstved Varmeværk A.m.b.a.	Åderupvej 22-24	Postboks 160	4700	Næstved	DK
Nørre Aaby Kraftvarmeværk	Grønnegade 7		5580	Nørre Aaby	DK
Nørresundby Fjernvarmeforsyning A.m.b.a.	Galstersgade 6		9400	Nørresundby	DK
Odder Varmeværk A.m.b.A.	Skovdalsvej 8		8300	Odder	DK
Odense Nord Aps	c/o Energi Fyn Holding A/S	Sanderumvej 16	5250	Odense SV	DK
Odense Staalskibsværft A/S	Lindø Alleen 150		5330	Munkebo	DK
OK a.m.b.a	Åhave Parkvej 11		8260	Viby J	DK
Palsgaard A/S	Palsgaardvej 10		7130	Juelsminde	DK
Pernod Ricard Denmark A/S	Kanonbådsvej 8		1437	København K	DK
Petersen Tegl A/S	Nybølnorvej 14	Nybølnor	6310	Broager	DK
Pipers Teglværker A/S	Mineralvej 2		9220	Aalborg Øst	DK
REFA Energi A/S	Energivej 4		4800	Nykøbing 4	DK
Regulerkraft Ikast Aps	Ved Banen 29		7430	Ikast	DK
Ribe fjernvarme Amba	Mosevej 100		6760	Ribe	DK
Ringe Fjernvarmeselskab A M B A	Østre Ringvej 43	Postboks 140	5750	Ringe	DK
Ringkøbing Fjernvarmeværk AmbA	Kongevejen 19		6950	Ringkøbing	DK

Legal Entity	Address Line 1	Address Line 2	Postal Code	City	Country
Ringsted Kraftvarmeværk	Bragesvej 18		4100	Ringsted	DK
Rockwool A/S	Hovedgaden 501		2640	Hedehusene	DK
Rockwool International A/S	Hovedgaden 584	Fløng	2640	Hedehusene	DK
Roskilde Varme A/S	Betonvej 12		4000	Roskilde	DK
Roulunds Energy ApS	Hestehaven 39		5260	Odense S	DK
Rønne Varme A/S	Sandemansvej 1 A		3700	Rønne	DK
Saint Gobain Isover A/S	Østermarksvej 4		6580	Vamdrup	DK
Saint-Gobain Weber A/S	Randersvej 75		8940	Randers SV	DK
Scanenergi A/S	Finsensvej 3		7430	Ikast	DK
Silkeborg Varme A/S	Tietgensvej 3		8600	Silkeborg	DK
Sindal Varmeforsyning	Baggevognsvej 32		9870	Sindal	DK
Skagen Varmeværk a.m.b.a.	Ellehammervej 21		9990	Skagen	DK
Skanderborg-Hørning Fjernvarme	Danmarksvej 15		8660	Skanderborg	DK
Skjern Fjernvarme amba	Kongevej 41		6900	Skjern	DK
Skjern Papirfabrik A/S	Birkvej 14		6900	Skjern	DK
Skou Hansen I/S	Stormarksvej 30		4673	Rødvig	DK
SK-Varme A/S	Lilleøvej 3		4220	Korsør	DK
Smørum Kraftvarme A.m.b.A	Skebjergvej 25	Lille Smørum	2765	Smørum	DK
Solrød Fjernvarmeværk	Lerbækvej 17		2680	Solrød	DK
Sophus Fuglsang Export-Maltfabrik	Ribe Landevej 12		6100	Haderslev	DK
Statoil Refining Denmark A/S	Melbyvej 17		4400	Kalunborg	DK
Støvring Kraftvarmeværk A.m.b.a.	Hjedsbækvej 2	Juelstrup	9530	Støvring	DK
Sun Chemical A/S	Københavnsvej 112		4600	Køge	DK
Sunds Vand og Varme	Sunds Vand - og varmeværk	Teglgårdvej 7A	7451	Sunds	DK
Svendborg Fjernvarme A.M.B.A.	Bagergade 40A		5700	Svendborg	DK
Svogerslev Fjernvarme	Stamvejen 11		4000	Roskilde	DK
Sæby Varmeværk amba	Energivej 1		9300	Sæby	DK
Sønderborg Fjernvarme A.m.b.a.	Nørrekobbel 54		6400	Sønderborg	DK
Sønderborg Kraftvarmeværk I/S	Vestermark 16		6400	Sønderborg	DK
Tarm varmeværk	Skolegade 23		6880	Tarm	DK
Thisted Varmeforsyning amba	Ringvej 26		7700	Thisted	DK
Toftlund Fjernvarme A.m.b.a	Østerdalen 3		6520	Toftlund	DK
Torben Frøberg	Fasanvænget 484		2980	Kokkedal	DK
Tranbjerg Varmeværk	Jegstrupvænget 630		8310	Tranbjerg	DK
TRE-FOR Varme A/S	Kokbjerg 30		6000	Kolding	DK
Tripleline Fish Protein A.m.b.a.	Fiskerihavnsgade 35		6700	Esbjerg	DK
Tulip Food Company	Tulipvej 1		8940	Randers SV	DK
Tychsens Teglværk A/S	Nybølnorvej 17		6310	Broager	DK
Tønder Fjernvarmeselskab A.m.b.a	Østergade 83		6270	Tønder	DK
Tørring Kraftvarmeværk	Bygade 5 a		7160	Tørring	DK
Tårs Varmeværk Amba	Damhusvej 27		9830	Tårs	DK
Vamdrup Fjernvarme I.M.B.A.	Nygade 6		6580	Vamdrup	DK
Varde Varmeforsyning A/S	Gl. Kærvej 15		6800	Varde	DK
Vattenfall A/S	Støberigade 14		2450	København SV	DK
Vedstaarup Teglværk A/S	Bogyden 12		5610	Assens	DK
Vejle Fjernvarme a.m.b.a.	Langelinie 60		7100	Vejle	DK
Verdo Energy A/S	Agerskellet 7		8920	Randers NV	DK
Verdo Produktion A/S	Agerskellet 7		8920	Randers NV	DK
Vesterled Teglværk A/S	Vandmøllevej 1	Nybøl	6400	Sønderborg	DK
Vestforsyning Varme A/S	Nupark 51		7500	Holstebro	DK
Videbæk Varme A/S	Godthaabsvej 3		6920	Videbæk	DK
Videbæk Varme A/S	Godthaabsvej 3		6920	Videbæk	DK

Legal Entity	Address Line 1	Address Line 2	Postal Code	City	Country
Vildbjerg Varmeværk	Islandsvej 2		7480	Vildbjerg	DK
VillemoesTeglværk A/S	Lourupvej 2		6690	Gørding	DK
Vinderup Varmeværk	Sevelvej 67 A		7830	Vinderup	DK
Vojens Fjernvarme a.m.b.a.	Hejmdals Brovej 285		6500	Vojens	DK
Vordingborg fjernvarme A/S	Færgegårdsvej 3		4760	Vordingborg	DK
Vordingborg Kraftvarme A/S	Færgegårdsvej 3		4760	Vordingborg	DK
Vorskla Steel Denmark A/S	Havnevej 31		3300	Frederiksværk	DK
Vrå Varmeværk Amba	Korsgade 9		9760	Vrå	DK
Vækst og Miljø v/Ulrik Dahl	Skovsøvej 10		4200	Slagelse	DK
Værløse Varmeværk Amba	Klostergårdsvej 59.		3500	Værløse	DK
Wienerberger A/S	Rørmosevej 85		3200	Helsinge	DK
Østermose BioEnergi A/S	Nedre Hestlundvej 15		7441	Bording	DK
Østervang Sjælland A/S	Myrekærvej 3		4652	Hårlev	DK
Østervrå varmeværk	Industrivej 3		9750	Øster Vrå	DK
Østkraft Production A/S	Skansevej 2		3700	Rønne	DK
Aabenraa-Rødekro Fjernvarme	Humlehaven 2		6200	Aabenraa	DK
AAEN RÅDGIVENDE INGENIØRER A/S	NORDRE STRANDVEJ 46		8240	RISSKOV	DK
Aalborg Kommune	Stigsborg Brygge 5		9400	Nørresundby	DK
Aalborg Portland A/S	Rørdalsvej 44, Postboks 165,		9100	Aalborg	DK
Aarhus Karlshamn Denmark A/S	M.P. Bruuns Gade 27	.	8000	Århus C	DK
Åsum og Langeskov Aps	c/o Energi Fyn Holding A/S	Sanderumvej 16	5250	Odense SV	DK

Annex B 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*[39] 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[40]

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 relation 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.

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.

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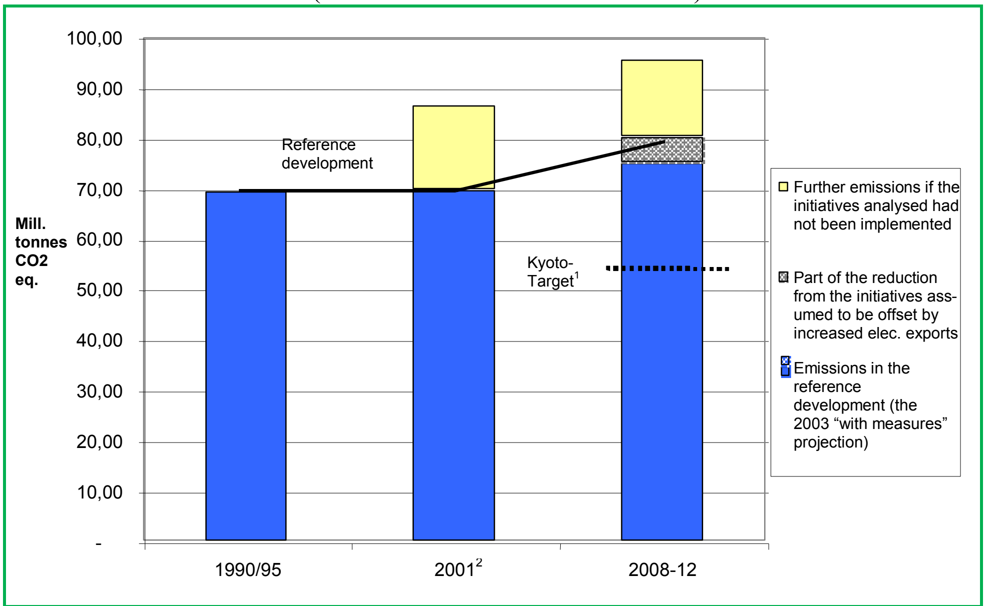
[39] The Effort Analysis is published in the report "Danmarks udledning af CO_2 – indsatsen i perioden 1990-2001 og omkostningerne herved (Denmark's CO_2 Emissions – Efforts in the Period 1990-2001 and the costs involved) – Main and Annex Report, Statement from the Danish EPA no. 2 and 3, 2005 (in Danish).

[40] 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.

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 B-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.

FIGURE B-1: DEVELOPMENTS IN TOTAL CO2 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 CO_2 reductions that domestic actions have led to in other countries.

As Figure B-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*[41])

The *Effort Analysis'* 'without measures' calculation of CO_2 emissions per sector is shown in Table B-1.

[41] 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 B-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 CO2 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. CO_2, CH_4 and N_2O 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 CO_2 per year include the full effects, i.e. they include the CO_2 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 CO_2 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 B-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 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.

TABLE B-2: HISTORICAL CO2 SHADOW PRICES FOR SELECTED MEASURES (CONSUMPTION-BASED CALCULATION)

Sector	Measure	Average annual CO_2 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 CO_2 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 CO_2), Heat pumps (DKK 650/tonne CO_2) and Biomass (DKK 600/tonne CO_2).
[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 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.
[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.

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 B-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 measures in the 1990s: Costs and CO_2 effects*".

TABLE B-3: SENSITIVITY ANALYSES FOR SELECTED MEASURES – EXAMPLES

Measure	Change in parameter	Result of base calculation Shadow price reduction in 2008-12	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.

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 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 B-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 B-4 OVERVIEW OF REDUCTION CONTRIBUTIONS OF MEASURES IN 2001 AND EXPRECTED CONTRIBUTIONS AS ANNUAL AVERAGE REDUCTION IN THE PERIOD 2008-2012 (MILLION TONNES CO2 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 B-4 includes a row with further energy measures.

Table B-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 B-5.

TABLE B-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 CO_2 reductions for 2008-12, an increase in methane corresponding to 0.3 million tonnes CO_2 equivalents has been included. The estimate of CO_2 reductions in 2008-12 from the energy policy of the 1990s includes an increase in methane corresponding to 0.1 million tonnes CO_2 equivalents.

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.

Annex C The effect of selected measures

In December 2013 the Ministry of Climate, Energy and Building published a paper in response to recommendations in a report published by the National Audit Office in October 2012. This paper contains an evaluation of the effects of climate change mitigation measures selected by the National Audit Office and is reproduced in English in this Annex.

"Evaluation of the effects of measures implemented to meet the Kyoto commitment for 2008-12.

1 Introduction

In October 2012 the National Audit Office submitted a report on Denmark's reduction of CO_2 emissions. In this context, the National Audit Office highlighted the impact assessment of national measures to fulfil Denmark's Kyoto commitment and included a note that the Ministry of Climate, Energy and Building had not followed up the assessment of the CO_2 - reducing effect of national reduction measures, including the reductions in individual actions had contributed. Against this background, the National Audit Office found that:

"The Ministry of Climate, Energy and Building Department should calculate the Danish State's total costs of meeting the Kyoto target, and within the limits of its capabilities the Ministry should determine the impact of the national reduction measures. This allows the Ministry to ensure parliament the best possible basis when strategies for future reductions in CO_2 emissions are to be determined."

Specifically, the National Audit Office found that the Ministry should assess the impact of the nine national reduction measures set out in Table C.1 below, on an updated basis.

In his reply of 7 December 2012, the Minister for Climate, Energy and Building noted that the Ministry of Climate, Energy and Building would initiate a comprehensive assessment of the effects of these reduction measures and present the results during 2013. This paper presents the results.

The assessment of the nine measures focuses on both the effect of reductions in 2008-12 non-ETS emissions and the effect on governmental costs. For tax measures, the impact assessment was carried out by the Ministry of Taxation. With regard to the nitrogen effects of the Green Growth agreement, the Ministry of Food, Agriculture and Fisheries announced that an updated assessment is awaiting new figures from DCA / DCE. When the nitrogen effect has been calculated, the climate impact of the Green Growth initiative will be calculated, and an updated assessment will be forwarded.

Other initiatives are assessed by the DEA.

The assessment of individual national efforts is supplemented initially by an updated status of Denmark's use of carbon credits from projects abroad in order to assess the overall state spending on meeting the Kyoto target.

TABLE C.1: NATIONAL REDUCTION INITIATIVES, WHERE THERE IS AN UPDATED IMPACT ASSESSMENT

	Originally expected non-ETS GHG reduction. Annual output in 2008-12 in million tonnes CO_2 equivalents.
1 Heat pumps Replacing oil burners with heat pumps. Awareness campaigns , labeling of efficient pumps , limited subsidies , etc.	0.03
2 Biogas Subsidy for biogas plants when biogas is used with natural gas	Unknown reduction
3 Biofuels Biofuels for blending into gasoline and diesel	0.29
4 Agriculture A number of initiatives on energy, nature and the environment in the Green Growth Agreement in 2009 , including the reduction of nitrogen emissions to the aquatic environment and permanent spraying, fertilizer and crop-free zones	0.24
5 Electric cars Funds for pilot scheme for electric vehicles	Unknown reduction
6 Natural gas -fired power plants Reduction of methane from gas engines through implementation of a methane tax equal, in terms of CO_2 equivalents, to the CO_2 tax.	0.01
7 Energy and CO_2 taxes Increase in energy and CO_2 taxes in the non-ETS sector	0.58
8 Energy savings and efficiency improvements Increased demands for energy savings in buildings and electricity companies	0.13
9 CO_2 tax on plastic and waste Introduction of the same tax on plastic as tax on fossil fuels	Unknown reduction

Note: It should be noted that the initially expected effect of increased demands for energy savings in buildings and electricity companies (item 8) was 0.13 million tonnes and not 0.3 million tonnes. Due to an unfortunate typing error the latter figure was reported by the DEA to the National Audit Office and therefore included in the corresponding table in the National Audit Office report.

2 Overview of JI/CDM carbon credit costs for closing the gap in achieving compliance with the Kyoto Protocol.

The total numbers of expected credits constitute 15.8 million cf. Table C.2 below. The number of completed credits is 14.8 million. Outstanding expected delivery represents 1.0 million, which essentially consists of CDM credits. CDM credits are, compared to JI-credits, subject to a time - prolonging UN process before the issuance of the credits is possible, which must happen before 2015.

Compared to previous expectation, JI projects have generally provided a higher proportion of the total estimated amount of credits, while CDM-projects have provided a declining rate compared to previous expectations.

TABLE C.2: SUMMARY OF CREDITS DELIVERED FOR KYOTO COMPLIANCE, COMPILED OCTOBER 2013.

The period 2008-2012	Delivered credits Million	Number of expected credits Million	Pending deliveries Million
CDM credits	3.2	3.9	0.7
JI credits	10.4	10.4	0
Credits from funds	1.2	1.5	0.3
Total	**14.8**	**15.8**	**1.0**

There are no pending JI credits. The pending CDM credits will be delivered later in 2013 and 2014. Fund Credits are subject to the same UN procedure as the CDM credits as the underlying projects are CDM projects.

Total costs and unit costs are shown in Table C.3 for each type of credit. The costs have decreased compared to previous years. The lower costs are due to withdrawal of financial risk coverage on the individual project contracts and cancellation of contracts which under deliver. The cancellation is realized gradually as projects are completed.

No additional significant decrease in the expected total unit costs is forecast, as the expected non-cancellation has been included.

TABLE C.3: SUMMARY OF THE EXPECTED COSTS FOR THE ENTIRE PERIOD 2008-12. COMPILED OCTOBER 2013.

Period 2008-2012	Direct credit purchases DKK million.	Administrative costs DKK million	Project Development DKK million	Total government spending DKK million.	Expected costs DKK per credit
CDM credits	327.7	22.9	23.1	373.7	96
JI credits	598.5	61.0	61.4	720.9	70
Credits from funds	138.3	9.0	0	177.3	97
Total	**1,064.5**	**92.9**	**84.5**	**1,241.9**	**79**

As shown in Table C.3, total government spending to purchase credits to meet the Kyoto commitment is expected to be DKK 1241.9 million in total over the period, equivalent to an average annual cost over 5 years (Kyoto period 2008-12) of approx. DKK 250 million.

The overall effect is expected to be 15.8 million tonnes of CO_2, equivalent to an average annual impact over 5 years (the Kyoto period 2008-12) of 3.16 million tonnes of CO_2.

3. Assessment of national actions

Item 1 Heat pumps

The initiative is to promote the sales of heat pumps in order to reduce oil consumption and reduce CO_2 emissions. Specifically, in the Energy Agreement of 21 February 2008, DKK 30 million was allocated over two years for public awareness campaigns, labelling of efficient pumps, limited subsidies etc. targeting heat consumers outside the areas supplied by district heating.

There is not considered to be a loss of revenue associated with the operation. Via electricity taxes, heat pumps provide virtually the same revenue as the oil-fired boilers they replace. Government spending is limited to the allocated DKK 30 million.

The funds have been used within the following broad categories:

- Promotions: approx. 7% of the funds,
- Labelling: 23% of the funds, and
- Grants etc.: approx. 70% of the funds.

Sales figures from the heat pump industry show that sales of heat pumps from 2008 onwards were at a significantly higher level than in the past, cf. sales statistics shown in Table C.4 for the two types of heat pumps that efforts have focused on.

TABLE C.4: HEAT PUMPS SOLD BY MEMBERS OF THE HEAT PUMP ASSOCIATION (ROUNDED TO THE NEAREST 100)

	2007	2008	2009	2010	2011	2012
Liquid-water (geothermal heating)	1800	4100	3500	4100	4200	3100
Air –water	400	1400	1100	1300	1600	2100

It should be noted that the sales statistics do not cover the entire market, as heat pumps are also sold by importers / manufacturers who are not members of manufacturers' association. However, for geothermal heating and air-water it is estimated that the registrations cover the vast majority of the market (more than 90%).

How much of the increase from 2007 is due to the subsidy and the extra effort is very uncertain. In the following a campaign effect as shown in Table C.5 is assumed. This is an experience-based estimate, which is supported by the jump in level of heat pumps sold from 2007 to 2008, but it is still subject to considerable uncertainty.

TABLE C.5: ASSUMED CAMPAIGN EFFECT.

	2008	2009	2010	2011	2012
Campaign effect of additional sales from 2007	40%	35%	30%	20%	10%

Hence a total output of 4100 replacements was achieved, see Table C.6. Each pump is assumed to replace about 100 GJ of oil annually. This corresponds to a CO_2 output of 0.03 million tonnes in 2012 at full implementation. The average annual output for the period 2008-2012 is estimated to be in the range of 0.02 million tonnes/year.

TABLE C.6: ESTIMATED IMPACT OF FUNDING FOR THE PROMOTION OF HEAT PUMPS (1 OIL BURNER ~ 100GJ OIL / YEAR)

	2008	2009	2010	2011	2012	Average 2008-12
Cumulative effect of initiative [Number of oil burners replaced]	1300	2200	3100	3800	4100	
CO_2 reduction [million . tonnes]	0.010	0.016	0.023	0.028	0.031	0.02

Overall, the fact remains that there is considerable uncertainty in estimating the effect of market - supporting activities.

The initial assessment of the effect was 0.03 million tonnes per year in 2008-12. This was estimated by a recalculation to be correct in the long-term. However, in the period 2008-12 the effect is estimated to have been a little lower, corresponding to approx. 0.02 million tonnes of CO_2.

Item 2 Biogas

The Energy Agreement of 21 February 2008 included an increase in the electricity settlement price when biogas is used in conjunction with natural gas of DKK 0.745/kWh or as a fixed price supplement of DKK 0.405/kWh. The electricity settlement price and the price supplement will be adjusted by 60% of the increase in the consumer net-price index.

The increase in support for biogas in the Energy Agreement was originally expected to cause an increase in gas production from biogas as shown at the top of Table C.7.

TABLE C.7. EFFECT OF INCREASED SUPPORT FOR BIOGAS PLANTS.

Year	2007	2008	2009	2010	2011	2012
Expected energy production (PJ)	3.91	4.53	5.07	5.75	6.52	7.42
Actual energy production from biogas (PJ)	3.91	3.93	4.17	4.28	4.11	
Actual reduction in greenhouse gases from manure due to increased biogas production (million tonnes of CO_2 equivalent)		0.002	0.019	0.027	0.018	0.018

The initiative has not resulted in the expected increase in biogas production because of other barriers to setting up biogas plants (location of construction, financing, marketing, etc.). The actual development is shown in Table C.7. An increase of 66% in biogas production from 2007 to 2011 was expected, but only an increase of 5 % was realised.

The reduction of greenhouse gas emissions from the actual development can be seen in Table C.7.

The effect is calculated by the DCE on the basis of figures for the actual biogas production. No figures are available for 2012 yet. The effect in 2012 is cautiously assumed to be the same as in 2011.

The average CO_2 reduction in 2008-12 is thus 0.017 million tonnes.

The support for biogas is funded via the PSO revenues: Therefore there is no direct effect on government finances. The tax revenue loss associated with the displacement of taxed fossil fuels is estimated to be less than DKK 10 million per year on average for the period 2008-12.

Item 3 Incorporation Requirements for Biofuels :
In the Energy Agreement of 21 February 2008 it was agreed that the share of biofuels etc. in ground transportation should be at 5.75% by 2010 and 10% by 2020. This is similar to the EU goals.

The specific instrument is a statutory blending requirement for the oil companies, and the initial impact assessment is a CO_2 reduction of 0.29 million tonnes on average per year in 2008-12.

In 2009, the blending requirement was implemented by law. The requirement was phased in gradually with 0.75% biofuel in 2010, 3.3% in 2011 and 5.75% in 2012. Subsequent verification of compliance with the blending requirement proved that it was difficult for oil companies to fulfill the requirement in 2010. There was therefore an amendment to the Statutory Order regarding biofuels stating companies should just have a total of 2.025% on average per year for the 2 years, 2010 and 2011,.

The direct CO_2 reductions follow from replacing fossil fuels with biofuels. However, there is also a secondary effect due to the higher price of biofuels, which leads to lower sales. In addition to the regular price effect, the border trade will be reinforced, which reduces consumption further.

Below is the updated estimate of CO_2 displacement in the period 2010 to 2012 including the secondary effect from increased prices. For 2010 to 2011 the estimates are based on statistics, while the estimate for 2012 is based on the energy projection from 2012. The CO_2 effect is calculated on the basis of consumption of bioethanol and biodiesel respectively, replacing petrol and diesel respectively. For petrol CO_2 emissions are reduced by 73 kg/GJ and for diesel by 74 kg / GJ when these fuels are replaced with biofuels.

TABLE C.8 BIOFUEL USE AND CO2 DISPLACEMENT.

	2010	**2011**	**2012**	Total	Average 08-12
Bioethanol (consumption in TJ)	1,118	2,062	1,993		
Biodiesel (consumption in TJ)	16	3,492	7,019		
CO_2 reduction (direct) (million tonnes)	0.08	0.42	0.62	1.12	0.22
CO_2 reduction incl. secondary effects (million tonnes)	0.11	0.54	0.81	1.46	0.29

The direct effects are calculated savings directly related to the sale of biofuels, while the secondary effects are calculated effects based on assumptions regarding border trade etc. The secondary effects are thus subject to considerable uncertainty. When the secondary effects are included, the total CO_2 effect is largely as expected.

Financial consequences for the state.
With no CO_2 tax on biofuels, there has been an immediate loss of revenue of approx. DKK 30 million per year on average in 2008-12.

In addition, there has been a derivative loss of revenue resulting from the effect of the price of fuel rises and consumption falls, including through increased cross-border trade to the detriment of Denmark. These effects are associated with considerable uncertainty. The total tax revenue loss is therefore estimated to be up to DKK 250 million per year, although with great uncertainty.

Item 4 Agriculture
The Ministry for Food, Agriculture and Fisheries has stated that an updated assessment is awaiting new figures from DCA / DCE. An estimate of the climate impact of the Green Growth Plan from 2009 will be calculated as soon as this plan's effect on nitrogen leakage to the water environment has been calculated.

Item 5 Electric cars
An element in the Energy Agreement of 21 February 2008 was a fund of DKK 30 million over 5 years (2008-12) for a pilot scheme for electric cars.

The objective was to provide grants for projects designed to implement testing and trial operation of a fleet of electric cars for a longer period in order gather experience on technical, organizational, economic and environmental conditions. The scheme has not been directed at short term CO_2 reductions, and no reduction targets have been set for the scheme.

There is a limited effect on the number of electric vehicles, corresponding to CO_2 reduction of around 0.002 million tonnes in 2012 and less in the years before.

Item 6 Natural gas -fired power plants. Reduction of methane from gas engines through implementation of a methane tax equal, in terms of CO_2 equivalents, to the CO_2 tax.

The measure was implemented by Act No. 722 of 25 June 2010 and entered into force on 1 January 2011.

As a result of the tax increase behavioral changes are expected through changing from motor operation to boiler operation and establishing treatment measures. Consumption is also expected to fall as the price of heat will increase. These behavioral changes will result in falls in the emissions of unburned methane from power stations. In addition, CO_2 emissions will fall and consumption of natural gas will fall.

Emissions of greenhouse gases outside the ETS sector are estimated to decrease by approx. 0.06 million tonnes of CO_2 equivalents in the short term of which 50% constitutes a decrease in methane emissions. A decline of 0.06 million tonnes in 2 out of 5 years corresponds to an average annual reduction effect of approximately 0.02 million tonnes per year in 2008-12.

Taxes on greenhouse gases other than CO_2 are expected to have an immediate long-lasting effect of DKK 25 million (2009 prices). After the effects on other accounts (VAT) and after other rebound effects the lasting effect is estimated at 20 million (2009 prices). After the rebound effects and change in behavior, the lasting effect is estimated at DKK 5 million (2009 prices). In 2011, additional revenue of DKK 18 million on the CO_2 tax account was estimated as a consequence of the draft Bill. At the same time, there was an expected loss of revenue on natural gas of approx. DKK 10 million in 2011.

All in all, total revenues on the CO_2 tax account in 2011 were estimated at DKK 5,900 million. The income for 2011 was DKK 5,897 million. However, other draft bills with effects on the revenues on the CO_2 account from 2011have also been adopted. This makes it difficult to distinguish the effect of the individual changes.

Item 7 Energy and CO_2 taxes. Increase in energy and CO_2 taxes in the non-ETS sectors.
The measure was implemented by Act No. 528 of 17 June 2008 and entered into force on 1 January 2010.

The total estimate of the environmental impact of a increase in the CO_2 tax on fuels from DKK 3-90 to 150 per tonnes of CO_2 is an approx. 0.69 million tonnes per year decrease in CO_2 emissions.

A decline of 0.69 million tonnes CO_2 for three out of five years corresponds to an average annual reduction of approximately 0.41 million tonnes CO_2 per year in 2008-12. Originally, entry into force was expected one year earlier with a correspondingly greater effect in the Kyoto Protocol's first commitment period.

The expected effect in 2010 on the CO_2 tax account, with adjustment for accruals, was expected to be at DKK 779 million (2010 prices) as a result of the draft legislation on the CO_2 tax. However, the total tax package (as part of the Energy Agreement of 2008) including introduction of a NOx tax from 1 January 2010 was revenue-neutral.

The final estimate of the CO_2 tax account in 2010 was DKK 6,225 million. Revenues on the CO_2 tax account were DKK 5,757 million in 2010.

As noted by the Ministry of Taxation, several other changes in the law have been made and several other factors have changed, including economic conditions affecting the CO_2 tax account. It is therefore difficult to assess how individual regulatory changes contribute to the total revenues in the account. From the available data, the Ministry of Taxation finds that there is no basis for evaluating the annual effect differently than originally expected.

Item 8 Energy savings and efficiency improvements

The effort under this item consists of two measures:

> *8a• Increase in energy companies saving obligations:* Some energy companies are obliged to contribute to energy savings. The requirement for the amount of annual energy savings that companies should contribute to has increased from 2.95 PJ per year up to 2009 to 6.10 PJ per year from 2010.
>
> *8b• Tightening of the building energy requirements:* The building regulations include a variety of energy-standard requirements for new buildings. One of these requirements is measurement of the building's heating requirements etc. In 2011 the requirement was changed from approximately 85.7 kWh per m^2 per year to 63.5 kWh per m^2 per year (for housing).

The calculations suggest an annual reduction in CO_2 emissions of 0.06 million tonnes of CO_2 per year on average 2008-2012. Correspondingly, the impact on the state budget is approx. DKK 50 million on average over the same period. The effect on the budget stems from reduced revenues from energy taxes and CO_2 taxes.

8a The energy companies saving obligations

A number of energy companies are required to contribute to energy savings up to a certain total amount of energy. Energy companies can, for example, grant subsidies or give advice to a company that wants to make an investment that reduces energy consumption. Energy companies must contribute to the amount of energy savings determined, and energy savings should be sought with as little cost as possible. The costs involved are covered by the energy companies through consumer tariffs.

Energy companies' costs due to energy saving obligations do not affect the state budget.

When energy companies contribute to energy savings, it is unknown whether the specific energy saving would have been undertaken anyway without the energy companies' involvement. Therefore, the effect cannot simply be equal to the fixed amount of energy savings imposed on the companies.

Calculations are based on data from energy companies that provide detailed information on individual energy savings to the DEA. Calculations also include an estimate of the proportion of the savings that result from energy companies' involvement[42].

[42] EA Energianalyse, Viegand & Maagøe og Niras (2012): "Energiselskabernes energispareindsats" (in Danish), see http://www.ea-energianalyse.dk/reports/1161_evaluering_af_energiselskabernes_spareaktiviteter_bilag.pdf

A study from 2012 suggests that 46% of the energy savings in the business sector are due to the energy companies' participation, while 20% of the energy savings in the household sector are due to the energy companies' participation.

These factors are methodologically very difficult to assess and therefore very uncertain.

The total requirements for energy companies were 2.95 PJ per year until 2009 and 6.10 PJ per year starting in 2010. As of 2010, additional types of energy savings are included - including efficiency improvements in energy companies' own installations (e.g. grid).

In practice, the energy companies exceeded their obligations. Instead of calculating the effect based on the modified obligation (from 2.95 PJ/year to 6.1 PJ/year) the effect is calculated on the basis of actual energy savings that companies have generated. For the years 2008 and 2009 the energy companies contributed to savings totaling 3.8 PJ per year on average over the two years.
The corresponding figure for 2010-2012 was 7.0 PJ per year. So after the tightening of the requirement, the energy-companies have contributed an additional 3.2 PJ per year of energy savings.

The distribution of the change in the energy savings that energy companies have contributed to is shown in Table C.9.

TABLE C.9 INCREASE IN THE LEVEL OF ENERGY SAVINGS THAT ENERGY COMPANIES HAVE GENERATED SHOWN AS CHANGE IN ANNUAL AVERAGE FROM THE PERIOD 2008-2009 TO 2010-2012, TJ PER YEAR.

	District Heating	Electricity	Other	Natural-Gas	Oil	Total
Households	282	-152	-40	155	39	284
Public sector	4	79	7	49	36	174
Business	437	267	-8	751	819	2266
Supply	197	255	8	56	19	536
Total	**920**	**449**	**-33**	**1010**	**913**	**3259**

Source: DEA based on reports from energy companies.
Note: Negative figures, such as electricity in households, are due to increased prioritization of the business sector.
"Other" primarily covers biomass, but also coal, etc.

With these assumptions, estimated CO_2 reductions outside the ETS sector (i.e. excluding electricity and district heating) as a result of the energy companies' savings efforts are on average for 2008-2012 63,216 tonnes per year; equivalent to approx. 0.06 million tonnes. The estimate is based on the assumptions described above for the effect of the energy companies' efforts outside the ETS sector and CO_2 emission factors for oil and natural gas.

Effects of companies' energy-savings obligations on state finances.
The companies' efforts are financed through the price of electricity and thus have no direct impact on the state budget.

Energy savings cause lower revenues from taxes on energy.

On average, over the five years from 2008 to 2012, the reduction in tax revenue is estimated at DKK 39 million per year.

8b Strengthening of the Building Regulation
The Building Regulation covers a wide range of requirements for the energy standard of new buildings. For example there are requirements for the energy properties of individual building components– e.g. through windows - but there is also a requirement for the building's total energy consumption. "Component Requirements" and the requirements for the total building fit roughly together, so figures below are calculated from the tightening of the overall requirements shown in Table C.10.

TABLE C.10 STRENGTHENING IN THE ENERGY REQUIREMENTS OF THE BUILDING REGULATION

		Space requirements	Fixed increase	Assumed average size	Calculated requirements	Reduction
		kWh per m^2 per year	kWh per year	m^2	kWh per m^2 per year	kWh per m^2 per year
Up to and including 2010	Housing	70	2200	150	84.7	
	Offices	95	2200	1000	97.2	
From 2011	Housing	52.5	1650	150	63.5	21
	Offices	71.3	1650	1000	73.0	24.25

Source: Bygningsreglementet.dk .

In the calculations of the effect of the tightening of the Building Regulations, it is assumed that the actual energy consumption drop corresponds to the tightening of the Building Regulations. It is not certain that this is the case. It could be possible, for example, that energy consumption of buildings would fall alone due to market developments over time and it is possible that actual energy consumption will not fall in line with the decrease in the amount of energy that buildings are designed to need.

Table C.11 shows the distribution of new construction by the types of heating.

TABLE C.11 DISTRIBUTION OF THE AREA OF NEW CONSTRUCTION IN THE FORM OF HEATING, THE AVERAGE FOR 2011 AND 2012, PERCENT

	Other	District Heating	Natural Gas	Oil	Heat Pumps	Total
Residential	3	60	16	2	19	100
Office buildings	17	62	17	1	3	100

Source: BBR, own calculations.

The effect of the tightening of building regulations for new construction obviously depends on the volume of new construction, as shown in Table C.12

TABLE C.12 THE VOLUME OF NEW CONSTRUCTION 2011-2012, '000 M2.

	2011	2012
Housing	2019	1303
Offices	1222	804

Source: Statistics Denmark, Statistics Bank.

The effects on energy consumption and CO_2 emissions outside the ETS sector are calculated in the new building scale (Table C.12) times the tightening of building regulations (Table C.10) for the relevant heating methods (Table C.11) . For CO_2 emissions this is multiplied further by CO_2 coefficients, and the results are on average over the five years from 2008 to 2012, that the emissions have been reduced by 1,292 tonnes (or 0.001 million tonnes).

The small effect should be seen in light of the fact that this is a long-term measure that will have a significantly greater effect in the long term.

Financial effects for the state
The calculated effect of reducing tax revenue by tightening building regulations outside the ETS sector is estimated at DKK 12.4 million per year on average over the five years from 2008 to 2012.

Item 9 CO_2 tax on plastic and waste. Introduction of the same tax on plastic as the tax on fossil fuels.
The measure was implemented by Act No. 461 of 12 June 2009 and entered into force on 1 January 2010.

Since it is expected that the introduction of the tax would lead to increased recycling of waste with high energy , there will be an environmental benefit . This is because the CO_2 is emitted during burning of waste containing plastic. Waste incineration plants are outside the ETS sector in 2008-2012. Under the previous rules , before the law came into force , there was a significantly higher tax burden on waste incinerated in central CHP plants and in industrial process plants (subject to CO_2 allowances) than in the general waste incinerators. With this Act, the tax-based incentives were harmonized. Therefore, less waste will be incinerated in general installations outside the ETS sector. A part of it will be recycled, while another part will be burned by the ETS operators. Therefore, CO_2 emissions outside the ETS sector fall as a result of the measure. Since several laws that affect the CO_2 tax account were passed in 2010, it is difficult to assess the impact of each measure. The same applies to the effect on total CO_2 emissions.

4 Summary
In Table C.13 below the updated *CO_2 impact* calculation is summarised and compared with the initial assessment.

TABLE C.13 NATIONAL REDUCTION MEASURES. ORIGINAL AND UPDATED IMPACT ASSESSMENTS. (EXPECTED NON- ETS CO2 REDUCTION. ANNUAL AVERAGE REDUCTION IN 2008-12 IN MILLION TONNES CO2 EQUIVALENTS)).

	Original assessment	Updated assessment
1. Heat pumps Replacing the oil burner with heat pumps. Awareness campaigns , labeling of efficient pumps , limited subsidies , etc.	0.03	0.02
2. Biogas Subsidy for biogas plants when biogas is used with natural gas	Unknown reduction	0.017
3. Biofuels Biofuels for blending into gasoline and diesel	0.29	0.29
4. Agriculture A number of initiatives on energy, nature and the environment in Green Growth Agreement in 2009, including the reduction of nitrogen emissions to the aquatic environment and permanent spraying, fertilizer-free and crop-free zones	0.24	Pending
5. Electric cars Funds for pilot scheme for electric vehicles	Unknown reduction	<0.002
6. Natural gas -fired power plants Reduction of methane from gas engines on introduction of tax equivalent to the CO_2 tax.	0.01	0.02
7. Energy and CO_2 taxes Increase in energy and CO_2 taxes in the non-ETS sector	0.58	0.41
8. Energy savings and efficiency improvements Increased demands for energy savings in buildings and electricity companies	0.13	0.06
9. CO_2 tax on plastic and waste Introduction of the same tax on plastic as on fossil fuels Unknown Reduction	Unknown reduction	-
Total	**1.28**	**[1.06]***

* In the preliminary total effect of 1.06 million tonnes, the 0.24 million tonnes effect of the Green Growth agreement assumed until now is included.

It appears that CO_2 effects are generally considered to be slightly less than originally expected. The difference is not significant, the uncertainty considered. An updated impact assessment of the Green Growth agreement is pending. The effect of the Green Growth agreement assumed until now is therefore included in the total effect of 1.06 million tonnes shown in Table C.13.

It may be added that the actual trend in total emissions - regardless of the minor to evaluate the efficacy of the individual instruments - has led to the Kyoto target more than met.

The fiscal costs are summarised in Table C.14, incl. the cost of credits. All figures for the fiscal costs - like CO_2 effects – are calculated annual averages in 2008-12.

As can be seen, the direct costs for the state budget (excluding related revenue losses) to meet the Kyoto commitment are estimated at DKK 265 million per year on average in the period 2008-12.

The related revenue loss amounts to DKK 310 million per year on average in the period 2008-12, but with great uncertainty, especially regarding the effect of cross-border trade from the biofuel measure, which accounts for DKK 250 million out of the DKK 310 million in total revenue losses.

TABLE C.14 STATE FINANCE COSTS IN DKK MILLION AS ANNUAL AVERAGE 2008-12

	State Expenditure budget **Annual average 2008-12**	**State Losses on Tax Budget** **Annual average 2008-12**
Heat pumps Replacing the oil burner with heat pumps. Awareness campaigns , labeling of efficient pumps , limited subsidies , etc.	6	0
Biogas Subsidy for biogas plants when biogas is used with natural gas	0	10
Biofuels Biofuels for blending into gasoline and diesel	0	Up to 250
Agriculture A number of initiatives on energy, nature and the environment in Green Growth Agreement in 2009 , including the reduction of nitrogen emissions to the aquatic environment and permanent spraying, fertiliser-free and crop-free zones	Pending	Pending
Electric cars Funds for pilot scheme for electric cars	6	0
Natural gas -fired power plants Reduction of methane from gas engines through implementation of a methane tax equal, in terms of CO_2 equivalents, to the CO_2 tax	-	-
Energy and CO_2 taxes Increase in energy and CO_2 taxes in the non-ETS sector	-	-
Energy savings and efficiency improvements Increased demands for energy savings in buildings and electricity companies	0	50
CO_2 tax on plastic and waste Introduction of the same tax on plastic as on fossil fuels	**-**	**-**
Credits The state JI and CDM programme	253	
Total	**265**	**Up to 310**

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Annex D Denmark's First Biennial Report

– under the United Nations Framework Convention on Climate Change

Denmark's First Biennial Report

– under the United Nations Framework Convention on Climate Change

Contents

I. Introduction

This report is Denmark's first biennial report (BR1) under UNFCCC. The report has been elaborated in accordance with the UNFCCC biennial reporting guidelines for developed country Parties contained in Decision 2/CP.17 (Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention - Document: FCCC/CP/2011/9/Add.1) adopted by the Conference of the Parties on its seventeenth session.

The report provides information on the historical and projected progress made in Denmark regarding Denmark's contribution to the achievement of joint EU quantified economy-wide emission reduction targets, including information on targets, historic emissions, projected emissions and references to where further information can be found. Furthermore the report includes information on Denmark's provision of financial, technological and capacity-building support to Parties not included in Annex I to the Convention.

The information to be reported electronically in the so-called Common Tabular Format contained in Decision 19/CP.18 - Document: FCCC/CP/2012/8/Add.3) adopted by the Conference of the Parties on its eighteenth session is included in Chapter VIII of the biennial report. With the annual information on historical progress towards Denmark's target in the 2nd commitment period under the Kyoto Protocol not being available until after the first reporting on the first year of the commitment period (2013) in April 2015, Chapter VIII, in addition to the electronically reported CTF, contains tables with annual information on historical (1990-2011) and projected (2012-2030) progress in Denmark in reducing greenhouse gas emissions since 1990.

II. Information on greenhouse gas emissions and trends

A. Summary information from Denmark's greeenhouse gas inventory on emissions and emission trends

The total inventories for Denmark, Greenland and the Faroe Islands (the Realm) are given in the Common Tabular Format (CTF).

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.

The emissions from the Kingdom (i.e. including emissions from Greenland and Faroe Islands) of the greenhouse gases CO_2 (carbon dioxide), CH_4 (methane), N_2O (nitrous oxide), and the so-called potent greenhouse gases (F-gases), which include HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), and SF_6 (sulphurhexafluoride) during the period 1990-2011 are shown in Figures 2.1-2.4, aggregated into the IPCC's six main sectors and the most relevant sub-sectors. The underlying data are included in the CTF. Total greenhouse gas emissions for the Kingdom measured in

CO_2 equivalents on the basis of the global warming potential of each gas are shown together with the distribution with respect to gas and source/sector in Figures 2.5-2.6.

The inventory data to be reported electronically in Table 1 of the CTF are shown in Chapter VIII. Since Greenland and the Faroe Islands are not part of the EU territory, inventory data for Denmark alone are also shown in Chapter VIII.

Carbon dioxide, CO_2

Most CO_2 emissions come from combustion of coal, oil and natural gas at power stations, residential properties and by industry. Road transport is also a major contributor. Outside the energy sector, the only major CO_2 emissions come from cement production, which accounts for 2-3 % of the annual national total. The transport sector is the only major emitting sector that has shown an increasing trend since 1990. However, in the latest years, CO_2 emissions from the transport sector have stabilised and even decreased slightly.

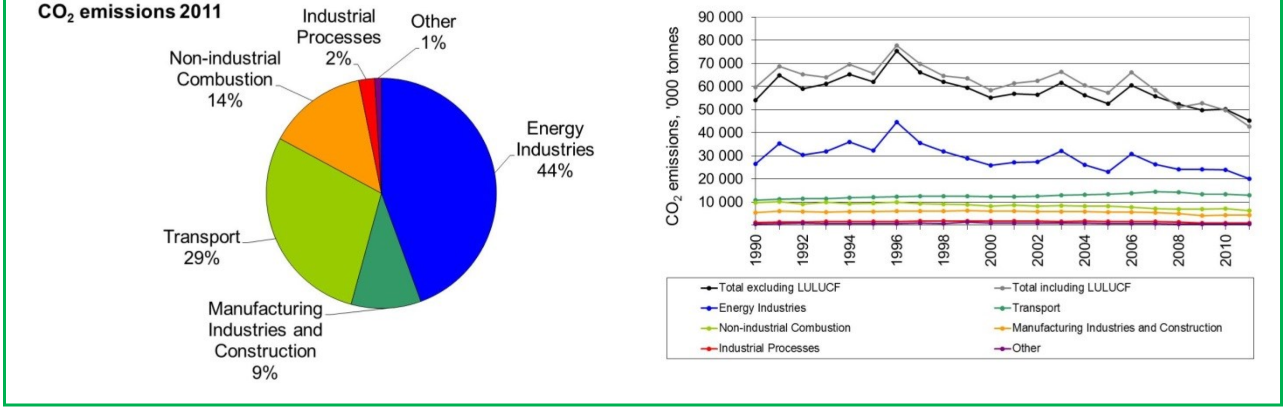
The relatively large fluctuations in the emissions from year to year are due to trade in electricity with other countries - primarily the Nordic countries. The large emissions in 1991, 1994, 1996, 2003 and 2006 are due to large electricity exports. This effect is further demonstrated in section 3.6, where emission trends with corrections for inter-annual variations in temperature and electricity exchange are shown.

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 or oil-based products, both in stationary and mobile sources. Also, there has been a decrease in gross energy consumption, especially since 2006.

In 2011, total actual CO_2 emissions inventoried under the Climate Convention, excluding land-use change and forestry (LULUCF), were about 16 % lower than in 1990. If LULUCF is included, net emissions were about 28 % lower.

FIGURE 2.1: CO_2 EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.



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. Over the time series from 1990 to 2011, the emission of CH_4 from enteric fermentation has decreased by around 13 % due to the decrease in the number of cattle. However, in the same period the emissions from manure management increased by around 32 % due to a change in traditional stable systems towards an increase in slurry-based stable systems.

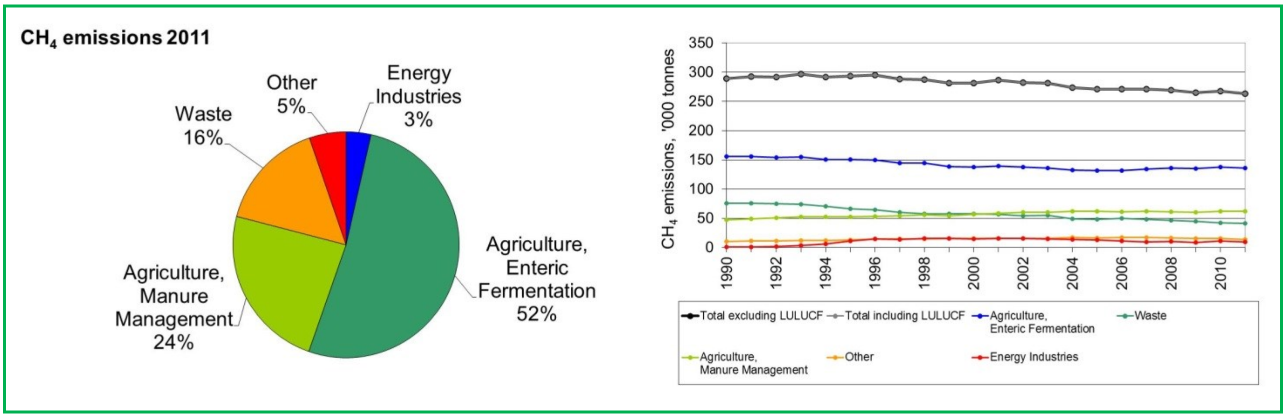
Emissions of methane from landfills are decreasing, because of the ban on landfilling combustible waste. This has led to a decrease in the amount of landfilled waste and hence the emissions. Also, contributing to the decrease in emissions was the increased CH_4 recovery in the early part of the time series. This recovery has decreased in later years due to less CH_4 production in the landfills.

Emissions of methane from the energy sector increased up to 2003 due to increased use of gas-driven engines, which emit large amounts of methane compared to other combustion technologies. However in later years new legislation establishing emission limits for existing gas-driven engines came into force pursuant to Statutory Order No. 720 of 5 October 1998, and combined with decreased use of gas engines, this has resulted in lower emissions.

In 2011, total CH_4 emissions were 9 % below the 1990 level.

FIGURE 2.2 CH_4 EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.



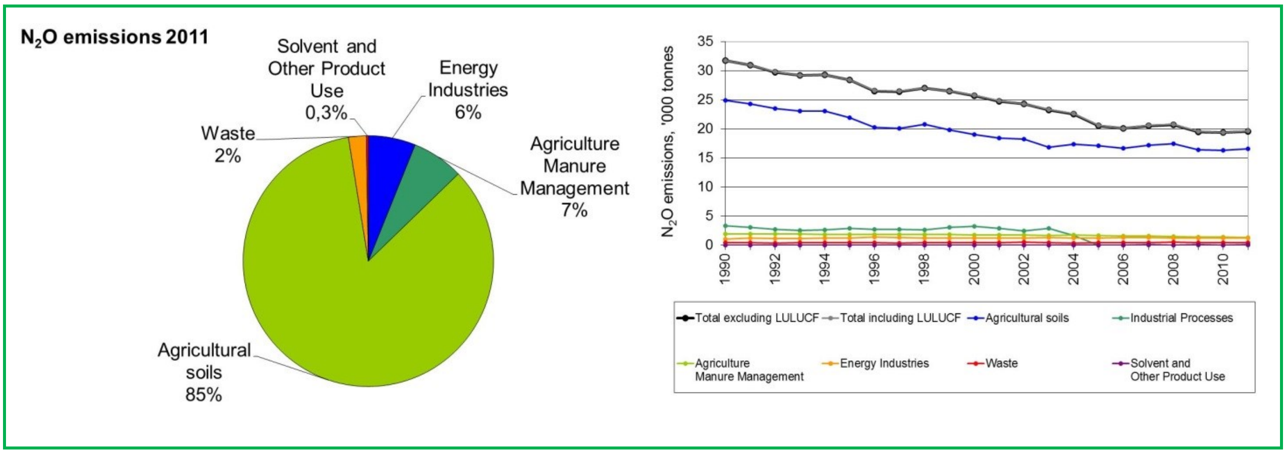
Nitrous oxide, N_2O

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 fertiliser 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 have dropped by 33.5 % due to legislation to improve the utilisation of nitrogen in manure. The legislation has resulted in less nitrogen excreted per unit of livestock produced and a considerable reduction in the use of nitrogen fertilisers. The basis for the N_2O emission is then reduced. A small share of the nitrous oxide emissions originates from power and district heating plants, and cars with catalytic converters. Previously, a plant producing nitric acid was in operation in Denmark. However, this plant shut down in 2004, eliminating N_2O emissions from this activity.

In 2011, total N_2O were 38 % below the 1990 level.

FIGURE 2.3 N_2O EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2011

Source: Nielsen et al., 2013.



The f-gases: HFCs, PFCs, and SF_6

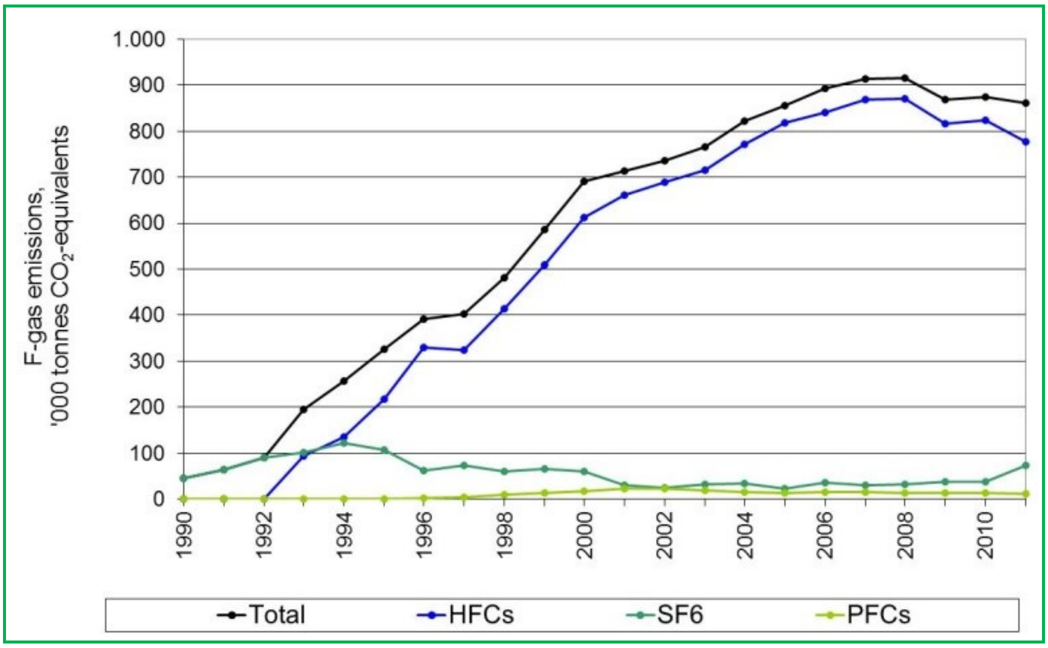
The contribution of f-gases (HFCs, PFCs and SF_6), to Denmark's total emissions of greenhouse gases is relatively modest. However, the emissions of these gases increased significantly during the 1990s. Collection of data on the consumption of these substances started in the mid-1990s. Therefore, f-gas data and emissions inventories from before 1995 are 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 refrigeration and air conditioning, are the biggest contributor to f-gas emissions. From 1995 to 2011 annual emissions of HFCs increased from 218 to 778 Gg of CO_2 equivalents. However, emissions of HFCs peaked at 872 Gg of CO_2 equivalents in 2008. Emissions of PFCs increased in the same period from 0.5 to 11.1 Gg of CO_2 equivalents, the emissions of PFCs peaked in 2002 at 22.2 Gg of CO_2 equivalents. The emissions of SF_6 decreased from 108 Gg in 1995 to 73 Gg of CO_2 equivalents in 2011. Emissions of SF_6 peaked in 1995.

The total emissions of HFCs, PFCs and SF_6 increased by 165 % from 1995 to 2011.

FIGURE 2.4 DEVELOPMENT IN HFC, PFC, AND SF_6 EMISSIONS IN 1990-2011

Source: Nielsen et al., 2013.



Total Danish emissions and removals of greenhouse gases

Figures 2.5 and 2.6 show the development in the Danish greenhouse gas emissions and removals as CO_2 equivalents and by gases and sources according to the reporting guidelines under the Climate Convention. CO_2 is the most important greenhouse gas followed by N_2O and CH_4. As mentioned previously, emissions fluctuate in line with electricity trade. To illustrate this, the emissions in 1996 (excl. LULUCF) were estimated to 89 002 Gg of CO_2 equivalents, whereas the total greenhouse gas emissions in 2003 were estimated to 74 036 Gg of CO_2 equivalents (excl. LULUCF). In 2011 the total emissions were estimated to 56 248 Gg of CO_2 equivalents,

Of the total Danish greenhouse gas emissions in 2011, CO_2 made up 78 %, methane 9.8 %, nitrous oxide 10.7 %, and f-gases 1.5 %. If CO_2 emissions by sources and removals by sinks from forests and soils are included (i.e. with LULUCF), then net total Danish greenhouse gas emissions corresponded to 53 583 Gg of CO_2 equivalents in 2011. The data underlying Figures 2.5 and 2.6 are included in the CTF.

FIGURE 2.5 DANISH GREENHOUSE GAS EMISSIONS BY TYPE OF GAS IN 1990 - 2011.

Source: Nielsen et al., 2013.

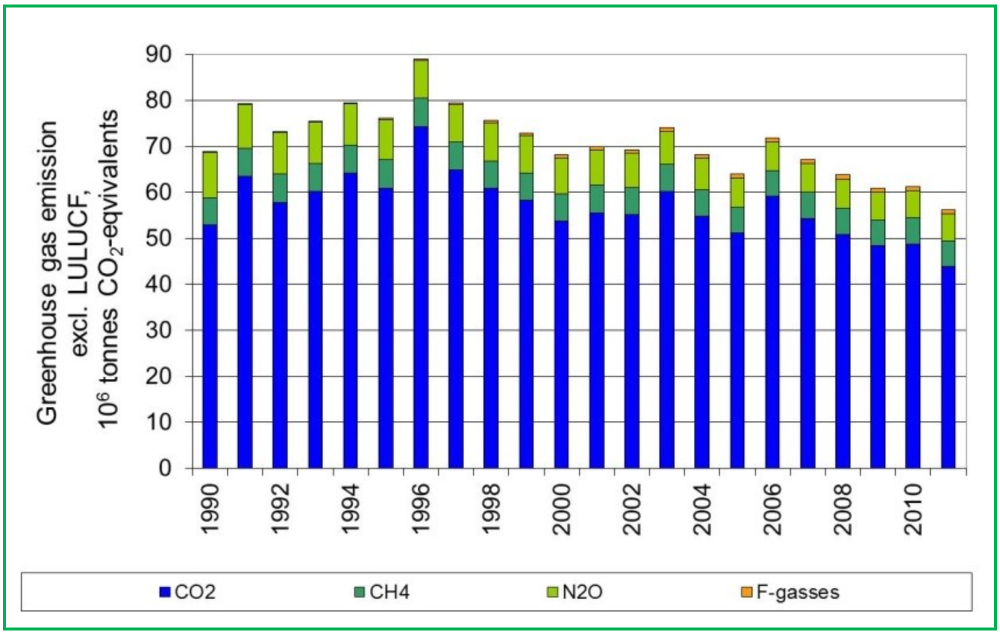
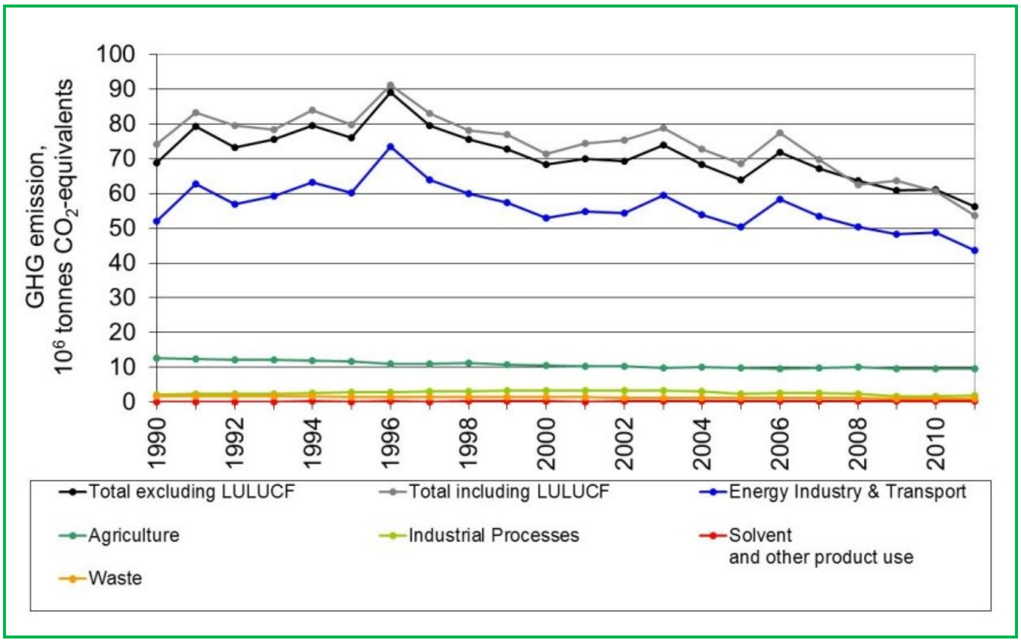


FIGURE 2.6 DANISH GREENHOUSE GAS EMISSIONS BY SOURCE/SECTOR IN 1990 – 2011

Source: Nielsen et al., 2013



As mentioned above, the emissions from Greenland and the Faroe Islands only contribute a very small share to the total emissions, hence the trends as described above are basically the trends in the emissions from Denmark.

B. SUMMARY INFORMATION ON DENMARK'S NATIONAL INVENTORY ARRANGEMENTS

Organisation of work etc.

The Danish Centre for Environment and Energy (DCE) is responsible for producing the Danish greenhouse gas emission inventories and the annual reporting to the UNFCCC and is designated the single national entity under the Kyoto Protocol. Furthermore, DCE participates in work under the auspices of the UNFCCC, where guidelines for reporting are discussed and decided upon. DCE also participates 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 cooperating institutions provide a range of data that are needed to produce the inventory. DCE therefore has formal agreements with the most important partners to ensure that DCE receives the necessary data on time. For more comprehensive information, please see Nielsen et al. (2013).

Calculation methods

The Danish emission 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) programme 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 plant-specific, country-specific, default factors from the IPCC guidelines, or values from international scientific literature.

Key categories

The choice of methodological tier for the individual categories depends, among other things, on the significance of the source. The categories that together accounted for 95 % of greenhouse gas emissions in 2011 or accounted for 95 % of the change in emission levels from the base year to the most recently calculated year (2011) are defined as key categories according to the IPCC guidelines. An analysis of the Danish inventory shows that 22 sources account for 95 % of total greenhouse gas emissions and that the three largest sources – that together account for 50 % – are CO_2 emissions from the combustion of solid fuels at stationary combustion plants, CO_2 emissions from road transport and CO_2 from combustion of natural gas at stationary combustion plants.

Procedure for recalculation

At the same time as the annual calculation of emissions for another 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, e.g. updated statistical data, improvements of methodologies, updated emission factors due 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 and following the guidance in the IPCC good practice guidance.

Uncertainty

Uncertainty in the greenhouse gas inventories is calculated as recommended in the IPCC guidelines and covers 100 % of the total Danish greenhouse gas (GHG) emissions reported under the Kyoto Protocol. The result of the calculations shows that total GHG emissions were calculated to have an uncertainty of 6.7 % and the decrease in GHG emissions since 1990 was calculated to be -27.7 % ± 2.9 %. Uncertainty is greatest for N_2O emissions from stationary combustion and agricultural land and CH_4 emissions from enteric fermentation and solid waste disposal on land.

Quality assurance and quality control

As part of the national system, DCE is drawing up a manual to use in quality assurance and quality control of the emission inventories. The manual is in accordance with the guidelines provided by the UNFCCC (IPCC, 1997), and the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000). The ISO 9000 standards are also being used as important input for the plan.

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 DCE who are experts in the area in question, but not directly involved in the inventory work. In addition, a project has been completed 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.

For a more detailed description of the QA/QC system, please see the Danish National Inventory Report (Nielsen et al., 2013).

Annual reporting

DCE produces an annual report (National Inventory Report – NIR) 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. Over the years, improvements have been made regarding the quality and documentation of the greenhouse gas inventory, 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 the following section.

Improvements of emission inventories

A number of improvements have been made to the Danish greenhouse gas emission inventories since Denmark's Fifth National Communication to the Climate Convention (NC5). The improvements have either been at the initiative of DCE, or as a result of external reviews of the inventories. The majority of improvements have been concerned with better documentation, i.e. improvements in transparency. Furthermore, overall focus will be on improving procedures for quality assurance and control and on improving documentation of the national emission factors.

Procedures for the official consideration and approval of the inventory

The complete emission inventories for the three different submissions (EU, Kyoto Protocol and UNFCCC) by Denmark are compiled by DCE and sent for official approval along with the documentation report (NIR). In recent years the responsibility for official approval has changed. Previously it was the Danish Environmental Protection Agency (Ministry of the Environment) now it is the Danish Energy Agency (Ministry of Climate, Energy and Building). This means that the emission inventory is finalised by no later than March 15,so that the official approval is prior to the reporting deadlines under the UNFCCC and the Kyoto Protocol.

Changes in national inventory arrangements since the previous submission

Since NC5, the national inventory arrangements in Denmark have been strengthened by the signing of a formal data delivery agreement with the Government of Greenland. The data agreement ensures that Greenland will make a complete CRF reporting of emissions and removals, and send the data to DCE. DCE is responsible for aggregating the CRF's from Denmark and Greenland and for submitting a common CRF under the Kyoto Protocol. Also, the national inventory arrangements were strengthened by a new updated data delivery agreement with the Danish Energy Agency.

On June 30 2011 the National Environmental Research Institute (NERI) under Aarhus University ceased to exist. In its place is now DCE – Danish Centre for Environment and Energy under Aarhus University. The scientific staff in the former NERI departments were split between two departments of the Faculty of Science and Technology under Aarhus University. The staff associated with the task of preparing emission inventories became part of the Department of Environmental Science.

The contract to prepare the emission inventories is now between the Danish Centre for Environment and Energy at Aarhus University, the Ministry of the Environment, and the Ministry of Climate, Energy and Building. The Department of Environmental Science, Aarhus University is responsible for the calculation and reporting of the Danish national emission inventory to the EU and the UNFCCC (United Nations Framework Convention on Climate Change) and UNECE CLRTAP (Convention on Long Range Transboundary Air Pollution) conventions.

No changes have been made concerning the staff carrying out the work, nor has the change in administrative structure caused changes to the available resources.

III. Quantified economy-wide emission reduction target

Targets for 2020 and 2013-2020

Information on Denmark's quantified economy-wide emission reduction target, including conditions and assumptions relevant to the attainment of the target, has been communicated to the secretariat and is contained in document FCCC/SB/2011/INF.1/Rev.1[43] and document FCCC/AWGLCA/2012/MISC.1[44] as part of the information on the joint target under the Convention for the EU and its 28 Member States[45], which is an independent quantified economy-wide emission reduction target of a 20 % emission reduction by 2020 compared with 1990 levels.

As this 20 % reduction target will be fulfilled jointly by the EU and its member states, no individual target for Denmark is included in the documents mentioned above.

In its submission to the UNFCCC from 20 March 2012 (FCCC/AWGLCA/2012/ MISC1) the EU provided additional information for the joint target as part of the process of clarifying its quantified economy-wide emission reduction targets contained in document FCCC/SB/2011/INF.1/Rev.1. This biennial report provides the additional detailed information related to the target as requested in the guidelines for biennial reports and Table 2 of the Common Tabular Format (CTF).

Hence, Table 2 of the CTF included in Chapter VIII of this biennial report contains information on: the base year, the gases and sectors covered, which set of global warming potentials on which the target in absolute terms will be based, the approach to counting emissions and removals from the land use, land-use change and forestry (LULUCF) sector, the possible scale of contribution from use of international market-based mechanisms in achieving the emission reduction target and other relevant information.

This information is also relevant in relation to the joint target under the Kyoto Protocol for the EU and its 28 Member States, which is an quantified economy-wide emission reduction target of a 20 % emission reduction by 2020 compared with Kyoto Protocol base year levels, cf. Decision 1/CMP.8[46].

Since Greenland and the Faroe Islands are not included in the EU territory, the above EU targets are not applicable to these parts of the Realm. Regarding the 2nd commitment period under the Kyoto Protocol (2013-2020), it is expected that a territorial reservation for Greenland will be taken in accordance with the Vienna Convention, when the amendment to the Kyoto Protocol is ratified, cf. the note of 7 April 2010 submitted to the UNFCCC[47].

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[43] http://unfccc.int/resource/docs/2011/sb/eng/inf01r01.pdf
[44] http://unfccc.int/resource/docs/2012/awglca15/eng/misc01.pdf
[45] Although the documents refers to EU27, relevant arrangements will be made for EU28, in line with and as part of EU mitigation efforts, in order to take into account the accession of Croatia to the EU as of 1 July 2013.
[46] http://unfccc.int/resource/docs/2012/cmp8/eng/13a01.pdf
[47] http://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/denmarkcphaccord_app1.pdf

Domestically, in its strategy to put Denmark on track for the 80 % – 95 % reduction by 2050 by developed countries, as recommended by science as part of an overall 50 % reduction in global greenhouse gas emissions, the Danish government has set an interim quantified economy-wide emission reduction target of 40 % reduction by 2020 in Denmark's total greenhouse gas emissions compared with Denmark's base year under the Kyoto Protocol. When calculating whether the 40 % domestic target in 2020 has been met, emissions in 2020 will be adjusted for electricity trading. Furthermore RMU-credits from CO_2 removals by sinks under Articles 3.3 and 3.4 of the Kyoto Protocol, as annual average in the period 2013-2019, will be taken into account. Neither Greenland nor the Faroe Islands are included in Denmark's domestic target.

Target for 2008-2012

In relation to the 1st commitment period under the Kyoto Protocol (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. Under the EU15 Burden Sharing of this target, Denmark has committed itself to a reduction of 21% as an element of the burden-sharing agreement within the EU in accordance with Article 4 of the Kyoto Protocol.

With Greenland and Faroe Island not being included in the EU territory, and with a territorial reservation for the Faroe Islands in accordance with the Vienna Convention, when the Kyoto Protocol was ratified by the Kingdom of Denmark, the quantified emission limitation for Greenland in 2008-2012 is 92 % of Greenland's base-year emissions. On the basis of total base-year emissions estimated at 69,978,070 tonnes CO_2 equivalents, the initial review report concluded in 2007 that the total assigned amount for Denmark and Greenland for the period 2008-2012 is 276,838,955 tonnes CO_2 equivalents[48]. Further information on the target for 2008-2012 is provided in Chapter 3 of Denmark's Sixth National Communication.

IV. Progress in achievement of quantified economy-wide emission reduction targets and relevant information

A. Mitigation actions and their effects

Information on Denmark's mitigation actions, including information on policies and measures implemented or planned to achieve the economy-wide emission reduction targets described in section III of this biennial report, is included in Chapter 4 of Denmark's Sixth National Communication.

[48] http://unfccc.int/resource/docs/2007/irr/dnk.pdf

A summary table organised by sector: energy (excl. transport), transport, industrial processes and product use, agriculture, LULUCF and waste, and with information on which of the following gases will be affected by the individual measure: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, is included as Table 3 in the CTF in Section VIII of this biennial report.

Information on changes in Denmark's domestic institutional arrangements, including institutional, legal, administrative and procedural arrangements used for domestic compliance, monitoring, reporting, archiving of information and evaluation of the progress towards Denmark's economy-wide emission reduction targets described in section III of this biennial report, is included in Chapter 4 of Denmark's Sixth National Communication.

In Denmark, the government's proposals for new response measures to put before the parliament are in most cases accompanied by an assessment of the economic consequences. For the purpose of analysing the economic consequences of potential additional measures to be implemented in order to achieve the economy-wide emission reduction targets described in section III of this biennial report, in 2012 the Danish government established a inter-ministerial working group to undertake such an analysis. In August 2013 the results of this analysis were published in parallel with the government's Climate Policy Plan, including a catalogue of potential additional measures with potential emission reductions and the related costs. Further information on economic consequences of potential additional measures, including the so-called MAC-curve (Marginal Abatement Cost curve), is included in Chapter 4 of Denmark's Sixth National Communication.

B. ESTIMATES OF EMISSION REDUCTIONS AND REMOVALS AND THE USE OF UNITS FROM THE MARKET-BASED MECHANISMS AND LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES

Base-year emission information

In relation to the economy-wide emission reduction targets described in section III of this biennial report, final base-year information is only available for Denmark and Greenland for the establishment of the target, i.e. the assigned amount, in the 1st commitment period under the Kyoto Protocol. This information is included in Chapter 3 of Denmark's Sixth National Communication.

Final base-year information in relation to Denmark's target in the 2nd commitment period under the Kyoto Protocol will not be available until after the finalization of the UNFCCC review of Denmark's initial report to be submitted in April 2015. In comparison with the base year in relation to the 1st commitment period, base-year emissions will be recalculated using the IPCC 2006 guidelines instead of the IPCC 1996 revised guidelines and using GWPs from the IPCC's AR4 instead of GWPs from IPCC's SAR. Furthermore, emissions of NF3, if any, will be included in the base year for the 2nd commitment period under the Kyoto Protocol.

Annual information on progress towards the emission reduction target with emissions, removals and the use of units from market-based mechanisms

In relation to the economy-wide emission reduction targets described in section III of this biennial report annual information on historical progress towards the emission reduction targets with emissions, removals and the use of units from market-based mechanisms is only available for the achievement of Denmark's and Greenland's target in the 1st commitment period under the Kyoto Protocol. This information is included in Chapters 3 and 5 of Denmark's Sixth National Communication.

Annual information on historical progress towards Denmark's target in the 2nd commitment period under the Kyoto Protocol on:

- Total GHG emissions, excluding emissions and removals from the LULUCF sector;
- Emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the COP and the activities and/or lands that will be accounted for;
- Total GHG emissions, including emissions and removals from the LULUCF sector; and
- Information on the use of units from market-based mechanisms,

will not be available until after the first reporting in April 2015 for the first year of the commitment period, i.e. for 2013.

V. Projections

Information on updated projections of Denmark's greenhouse gas emissions in 2020 and 2030 is included as Table 6 in the CTF in Section VIII of this biennial report.

Table 6(a) in the CTF contains the results from the "with measures" projection and Table 6(b) contains the results from the "without measures" projection elaborated in 2005 as part of the Effort Analysis described in Annex B of Denmark's Sixth National Communication.

In Table 5 of the CTF in Section VIII, a summary of key variables and assumptions used in the projections is given.

Further information on the projections, including further results for the whole projection period (2012-2035), projected progress towards Denmark's targets under the EU climate and energy package, projected progress towards Denmark's domestic target and information on models and methodologies used, is contained in Chapter 5, Annex E of Denmark's Sixth National Communication.

VI. Provision of financial, technological and capacity-building support to developing country Parties

Financial support to developing country Parties

The figures in Tables 7, 7(A) and 7(B) of the CTF in Section VIII reflect the firm commitments in the years 2011 and 2012. All contributions are reported as ODA and are provided as grants.

Identification of climate-related contributions has been done with the Rio-Markers.

When aggregating the data, activities marked with “significant” count ½ while activities marked with “principal” count 1.

Technological support to developing country Parties

Danish support to technology transfer in relation to implementation of the UNFCCC 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. 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. The tables in Annex F contain examples of Danish assistance to technology transfer in the form of projects and programmes with both soft and hard technology.

Capacity building support to developing country Parties

Danish support to technology transfer in relation to implementation of the UNFCCC includes a broad spectrum of activities. These activites comprise transfer of both “soft” technology and “hard” technology. The extend 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. 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. Selected project/programmes are i.a.:

- Sector programme for energy in Burkina Faso
- Environmental Programme in Indonesia
- Programme for sustainable energy in rural areas in Nepal

VII. Other reporting matters

The Danish government is continuously assessing historical and projected progress towards Denmark's economy-wide emission reduction targets described in section III of this biennial report.

The latest assessment is contained in the Danish Government's Climate Policy Plan published in August 2013[49].

Furthermore, in accordance with recent EU legislation[50], Denmark will, by no later than 9 July 2015, set up, operate and seek to continuously improve a national system for reporting on policies and measures and for reporting on projections of anthropogenic greenhouse gas emissions by sources and removals by sinks.

This national system will include the relevant institutional, legal and procedural arrangements established in Denmark for evaluating policy and making projections of anthropogenic greenhouse gas emissions by sources and removals by sinks.

These domestic arrangements are considered to be sufficient for the process of the self-assessment of compliance with emission reductions in comparison with emission reduction commitments and the level of emission reduction recommended by science.

Denmark has established national rules for taking action against Danish entities under the EU ETS in case of non-compliance with their emission reduction targets under the EU ETS. These rules are contained in the Danish Act on CO_2 quotas (the Act of 9 May 2008 with amendments for the period 2008-2012[51] and the Act of 28 November 2012 for the period 2013-2020[52]).

VIII. Common tabular format for UNFCCC biennial reporting

The information to be reported electronicly in the so-called Common Tabular Format (CTF) contained in Decision 19/CP.18 - Document: FCCC/CP/2012/8/Add.3) adopted by the Conference of the Parties on its eighteenth session is included in this chapter.

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49 http://www.kebmin.dk/sites/kebmin.dk/files/climate-energy-and-building-policy/denmark/Climate-policy-plan/danishclimatepolicyplan.pdf
50 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:165:0013:0040:EN:PDF
51 https://www.retsinformation.dk/Forms/R0710.aspx?id=117147
52 https://www.retsinformation.dk/Forms/R0710.aspx?id=144102

With the annual information on historical progress towards Denmark's target in the 2nd commitment period under the Kyoto Protocol not being available until after the first reporting on the first year of the commitment period (2013) in April 2015, several tables in the CTF have to be filled in with "NA" (Not Applicable). Therefore, in addition to the CTF tables to be reported electronically, tables with annual information on historical (1990-2011) and projected (2012-2030) progress in Denmark in reducing greenhouse gas emissions since 1990 have been included in this chapter.

The following notation keys have been used in the tables:

NA = Not Applicable.
NE = Not Estimated.
NO = Not Occuring.
IE = Included Elsewhere.

TABLE 1.1: EMISSION TRENDS IN THE KINGDOM OF DENMARK (DENMARK, GREENLAND AND FAROE ISLANDS)

Table 1

Emission trends: summary

CRF - TABLE 10 EMISSION TRENDS SUMMARY — Inventory 2011, Submission 2013 v1.1

Denmark, Greenland and the Faroe Islands under the UNFCCC — DENMARK KINGDOM

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	CO2 equivalent (Gg)	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	(%)
CO2 emissions including net CO2 from LULUCF	59.601,98	68.787,14	65.286,19	63.989,27	69.548,64	65.640,56	77.657,97	69.696,43	64.522,18	63.565,21	58.274,67	61.437,55	62.485,63	66.382,82	60.538,94	57.178,05	66.112,99	58.262,21	50.940,90	52.699,13	49.793,36	42.622,19	-28,49
CO2 emissions excluding net CO2 from LULUCF	54.145,78	64.807,32	59.066,51	61.216,07	65.169,80	62.006,03	75.416,77	66.086,83	62.012,87	59.457,81	55.070,57	56.898,94	56.466,20	61.627,14	56.151,49	52.495,34	60.463,28	55.704,12	52.251,89	49.779,65	50.278,80	45.298,71	-16,34
CH4 emissions including CH4 from LULUCF	6.068,94	6.135,21	6.134,63	6.230,20	6.126,12	6.162,50	6.205,47	6.045,99	6.030,22	5.917,29	5.912,84	6.016,31	5.932,06	5.911,56	5.755,33	5.684,22	5.692,92	5.694,05	5.651,79	5.558,95	5.620,12	5.524,68	-8,97
CH4 emissions excluding CH4 from LULUCF	6.068,39	6.135,21	6.134,62	6.230,20	6.126,11	6.162,50	6.205,46	6.045,99	6.030,19	5.917,28	5.912,84	6.016,30	5.932,05	5.911,55	5.754,76	5.684,20	5.692,89	5.694,04	5.651,78	5.558,94	5.620,11	5.524,67	-8,96
N2O emissions including N2O from LULUCF	9.845,53	9.602,65	9.240,49	9.055,82	9.077,80	8.809,11	8.234,19	8.198,09	8.372,16	8.215,22	7.989,70	7.688,18	7.532,15	7.219,82	7.004,13	6.374,95	6.223,79	6.379,18	6.430,00	6.058,88	6.017,47	6.075,55	-38,29
N2O emissions excluding N2O from LULUCF	9.829,06	9.586,82	9.224,84	9.040,35	9.062,51	8.794,01	8.219,27	8.183,36	8.357,59	8.200,86	7.975,52	7.674,17	7.518,32	7.206,18	6.990,21	6.361,59	6.210,64	6.366,24	6.417,25	6.046,32	6.004,92	6.063,01	-38,32
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	93,93	134,56	217,78	329,44	324,80	413,14	508,61	612,96	660,35	688,83	715,66	772,05	819,02	840,48	868,05	871,64	817,02	823,07	777,53	100,00
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,05	0,50	1,66	4,12	9,10	12,48	17,89	22,13	22,17	19,34	15,90	13,90	15,68	15,36	12,79	14,18	13,27	11,06	100,00
SF6	44,45	63,50	89,27	101,30	122,20	107,53	61,13	73,24	59,61	65,45	59,31	30,48	25,10	31,45	33,33	21,91	36,14	30,48	31,76	36,90	38,46	73,35	65,01
Total (including LULUCF)	**75.560,90**	**84.588,50**	**80.750,58**	**79.470,52**	**85.009,37**	**80.937,97**	**92.489,85**	**84.342,67**	**79.406,40**	**78.284,26**	**72.867,37**	**75.855,00**	**76.685,94**	**80.280,66**	**74.119,68**	**70.092,04**	**78.922,00**	**71.249,34**	**63.938,87**	**65.185,05**	**62.305,75**	**55.084,37**	**-27,10**
Total (excluding LULUCF)	**70.087,68**	**80.592,85**	**74.515,24**	**76.681,86**	**80.615,24**	**77.288,34**	**90.233,74**	**80.718,34**	**76.882,50**	**74.162,50**	**69.649,08**	**71.302,38**	**70.652,67**	**75.511,33**	**69.717,74**	**65.395,96**	**73.259,10**	**68.678,29**	**65.237,10**	**62.253,00**	**62.778,63**	**57.748,33**	**-17,61**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	CO2 equivalent (Gg)	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	equivalent	(%)
1. Energy	53.413,16	63.951,66	58.081,53	60.282,18	64.275,04	61.246,27	74.676,16	65.173,62	61.168,59	58.636,43	54.216,52	56.085,01	55.622,13	60.931,57	55.333,33	51.694,72	59.662,36	54.850,25	51.678,61	49.576,86	50.195,48	44.972,27	-15,80
2. Industrial Processes	2.239,52	2.347,10	2.379,96	2.456,58	2.555,02	2.725,99	2.828,15	3.016,69	2.993,63	3.219,89	3.389,98	3.299,09	3.209,82	3.229,28	3.039,11	2.457,77	2.538,25	2.559,30	2.273,07	1.782,38	1.703,66	1.872,74	-16,38
3. Solvent and Other Product Use	116,38	132,72	142,63	126,42	147,55	137,34	148,02	135,13	144,00	152,36	153,79	141,02	165,45	160,07	164,50	189,56	171,11	173,76	157,38	170,18	187,68	167,18	43,65
4. Agriculture	12.585,57	12.425,07	12.200,15	12.106,69	11.997,32	11.633,09	11.087,66	10.979,17	11.225,88	10.785,33	10.512,56	10.419,60	10.340,03	9.878,25	10.008,21	9.893,98	9.700,74	9.929,04	9.985,31	9.639,17	9.654,97	9.712,30	-22,83
5. Land Use, Land-Use Change and Forestry(5)	5.473,22	3.995,66	6.235,34	2.788,66	4.394,13	3.649,64	2.256,12	3.624,33	2.523,90	4.121,77	3.218,29	4.552,62	6.033,27	4.769,33	4.401,94	4.696,08	5.662,90	2.571,04	-1.298,23	2.932,05	-472,88	-2.663,97	-148,67
6. Waste	1.733,05	1.736,30	1.710,97	1.709,99	1.640,31	1.545,65	1.493,74	1.413,74	1.350,40	1.368,49	1.376,23	1.357,66	1.315,24	1.312,16	1.172,58	1.159,93	1.186,64	1.165,93	1.142,73	1.084,42	1.036,84	1.023,85	-40,92
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Total (including LULUCF)(5)	**75.560,90**	**84.588,50**	**80.750,58**	**79.470,52**	**85.009,37**	**80.937,97**	**92.489,85**	**84.342,67**	**79.406,40**	**78.284,26**	**72.867,37**	**75.855,00**	**76.685,94**	**80.280,66**	**74.119,68**	**70.092,04**	**78.922,00**	**71.249,34**	**63.938,87**	**65.185,05**	**62.305,75**	**55.084,37**	**-27,10**

Notes:

(1) Further detailed information could be found in the common reporting format tables of the Party's greenhouse gas inventory, namely "Emission trends (CO2)", "Emission trends (CH4)", "Emission trends (N2O)" and "Emission trends (HFCs, PFCs and SF6)", which is included in an annex to this biennial report; (2) 20XX is the latest reported inventory year; (3) 1 kt CO2 eq equals 1 Gg CO2 eq.

Abbreviation: LULUCF = land use, land-use change and forestry.

a The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

b Includes net CO2, CH4 and N2O from LULUCF.

Table 1

(cont.) Emission trends (CO2)

CRF - TABLE 10 EMISSION TRENDS Inventory 2011

SUMMARY Submission 2013 v1.1

Denmark, Greenland and the Faroe Islands under the UNFCCC DENMARK KINGDOM

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	se year (199	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	**52.857,52**	**63.325,97**	**57.456,03**	**59.603,68**	**63.511,13**	**60.351,65**	**73.645,86**	**64.164,71**	**60.144,51**	**57.604,40**	**53.202,50**	**55.040,35**	**54.585,71**	**59.884,59**	**54.290,76**	**50.694,97**	**58.638,55**	**53.878,41**	**50.726,46**	**48.689,02**	**49.255,40**	**44.115,72**	**-16,54**
A. Fuel Combustion (Sectoral Approach)	52.532,83	62.682,98	56.792,54	59.026,52	62.941,17	59.902,19	73.152,23	63.469,76	59.629,61	56.510,55	52.482,46	54.270,87	53.938,41	59.214,85	53.539,00	50.152,12	58.106,41	53.334,40	50.334,06	48.423,69	48.898,51	43.860,19	-16,51
1. Energy Industries	26.426,18	35.286,21	30.352,95	31.903,97	35.877,93	32.363,74	44.636,42	35.525,58	31.891,73	28.805,93	25.793,98	27.138,28	27.321,13	32.048,84	26.181,62	22.969,73	30.900,57	26.263,32	24.157,64	24.047,27	23.986,49	20.124,23	-23,85
2. Manufacturing Industries and Construction	5.472,84	6.013,88	5.845,87	5.704,19	5.796,63	5.928,80	6.090,39	6.141,74	6.171,95	6.265,15	6.072,15	6.165,69	5.874,03	5.823,10	5.872,11	5.581,28	5.701,49	5.512,98	5.066,17	4.089,07	4.453,61	4.451,49	-18,66
3. Transport	10.819,74	11.201,17	11.409,11	11.507,64	11.974,86	12.126,77	12.374,23	12.579,99	12.549,12	12.587,80	12.377,39	12.385,03	12.485,76	12.948,18	13.274,86	13.396,36	13.784,06	14.403,85	14.184,81	13.374,07	13.308,68	12.957,83	19,76
4. Other Sectors	9.686,79	9.887,01	9.035,98	9.666,52	9.033,42	9.224,35	9.868,62	9.044,98	8.806,14	8.662,67	8.121,76	8.478,34	8.162,06	8.296,10	7.963,91	7.926,65	7.584,18	6.971,71	6.807,79	6.737,30	7.018,31	6.112,29	-36,90
5. Other	127,28	294,72	148,62	244,20	258,33	258,53	182,56	177,47	210,68	189,00	117,18	103,53	95,43	98,64	246,50	278,10	136,11	182,53	117,65	175,97	131,42	214,35	68,40
B. Fugitive Emissions from Fuels	324,69	642,98	663,48	577,16	569,97	449,46	493,63	694,95	514,90	1.093,84	720,04	769,49	647,30	669,74	751,76	542,86	532,15	544,01	392,40	265,34	356,89	255,53	-21,30
1. Solid Fuels	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
2. Oil and Natural Gas	324,69	642,98	663,48	577,16	569,97	449,46	493,63	694,95	514,90	1.093,84	720,04	769,49	647,30	669,74	751,76	542,86	532,15	544,01	392,40	265,34	356,89	255,53	-21,30
2. Industrial Processes	**1.152,16**	**1.328,76**	**1.447,10**	**1.466,42**	**1.491,69**	**1.496,33**	**1.601,60**	**1.766,30**	**1.705,28**	**1.683,15**	**1.696,33**	**1.700,82**	**1.699,64**	**1.568,16**	**1.687,11**	**1.602,94**	**1.645,96**	**1.645,40**	**1.356,89**	**914,28**	**828,86**	**1.010,80**	**-12,27**
A. Mineral Products	1.068,76	1.246,17	1.365,59	1.382,84	1.406,09	1.404,22	1.512,28	1.678,99	1.612,77	1.592,11	1.611,35	1.609,88	1.654,76	1.525,58	1.642,39	1.542,30	1.604,12	1.603,58	1.317,82	879,04	792,01	973,41	-8,92
B. Chemical Industry	0,80	0,80	0,80	0,80	0,80	0,80	1,45	0,87	0,56	0,58	0,65	0,83	0,55	1,05	3,01	3,01	2,18	2,16	2,40	2,13	2,12	2,20	174,38
C. Metal Production	28,45	28,45	28,45	30,97	33,50	38,56	35,19	35,01	42,19	43,04	40,73	46,68	NA,NO	NA,NO	NA,NO	15,58	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	-100,00
D. Other Production	4,45	4,49	4,14	4,26	4,36	3,91	3,80	4,29	4,90	4,71	3,90	4,95	4,47	4,49	3,97	4,46	2,17	1,72	2,67	1,92	1,56	2,01	-54,77
E. Production of Halocarbons and SF6																							
F. Consumption of Halocarbons and SF6																							
G. Other	49,71	48,86	48,12	47,55	46,95	48,84	48,89	47,15	44,85	42,72	39,70	38,49	39,86	37,03	37,73	37,59	37,49	37,94	34,01	31,19	33,18	33,18	-33,25
3. Solvent and Other Product Use	115,26	131,37	141,15	125,11	146,03	135,20	146,01	133,44	141,49	147,93	149,77	135,88	159,40	151,73	152,83	176,14	156,95	157,93	144,03	152,23	173,23	150,85	30,87
4. Agriculture																							
A. Enteric Fermentation																							
B. Manure Management																							
C. Rice Cultivation																							
D. Agricultural Soils																							
E. Prescribed Burning of Savannas																							
F. Field Burning of Agricultural Residues																							
G. Other																							
5. Land Use, Land-Use Change and Forestry(2)	**5.456,20**	**3.979,82**	**6.219,68**	**2.773,19**	**4.378,85**	**3.634,53**	**2.241,20**	**3.609,59**	**2.509,31**	**4.107,40**	**3.204,10**	**4.538,60**	**6.019,43**	**4.755,67**	**4.387,45**	**4.682,71**	**5.649,71**	**2.558,09**	**-1.311,00**	**2.919,48**	**-485,44**	**-2.676,52**	**-149,05**
A. Forest Land	118,75	-782,73	-674,54	-934,33	-757,28	-961,89	-894,01	-986,42	-988,78	-587,51	-770,91	796,22	727,49	658,74	589,96	666,70	596,40	-2.161,73	-5.584,24	-248,73	-4.362,39	-6.398,96	-5.488,71
B. Cropland	5.046,48	4.475,71	6.609,89	3.427,01	4.866,14	4.362,26	2.844,85	4.269,61	3.211,18	4.446,21	3.732,93	3.493,60	5.029,16	3.833,57	3.521,03	3.654,26	4.657,23	4.358,69	3.911,43	2.806,03	3.530,12	3.336,92	-33,88
C. Grassland	183,63	187,09	184,29	192,23	184,73	152,32	193,40	207,44	186,79	165,17	159,08	156,82	159,98	164,53	170,55	203,52	235,93	220,46	239,62	226,55	218,03	249,22	35,72
D. Wetlands	91,21	82,55	81,80	68,97	64,89	60,40	74,45	95,39	75,47	57,84	56,26	64,23	74,07	69,11	75,20	114,40	114,47	93,03	72,40	83,93	75,02	80,36	-11,90
E. Settlements	16,13	17,19	18,25	19,32	20,38	21,44	22,51	23,58	24,64	25,70	26,75	27,74	28,73	29,72	30,70	43,83	45,68	47,64	49,79	51,70	53,78	55,94	246,87
F. Other Land	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
G. Other	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	
6. Waste	**20,84**	**21,22**	**22,23**	**20,86**	**20,95**	**22,84**	**23,30**	**22,38**	**21,60**	**22,33**	**21,98**	**21,90**	**21,44**	**22,67**	**20,79**	**21,29**	**21,82**	**22,38**	**24,51**	**24,11**	**21,31**	**21,34**	**2,45**
A. Solid Waste Disposal on Land	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
B. Waste-water Handling																							
C. Waste Incineration	2,55	2,57	2,59	2,61	2,66	2,74	2,93	3,09	3,51	3,42	3,21	3,28	3,24	3,14	3,07	3,09	3,10	3,10	3,08	3,10	3,12	3,13	22,79
D. Other	18,28	18,65	19,65	18,25	18,29	20,11	20,37	19,30	18,09	18,91	18,77	18,61	18,20	19,52	17,73	18,20	18,72	19,29	21,43	21,01	18,19	18,21	-0,39
7. Other (as specified in Summary 1.A)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	
Total CO2 emissions including net CO2 from LULUCF	**59.601,98**	**68.787,14**	**65.286,19**	**63.989,27**	**69.548,64**	**65.640,56**	**77.657,97**	**69.696,43**	**64.522,18**	**63.565,21**	**58.274,67**	**61.437,55**	**62.485,63**	**66.382,82**	**60.538,94**	**57.178,05**	**66.112,99**	**58.262,21**	**50.940,90**	**52.699,13**	**49.793,36**	**42.622,19**	**-28,49**
Total CO2 emissions excluding net CO2 from LULUCF	**54.145,78**	**64.807,32**	**59.066,51**	**61.216,07**	**65.169,80**	**62.006,03**	**75.416,77**	**66.086,83**	**62.012,87**	**59.457,81**	**55.070,57**	**56.898,94**	**56.466,20**	**61.627,14**	**56.151,49**	**52.495,34**	**60.463,28**	**55.704,12**	**52.251,89**	**49.779,65**	**50.278,80**	**45.298,71**	**-16,34**
Memo Items:																							
International Bunkers	**4.741,07**	**4.305,12**	**4.595,52**	**6.015,52**	**6.701,84**	**6.974,96**	**6.838,83**	**6.474,76**	**6.608,46**	**6.465,30**	**6.653,83**	**5.924,35**	**4.891,24**	**5.120,93**	**5.038,54**	**5.216,93**	**5.937,97**	**6.185,27**	**5.690,40**	**3.992,66**	**4.778,78**	**4.924,40**	**3,87**
Aviation	1.736,10	1.632,25	1.693,32	1.658,97	1.817,83	1.867,18	1.971,37	2.010,74	2.159,42	2.290,66	2.350,65	2.385,00	2.059,13	2.141,81	2.448,60	2.575,05	2.582,75	2.648,01	2.648,44	2.317,16	2.421,69	2.493,32	43,62
Marine	3.004,96	2.672,87	2.902,20	4.356,55	4.884,01	5.107,78	4.867,47	4.464,02	4.449,04	4.174,64	4.303,18	3.539,35	2.832,11	2.979,12	2.589,95	2.641,88	3.355,22	3.537,26	3.041,96	1.675,49	2.357,08	2.431,08	-19,10
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
CO2 Emissions from Biomass	4.681,28	5.076,31	5.327,95	5.541,86	5.479,36	5.746,23	6.131,52	6.349,50	6.303,04	6.632,35	6.936,30	7.664,50	8.168,09	9.269,54	10.007,54	10.765,43	11.147,13	12.172,31	12.372,48	12.665,37	14.942,88	14.534,66	210,48

Table 1

(cont.) Emission trends (CH4)

CRF - TABLE 10 EMISSION TRENDS
SUMMARY

Inventory 2011
Submission 2013 v1.1

Denmark, Greenland and the Faroe Islands under the UNFCCC

DENMARK KINGDOM

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	se year (199	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	10,65	12,11	12,60	14,87	18,40	24,67	28,83	28,82	30,26	30,70	30,26	31,18	30,63	30,27	30,83	29,13	29,00	27,02	26,56	24,23	26,18	23,16	117,45
A. Fuel Combustion (Sectoral Approach)	8,58	9,54	10,14	12,18	15,41	21,28	25,51	25,26	26,75	26,74	26,16	26,91	26,33	25,87	25,60	23,92	22,49	20,73	20,50	18,59	20,85	17,88	108,45
1. Energy Industries	0,69	1,04	1,45	3,06	6,11	11,38	14,48	13,87	15,25	15,36	14,65	15,56	15,13	14,41	14,09	12,47	11,56	9,64	10,18	8,90	11,10	9,34	1.257,16
2. Manufacturing Industries and Con	0,37	0,38	0,36	0,37	0,37	0,48	0,92	0,91	1,01	0,99	1,21	1,25	1,16	1,12	1,14	1,00	0,87	0,64	0,70	0,66	0,67	0,62	69,55
3. Transport	2,33	2,43	2,44	2,43	2,41	2,33	2,26	2,20	2,12	2,10	1,89	1,78	1,68	1,60	1,51	1,44	1,34	1,23	1,07	0,90	0,82	0,74	-68,47
4. Other Sectors	5,19	5,67	5,87	6,31	6,51	7,06	7,83	8,26	8,36	8,29	8,41	8,32	8,36	8,73	8,85	9,01	8,72	9,21	8,55	8,12	8,26	7,18	38,44
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	0,01	0,01	0,01	0,01	0,01	0,00	0,01	0,01	0,01	28,57
B. Fugitive Emissions from Fuels	2,07	2,57	2,46	2,68	2,99	3,39	3,32	3,56	3,51	3,95	4,10	4,27	4,30	4,40	5,23	5,21	6,51	6,29	6,06	5,65	5,34	5,28	154,70
1. Solid Fuels	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
2. Oil and Natural Gas	2,07	2,57	2,46	2,68	2,99	3,39	3,32	3,56	3,51	3,95	4,10	4,27	4,30	4,40	5,23	5,21	6,51	6,29	6,06	5,65	5,34	5,28	154,70
2. Industrial Processes	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	
A. Mineral Products	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	
B. Chemical Industry	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	
C. Metal Production	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	
D. Other Production																							
E. Production of Halocarbons and SF6																							
F. Consumption of Halocarbons and SF6																							
G. Other	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	
3. Solvent and Other Product Use																							
4. Agriculture	203,11	204,61	204,86	208,02	203,20	202,97	202,63	198,69	199,76	193,37	193,86	198,35	198,04	196,70	194,19	193,64	192,55	196,35	196,59	196,08	199,39	198,73	-2,16
A. Enteric Fermentation	155,69	155,87	153,97	155,16	150,78	150,29	149,31	144,77	144,14	138,71	137,30	139,67	137,80	135,96	132,15	131,39	131,51	134,62	135,81	135,45	137,32	136,29	-12,46
B. Manure Management	47,34	48,65	50,80	52,77	52,33	52,58	53,22	53,80	55,49	54,53	56,43	58,55	60,13	60,61	61,90	62,11	60,90	61,61	60,67	60,49	61,97	62,34	31,71
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
D. Agricultural Soils	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
F. Field Burning of Agricultural Residues	0,09	0,09	0,09	0,09	0,09	0,10	0,10	0,11	0,14	0,13	0,13	0,13	0,11	0,13	0,14	0,14	0,14	0,13	0,12	0,14	0,10	0,10	13,53
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5. Land Use, Land-Use Change and Forestr	0,03	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	0,03	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-97,59
A. Forest Land	0,03	NA,NE,NO	0,00	NA,NE,NO	0,00	0,00	NA,NE,NO	NA,NE,NO	0,00	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,03	NA,NE,NO	0,00	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	-100,00
B. Cropland	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	
C. Grassland	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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	702,13
D. Wetlands	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
E. Settlements	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
F. Other Land	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
G. Other	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	
6. Waste	75,21	75,43	74,66	73,78	70,12	65,82	64,04	60,39	57,13	57,70	57,44	56,96	53,80	54,53	49,02	47,90	49,54	47,77	45,98	44,39	42,05	41,19	-45,24
A. Solid Waste Disposal on Land	70,54	70,62	69,71	68,68	64,84	60,64	58,47	54,43	51,08	51,31	50,77	50,47	47,12	47,64	42,35	40,98	42,42	40,24	38,78	36,93	34,48	33,47	-52,56
B. Waste-water Handling	3,15	3,16	3,17	3,19	3,22	3,27	3,34	3,42	3,43	3,41	3,52	3,54	3,49	3,56	3,51	3,54	3,53	3,55	3,56	3,59	3,59	3,62	14,99
C. Waste Incineration	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,10	0,09	0,09	0,08	0,08	0,07	0,08	0,08	0,08	0,08	0,08	0,08	0,08	-29,00
D. Other	1,40	1,54	1,68	1,81	1,94	1,80	2,12	2,43	2,52	2,88	3,06	2,87	3,11	3,25	3,08	3,31	3,50	3,91	3,57	3,80	3,91	4,02	185,86
7. Other (as specified in Summary 1.A)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total CH4 emissions including CH4 from LULUCF	289,00	292,15	292,13	296,68	291,72	293,45	295,50	287,90	287,15	281,78	281,56	286,49	282,48	281,50	274,06	270,68	271,09	271,15	269,13	264,71	267,62	263,08	-8,97
Total CH4 emissions excluding CH4 from LULUCF	288,97	292,15	292,12	296,68	291,72	293,45	295,50	287,90	287,15	281,78	281,56	286,49	282,48	281,50	274,04	270,68	271,09	271,14	269,13	264,71	267,62	263,08	-8,96
Memo Items:																							
International Bunkers	0,09	0,09	0,09	0,12	0,14	0,15	0,15	0,14	0,14	0,14	0,15	0,10	0,08	0,09	0,09	0,09	0,11	0,11	0,10	0,06	0,08	0,09	-1,77
Aviation	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,05	0,02	0,02	0,02	0,02	0,02	0,03	0,02	0,02	0,02	0,02	0,02	-26,98
Marine	0,06	0,06	0,06	0,09	0,11	0,11	0,11	0,10	0,10	0,09	0,10	0,08	0,06	0,07	0,07	0,07	0,09	0,09	0,08	0,05	0,07	0,07	10,57
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
CO2 Emissions from Biomass																							

Table 1

(cont.) Emission trends (N2O)

CRF - TABLE 10 EMISSION TRENDS
SUMMARY

Inventory 2011
Submission 2013 v1.1

Denmark, Greenland and the Faroe Islands under the UNFCCC

DENMARK KINGDOM

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	se year (199	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	1,07	1,20	1,16	1,18	1,22	1,21	1,37	1,30	1,25	1,25	1,22	1,26	1,27	1,33	1,27	1,25	1,34	1,30	1,27	1,22	1,26	1,19	11,50
A. Fuel Combustion (Sectoral Approach)	1,07	1,19	1,16	1,18	1,21	1,21	1,37	1,30	1,25	1,24	1,22	1,25	1,26	1,32	1,27	1,25	1,33	1,30	1,27	1,22	1,26	1,19	11,61
1. Energy Industries	0,28	0,36	0,32	0,35	0,38	0,36	0,49	0,42	0,39	0,38	0,36	0,37	0,38	0,42	0,37	0,34	0,40	0,34	0,33	0,34	0,35	0,31	12,84
2. Manufacturing Industries and Co	0,18	0,19	0,19	0,17	0,16	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,14	0,14	0,14	0,13	0,15	0,14	0,14	0,11	0,12	0,12	-33,94
3. Transport	0,37	0,38	0,40	0,40	0,43	0,44	0,46	0,48	0,48	0,48	0,47	0,47	0,47	0,48	0,48	0,48	0,48	0,49	0,48	0,45	0,44	0,45	21,77
4. Other Sectors	0,25	0,25	0,25	0,25	0,24	0,24	0,25	0,24	0,23	0,23	0,24	0,26	0,26	0,28	0,27	0,30	0,31	0,32	0,32	0,32	0,34	0,31	26,60
5. Other	0,00	0,01	0,00	0,01	0,01	0,01	0,01	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,01	0,00	0,01	0,00	0,01	79,32
B. Fugitive Emissions from Fuels	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,00	0,01	0,01	0,01	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-32,77
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
2. Oil and Natural Gas	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,00	0,01	0,01	0,01	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-32,77
2. Industrial Processes	3,36	3,08	2,72	2,56	2,60	2,92	2,69	2,74	2,60	3,07	3,24	2,86	2,50	2,89	1,71	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	-100,00
A. Mineral Products	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0,00
B. Chemical Industry	3,3642	3,080112	2,721264	2,564268	2,601648	2,91564	2,69136	2,736216	2,601648	3,06516	3,237108	2,855832	2,497	2,886	1,712	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	-100,00
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
D. Other Production																							
E. Production of Halocarbons and SF6																							
F. Consumption of Halocarbons and SF6																							
G. Other	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
3. Solvent and Other Product Use	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,02	0,02	0,03	0,04	0,04	0,05	0,05	0,04	0,06	0,05	0,05	1.360,91
4. Agriculture	26,84	26,22	25,48	24,96	24,94	23,78	22,04	21,96	22,68	21,69	20,78	20,18	19,94	18,54	19,13	18,80	18,25	18,73	18,89	17,81	17,64	17,87	-33,43
A. Enteric Fermentation																							
B. Manure Management	1,94	1,93	1,95	1,93	1,88	1,83	1,83	1,85	1,88	1,84	1,74	1,74	1,74	1,69	1,73	1,66	1,55	1,55	1,48	1,37	1,37	1,30	-32,80
C. Rice Cultivation																							
D. Agricultural Soils	24,896844	24,29125	23,530464	23,025177	23,051267	21,94272	20,208975	20,104785	20,799425	19,849308	19,03667	18,426747	18,197318	16,850472	17,399577	17,13574	16,697224	17,172409	17,40985	16,437212	16,266024	16,561126	-33,48
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	13,53
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
5. Land Use, Land-Use Change and Forest	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	-23,86
A. Forest Land	0,05	0,0504226	0,05	0,049231	0,05	0,05	0,0474442	0,0468487	0,05	0,0456581	0,045063	0,0444679	0,0438729	0,043278	0,04	0,0420519	0,04	0,0407926	0,0401646	0,0395378	0,0395004	0,0394629	-24,78
B. Cropland	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0004936	0,0004936	0,0004936	0,0004936	0,0004936	0,0004936	0,0004936	120,84
C. Grassland	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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	701,67
D. Wetlands	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,00
E. Settlements	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00
F. Other Land	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00
G. Other	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	0,00
6. Waste	0,43	0,42	0,39	0,45	0,47	0,45	0,41	0,40	0,42	0,43	0,48	0,45	0,53	0,47	0,39	0,43	0,40	0,45	0,49	0,41	0,43	0,44	3,57
A. Solid Waste Disposal on Land																							
B. Waste-water Handling	0,39	0,38	0,34	0,40	0,42	0,40	0,34	0,32	0,33	0,32	0,34	0,32	0,36	0,30	0,29	0,32	0,28	0,32	0,37	0,28	0,29	0,30	-23,13
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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-16,35
D. Other	0,04	0,04	0,05	0,05	0,05	0,05	0,06	0,07	0,08	0,11	0,13	0,13	0,16	0,17	0,10	0,10	0,11	0,13	0,12	0,13	0,14	0,14	278,79
7. Other (as specified in Summary 1.A)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Total N2O emissions including N2O from LULUCF	31,76	30,98	29,81	29,21	29,28	28,42	26,56	26,45	27,01	26,50	25,77	24,80	24,30	23,29	22,59	20,56	20,08	20,58	20,74	19,54	19,41	19,60	-38,29
Total N2O emissions excluding N2O from LULUCF	31,71	30,93	29,76	29,16	29,23	28,37	26,51	26,40	26,96	26,45	25,73	24,76	24,25	23,25	22,55	20,52	20,03	20,54	20,70	19,50	19,37	19,56	-38,32
Memo Items:																							
International Bunkers	0,25	0,22	0,24	0,33	0,37	0,39	0,38	0,35	0,36	0,34	0,35	0,31	0,25	0,26	0,24	0,25	0,29	0,30	0,27	0,18	0,22	0,23	-9,21
Aviation	0,06	0,06	0,06	0,06	0,06	0,06	0,07	0,07	0,08	0,08	0,08	0,08	0,07	0,07	0,08	0,09	0,09	0,09	0,09	0,08	0,08	0,09	45,03
Marine	0,19	0,17	0,18	0,27	0,31	0,32	0,31	0,28	0,28	0,26	0,27	0,22	0,18	0,19	0,15	0,16	0,20	0,21	0,18	0,10	0,14	0,14	-26,16
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
CO2 Emissions from Biomass																							

Table 1

(cont.) Emission trends (HFCs, PFCs and SF6)

CRF - TABLE 10 EMISSION TRENDS Inventory 2011

SUMMARY Submission 2013 v1.1

Denmark, Greenland and the Faroe Islands under the UNFCCC DENMARK KINGDOM

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	se year (199	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
Emissions of HFCs(3) - (Gg CO2 equivalent)	NA,NE,NO	NA,NE,NO	NA,NE,NO	93,93	134,56	217,78	329,44	324,80	413,14	508,61	612,96	660,35	688,83	715,66	772,05	819,02	840,48	868,05	871,64	817,02	823,07	777,53	100,00
HFC-23	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00	0,00	0,00	0,00	0,00	0,00	100,00
HFC-32	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	100,00
HFC-41	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
HFC-43-10mee	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
HFC-125	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00	0,00	0,01	0,02	0,02	0,03	0,04	0,05	0,05	0,06	0,06	0,07	0,07	0,08	0,08	0,08	0,08	0,07	100,00
HFC-134	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
HFC-134a	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,07	0,10	0,15	0,20	0,17	0,21	0,23	0,25	0,27	0,29	0,27	0,29	0,29	0,29	0,30	0,29	0,26	0,27	0,27	100,00
HFC-152a	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,03	0,05	0,04	0,03	0,02	0,01	0,04	0,02	0,01	0,01	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	100,00
HFC-143	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
HFC-143a	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00	0,00	0,01	0,01	0,02	0,03	0,04	0,04	0,04	0,05	0,05	0,06	0,07	0,07	0,07	0,07	0,06	0,06	100,00
HFC-227ea	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
HFC-236fa	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
HFC-245ca	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
Unspecified mix of listed HFCs(4) - (Gg CO2 equivalent)	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00	0,01	0,01	0,02	0,03	0,04	0,06	0,07	0,08	0,11	0,13	0,18	0,23	0,23	0,25	0,28	100,00
Emissions of PFCs(3) - (Gg CO2 equivalent)	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,05	0,50	1,66	4,12	9,10	12,48	17,89	22,13	22,17	19,34	15,90	13,90	15,68	15,36	12,79	14,18	13,27	11,06	100,00
CF4	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00	0,00	0,00	0,00	0,00	0,00	100,00
C2F6	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
C 3F8	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	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	0,00	0,00	0,00	0,00	100,00
C4F10	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
c-C4F8	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00	0,00	0,00	0,00	0,00	0,00	100,00
C5F12	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
C6F14	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
Unspecified mix of listed PFCs(4) - (Gg CO2 equivalent)	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	
Emissions of SF6(3) - (Gg CO2 equivalent)	44,45	63,50	89,27	101,30	122,20	107,53	61,13	73,24	59,61	65,45	59,31	30,48	25,10	31,45	33,33	21,91	36,14	30,48	31,76	36,90	38,46	73,35	65,01
SF6	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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	65,01

Abbreviation: GWP = global warming potential.

a The column “Base year” should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

b For the second and subsequent biennial reports, the global warming potential values need to be revised in accordance with decision 15/CP.17.

c Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO2 equivalent emissions.

d In accordance with the “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories”, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is kt of CO2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

Documentation box:

TABLE 1.2: EMISSION TRENDS IN DENMARK (WITHOUT GREENLAND AND FAROE ISLANDS)

Table 1

Emission trends: summary

CRF - TABLE 10 EMISSION TRENDS SUMMARY — Inventory 2011, Submission 2013 v1.4

Denmark without Greenland and the Faroe Islands — DENMARK

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	CO2 equivalent (Gg)	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	(%)
CO2 emissions including net CO2 from LULUCF	58.308,53	67.527,55	64.050,81	62.914,10	68.518,77	64.566,06	76.500,41	68.522,29	63.325,60	62.328,83	56.940,98	60.083,71	61.180,99	64.997,33	59.158,86	55.810,02	64.724,61	56.865,11	49.566,26	51.378,39	48.323,90	41.212,60	-29,32
CO2 emissions excluding net CO2 from LULUCF	52.852,54	63.548,01	57.831,44	60.141,25	64.140,29	60.931,92	74.259,63	64.913,15	60.816,76	58.221,94	53.737,41	55.545,72	55.161,65	60.242,38	54.772,25	51.127,96	59.075,52	54.307,98	50.878,12	48.459,07	48.810,76	43.890,32	-16,96
CH4 emissions including CH4 from LULUCF	6.037,50	6.104,39	6.104,22	6.200,42	6.094,99	6.130,74	6.173,52	6.013,42	5.998,16	5.884,21	5.881,62	5.984,80	5.900,76	5.880,22	5.723,60	5.651,54	5.660,70	5.661,90	5.620,01	5.527,65	5.588,73	5.493,45	-9,01
CH4 emissions excluding CH4 from LULUCF	6.036,95	6.104,39	6.104,21	6.200,42	6.094,99	6.130,73	6.173,51	6.013,41	5.998,14	5.884,21	5.881,62	5.984,79	5.900,74	5.880,21	5.723,02	5.651,52	5.660,67	5.661,89	5.620,00	5.527,64	5.588,72	5.493,44	-9,00
N2O emissions including N2O from LULUCF	9.802,85	9.560,59	9.198,51	9.015,59	9.037,15	8.768,00	8.191,81	8.156,08	8.328,79	8.171,57	7.946,21	7.644,13	7.488,13	7.175,32	6.959,35	6.330,24	6.178,77	6.334,52	6.383,97	6.016,31	5.974,75	6.034,35	-38,44
N2O emissions excluding N2O from LULUCF	9.786,38	9.544,76	9.182,85	9.000,12	9.021,87	8.752,90	8.176,90	8.141,35	8.314,22	8.157,21	7.932,03	7.630,12	7.474,30	7.161,68	6.945,44	6.316,89	6.165,61	6.321,58	6.371,21	6.003,75	5.962,20	6.021,81	-38,47
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	93,93	134,53	217,73	329,30	323,75	411,20	504,04	606,74	650,46	676,24	700,70	755,23	802,31	823,26	849,90	852,72	798,84	804,18	758,63	100,00
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	0,05	0,50	1,66	4,12	9,10	12,48	17,89	22,13	22,17	19,34	15,90	13,90	15,68	15,36	12,79	14,18	13,27	11,06	100,00
SF6	44,45	63,50	89,15	101,17	122,06	107,34	60,96	73,06	59,42	65,36	59,23	30,40	25,01	31,37	33,15	21,75	35,99	30,35	31,60	36,69	38,29	73,19	64,64
Total (including LULUCF)	**74.193,34**	**83.256,03**	**79.442,69**	**78.325,21**	**83.907,55**	**79.790,36**	**91.257,66**	**83.092,73**	**78.132,26**	**76.966,49**	**71.452,67**	**74.415,63**	**75.293,30**	**78.804,29**	**72.646,08**	**68.629,78**	**77.439,01**	**69.757,14**	**62.467,34**	**63.772,05**	**60.743,12**	**53.583,27**	**-27,78**
Total (excluding LULUCF)	**68.720,33**	**79.260,66**	**73.207,66**	**75.536,89**	**79.513,79**	**76.141,12**	**89.001,96**	**79.468,85**	**75.608,84**	**72.845,23**	**68.234,91**	**69.863,62**	**69.260,11**	**74.035,69**	**68.244,98**	**63.934,33**	**71.776,74**	**67.187,05**	**63.766,44**	**60.840,16**	**61.217,42**	**56.248,45**	**-18,15**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	CO2 equivalent (Gg)	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	2 equivalent	(%)
1. Energy	52.111,32	62.684,29	56.838,29	59.200,88	63.239,21	60.165,45	73.512,02	63.992,97	59.965,44	57.391,43	52.875,16	54.723,21	54.308,76	59.537,42	53.944,15	50.316,58	58.263,56	53.443,26	50.294,95	48.246,34	48.716,54	43.554,23	-16,42
2. Industrial Processes	2.239,52	2.347,10	2.379,84	2.456,45	2.554,84	2.725,75	2.827,85	3.015,46	2.991,50	3.215,23	3.383,68	3.289,11	3.197,13	3.214,23	3.022,10	2.440,91	2.520,89	2.541,01	2.253,99	1.763,99	1.684,59	1.853,68	-17,23
3. Solvent and Other Product Use	116,12	132,46	142,37	126,16	147,27	137,07	147,81	134,86	143,73	152,05	153,55	140,80	165,22	159,76	164,23	189,23	170,88	173,54	157,16	169,84	187,47	166,95	43,78
4. Agriculture	12.544,75	12.385,05	12.160,81	12.068,15	11.957,05	11.592,28	11.045,84	10.937,32	11.183,61	10.743,60	10.471,27	10.377,90	10.298,67	9.836,78	9.966,39	9.852,14	9.659,30	9.887,92	9.942,81	9.598,00	9.613,86	9.671,85	-22,90
5. Land Use, Land-Use Change and Forestry(5)	5.473,00	3.995,37	6.235,03	2.788,32	4.393,77	3.649,24	2.255,69	3.623,88	2.523,42	4.121,26	3.217,75	4.552,00	6.033,19	4.768,60	4.401,10	4.695,44	5.662,28	2.570,09	-1.299,09	2.931,89	-474,30	-2.665,18	-148,70
6. Waste	1.708,62	1.711,76	1.686,35	1.685,25	1.615,41	1.520,58	1.468,44	1.388,23	1.324,56	1.342,93	1.351,26	1.332,61	1.290,33	1.287,49	1.148,12	1.135,48	1.162,10	1.141,32	1.117,52	1.061,99	1.014,96	1.001,74	-41,37
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Total (including LULUCF)(5)	**74.193,34**	**83.256,03**	**79.442,69**	**78.325,21**	**83.907,55**	**79.790,36**	**91.257,66**	**83.092,73**	**78.132,26**	**76.966,49**	**71.452,67**	**74.415,63**	**75.293,30**	**78.804,29**	**72.646,08**	**68.629,78**	**77.439,01**	**69.757,14**	**62.467,34**	**63.772,05**	**60.743,12**	**53.583,27**	**-27,78**

Notes:

(1) Further detailed information could be found in the common reporting format tables of the Party's greenhouse gas inventory, namely "Emission trends (CO2)", "Emission trends (CH4)", "Emission trends (N2O)" and "Emission trends (HFCs, PFCs and SF6)", which is included in an annex to this biennial report; (2) 20XX is the latest reported inventory year; (3) 1 kt CO2 eq equals 1 Gg CO2 eq.

Abbreviation: LULUCF = land use, land-use change and forestry.

a The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

b Includes net CO2, CH4 and N2O from LULUCF.

Table 1

(cont.) Emission trends (CO2)

CRF - TABLE 10 EMISSION TRENDS SUMMARY — Inventory 2011, Submission 2013 v1.4

Denmark without Greenland and the Faroe Islands — DENMARK

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	se year (199	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	**51.567,10**	**62.069,49**	**56.223,80**	**58.531,72**	**62.484,56**	**59.280,55**	**72.491,86**	**62.994,38**	**58.952,18**	**56.372,25**	**51.872,81**	**53.690,63**	**53.284,64**	**58.503,28**	**52.914,87**	**49.331,01**	**57.254,13**	**52.485,59**	**49.355,99**	**47.371,88**	**47.790,70**	**42.710,69**	**-17,17**
A. Fuel Combustion (Sectoral Approach)	51.242,41	61.426,51	55.560,32	57.954,56	61.914,59	58.831,09	71.998,22	62.299,42	58.437,29	55.278,41	51.152,77	52.921,15	52.637,34	57.833,54	52.163,11	48.788,15	56.721,98	51.941,57	48.963,59	47.106,54	47.433,82	42.455,18	-17,15
1. Energy Industries	26.146,21	35.014,99	30.086,31	31.660,62	35.655,27	32.163,16	44.420,37	35.308,50	31.666,00	28.575,96	25.542,00	26.841,11	27.059,80	31.780,37	25.920,34	22.720,36	30.636,34	25.999,79	23.876,78	23.789,61	23.596,03	19.738,18	-24,51
2. Manufacturing Industries and Construction	5.384,62	5.915,11	5.777,60	5.642,38	5.738,17	5.853,06	6.007,97	6.057,87	6.077,97	6.166,70	5.964,59	6.053,26	5.763,19	5.695,18	5.748,05	5.460,96	5.586,16	5.394,91	4.951,07	4.002,98	4.371,62	4.361,26	-19,01
3. Transport	10.618,70	11.002,42	11.201,23	11.321,10	11.803,39	11.940,42	12.188,72	12.381,23	12.352,77	12.373,40	12.172,77	12.184,50	12.281,93	12.738,23	13.047,06	13.166,00	13.544,27	14.160,93	13.928,94	13.134,68	13.071,96	12.715,67	19,75
4. Other Sectors	8.973,86	9.207,30	8.354,40	9.093,34	8.465,76	8.622,56	9.205,24	8.380,99	8.136,52	7.980,00	7.362,87	7.745,41	7.443,64	7.527,78	7.208,64	7.170,03	6.828,76	6.211,08	6.099,18	6.019,28	6.287,17	5.447,03	-39,30
5. Other	119,01	286,69	140,79	237,13	252,01	251,89	175,92	170,83	204,03	182,35	110,53	96,87	88,78	91,98	239,02	270,80	126,46	174,87	107,62	159,99	107,05	193,03	62,19
B. Fugitive Emissions from Fuels	324,69	642,98	663,48	577,16	569,97	449,46	493,63	694,95	514,90	1.093,84	720,04	769,49	647,30	669,74	751,76	542,86	532,15	544,01	392,40	265,34	356,87	255,50	-21,31
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
2. Oil and Natural Gas	324,69	642,98	663,48	577,16	569,97	449,46	493,63	694,95	514,90	1.093,84	720,04	769,49	647,30	669,74	751,76	542,86	532,15	544,01	392,40	265,34	356,87	255,50	-21,31
2. Industrial Processes	**1.152,16**	**1.328,76**	**1.447,10**	**1.466,42**	**1.491,69**	**1.496,33**	**1.601,60**	**1.766,30**	**1.705,28**	**1.683,15**	**1.696,32**	**1.700,81**	**1.699,64**	**1.568,16**	**1.687,10**	**1.602,94**	**1.645,96**	**1.645,40**	**1.356,88**	**914,28**	**828,85**	**1.010,80**	**-12,27**
A. Mineral Products	1.068,76	1.246,16	1.365,59	1.382,84	1.406,09	1.404,22	1.512,28	1.678,99	1.612,77	1.592,11	1.611,35	1.609,87	1.654,76	1.525,58	1.642,39	1.542,30	1.604,11	1.603,58	1.317,81	879,04	792,00	973,41	-8,92
B. Chemical Industry	0,80	0,80	0,80	0,80	0,80	0,80	1,45	0,87	0,56	0,58	0,65	0,83	0,55	1,05	3,01	3,01	2,18	2,16	2,40	2,13	2,12	2,20	174,38
C. Metal Production	28,45	28,45	28,45	30,97	33,50	38,56	35,19	35,01	42,19	43,04	40,73	46,68	NA,NO	NA,NO	NA,NO	15,58	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	-100,00
D. Other Production	4,45	4,49	4,14	4,26	4,36	3,91	3,80	4,29	4,90	4,71	3,90	4,95	4,47	4,49	3,97	4,46	2,17	1,72	2,67	1,92	1,56	2,01	-54,77
E. Production of Halocarbons and SF6																							
F. Consumption of Halocarbons and SF6																							
G. Other	49,71	48,86	48,12	47,55	46,95	48,84	48,89	47,15	44,85	42,72	39,70	38,49	39,86	37,03	37,73	37,59	37,49	37,94	34,01	31,19	33,18	33,18	-33,25
3. Solvent and Other Product Use	115,00	131,11	140,90	124,85	145,75	134,92	145,81	133,18	141,22	147,62	149,52	135,66	159,16	151,42	152,55	175,81	156,71	157,70	143,81	151,90	173,02	150,62	30,98
4. Agriculture																							
A. Enteric Fermentation																							
B. Manure Management																							
C. Rice Cultivation																							
D. Agricultural Soils																							
E. Prescribed Burning of Savannas																							
F. Field Burning of Agricultural Residues																							
G. Other																							
5. Land Use, Land-Use Change and Forestry(2)	**5.455,98**	**3.979,54**	**6.219,37**	**2.772,86**	**4.378,48**	**3.634,14**	**2.240,78**	**3.609,14**	**2.508,83**	**4.106,90**	**3.203,57**	**4.537,99**	**6.019,35**	**4.754,95**	**4.386,61**	**4.682,07**	**5.649,09**	**2.557,13**	**-1.311,86**	**2.919,33**	**-486,86**	**-2.677,73**	**-149,08**
A. Forest Land	118,75	-782,71	-674,52	-934,32	-757,27	-961,87	-893,99	-986,39	-988,76	-587,48	-770,88	796,25	727,53	658,78	590,00	666,74	596,45	-2.161,68	-5.584,19	-248,69	-4.362,35	-6.398,92	-5.488,67
B. Cropland	5.046,48	4.475,71	6.609,89	3.427,01	4.866,14	4.362,26	2.844,85	4.269,61	3.211,18	4.446,21	3.732,93	3.493,57	5.029,13	3.833,55	3.521,01	3.654,24	4.657,20	4.358,66	3.911,41	2.806,00	3.530,09	3.336,87	-33,88
C. Grassland	183,42	186,80	183,96	191,87	184,34	151,91	192,96	206,96	186,29	164,63	158,51	156,20	159,88	163,79	169,69	202,86	235,28	219,47	238,73	226,39	216,60	248,02	35,22
D. Wetlands	91,21	82,55	81,80	68,97	64,89	60,40	74,45	95,39	75,47	57,84	56,26	64,23	74,07	69,11	75,20	114,40	114,47	93,03	72,40	83,93	75,02	80,36	-11,90
E. Settlements	16,13	17,19	18,25	19,32	20,38	21,44	22,51	23,58	24,64	25,70	26,75	27,74	28,73	29,72	30,70	43,83	45,68	47,64	49,79	51,70	53,78	55,94	246,87
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
6. Waste	**18,28**	**18,65**	**19,65**	**18,25**	**18,29**	**20,11**	**20,37**	**19,30**	**18,09**	**18,91**	**18,77**	**18,61**	**18,20**	**19,52**	**17,73**	**18,20**	**18,72**	**19,29**	**21,43**	**21,01**	**18,19**	**18,21**	**-0,39**
A. Solid Waste Disposal on Land	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0,00
B. Waste-water Handling																							
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
D. Other	18,28	18,65	19,65	18,25	18,29	20,11	20,37	19,30	18,09	18,91	18,77	18,61	18,20	19,52	17,73	18,20	18,72	19,29	21,43	21,01	18,19	18,21	-0,39
7. Other (as specified in Summary 1.A)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0,00**
Total CO2 emissions including net CO2 from LULUCF	**58.308,53**	**67.527,55**	**64.050,81**	**62.914,10**	**68.518,77**	**64.566,06**	**76.500,41**	**68.522,29**	**63.325,60**	**62.328,83**	**56.940,98**	**60.083,71**	**61.180,99**	**64.997,33**	**59.158,86**	**55.810,02**	**64.724,61**	**56.865,11**	**49.566,26**	**51.378,39**	**48.323,90**	**41.212,60**	**-29,32**
Total CO2 emissions excluding net CO2 from LULUCF	**52.852,54**	**63.548,01**	**57.831,44**	**60.141,25**	**64.140,29**	**60.931,92**	**74.259,63**	**64.913,15**	**60.816,76**	**58.221,94**	**53.737,41**	**55.545,72**	**55.161,65**	**60.242,38**	**54.772,25**	**51.127,96**	**59.075,52**	**54.307,98**	**50.878,12**	**48.459,07**	**48.810,76**	**43.890,32**	**-16,96**
Memo Items:																							
International Bunkers	**4.741,07**	**4.304,98**	**4.490,18**	**5.872,79**	**6.561,69**	**6.843,24**	**6.696,52**	**6.336,50**	**6.495,96**	**6.343,36**	**6.517,37**	**5.687,38**	**4.748,86**	**4.993,98**	**4.746,12**	**4.926,34**	**5.717,96**	**5.938,91**	**5.456,82**	**3.803,02**	**4.484,42**	**4.588,33**	**-3,22**
Aviation	1.736,10	1.632,12	1.693,19	1.658,84	1.817,70	1.867,05	1.971,08	2.010,44	2.158,98	2.290,07	2.349,78	2.383,52	2.057,98	2.140,56	2.447,44	2.573,84	2.581,47	2.646,97	2.647,44	2.316,42	2.420,92	2.492,12	43,55
Marine	3.004,96	2.672,87	2.796,99	4.213,95	4.744,00	4.976,19	4.725,44	4.326,06	4.336,98	4.053,30	4.167,59	3.303,86	2.690,89	2.853,42	2.298,68	2.352,50	3.136,50	3.291,95	2.809,37	1.486,60	2.063,50	2.096,22	-30,24
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
CO2 Emissions from Biomass	4.661,98	5.056,95	5.306,98	5.521,40	5.459,35	5.725,02	6.108,18	6.323,34	6.272,29	6.598,33	6.899,22	7.626,43	8.128,58	9.231,20	9.969,99	10.728,27	11.109,81	12.130,78	12.332,07	12.627,48	14.901,50	14.491,93	210,85

Table 1

(cont.) Emission trends (CH4)

CRF - TABLE 10 EMISSION TRENDS — Inventory 2011

SUMMARY — Submission 2013 v1.4

Denmark without Greenland and the Faroe Islands — DENMARK

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	se year (199	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	10,55	12,01	12,50	14,78	18,31	24,57	28,72	28,72	30,16	30,51	30,15	31,07	30,52	30,15	30,70	28,94	28,82	26,85	26,38	24,08	26,03	23,01	118,11
A. Fuel Combustion (Sectoral Approach)	8,48	9,44	10,04	12,09	15,32	21,18	25,41	25,16	26,65	26,56	26,05	26,80	26,22	25,75	25,46	23,74	22,30	20,56	20,33	18,44	20,70	17,73	109,18
1. Energy Industries	0,68	1,03	1,44	3,05	6,10	11,38	14,48	13,86	15,24	15,35	14,63	15,54	15,12	14,40	14,08	12,45	11,54	9,63	10,16	8,88	11,08	9,32	1.276,24
2. Manufacturing Industries and Con	0,36	0,38	0,36	0,37	0,37	0,48	0,92	0,91	1,00	0,99	1,21	1,25	1,16	1,12	1,13	0,99	0,87	0,64	0,70	0,66	0,67	0,62	69,76
3. Transport	2,29	2,38	2,40	2,38	2,37	2,29	2,21	2,15	2,07	1,96	1,84	1,72	1,62	1,54	1,44	1,32	1,22	1,11	0,95	0,81	0,73	0,64	-71,80
4. Other Sectors	5,15	5,63	5,83	6,28	6,48	7,03	7,79	8,22	8,32	8,25	8,36	8,27	8,32	8,69	8,80	8,96	8,67	9,17	8,51	8,08	8,22	7,14	38,82
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	0,01	0,01	0,01	0,01	0,00	0,01	0,00	0,01	14,20
B. Fugitive Emissions from Fuels	2,07	2,57	2,46	2,68	2,99	3,39	3,32	3,56	3,51	3,95	4,10	4,27	4,30	4,40	5,23	5,21	6,51	6,29	6,06	5,65	5,33	5,28	154,64
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	
2. Oil and Natural Gas	2,07	2,57	2,46	2,68	2,99	3,39	3,32	3,56	3,51	3,95	4,10	4,27	4,30	4,40	5,23	5,21	6,51	6,29	6,06	5,65	5,33	5,28	154,64
2. Industrial Processes	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	
B. Chemical Industry	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	
C. Metal Production	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	
D. Other Production																							
E. Production of Halocarbons and SF6																							
F. Consumption of Halocarbons and SF6																							
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3. Solvent and Other Product Use																							
4. Agriculture	202,00	203,53	203,80	206,99	202,11	201,85	201,51	197,54	198,64	192,28	192,76	197,24	196,94	195,60	193,08	192,54	191,47	195,26	195,52	195,01	198,31	197,66	-2,15
A. Enteric Fermentation	154,62	154,83	152,95	154,16	149,73	149,22	148,24	143,68	143,06	137,66	136,25	138,61	136,75	134,91	131,09	130,33	130,47	133,57	134,78	134,42	136,28	135,25	-12,52
B. Manure Management	47,29	48,61	50,76	52,73	52,28	52,53	53,17	53,76	55,44	54,49	56,39	58,50	60,09	60,56	61,85	62,07	60,85	61,57	60,63	60,45	61,93	62,30	31,74
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
D. Agricultural Soils	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
F. Field Burning of Agricultural Residues	0,09	0,09	0,09	0,09	0,09	0,10	0,10	0,11	0,14	0,13	0,13	0,13	0,11	0,13	0,14	0,14	0,14	0,13	0,12	0,14	0,10	0,10	13,53
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5. Land Use, Land-Use Change and Forestr	0,03	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	0,03	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-97,59
A. Forest Land	0,03	NA,NO	0,00	NA,NO	0,00	0,00	NA,NO	NA,NO	0,00	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,03	NA,NO	0,00	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	-100,00
B. Cropland	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	
C. Grassland	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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	702,13
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
6. Waste	74,93	75,14	74,38	73,49	69,82	65,52	63,74	60,09	56,83	57,41	57,16	56,68	53,53	54,25	48,75	47,63	49,27	47,51	45,72	44,13	41,79	40,92	-45,38
A. Solid Waste Disposal on Land	70,37	70,44	69,53	68,50	64,65	60,45	58,28	54,24	50,88	51,12	50,58	50,27	46,93	47,45	42,15	40,79	42,23	40,05	38,59	36,75	34,29	33,28	-52,70
B. Waste-water Handling	3,15	3,16	3,17	3,19	3,22	3,27	3,34	3,42	3,43	3,41	3,52	3,54	3,49	3,56	3,51	3,54	3,53	3,55	3,56	3,59	3,59	3,62	14,99
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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	38,56
D. Other	1,40	1,54	1,68	1,81	1,94	1,80	2,12	2,43	2,52	2,88	3,06	2,87	3,11	3,25	3,08	3,31	3,50	3,91	3,57	3,80	3,91	4,02	185,86
7. Other (as specified in Summary 1.A)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total CH4 emissions including CH4 from LULUCF	287,50	290,69	290,68	295,26	290,24	291,94	293,98	286,35	285,63	280,20	280,08	284,99	280,99	280,01	272,55	269,12	269,56	269,61	267,62	263,22	266,13	261,59	-9,01
Total CH4 emissions excluding CH4 from LULUCF	287,47	290,69	290,68	295,26	290,24	291,94	293,98	286,35	285,63	280,20	280,08	284,99	280,99	280,01	272,52	269,12	269,56	269,61	267,62	263,22	266,13	261,59	-9,00
Memo Items:																							
International Bunkers	0,09	0,09	0,09	0,12	0,13	0,14	0,14	0,13	0,14	0,13	0,14	0,09	0,07	0,08	0,07	0,07	0,09	0,09	0,08	0,05	0,06	0,06	-34,27
Aviation	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	-65,47
Marine	0,06	0,06	0,06	0,09	0,10	0,11	0,10	0,10	0,10	0,09	0,09	0,08	0,06	0,07	0,05	0,06	0,07	0,08	0,07	0,04	0,05	0,05	-19,00
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
CO2 Emissions from Biomass																							

Table 1

(cont.) Emission trends (N2O)

CRF - TABLE 10 EMISSION TRENDS — Inventory 2011

SUMMARY — Submission 2013 v1.4

Denmark without Greenland and the Faroe Islands — DENMARK

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	se year (199	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	1,04	1,17	1,14	1,16	1,19	1,19	1,35	1,28	1,23	1,22	1,19	1,23	1,24	1,29	1,24	1,22	1,30	1,27	1,24	1,19	1,22	1,16	11,66
A. Fuel Combustion (Sectoral Approach)	1,04	1,16	1,13	1,15	1,19	1,19	1,34	1,27	1,22	1,21	1,19	1,22	1,23	1,29	1,24	1,21	1,30	1,27	1,24	1,19	1,22	1,16	11,78
1. Energy Industries	0,27	0,35	0,32	0,34	0,38	0,36	0,49	0,42	0,38	0,38	0,36	0,37	0,38	0,42	0,37	0,33	0,39	0,34	0,33	0,33	0,35	0,31	12,28
2. Manufacturing Industries and Co	0,17	0,19	0,19	0,17	0,16	0,15	0,15	0,15	0,15	0,14	0,15	0,14	0,14	0,13	0,13	0,13	0,14	0,13	0,13	0,11	0,12	0,11	-33,76
3. Transport	0,36	0,37	0,39	0,40	0,42	0,44	0,46	0,47	0,47	0,47	0,46	0,46	0,46	0,47	0,48	0,47	0,47	0,48	0,47	0,44	0,44	0,44	22,00
4. Other Sectors	0,23	0,24	0,23	0,24	0,23	0,23	0,23	0,22	0,21	0,21	0,22	0,24	0,24	0,26	0,25	0,28	0,29	0,30	0,30	0,30	0,32	0,29	28,50
5. Other	0,00	0,01	0,00	0,01	0,01	0,01	0,01	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,01	0,00	0,01	0,00	0,01	77,88
B. Fugitive Emissions from Fuels	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,00	0,01	0,01	0,01	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-32,79
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	
2. Oil and Natural Gas	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,00	0,01	0,01	0,01	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-32,79
2. Industrial Processes	**3,36**	**3,08**	**2,72**	**2,56**	**2,60**	**2,92**	**2,69**	**2,74**	**2,60**	**3,07**	**3,24**	**2,86**	**2,50**	**2,89**	**1,71**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**-100,00**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	
B. Chemical Industry	3,3642	3,080112	2,721264	2,564268	2,601648	2,91564	2,69136	2,736216	2,601648	3,06516	3,237108	2,855832	2,497	2,886	1,712	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	-100,00
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
D. Other Production																							
E. Production of Halocarbons and SF6																							
F. Consumption of Halocarbons and SF6																							
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3. Solvent and Other Product Use	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,01**	**0,01**	**0,01**	**0,01**	**0,01**	**0,01**	**0,02**	**0,02**	**0,03**	**0,04**	**0,04**	**0,05**	**0,05**	**0,04**	**0,06**	**0,05**	**0,05**	**1.360,91**
4. Agriculture	**26,78**	**26,16**	**25,42**	**24,91**	**24,88**	**23,72**	**21,98**	**21,90**	**22,62**	**21,63**	**20,72**	**20,12**	**19,88**	**18,48**	**19,07**	**18,74**	**18,19**	**18,67**	**18,83**	**17,75**	**17,58**	**17,81**	**-33,50**
A. Enteric Fermentation																							
B. Manure Management	1,93	1,92	1,94	1,93	1,88	1,83	1,82	1,84	1,87	1,83	1,73	1,74	1,73	1,68	1,72	1,65	1,54	1,55	1,47	1,36	1,36	1,30	-32,89
C. Rice Cultivation																							
D. Agricultural Soils	24,846286	24,241141	23,480897	22,976246	23,001341	21,892498	20,155603	20,053253	20,744723	19,794538	18,983253	18,372906	18,143924	16,796905	17,345425	17,081232	16,642635	17,11949	17,351216	16,382943	16,212097	16,508876	-33,56
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	13,53
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5. Land Use, Land-Use Change and Forest	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,05**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**	**0,04**	**-23,86**
A. Forest Land	0,05	0,0504226	0,05	0,049231	0,05	0,05	0,0474442	0,0468487	0,05	0,0456581	0,045063	0,0444679	0,0438729	0,043278	0,04	0,0420519	0,04	0,0407926	0,0401646	0,0395378	0,0395004	0,0394629	-24,78
B. Cropland	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0002235	0,0004936	0,0004936	0,0004936	0,0004936	0,0004936	0,0004936	0,0004936	120,84
C. Grassland	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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	701,67
D. Wetlands	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,0004353	0,00
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
6. Waste	**0,38**	**0,37**	**0,34**	**0,40**	**0,42**	**0,40**	**0,35**	**0,35**	**0,36**	**0,38**	**0,43**	**0,40**	**0,48**	**0,41**	**0,34**	**0,38**	**0,35**	**0,40**	**0,44**	**0,37**	**0,38**	**0,40**	**6,21**
A. Solid Waste Disposal on Land																							
B. Waste-water Handling	0,34	0,33	0,29	0,35	0,37	0,35	0,29	0,27	0,28	0,27	0,29	0,27	0,31	0,25	0,24	0,27	0,24	0,27	0,32	0,24	0,25	0,26	-24,29
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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	38,56
D. Other	0,04	0,04	0,05	0,05	0,05	0,05	0,06	0,07	0,08	0,11	0,13	0,13	0,16	0,17	0,10	0,10	0,11	0,13	0,12	0,13	0,14	0,14	278,79
7. Other (as specified in Summary 1.A)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	
Total N2O emissions including N2O from LULUCF	**31,62**	**30,84**	**29,67**	**29,08**	**29,15**	**28,28**	**26,43**	**26,31**	**26,87**	**26,36**	**25,63**	**24,66**	**24,16**	**23,15**	**22,45**	**20,42**	**19,93**	**20,43**	**20,59**	**19,41**	**19,27**	**19,47**	**-38,44**
Total N2O emissions excluding N2O from LULUCF	**31,57**	**30,79**	**29,62**	**29,03**	**29,10**	**28,24**	**26,38**	**26,26**	**26,82**	**26,31**	**25,59**	**24,61**	**24,11**	**23,10**	**22,40**	**20,38**	**19,89**	**20,39**	**20,55**	**19,37**	**19,23**	**19,43**	**-38,47**
Memo Items:																							
International Bunkers	0,25	0,22	0,23	0,32	0,36	0,38	0,37	0,34	0,35	0,34	0,34	0,29	0,24	0,25	0,23	0,24	0,29	0,30	0,27	0,17	0,21	0,22	-12,29
Aviation	0,06	0,06	0,06	0,06	0,06	0,06	0,07	0,07	0,08	0,08	0,08	0,08	0,07	0,07	0,08	0,09	0,09	0,09	0,09	0,08	0,08	0,09	44,95
Marine	0,19	0,17	0,18	0,27	0,30	0,31	0,30	0,27	0,27	0,26	0,26	0,21	0,17	0,18	0,14	0,15	0,20	0,21	0,18	0,09	0,13	0,13	-30,18
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
CO2 Emissions from Biomass																							

Table 1
(cont.) Emission trends (HFCs, PFCs and SF6)

CRF - TABLE 10 EMISSION TRENDS Inventory 2011
SUMMARY Submission 2013 v1.4
Denmark without Greenland and the Faroe Islands **DENMARK**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	se year (199	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
Emissions of HFCs(3) - (Gg CO2 equivalent)	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**93,93**	**134,53**	**217,73**	**329,30**	**323,75**	**411,20**	**504,04**	**606,74**	**650,46**	**676,24**	**700,70**	**755,23**	**802,31**	**823,26**	**849,90**	**852,72**	**798,84**	**804,18**	**758,63**	**100,00**
HFC-23	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00	0,00	0,00	100,00
HFC-32	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	100,00
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
HFC-43-10mee	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
HFC-125	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,01	0,02	0,02	0,03	0,04	0,05	0,05	0,05	0,06	0,07	0,07	0,07	0,08	0,07	0,07	0,07	100,00
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
HFC-134a	NA,NO	NA,NO	NA,NO	0,07	0,10	0,15	0,20	0,17	0,21	0,23	0,25	0,27	0,28	0,27	0,29	0,29	0,29	0,29	0,29	0,25	0,27	0,26	100,00
HFC-152a	NA,NO	NA,NO	NA,NO	0,03	0,05	0,04	0,03	0,02	0,01	0,04	0,02	0,01	0,01	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	100,00
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
HFC-143a	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,01	0,01	0,02	0,03	0,04	0,04	0,04	0,05	0,05	0,06	0,06	0,07	0,07	0,06	0,06	0,06	100,00
HFC-227ea	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
Unspecified mix of listed HFCs(4) - (Gg CO2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
Emissions of PFCs(3) - (Gg CO2 equivalent)	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**0,05**	**0,50**	**1,66**	**4,12**	**9,10**	**12,48**	**17,89**	**22,13**	**22,17**	**19,34**	**15,90**	**13,90**	**15,68**	**15,36**	**12,79**	**14,18**	**13,27**	**11,06**	**100,00**
CF4	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00	0,00	0,00	100,00
C2F6	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
C 3F8	NA,NO	NA,NO	NA,NO	NA,NO	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	0,00	0,00	0,00	0,00	100,00
C4F10	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
c-C4F8	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00	0,00	0,00	100,00
C5F12	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
C6F14	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
Unspecified mix of listed PFCs(4) - (Gg CO2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
Emissions of SF6(3) - (Gg CO2 equivalent)	**44,45**	**63,50**	**89,15**	**101,17**	**122,06**	**107,34**	**60,96**	**73,06**	**59,42**	**65,36**	**59,23**	**30,40**	**25,01**	**31,37**	**33,15**	**21,75**	**35,99**	**30,35**	**31,60**	**36,69**	**38,29**	**73,19**	**64,64**
SF6	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	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	64,64

Abbreviation: GWP = global warming potential.
a The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.
b For the second and subsequent biennial reports, the global warming potential values need to be revised in accordance with decision 15/CP.17.
c Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO2 equivalent emissions.
d In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is kt of CO2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

Documentation box:

TABLE 2(A): DESCRIPTION OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET: BASE YEAR

Table 2(a)		
Description of quantified economy-wide emission reduction target: base year [a]		
Party	Denmark*	
Base year /base period	CO2, CH4 and N2O: 1990 HFCs, PFCs and SF6: 1995 NF3: To be decided	
	% of base year/base period	% of 1990 [b]
Emission reduction target	80 *	-
Period for reaching target	2013-2020	

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Optional.

* Under the assumption that Denmark's quantified economy-wide emission reduction target is Denmark's commitment as part of the joint target for the EU and its 28 Member States and Iceland under the second commitment period of the Kyoto Protocol inscribed in Annex B to the protocol cf. Decision 1/CMP.8 and with the assumption that territorial reservations to Greenland will be taken in accordance with the Vienna Convention, when the amendments to the Kyoto Protocol will be ratified by the Kingdom of Denmark. It should be noted that a territorial reservation to the Faroe Islands was taken in accordance with the Vienna Convention when the Kyoto Protocol was ratified by the Kingdom of Denmark in 2002.

Table 2(b)

Description of quantified economy-wide emission reduction target: gases and sectors covered [a]

Gases covered		Base year for each gas (year):
CO2	Yes	1990
CH4	Yes	1990
N2O	Yes	1990
HFCs	Yes	1995
PFCs	Yes	1995
SF6	Yes	1995
NF3	Yes	To be determined
Other gases	No	NA
Sectors covered [b]		
Energy	Yes	
Transport [c]	Yes	
Industrial processes [d]	Yes	
Agriculture	Yes	
LULUCF	No*	
Waste	Yes	
Other (specify)	NA	

Abbreviations: LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] More than one selection will be allowed. If Parties use sectors other than those indicated above, the explanation of how these sectors relate to the sectors defined by the IPCC should be provided.

[c] Transport is reported as a subsector of the energy sector.

[d] Industrial processes refer to the industrial processes and solvent and other product use sectors.

* In accordance with the EU Climate and Energy Package, Denmark will not use of credits from Article 3.3 and 3.4 activities under the Kyoto Protocol or any possible future credits from LULUCF under the Convention for the purpose of achieving the quantified economy-wide emission reduction target under the 2nd commitment period of the Kyoto Protocol. However, if the activities under articles 3.3 and 3.4 result in net-emissions in certain calender years during the period 2013-2020, it is assumed that net-removals in other years during the period could be used to off-set the net-emissions in those years. It should be noted that Denmark, in accordance with the Kyoto Protocol, will continue to estimate and report emissions and removals and issue RMUs relation to activities under articles 3.3 and 3.4 of the Kyoto Protocol.

Table 2(c)	
Description of quantified economy-wide emission reduction target: global warming potential values (GWP) [a]	
Gases	GWP values [b]
CO_2	AR4*
CH_4	AR4*
N_2O	AR4*
HFCs	AR4*
PFCs	AR4*
SF_6	AR4*
NF_3	AR4*
Other gases [c]	NA

Abbreviations: GWP = global warming potential

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Please specify the reference for the GWP: Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) or the Fourth Assessment Report of the IPCC.

[c] Specify.

* Under the assumption that the GWPs referred to in this table are the GWPs used for the calculation of the assigned amounts in the implementation of Denmark's quantified economy-wide emission reduction target as part of the joint target for the EU and its 28 Member States and Iceland under the second commitment period of the Kyoto Protocol inscribed in Annex B to the protocol cf. Decision 1/CMP.8.

TABLE 2(D): DESCRIBTION OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET: APPROACH TO COUNTING EMISSIONS AND REMOVALS FROM THE LULUCF SECTOR

Table 2(d)			
Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF sector [a]			
Role of LULUCF	LULUCF in base year level and target	Included	
		Excluded	X*
	Contribution of LULUCF is calculated using	Land-based approach	NA for counting contribution from LULUCF (but the approach is used for reporting under UNFCCC)
		Activity-based approach	NA for counting contribution from LULUCF (but the approach is used for reporting under the KP)
		Other (specify)	NA

Abbreviation: LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

* If net-emissions are calculated for the base year, these will have to be included in accordance with article 3(7bis) of the Kyoto Protocol as amended according to Decision 1/CMP.8.

TABLE 2(E)I: DESCRIBTION OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET: MARKET-BASED MECHANISMS UNDER THE CONVENTION

Table 2(e)I	
Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention [a]	
	Possible scale of contributions (estimated kt CO2 eq)
CERs	State: 0 *
ERUs	State: 0 *
AAUs [b]	AAUs issued by Denmark only, no state purchases of AAUs are expected
Carry-over units [c]	The amount of units carried over in relation to the EU ETS will not be known until the end of CP1
Other mechanism units under the Convention (specify) [d]	NA (until a decision on this has been taken by the COP - and if applicable - by the CMP)

Abbreviations: AAU = assigned amount unit, CER = certified emission reduction, ERU = emission reduction unit.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] AAUs issued to or purchased by a Party.

[c] Units carried over from the first to the second commitment periods of the Kyoto Protocol, as described in decision 13/CMP.1 and consistent with decision XX /CMP.8.

[d] As indicated in paragraph 5(e) of the guidelines contained in annex I of decision 2/CP.17.

*This is the possible scale by the state. The possible scale by Danish entities under the EU ETS is unknown.

TABLE 2(E)II: DESCRIBTION OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET: OTHER MARKET-BASED MECHANISMS

Table 2(e)II	
Description of quantified economy-wide emission reduction target: other market-based mechanisms [a]	
	Possible scale of contributions
(Specify)	(estimated kt CO2 eq)
NA	NA

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

TABLE 2(F): DESCRIBTION OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET: ANY OTHER INFORMATION

Table 2(f)
Description of quantified economy-wide emission reduction target: any other information [a,b]
IE
[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets. [b] This information could include information on the domestic legal status of the target or the total assigned amount of emission units for the period for reaching a target. Some of this information is presented in the narrative part of the biennial report.

TABLE 3: PROGRESS IN ACHIEVEMENT OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET: INFORMATION ON MITIGATION ACTIONS AND THEIR EFFECTS

Table 3

Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/ or activity affected	Type of instrument [c]	Status of implementation [d]	Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)		
									20XX [f] = 2001	20XX [f] = 2010 or annual average 2008-2012	2020
TD-1a: Energy taxes	Energy (energy consumption in the Transport, Business, Household and Agricultural sectors)	CO2, CH4, N2O	Restructuring of existing acts on oil and gas taxes and later also reduction of consumption of polluting fuels as part of the energy policy. The tax rate is indexed with 1,8 pct. pr. year in the period 2008-2015	Economic / fiscal	Implemented	Tax on energy use in Denmark. See Chapter 4 in Denmark's Sixth National Communication.	1 January 1973	Ministry of Taxation	-1.5	-1	NE
TD-1b: Mineral-oil Tax Act	Energy (fuel consumption in the Transport, Business, Household and Agricultural sectors)	CO2, CH4, N2O	Restructuring of existing acts on oil and gas taxes and later also reduction of consumption of polluting fuels as part of the energy policy. The tax rate is indexed with 1,8 pct. pr. year in the period 2008-2016	Economic / fiscal	Implemented	Tax on mineral oil products in Denmark. See Chapter 4 in Denmark's Sixth National Communication.	1 January 1993	Ministry of Taxation	-1.2	-1.2	NE
TD-2: Gas Tax Act	Energy (primarily gas consumption in the Business and Household sectors)	CO2, CH4, N2O	In order to have a tax level on this fuel which match the tax level on other fuels. The tax rate is indexed with 1,8 pct. pr. year in the period 2008-2015	Economic / fiscal	Implemented	Tax on consumption of natural gas and town gas in Denmark.	1 January 1996	Ministry of Taxation	NE	NE	NE
TD-3: Coal Tax Act	Energy (primarily coal consumption in central power and CHP plants)	CO2, CH4, N2O	At its introduction the objective was both fiscal and reductions in energy use. Later, CO2 reduction also became an objective. The tax rate is indexed with 1,8 pct. pr. year in the period 2008-2015	Economic / fiscal	Implemented	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.	1 July 1982	Ministry of Taxation	NE	NE	NE
TD-4: Electricity Tax	Energy (primarily electricity consumption in the Business and Household sectors)	CO2, CH4, N2O	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.The tax rate is indexed with 1,8 pct. pr. year in the period 2008-2015.	Economic / fiscal	Implemented	Tax on consumption of elektricity.	1 April 1977	Ministry of Taxation	NE	NE	NE
TD-5: CO2 tax on energy products	Energy (primarily CO_2 emissions from energy consumption in the Business and Household sectors)	CO2	Reductions in energy use and related CO2 emissions. The tax rate is indexed with 1,8 pct. pr. year in the period 2008-2015.	Economic / fiscal	Implemented	Tax on energy products depending on their contribution to CO2 emissions.	1 March 1992	Ministry of Taxation	NE	-0.41	NE
TD-6: Green Owner Tax - a fuel-efficiency-dependent annual tax on motor vehicles	Energy (energy consumption in the Transport sector)	CO2, CH4, N2O	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.	Economic / fiscal	Implemented	Car owners have to pay half-yearly taxes which are differentiated in accordance with the fuel efficiency of the cars, expressed in kilometers per litre. Electric cars are exempted.	1 July 1997	Ministry of Taxation	-0.2	-0.6	NE
TD-7: Registration Tax - a fuel-efficiency-dependant registration tax on passenger cars and vans	Energy (energy consumption in the Transport sector)	CO2, CH4, N2O	Restructuring of existing legislation and reduction in consumption of polluting fuels by introducing incentives to buy more fuel efficient cars.	Economic / fiscal	Implemented	Tax on motorcycles and other motorised vehicles. The tax is furthermore regulated by how far it can drive per litre diesel or gasoline. Electric cars are exempted.	1 January 2000	Ministry of Taxation	IE (TD-6)	IE (TD-6)	NE
TD-8: Tax on HFCs, PFCs and SF6 - equivalent to the CO2 tax	Industrial Processes (the industrial gases)	HFCs, PFCs and SF6	Reduction of HFCs, PFCs and SF6 emissions	Economic / fiscal	Implemented	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.	1 March 2001	Ministry of Taxation	-0.05	-0.4	-0.02 (in 2015)
TD-9(new): Tax on methane from natural gas fired power plants - equivalent to the CO2 tax	Energy (gas consumption in gas engines in power and CHP plants)	CH4	Methane reduction	Economic / fiscal	Implemented	Tax on methane emissions from natural gas fired power plants - equal in terms of CO2 equivalents to the CO2 tax.	1 January 2011	Ministry of Taxation	NA	-0.02	NE

Table 3

Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/ or activity affected	Type of instrument [c]	Status of implementation [d]	Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)		
									20XX [f] = 2001	20XX [f] = 2010 or annual average 2008-2012	2020
EN-1: EU-CO2-allowances for electricity and district heat production and certain industrial processes (incl. Business)	Energy (primarily energy industries, off-shore and the energy intensive part of the Business Sector)	CO2	To regulate CO2 emissions	Regulatory (allowances) and economic (financial)	Implemented	EU-CO2-allowances for electricity and district heat production (including Business)	1 January 2005	Danish Energy Agency and entities under the EU ETS	NA	NE	NE
EN-2: Biomass Agreement (Agreement on the use of biomass in electricity production)	Energy	CO2	Increased use of biomass, R&D, demonstration, reduction of CO2	Economic (financial, subsidies)	Implemented, with the exception of one straw fired CHP plant	In 1993 it was agreed to increase the use of biomass in the energy supply. The agreement has been adjusted several times.	1993	The electricity producers	-0.2	-1.1	NE
EN-3: Price supplement and subsidies for renewable energy production	Energy	CO2	Increasing the share of renewable energy of the total energy consumption. Reduction of the impact on the environment, including CO2 emissions. Support for technology development	Economic (financial, subsidies, price supplement)	Implemented	Increasing the share of renewable energy of the total energy consumption. Reduction of the impact on the environment, including CO2 emissions. Support for technology development	21 February 2008	Danish Energy Agency and entities responsible for energy production	NA	NE	NE
EN-4: Tenders for offshore wind turbines	Energy	CO2	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.	Regulatory (administrative, tender), Economic (financial, tender)	Ongoing implementation	In accordance with the energy policy agreement from February 2008 an additional offshore wind farm has been built at Anholt. This 400 MW wind farm started to operate in September 2013. In accordance with the energy policy agreement from March 2012 tenders will be put out in 2013-15 for two additional offshore wind farms, one at Horns Rev (Horns Rev 3: 400 MW) in the North Sea and one at Krieger's Flak in the Baltic Sea (600 MW), with expected commissioning in the period 2017-20 beginning with the expansion at Horns Rev.	Adopted 21 February 2008 Implemented September 2013	Danish Energy Agency and entities responsible for energy production	NA	NE	NE
EN-5: Scrapping scheme for old wind turbines	Energy	CO2	Additional 350 MW installed kW before 2012. 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.	Economic (financial, price supplement)	The legal basis has been implemented. The planning of where to relocate old and locate new wind turbines began in 2005. Act no. 505 adopted 17th of June 2008 changes the Electricity supply Act. But the law has not come into force yet.	The scrapping scheme has supported yhe taking down of old and unfavourable placed wind turbines and has supported the expansion of wind power.	21 February 2008	Danish Energy Agency	NA	NE	NE
EN-6: Energy development and demonstration	Energy	CO2	The main objective of the EUDP 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. A further important goal is to strenghten and make use of Danish commercial potentials.	Development and demonstration (and directly related research)	Implemented	EUDP, under the responsability of the EUDP Secretariat c/o the Danish Energy Authority, support energy development and demonstration projects. Directly related research projects may also be supported as well as other activities such as public/private partnerships	2008	EUDP Secretariat c/o Danish Energy Agency	NA	NE	NE

Table 3

Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/ or activity affected	Type of instrument [c]	Status of implementation [d]	Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)		
									20XX [f] = 2001	20XX [f] = 2010 or annual average 2008-2012	2020
TR-1a: EU demands on vehicle manufactures to deliver fuel efficient cars and vans	Transport	CO2	Improve the efficiency of energy consumption, CO2-reduction	Regulatory	Implemented			European Commission	IE (TD-6)	IE (TD-6)	
TR-1b: Information campaign on fuel consumption of new cars	Transport	CO2	Improve the efficiency of energy consumption, CO2-reduction	Information	Implemented (the actual campaign lasted for 2 years)			Denmark`s Road Safety and Transport Agency	IE (TD-6)	IE (TD-6)	NE
TR-2: Energy-correct driving technique	Transport	CO2	Improve the efficiency of energy consumption, CO2-reduction	Information	Is included in the drivers education			Ministry of Justice	IE (TD-6)	IE (TD-6)	NE
TR-3: Initiative on enforcing speed limits	Transport	CO2	Improve the efficiency of energy consumption, CO2-reduction	Information, economic	Implemented			Ministry of Justice	NE	NE	NE
TR-4:Establishment of intermodal installations	Transport	CO2	Improve transport efficiency, CO2-reduction	Economic (financial)	Ongoing implementation			Ministry of Transport and Energy, counties, municipalities, HUR,	NE	NE	NE
TR-5: Promotion of environmentally friendly goods transport	Transport	CO2	Improve transport efficiency, CO2-reduction	Economic (financial) and information	Implemented			Danish Environmental Protection Agency, Haulage contractors	NE	NE	NE
TR-6: Reduced travel times for public transport	Transport	CO2	Improve transport efficiency, CO2-reduction	Regulatory (Administrative)	Ongoing implementation			Ministry of Transport and Energy, Counties and Danish State	NE	NE	NE
TR-7: Spatial planning	Transport	CO2	Reduce the need for transport, CO2-reduction	Regulatory (Administrative)	Ongoing implementation			Counties, municipalities	NE	NE	NE
TR-8(new): EU requirements regarding biofuels	Transport	CO2		Regulatory (Administrative)	Implemented			Danish Energy Agency			

Table 3											
Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects											
Name of mitigation action [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/ or activity affected	Type of instrument [c]	Status of implementation [d]	Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)		
									20XX [f] = 2001	20XX [f] = 2010 or annual average 2008-2012	2020
HO-1: Energy labelling of small and large buildings (incl. public sector and business)	Energy, Domestic sector	CO2	Promotion of energy savings.	Information, Regulation (administrative, order)	Implemented. The act is under revision in order to implement the EU building directive.	1. Energy labelling of buildings when built, sold or rented: Must be implemented after finishing the construction of a building and on the sale or rental of the building - primarily heating consumption. This applies in principle for all buildings indifferent of size, apart from production fascilities, factories etc. 2. Regular Energy labelling of large buildings and public buildings Energy labels and an energy plan must be prepared regularly every five years for all large buildings over 1,500 m2 (1000 m2 at July 2009) and for all public buildings over 60 m2 - primarily heating consumption and air conditioning systems	1 January 1997	Danish Energy Agency	-0.2	-0.4	NE
HO-2: Energy labelling of electric appliances	Energy, Domestic sector	CO2	To promote development and use of energy efficient appliances with the purpose of reducing energy consumption and CO2 emissions.	Information	Implemented. In the EU work on a recast of the framework directive is on-going, aiming for the inclusion of other types of appliances under the labelling scheme.	The EU energy labelling directives on household appliances within the scope of the framework directive 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.	1992	Danish Energy Agency	NE	NE	NE
HO-3 (new): Substitution of individual oil-based furnaces	Energy, Domestic sector	CO2	The promotion of modern, low-emitting heating solutions, including systems based on renewable energy such as heat pumps and solar heating.	2010-2012: Economic (subsidies) From 2013: Information	Implemented	In 2010-2012 DKK 400 mill. have been allocated to support the substitution of individual oil based furnaces for modern, low emitting heating solutions, including systems based on renewable energy such as heat pumps and solar heating. As of September 2013 the measure has been continued as an information effort without subsidies.	2010-2012 and from 2013	Danish Energy Agency and consumers	NA	-0.02	NE

Table 3											
Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects											
Name of mitigation action [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/ or activity affected	Type of instrument [c]	Status of implementation [d]	Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)		
									20XX [f] = 2001	20XX [f] = 2010 or annual average 2008-2012	2020
IP-1: Regulation of use of HFCs, PFCs and SF6 (phasing out most of the uses)	Industrial Processes (the industrial gases)	HFCs, PFCs and SF6	Reduction of HFCs, PFCs and SF6 emissions	Regulation (administrative, ban)	Implemented (full effect from 1 January 2006)	Import, sale and use of the substances or new products containing the substances is forbidden from 1 January 2006 with some exceptions.	In general 1 January 2006, but for some uses before	Danish Environmental Protection Agency	IE(TD-8)	IE(TD-8)	NE

Table 3

Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/ or activity affected	Type of instrument [c]	Status of implementation [d]	Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)		
									20XX [f] = 2001	20XX [f] = 2010 or annual average 2008-2012	2020
AG-1: Action Plan for the Aquatic Environment I+II and Action Plan for Sustainable Agriculture	Agriculture (/Land-use)	N2O	Reduction of nitrate pollution to the aquatic environment, i.e. reduction of N run-off from agriculture by 100,000 tonnes N per year.	Regulation (order)	Implemented	The action plans contain several measures e.g. with the objective to increase the area with winter green fields and better utilisation of manure.	1987, 1991, 1998	State and county authorities	-1.6	-2.2	NE
AG-2: Action Plan for the Aquatic Environment III	Agriculture	N2O	Protection of the aquatic environment from nitrate and phosphorus pollution.	Regulation (order), economic	Implemented	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.	2004	State and county authorities	NE	-0.2	NE
AG-4a/4b/4c/4d/4e: Reduced emissions of ammonia	Agriculture	N2O	Protection of the aquatic environment from nitrate pollution.	Regulation (order)	Implemented	1) Optimisation of manure handling in sheds for cattle, pigs, poultry and fur animals. 2) Rules on covering storage facilities for solid manure and slurry tanks. 3) Ban on overall surface spreading and reduction of the time from field application of manure to incorporation. 4) Ban on ammonia treatment of straw.	2001	State and county authorities	NE	-0.03	NE
AG-4f: Environmental Approval Act for Livestock Holdings	Agriculture	N2O	National minimum requirements for environmental protection (odour, ammonia, nitrate, phosphorous, landscape, etc.) when livestock holdings above 75 Livestock Units (LU) are established, expanded or changed. The purpose of the act is to ensure the use of best available techniques (BAT).	Regulation (order)	Implemented	The measures covered by the Environmental Approval Act for Livestock Holdings are: • 300 m buffer zones around ammonia sensistive areas where no extension of livestock farms can take place if such an extension would lead to increased ammonia deposition in natural areas vulnerable to ammonia. • Demand for reduction of ammonia emissions relative to production facility with lowest ammonia emission norm: 2007: 15%, 2008: 20%, 2009: 25% • Demands for injection of animal slurry on black soil and grass within buffer zones (1 km from vulnerable natural areas). • Demand for fixed cover on most new containers for solid manure and slurry tanks (depending on distance to neighbours and vulnerable natural areas). • Reduced number of LU/ha when in Nitrate vulnerable areas with low denitrification capacity • Regulation of phosphorous surplus on manure spreading areas	1 January 2007	State and county authorities	NE	NE	NE
AG-6: Biogas plants	Agriculture and Energy	CO2, N2O og CH4	Reduced CO2 and methane emissions and better exploitation of manure	Economic (subsidies)	Implemented		1987	State	-0.2	-0.017 to -0.036	-0.24
AG-9(new): Agreement on Green Growth	Agriculture	N2O	Reduced use of N due to a re-structuring of nitrogen regulation and reduction of N and P losses from agriculture	Regulation (order), economic	Ongoing implementation						-0.8

Table 3

Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/ or activity affected	Type of instrument [c]	Status of implementation [d]	Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)		
									20XX [f] = 2001	20XX [f] = 2010 or annual average 2008-2012	2020
LU-1: Ban on burning straw on fields	Agriculture	CO2, CH4, N2O	Less air pollution	Regulation (order)	Implemented	Ban on burning straw on fields	1989	State and county authorities	NE	NE	NE
LU-2: Planting of windbreaks	Agriculture	CO2	Binding of CO2	Economic (subsidies)	Implemented		1960s	State	NE	-0.14	NE
LU-3: Subsidies scheme for private afforestation on agricultural land (increase the forest area in Denmark)	Forstry / Land-use	CO2	Promote private afforestation in achieving the target of an increse in forest area by 450,000-500,000 ha in 100 years.	Economic (subsidies)	Implemented	Private owners of agricultural land can get grants for establishment of broadleaves or conifer forests, nursing of these in the first 3 years, establishment of fences, mapping and or accounting of the area - if the forest will be established in an area planned for afforestation.	8 February 1997	Danish Forest and Nature Agency	-0.021	-0,120	-0.28
LU-4: Public afforestation (state, counties and municipalities)	Forstry / Land-use	CO2	Public afforestation in achieving the target of an increase in forest area by 450,000-500,000 ha in 100 years for purposes such as outdoor recreation, groundwater protection and CO2 sequestration.	State: Regulation (adopted target, with financial support through the annual state budget) / Counties and Municipalities: Voluntary agreements	Ongoing implementation through annual budgets			Danish Forest and Nature Agency, counties and municipalities	-0.027	-0,068	-0.123

Table 3

Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/ or activity affected	Type of instrument [c]	Status of implementation [d]	Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)		
									20XX [f] = 2001	20XX [f] = 2010 or annual average 2008-2012	2020
WA-1: Obligation to send combustible waste to incineration (in practice a ban on landfilling).	Waste	CH4 (methane)	Reduce landfilling, energy production, greater recycling, CH4 reduction	Regulation (administative)	Implemented	0	1 January 1997	Municipalities	-0.021	-0.333	NE
WA-2: The waste tax	Waste	CH4 (methane)	Greater recycling and least possible landfilling.	Fiscal (tax)	Implemented	A tax is imposed on waste for incineration or landfilling. The taxes are DKK 375 per tonne for landfilling and DKK 330 per tonne for incineration.	1 January 1987	Ministry of Taxation	NE	NE	NE
WA-3: Weight-and-volume-based packaging taxes	Waste	CH4 (methane) and CO2	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.	Fiscal (tax)	Implemented	Taxes or compensations on several products. E.g. taxes on packings, tires, lead accumulators, CFCs and bags.			NE	NE	NE
WA-4: Subsidy programme – Enterprise Scheme (special scheme for businesses)	Waste	CH4 (methane)	Reduce environmental impacts from waste	Economic (subsidies)	Implemented		2004	Ministry for the Environment	NE	NE	NE
WA-5: Increased recycling of waste plastic packaging	Waste	CO2	Increase the recycling of plastic packaging waste to a level of 22.5% i 2008.	Regulation (administrative)	Implemented	The collection of plastic packaging waste for recycling is increased		Danish Environmental Protection Agency	NE	-0.005	NE
WA-6: Implementation of the EU landfill directive	Waste	CH4 (methane)	To introduce more rigorous demands for landfilling of waste and to lower the amount of waste going to landfills.	Regulation (administrative)	The statutory order on landfills is implemented.			Danish Environmental Protection Agency, counties and municipalities	NE	NE	NE
WA-7: Support for (construction of facilities for) gas recovery at landfill sites	Waste, measures no longer in place, but replaced with the general price supplement (See data sheet EN-3)	CH4 (methane) and CO2 from fossil fuel based energy supply	Energy supply and reduction of methane emissions.	Economic (subsidies)	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 methane 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.	Methane is recovered at landfills. The methane collected acts as fuel in CHP production.	Mid 1980s	Danish Energy Authority	See the Effort Analysis(1)	See the Effort Analysis(1)	NE
WA-8: Subsidy programme for cleaner products	Waste, measures no longer in place	CH4 (methane)	Reduce the impact of waste on the environmental.	Economic (subsidies)	Implemented, but no longer in place.	Under the subsidy programme for cleaner products it was possible to get grants for projects targetted at reducing the environmental impact from management of waste generated throughout the life cycle of products as well as for projects with the objective to limit environmental problems in connection with waste management.	1999	Ministry for the Environment	NE	NE	NE

Note: The two final columns specify the year identified by the Party for estimating impacts (based on the status of the measure and whether an ex post or ex ante estimation is available).
Abbreviations: GHG = greenhouse gas; LULUCF = land use, land-use change and forestry.
[a] Parties should use an asterisk (*) to indicate that a mitigation action is included in the 'with measures' projection.
[b] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors, cross-cutting, as appropriate.
[c] To the extent possible, the following types of instrument should be used: economic, fiscal, voluntary agreement, regulatory, information, education, research, other.
[d] To the extent possible, the following descriptive terms should be used to report on the status of implementation: implemented, adopted, planned.
[e] Additional information may be provided on the cost of the mitigation actions and the relevant timescale.
[f] Optional year or years deemed relevant by the Party.

TABLE 4: REPORTING ON PROGRESS

Table 4

Reporting on progress [a, b]

Year [c]	Total emissions excluding LULUCF (kt CO2 eq)	Contribution from LULUCF [d] (kt CO2 eq)	Quantity of units from market based mechanisms under the Convention (number of units and kt CO2 eq)	Quantity of units from other market based mechanisms (number of units and kt CO2 eq)
	(a) total GHG emissions, excluding emissions and removals from the LULUCF sector;	*(b) emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the Conference of the Parties and the activities and/or land that will be accounted for;*	*(c) total GHG emissions, including emissions and removals from the LULUCF sector.*	
Base year/base period (specify) **CO2, CH4 and N2O: 1990** **HFCs, PFC and SF6: 1995** **NF3: To be determined.**	NA*	NA*	NA*	NA*
2010	NA*	NA*	NA*	NA*
2011	NA*	NA*	NA*	NA*
2012	NA*	NA*	NA*	NA*

Abbreviation: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] For the base year, information reported on the emission reduction target shall include the following: (a) total GHG emissions, excluding emissions and removals from the LULUCF sector; (b) emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the Conference of the Parties and the activities and/or land that will be accounted for; (c) total GHG emissions, including emissions and removals from the LULUCF sector. For each reported year, information reported on progress made towards the emission reduction targets shall include, in addition to the information noted in paragraphs 9(a–c) of the UNFCCC biennial reporting guidelines for developed country Parties, information on the use of units from market-based mechanisms.

[c] Parties may add additional rows for years other than those specified below.

[d] Information in this column should be consistent with the information reported in table 4(a)I or 4(a)II, as appropriate. The Parties for which all relevant information on the LULUCF contribution is reported in table 1 of this common tabular format can refer to table 1.

* Historical annual information on progress towards Denmark's economy-wide target for the 2nd commitment period of the Kyoto Protocol (2013-2020) will not be available until 2015. Information on progress in reducing greenhouse gas emissions in the first commitment period under the Kyoto Protocol as well as projected progress in greeenhouse gas reductions until 2035 is included in Chapter 5 of Denmark's Sixth National Communication under the UNFCCC.

TABLE 4(A)I: REPORTING ON PROGRESS - IN ACHIEVING THE QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS – FURTHER INFORMATION ON MITIGATION ACTIONS RELEVANT TO THE CONTRIBUTION OF THE LAND USE, LAND-USE CHANGE AND FORESTRY SECTOR IN 2010

Table 4(a)I

Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 20XX-3 = 2013-3 = 2010 [a, b]

	Net GHG emissions/removals from LULUCF categories [c] (kt CO2 eq)	Base year/period or reference level value [d] (kt CO2 eq)	Contribution from LULUCF for reported year (kt CO2 eq)	Cumulative contribution from LULUCF [e] (kt CO2 eq)	Accounting approach [f]
Total LULUCF	NA*	NA*	NA*	NA*	NA*
A: Forest land	NA*	NA*	NA*	NA*	NA*
1. Forest land remaining forest land	NA*	NA*	NA*	NA*	NA*
2. Land converted to forest land	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
B. Cropland	NA*	NA*	NA*	NA*	NA*
1. Cropland remaining cropland	NA*	NA*	NA*	NA*	NA*
2. Land converted to cropland	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
C. Grassland	NA*	NA*	NA*	NA*	NA*
1. Grassland remaining grassland	NA*	NA*	NA*	NA*	NA*
2. Land converted to grassland	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
D. Wetlands	NA*	NA*	NA*	NA*	NA*
1. Wetlands remaining wetlands	NA*	NA*	NA*	NA*	NA*
2. Land converted to wetlands	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
E. Settlements	NA*	NA*	NA*	NA*	NA*
1. Settlements remaining settlements	NA*	NA*	NA*	NA*	NA*
2. Land converted to settlements	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
F. Other land	NA*	NA*	NA*	NA*	NA*
1. Other land remaining other land	NA*	NA*	NA*	NA*	NA*
2. Land converted to other land	NA*	NA*	NA*	NA*	NA*
3. Other [g]	NA*	NA*	NA*	NA*	NA*
G. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
Harvested wood products	NA*	NA*	NA*	NA*	NA*

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Parties that use the LULUCF approach that is based on table 1 do not need to complete this table, but should indicate the approach in table 2. Parties should fill in a separate table for each year, namely 20XX-3 and 20XX-2, where 20XX is the reporting year.

[c] For each category, enter the net emissions or removals reported in the most recent inventory submission for the corresponding inventory year. If a category differs from that used for

[d] Enter one reference level or base year/period value for each category. Explain in the biennial report how these values have been calculated.

[e] If applicable to the accounting approach chosen. Explain in this biennial report to which years or period the cumulative contribution refers to.

[f] Label each accounting approach and indicate where additional information is provided within this biennial report explaining how it was implemented, including all relevant accounting parameters (i.e. natural disturbances, caps).

[g] Specify what was used for the category "other". Explain in this biennial report how each was defined and how it relates to the categories used for reporting under the Convention or its Kyoto Protocol.

* Not applicable until the relevant information is available in 2015 relating to the first year of the commitment period 2013-2020 for Denmark's QELRO under the KP CP2.

TABLE 4(A)I: REPORTING ON PROGRESS - IN ACHIEVING THE QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS – FURTHER INFORMATION ON MITIGATION ACTIONS RELEVANT TO THE CONTRIBUTION OF THE LAND USE, LAND-USE CHANGE AND FORESTRY SECTOR IN 2011

Table 4(a)I

Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 20XX-2 = 2013-2 = 2011 [a, b]

	Net GHG emissions/removals from LULUCF categories [c] (kt CO2 eq)	Base year/period or reference level value [d] (kt CO2 eq)	Contribution from LULUCF for reported year (kt CO2 eq)	Cumulative contribution from LULUCF [e] (kt CO2 eq)	Accounting approach [f]
Total LULUCF	NA*	NA*	NA*	NA*	NA*
A: Forest land	NA*	NA*	NA*	NA*	NA*
1. Forest land remaining forest land	NA*	NA*	NA*	NA*	NA*
2. Land converted to forest land	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
B. Cropland	NA*	NA*	NA*	NA*	NA*
1. Cropland remaining cropland	NA*	NA*	NA*	NA*	NA*
2. Land converted to cropland	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
C. Grassland	NA*	NA*	NA*	NA*	NA*
1. Grassland remaining grassland	NA*	NA*	NA*	NA*	NA*
2. Land converted to grassland	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
D. Wetlands	NA*	NA*	NA*	NA*	NA*
1. Wetlands remaining wetlands	NA*	NA*	NA*	NA*	NA*
2. Land converted to wetlands	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
E. Settlements	NA*	NA*	NA*	NA*	NA*
1. Settlements remaining settlements	NA*	NA*	NA*	NA*	NA*
2. Land converted to settlements	NA*	NA*	NA*	NA*	NA*
3. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
F. Other land	NA*	NA*	NA*	NA*	NA*
1. Other land remaining other land	NA*	NA*	NA*	NA*	NA*
2. Land converted to other land	NA*	NA*	NA*	NA*	NA*
3. Other [g]	NA*	NA*	NA*	NA*	NA*
G. Other (please specify) [g]	NA*	NA*	NA*	NA*	NA*
Harvested wood products	NA*	NA*	NA*	NA*	NA*

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of

[b] Parties that use the LULUCF approach that is based on table 1 do not need to complete this table, but should indicate the approach in table 2. Parties should fill in a separate table for

[c] For each category, enter the net emissions or removals reported in the most recent inventory submission for the corresponding inventory year. If a category differs from that used for

[d] Enter one reference level or base year/period value for each category. Explain in the biennial report how these values have been calculated.

[e] If applicable to the accounting approach chosen. Explain in this biennial report to which years or period the cumulative contribution refers to.

[f] Label each accounting approach and indicate where additional information is provided within this biennial report explaining how it was implemented, including all relevant

[g] Specify what was used for the category "other". Explain in this biennial report how each was defined and how it relates to the categories used for reporting under the Convention or

* Not applicable until the relevant information is available in 2015 relating to the first year of the commitment period 2013-2020 for Denmark's QELRO under the KP CP2.

TABLE 4(A)II: REPORTING ON PROGRESS - IN ACHIEVEMENT OF THE QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS – FURTHER INFORMATION ON MITIGATION ACTIONS RELEVANT TO THE COUNTING OF EMISSIONS AND REMOVALS FROM THE LAND USE, LAND-USE CHANGE AND FORESTRY SECTOR IN RELATION TO ACTIVITIES UNDER ARTICLE 3, PARAGRAPHS 3 AND 4, OF THE KYOTO PROTOCOL

Table 4(a)II

Progress in achievement of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol [a,b, c]

INFORMATION TABLE ON ACCOUNTING FOR ACTIVITIES UNDER ARTICLES 3.3 AND 3.4 OF THE KYOTO PROTOCOL: 2013-2020

Commitment period accounting: To be decided

Annual accounting: To be decided

Number of the reported year in the commitment period: 0

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	Base year[d]	Net emissions/removals[e]									Accounting Parameters[h]	Accounting Quantity[i]
		2013	2014	2015	2016	2017	2018	2019	2020[f]	Total[g]		
	(kt CO2 eq)											
A. Article 3.3 activities												
A.1. Afforestation and Reforestation												
A.1.1. Units of land not harvested since the beginning of the commitment period [j]		NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*			
A.1.2. Units of land harvested since the beginning of the commitment period [j]												
A.2. Deforestation		NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*			
B. Article 3.4 activities												
B.1. Forest Management (if elected)		NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*			
3.3 offset [k]												
Forest management cap [l]											NA*	
B.2. Cropland Management (if elected)	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*			
B.3. Grazing Land Management (if elected)	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*			
B.4. Revegetation (if elected)	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*			

Note: 1 kt CO2 eq equals 1 Gg CO2 eq.

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b Developed country Parties with a quantified economy-wide emission reduction target as communicated to the secretariat and contained in document FCCC/SB/2011/INF.1/Rev.1 or any update to that document, that are Parties to the Kyoto Protocol, may use table 4(a)II for reporting of accounting quantities if LULUCF is contributing to the attainment of that target.

c Parties can include references to the relevant parts of the national inventory report, where accounting methodologies regarding LULUCF are further described in the documentation box or in the biennial reports.

d Net emissions and removals in the Party's base year, as established by decision 9/CP.2.

e All values are reported in the information table on accounting for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, of the CRF for the relevant inventory year as reported in the current submission and are automatically entered in this table.

f Additional columns for relevant years should be added, if applicable.

g Cumulative net emissions and removals for all years of the commitment period reported in the current submission.

h The values in the cells "3.3 offset" and "Forest management cap" are absolute values.

i The accounting quantity is the total quantity of units to be added to or subtracted from a Party's assigned amount for a particular activity in accordance with the provisions of Article 7, paragraph 4, of the Kyoto Protocol.

j In accordance with paragraph 4 of the annex to decision 16/CMP.1, debits resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be greater than the credits accounted for on that unit of land.

k In accordance with paragraph 10 of the annex to decision 16/CMP.1, for the first commitment period a Party included in Annex I that incurs a net source of emissions under the provisions of Article 3 paragraph 3, may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net source of emissions under the provisions of Article 3, paragraph 3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

l In accordance with paragraph 11 of the annex to decision 16/CMP.1, for the first commitment period of the Kyoto Protocol only, additions to and subtractions from the assigned amount of a Party resulting from Forest management under Article 3, paragraph 4, after the application of paragraph 10 of the annex to decision 16/CMP.1 and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

Documentation box:

* Not applicable until the relevant information is available in 2015 relating to the first year of the commitment period 2013-2020 for Denmark's QELRO under the KP CP2.

INFORMATION TABLE ON ACCOUNTING FOR ACTIVITIES UNDER ARTICLES 3.3 AND 3.4 OF THE KYOTO PROTOCOL: 2008-2012								
Commitment period accounting: NO				DENMARK (as part of the EU Burden Sharing under the KP - i.e. without Greenland)				
Annual accounting: YES								Inventory 2011
Number of the reported year in the commitment period: 4								Submission 2013 v1.4
GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	**BY(5)**	**Net emissions/removals(1)**					**Accounting Parameters (7)**	**Accounting Quantity (8)**
		2008	**2009**	**2010**	**2011**	**Total(6)**		
	(Gg CO2 equivalent)							
A. Article 3.3 activities								
A.1. Afforestation and Reforestation								-255.09
A.1.1. Units of land not harvested since the beginning of the commitment period(2)		351.79	-211.96	-321.82	-73.10	-255.09		-255.09
A.1.2. Units of land harvested since the beginning of the commitment period(2)								IE,NO
Denmark		IE,NO	IE,NO	IE,NO	IE,NO	IE,NO		IE,NO
A.2. Deforestation		78.85	78.55	80.15	82.83	320.39		320.39
B. Article 3.4 activities								
B.1. Forest Management (if elected)		-5,923.53	-24.48	-4,028.28	-6,313.59	-16,289.88		-981.97
3.3 offset(3)							65.30	-65.30
FM cap(4)							916.67	-916.67
B.2. Cropland Management (if elected)	5,053.87	3,939.56	2,835.09	3,560.12	3,367.84	13,702.62	20,215.47	-6,512.85
B.3. Grazing Land Management (if elected)	183.96	225.38	213.46	203.59	234.64	877.08	735.82	141.26
B.4. Revegetation (if elected)	NA	NA	NA	NA	NA	NA	NA	NA

(1) All values are reported in table 5(KP) of the CRF for the relevant inventory year as reported in the current submission and are automatically entered in this table.

(2) In accordance with paragraph 4 of the annex to decision 16/CMP.1, debits resulting from harvesting during the first commitment period following Afforestation and Reforestation since 1990 shall not be greater than credits accounted for on that unit of land.

(3) In accordance with paragraph 10 of the annex to decision 16/CMP.1, for the first commitment period, a Party included in Annex I that incurs a net source of emissions under the provisions of Article 3.3 may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under Forest Management under Article 3.4, up to a level that is equal to the net source of emissions under the provisions of Article 3.3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3.3.

(4) In accordance with paragraph 11 of the annex to decision 16/CMP.1, for the first commitment period only, additions to and subtractions from the assigned amount of a Party resulting from Forest Management under Article 3.4, after the application of paragraph 10 of the annex to decision 16/CMP.1 and resulting from Forest Management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

(5) Net emissions and removals in the Party’s base year, as established by decision 9/CP.2.

(6) Cumulative net emissions and removals for all years of the commitment period reported in the current submission.

(7) The values in the cells "3.3 offset" and "FM cap" are absolute values.

(8) The accounting quantity is the total quantity of units to be added to or subtracted from a Party's assigned amount for a particular activitity in accordance with the provisions of Article 7.4 of the Kyoto Protocol.

INFORMATION TABLE ON ACCOUNTING FOR ACTIVITIES UNDER ARTICLES 3.3 AND 3.4 OF THE KYOTO PROTOCOL: 2008-2012								
Commitment period accounting: NO								DENMARK KP (i.e. with Greenland)
Annual accounting: YES								Inventory 2011
Number of the reported year in the commitment period:	4							Submission 2013 v2.1
GREENHOUSE GAS SOURCE AND SINK ACTIVITIES		**Net emissions/removals(1)**					**Accounting Parameters (7)**	**Accounting Quantity (8)**
	BY(5)	**2008**	**2009**	**2010**	**2011**	**Total(6)**		
	(Gg CO2 equivalent)							
A. Article 3.3 activities								
A.1. Afforestation and Reforestation								-255.09
A.1.1. Units of land not harvested since the beginning of the commitment period(2)		351.79	-211.96	-321.82	-73.10	-255.09		-255.09
A.1.2. Units of land harvested since the beginning of the commitment period(2)								IE,NA,NO
Denmark		IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO		IE,NA,NO
A.2. Deforestation		78.85	78.55	80.15	82.83	320.39		320.39
B. Article 3.4 activities								
B.1. Forest Management (if elected)		-5,923.58	-24.51	-4,028.32	-6,313.62	-16,290.04		-981.97
3.3 offset(3)							65.30	-65.30
FM cap(4)							916.67	-916.67
B.2. Cropland Management (if elected)	5,053.87	3,939.59	2,835.12	3,560.15	3,367.89	13,702.75	20,215.47	-6,512.72
B.3. Grazing Land Management (if elected)	184.14	226.28	213.62	205.02	235.84	880.76	736.54	144.22
B.4. Revegetation (if elected)	NA	NA	NA	NA	NA	NA	NA	NA

(1) All values are reported in table 5(KP) of the CRF for the relevant inventory year as reported in the current submission and are automatically entered in this table.

(2) In accordance with paragraph 4 of the annex to decision 16/CMP.1, debits resulting from harvesting during the first commitment period following Afforestation and Reforestation since 1990 shall not be greater than credits accounted for on that unit of land.

(3) In accordance with paragraph 10 of the annex to decision 16/CMP.1, for the first commitment period, a Party included in Annex I that incurs a net source of emissions under the provisions of Article 3.3 may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under Forest Management under Article 3.4, up to a level that is equal to the net source of emissions under the provisions of Article 3.3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3.3.

(4) In accordance with paragraph 11 of the annex to decision 16/CMP.1, for the first commitment period only, additions to and subtractions from the assigned amount of a Party resulting from Forest Management under Article 3.4, after the application of paragraph 10 of the annex to decision 16/CMP.1 and resulting from Forest Management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

(5) Net emissions and removals in the Party's base year, as established by decision 9/CP.2.

(6) Cumulative net emissions and removals for all years of the commitment period reported in the current submission.

(7) The values in the cells "3.3 offset" and "FM cap" are absolute values.

(8) The accounting quantity is the total quantity of units to be added to or subtracted from a Party's assigned amount for a particular activity in accordance with the provisions of Article 7.4 of the Kyoto Protocol.

TABLE 4(B): REPORTING ON PROGRESS - IN ACHIEVEMENT OF THE QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS – FURTHER INFORMATION ON THE USE (I.E: RETIREMENT) OF KYOTO PROTOCOL UNITS (AAUS, ERUS, CERS TCERS AND LCERS) AND OTHER UNITS

Table 4(b)

Reporting on progress [a, b, c]

	Kyoto Protocol units [d] (kt CO2 eq)										Other units [,d,e] (kt CO2 eq)					
	AAUs		ERUs		CERs		tCERs		lCERs		Units from market-based mechanisms under the Convention		Units from other market-based mechanisms			
	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011		
Quantity of units	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*		
															20XX-3 = 2010	20XX-2 = 2011
Total															NA*	NA*

Note: 20XX is the latest reporting year.

Abbreviations: AAUs = assigned amount units, CERs = certified emission reductions, ERUs = emission reduction units, lCERs = long-term certified emission reductions, tCERs = temporary certified emission reductions.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] For each reported year, information reported on progress made towards the emission reduction target shall include, in addition to the information noted in paragraphs 9(a-c) of the reporting guidelines, on the use of units from market-based mechanisms.

[c] Parties may include this information, as appropriate and if relevant to their target.

[d] Units surrendered by that Party for that year that have not been previously surrendered by that or any other Party.

[e] Additional columns for each market-based mechanism should be added, if applicable.

* Not applicable until the relevant information is available in 2015 relating to the first year of the commitment period 2013-2020 for Denmark's QELRO under the KP CP2.

INFORMATION ON RETIREMENT OF UNITS IN 2010 AND 2011 UNDER THE FIRST COMMITMENT PERIOD UNDER THE KYOTO PROTOCOL

	Kyoto Protocol units [d] (kt CO2 eq)										Other units [,d,e] (kt CO2 eq)					
	AAUs		ERUs		CERs		tCERs		lCERs		Units from		Units from other			
	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011	20XX-3 = 2010	20XX-2 = 2011		
Quantity of units	25322,171	24446,840	NO	1,766	162,743	822,623	NO	NO	NO	NO	NA	NA	NA	NA		
															20XX-3 = 2010	20XX-2 = 2011
Total															25484,914	25271,229

Source: Denmark's SEF report submitted under the Kyoto Protocol in April 2013.

TABLE 5: SUMMARY OF KEY VARIABLES AND ASSUMPTIONS USED IN THE PROJECTIONS ANALYSIS

Table 5

Summary of key variables and assumptions used in the projections analysis [a]

			Historical [b]*							Projected				
Key underlying assumptions**			**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**...**	**2015**	**2020**	**2025**	**2030**	**2035**
Activity	**Suggested units**	**Units reported**								**Scenario 'with existing measures'**				
General economic parameters														
1a. Gross Domestic Product	Value (Billion €) GDP at constant prices (not derived from purchasing power parity).	2005 prices, billion €								223	249	266	284	302
1b. Gross domestic product growth rate	Annual growth rate (%)									2.4%	1.7%	1.3%	1.7%	1.8%
2a. Population	Thousand people	1000 pers.								5642.885	5736.52	5833.972	5923.124	5993.583
2b. Population growth rate and base year value	% of value									2.2%	3.9%	5.6%	7.2%	8.5%
3. International coal prices	€ per tonne or GJ (Gigajoule)	2010 prices, €/GJ								3.1	3.1	3.1	3.2	3.2
4. International oil prices	€ per barrel or GJ (Gigajoule)	2010 prices, €/GJ								13.0	13.4	14.0	14.5	14.8
5. International gas prices	€ per m3 or GJ (Gigajoule)	2010 prices, €/GJ								7.5	7.9	8.4	8.8	9.2
Carbon price (not required but recommended)	€ / t CO2	2010 prices, €/t CO2								12.2	21.7	25.3	28.9	32.5
Energy sector														
6. Total gross inland consumption										**779**	**757**	**771**	**783**	**798**
6a. - Oil (fossil)	Petajoule (PJ)									297	288	294	300	316
6b. - Gas (fossil)	Petajoule (PJ)									143	115	115	115	111
6c. - Coal	Petajoule (PJ)									101	69	58	45	39
6d. - Renewables	Petajoule (PJ)									230	273	293	309	317
6e. - Nuclear (IEA definition for energy calc.)	Petajoule (PJ)													
6f. Net electricity import (-+)	Petajoule (PJ)									-4	0	-1	2	2
6g. - Other please specify in column I	Petajoule (PJ)									12	12	12	12	12
Total gross electricity generation by fuel type										**18,234**	**17,308**	**16,183**	**18,156**	**18,533**
7. - Oil (fossil)	GWhe									256	249	193	232	277
8. - Gas (fossil)	GWhe									3,295	2,161	1,452	1,732	1,927
9. – solid fuels	GWhe									8,179	7,905	6,557	6,989	6,921
10. – Renewable	GWhe									5,598	5,994	6,887	8,015	8,178
11. Nuclear (IEA definition for energy calc.)	GWhe													
12. - Other Please Specify in Column I	GWhe									904	999	1,094	1,189	1,229
Energy demand by sector										**665**	**663**	**681**	**694**	**709**
13. Energy Industries										**42**	**44**	**52**	**58**	**57**
13a. Oil (fossil)	Peta joule (PJ)									18	18	18	18	18
13b. Gas (fossil)	Petajoule (PJ)									24	26	34	40	40
13c. Solid fuels	Petajoule (PJ)									0	0	0	0	0
13d. Renewables	Petajoule (PJ)									0	0	0	0	0
13e. Nuclear (IEA definition for energy calc.)	Petajoule (PJ)													
13e. - Other Please Specify in Column I	Petajoule (PJ)													

Table 5

Summary of key variables and assumptions used in the projections analysis [a]

			Historical [b*]							Projected				
Key underlying assumptions**			1990	1995	2000	2005	2010	2011	...	2015	2020	2025	2030	2035
Activity	Suggested units	Units reported								Scenario 'with existing measures'				
General economic parameters														
14. Industry										**101**	**100**	**98**	**96**	**95**
14a. Oil (fossil)	Petajoule (PJ)									20	18	18	18	18
14b. Gas (fossil)	Petajoule (PJ)									25	16	14	12	10
14c. Solid fuels	Petajoule (PJ)									4	2	2	2	1
14d. Renewables	Petajoule (PJ)									14	23	23	23	24
14e. Electricity	Petajoule (PJ)									31	34	35	35	35
14f. Heat (from CHP)	Petajoule (PJ)									6	8	7	7	7
14g. - Other Please Specify in Column I	Petajoule (PJ)													
15. Commercial (Tertiary)										**118**	**114**	**115**	**114**	**113**
15a. Oil (fossil)	Petajoule (PJ)									24	23	22	22	22
15b. Gas (fossil)	Petajoule (PJ)									10	9	9	8	8
15c. Solid fuels	Petajoule (PJ)									2	1	1	1	1
15d. Renewables	Petajoule (PJ)									5	5	5	6	6
15e. Electricity	Petajoule (PJ)									45	46	49	50	51
15f. Heat	Petajoule (PJ)									32	29	28	27	25
15g. - Other Please Specify in Column I	Petajoule (PJ)													
16. Residential										**187**	**176**	**179**	**181**	**184**
16a. Oil (fossil)	Petajoule (PJ)									15	11	9	8	7
16b. Gas (fossil)	Petajoule (PJ)									23	18	16	15	14
16c. Solid fuels	Petajoule (PJ)									0	0	0	0	0
16d. Renewables	Petajoule (PJ)									47	47	49	51	54
16e. Electricity	Petajoule (PJ)									35	37	39	39	40
16f. Heat	Petajoule (PJ)									67	64	65	68	70
16g. - Other Please Specify in Column I	Petajoule (PJ)													
17. Transport										**219**	**229**	**236**	**245**	**259**
17a. Gasoline	Petajoule (PJ)									62	62	63	67	72
of which biofuels	Petajoule (PJ)									3	6	6	7	7
17b. Diesel	Petajoule (PJ)									113	118	123	130	139
of which biofuels	Petajoule (PJ)									7	11	11	12	13
17c. Jet Kerosene	Petajoule (PJ)									41	47	48	45	45
17d. Other liquid fuels	Petajoule (PJ)									1	1	1	1	1
17e. Gas (fossil)	Petajoule (PJ)													
17f. Renewables	Petajoule (PJ)													
17g. - Other Please Specify in Column I	Petajoule (PJ)									1	2	2	2	2
Weather parameters														
18a. Heating Degree Days	Annual HDD	Degree x Days								3023	3023	3023	3023	3023
18b. Cooling Degree Days	Annual CDD									-	-	-	-	-
Industry sector (for industrial sectors contributing significantly to the national total for the base or target year)														
19. Gross value-added total industry, Bio Euro (EC95) 2000	Value (EUR billion)	2005 prices, € billion								29.0	33.0	34.5	36.4	38.7
For Member States using Macroeconomic Models:														
20. The share of the industrial sector in GDP										15.4%	15.7%	15.4%	15.2%	15.2%
Please include a row for each industrial sector	Value (€)													
21. The growth of the industrial sector in GDP	Annual growth rate (%)									1.9%	2.0%	0.9%	1.7%	1.9%
Please include a row for each industrial sector	Value (€)													
For Member States using other models:														
22. The production index for Industrial Sector: (suggested split is energy intensive industry based on physical production and manufacturing industry based on monetary value)														
Please include a row for each industrial sector	Gross value added													

Table 5

Summary of key variables and assumptions used in the projections analysis [a]

Key underlying assumptions**			Historical [b]*							Projected				
			1990	1995	2000	2005	2010	2011	...	2015	2020	2025	2030	2035
Activity	**Suggested units**	**Units reported**								**Scenario 'with existing measures'**				
General economic parameters														
Transport sector														
For Member States using macroeconomic models:														
23. The growth of transport relative to GDP	Gg fuel consumed/GDP													
For Member States using other models:														
24a. Growth of Passenger person kilometres (all transport modes in absolute figures)	million passenger km													
24b. Total kilometres by passenger cars, Mkm	million passenger km	Mio. veh. km								35,559	38,676	42,065	45,550	49,622
25a. The growth of freight tonne kilometres (absolute figures)	million tonne km													
25b. Freight transport (all modes), Mtkm	million tonne km	Mio. veh. km								12,403	13,299	14,215	15,160	16,428
Buildings (in residential and commercial or tertiary sector)														
26. Gross value-added — services, Bio Euro (EC95)	Value (EUR billion)	2005 prices, € billion								112.3	123.4	133.1	141.9	150.8
For Member States using macroeconomic models:														
27. The level of private consumption (excluding private transport)	Value (€)	2005 prices, € billion								103.1	117.0	128.9	139.6	150.4
28. The share of the tertiary sector in GDP and the growth rate (Implied Commercial GDP)	Value (€)	Share								59.8%	58.8%	59.4%	59.3%	59.3%
For Member States using other models:														
29. Average floor space per dwelling	m2 / dwelling													
30. Average Floor space per employee	m2 / employee													
The number of dwellings and number of employees in the tertiary sector														
31a. The number of dwellings	1000 dwellings									2291.4	2361.2	2433.1	2507.2	2581.3
31b. Number of employees in the tertiary sector	1000 employees													

Table 5

Summary of key variables and assumptions used in the projections analysis [a]

			Historical [b]*							Projected				
Key underlying assumptions**			1990	1995	2000	2005	2010	2011	...	2015	2020	2025	2030	2035
Activity	**Suggested units**	**Units reported**								Scenario 'with existing measures'				
General economic parameters														
Agriculture sector														
For Member States using macroeconomic models:														
32. The share of the agriculture sector in GDP and relative growth	Value (€)													
For Member States using other models:														
. The livestock numbers by animal type														
33. Total Cattle	1000 heads									**1531**	**1531**	**1531**	**1531**	**1531**
33a. Dairy cattle	1000 heads									549	549	549	549	549
33b. Non-dairy cattle	1000 heads									983	983	983	983	983
34. sheep	1000 heads									119	119	119	119	119
35. swine	1000 heads									13351	13607	14022	14314	14606
36. poultry	1000 heads									17609	17609	17609	17609	17609
37. Other, please specify	1000 heads									3995	3995	3995	3995	3995
38. The area of crops by crop type														
Please add rows and specify crop type	Hectares									2563905	2531405	2513905	2496405	2478905
39. Fertilizer used (synthetic & manure)	kt Nitrogen									392	382	379	376	375
The implied emissions factors														
40. enteric fermentation - dairy cattle	t CO2-equivalent / 1000 heads									2851	2951	3088	3225	3361
41. enteric fermentation - non-dairy cattle	t CO2-equivalent / 1000 heads									831	831	831	831	831
42. enteric fermentation - sheep	t CO2-equivalent / 1000 heads									361	361	361	361	361
43. manure management - dairy cattle	t CO2-equivalent / 1000 heads									721	567	560	552	529
44. manure management - non-dairy cattle	t CO2-equivalent / 1000 heads									330	332	332	332	332
45. manure management - sheep	t CO2-equivalent / 1000 heads									133	133	133	133	133
46. manure management - swine	t CO2-equivalent / 1000 heads									48	44	41	39	37
47. manure management - poultry	t CO2-equivalent / 1000 heads									6	6	6	6	6
48. fertilizer use & crops														
Please add rows and specify fertilizer type	kg N2O-N/kg N									0.0125	0.0125	0.0125	0.0125	0.0125
Please add rows and specify crop type and pollutant	tonne by crop type													
Waste sector														
49. Municipal solid waste generation	kt									10633	11140	12174	13069	14496
50. The organic fraction (DOC) of municipal solid waste	%									34	34	34	34	34
51. Municipal solid waste disposed to landfills	%									7	7	7	7	7
52. Municipal solid waste disposed incinerated	%									43	44	44	44	43
53. Municipal solid waste disposed composted	%									1	2	2	2	2
54. Municipal solid waste disposed to landfills	kt									744	780	852	915	1015
Forestry Sector														
55. Forest Definitions	Not specified													
56. Area of Managed Forest	1000 Hectares									595.3	611.1	626.9	642.7	659.8
57. Area of Unmanaged Forest	1000 Hectares													

[a] Parties should include key underlying assumptions as appropriate.

[b] Parties should include historical data used to develop the greenhouse gas projections reported.

* In general the starting point for the GHG projections are the latest historic GHG inventory data with the future delevelopment projected on the basis of the projected parameters only (i.e. not historic parameters) such as projected GDP, projected fuel prices etc.

** All activity parameters from the EU reporting is shown, although only numbers for the parameters used are reported.

TABLE 6(A): INFORMATION ON UPDATED GREENHOUSE GAS PROJECTIONS UNDER A 'WITH MEASURES' SCENARIO

Table 6(a)

Information on updated greenhouse gas projections under a 'with measures' scenario [a] *

	GHG emissions and removals [b] (kt CO2 eq)							GHG emission projections (kt CO2 eq)	
	Base year	1990	1995	2000	2005	2010	20XX[c]-3 =2011	2020	2030
Sector [d,e]									
Energy**	41333	41333	48042	40520	36978	35494	30689	21195	20089
Transport	10778	10778	12124	12355	13339	13223	12865	12641	13802
Industry/industrial processes***	2356	2356	2863	3537	2630	1872	2021	1409	1441
Agriculture	12545	12545	11592	10471	9852	9614	9672	8903	8876
Forestry/LULUCF	5473	5473	3649	3218	4695	-474	-2665	-3671	-3526
Waste management/waste	1709	1709	1521	1351	1135	1015	1002	749	615
Other (specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gas									
CO2 emissions including net CO2 from LULUCF	58309	58309	64566	56941	55810	48324	41213	30720	30904
CO2 emissions excluding net CO2 from LULUCF	52853	52853	60932	53737	51128	48811	43890	34409	34447
CH4 emissions including CH4 from LULUCF	6038	6038	6131	5882	5652	5589	5493	4920	4969
CH4 emissions excluding CH4 from LULUCF	6037	6037	6131	5882	5652	5589	5493	4920	4969
N2O emissions including N2O from LULUCF	9803	9803	8768	7946	6330	5975	6034	5444	5348
N2O emissions excluding N2O from LULUCF	9786	9786	8753	7932	6317	5962	6022	5427	5331
HFCs	NA,NE,NO	NA,NE,NO	218	607	802	804	759	73	61
PFCs	NA,NO	NA,NO	1	18	14	13	11	9	6
SF6	44	44	107	59	22	38	73	61	8
Other (specify, e.g. NF3)	NE	NE	NE	NE	NE	NE	NE	NE	NE
Total with LULUCF [f]	**74193**	**74193**	**79790**	**71453**	**68630**	**60743**	**53583**	**41226**	**41296**
Total without LULUCF	**68720**	**68720**	**76141**	**68235**	**63934**	**61217**	**56248**	**44898**	**44822**

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

[b] Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

[c] 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

[d] In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC

[e] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

[f] Parties may choose to report total emissions with or without LULUCF, as appropriate.

* Denmark without Greenland and the Faroe Islands.

** The IPCC category "Energy" excluding the subcategory "Transport".

*** Including the IPCC category "Solvent and Other Product Use".

Calculations for the CTF Table 6(a)	Base year	1990	1995	2000	2005	2010	20XX[c]-3 =2011	2020	2030
Energy (including Transport)	52111	52111	60165	52875	50317	48717	43554	33836	33891
Transport	10778	10778	12124	12355	13339	13223	12865	12641	13802
Energy**	**41333**	**41333**	**48042**	**40520**	**36978**	**35494**	**30689**	**21195**	**20089**
2. Industrial Processes	2240	2240	2726	3384	2441	1685	1854	1342	1380
3. Solvent and Other Product Use	116	116	137	154	189	187	167	67	61
Industry/industrial processes***	**2356**	**2356**	**2863**	**3537**	**2630**	**1872**	**2021**	**1409**	**1441**

TABLE 6(B): INFORMATION ON UPDATED GREENHOUSE GAS PROJECTIONS UNDER A 'WITHOUT MEASURES' SCENARIO

Table 6(b)

Information on updated greenhouse gas projections under a 'without measures' scenario [a] *

	GHG emissions and removals [b] (kt CO2 eq)							GHG emission projections (kt CO2 eq)	
	Base year	1990	1995	2000 #	2005	2010 ##	20XX[c]-3 =2011	2020	2030
Sector [d,e]									
Energy**				56800		64100			
Transport				13900		16300			
Industry/industrial processes***				700		1100			
Agriculture				13300		12700			
Forestry/LULUCF									
Waste management/waste				1500		1400			
Other (specify)									
Gas									
CO2 emissions including net CO2 from LULUCF									
CO2 emissions excluding net CO2 from LULUCF				69200		78500			
CH4 emissions including CH4 from LULUCF									
CH4 emissions excluding CH4 from LULUCF				5800		5500			
N2O emissions including N2O from LULUCF									
N2O emissions excluding N2O from LULUCF				10400		10600			
HFCs									
PFCs									
SF6									
Other (specify, e.g. NF3)****				800		1000			
Total with LULUCF [f]									
Total without LULUCF				**86200**		**95600**			

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

[b] Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

[c] 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

[d] In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 17 of those guidelines, namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry, agriculture, forestry and waste management.

[e] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

[f] Parties may choose to report total emissions with or without LULUCF, as appropriate.

* Denmark without Greenland and the Faroe Islands
** The IPCC category "Energy" excluding the subcategory "Transport".
*** Including the IPCC category "Solvent and Other Product Use".
**** Total F-gases under KP/CP1 (HFCs, PFCs and SF6)

The ex-post estimates in the Effort Analysis carried out in 2003-2005 are made for 2001. (Inventory estimate for 2001 in 2003: 69,4 MtCO2eq without LULUCF)

The ex-ante estimates in the Effort Analysis carried out in 2003-2005 are made for the average of projected annual emissions in 2008-2012. (Projection estimate for 2008-2012 in 2003: 80,1 MtCO2eq/year without LULUCF)

TABLE 6(C): INFORMATION ON UPDATED GREENHOUSE GAS PROJECTIONS UNDER A 'WITH ADDITIONAL MEASURES' SCENARIO

Table 6(c)

Information on updated greenhouse gas projections under a 'with additional measures' scenario [a]

	GHG emissions and removals [b] (kt CO2 eq)							GHG emission projections (kt CO2 eq)	
	Base year	1990	1995	2000	2005	2010	20XX[c]-3 =2011	2020	2030
Sector [d,e]									
Energy**	41333	41333	48042	40520	36978	35494	30689	NE#	NE#
Transport	10778	10778	12124	12355	13339	13223	12865	NE#	NE#
Industry/industrial processes***	2356	2356	2863	3537	2630	1872	2021	NE#	NE#
Agriculture	12545	12545	11592	10471	9852	9614	9672	NE#	NE#
Forestry/LULUCF	5473	5473	3649	3218	4695	-474	-2665	NE#	NE#
Waste management/waste	1709	1709	1521	1351	1135	1015	1002	NE#	NE#
Other (specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gas									
CO2 emissions including net CO2 from LULUCF	58309	58309	64566	56941	55810	48324	41213	NE#	NE#
CO2 emissions excluding net CO2 from LULUCF	52853	52853	60932	53737	51128	48811	43890	NE#	NE#
CH4 emissions including CH4 from LULUCF	6038	6038	6131	5882	5652	5589	5493	NE#	NE#
CH4 emissions excluding CH4 from LULUCF	6037	6037	6131	5882	5652	5589	5493	NE#	NE#
N2O emissions including N2O from LULUCF	9803	9803	8768	7946	6330	5975	6034	NE#	NE#
N2O emissions excluding N2O from LULUCF	9786	9786	8753	7932	6317	5962	6022	NE#	NE#
HFCs	NA,NE,NO	NA,NE,NO	218	607	802	804	759	NE#	NE#
PFCs	NA,NO	NA,NO	1	18	14	13	11	NE#	NE#
SF6	44	44	107	59	22	38	73	NE#	NE#
Other (specify, e.g. NF3)	NE	NE	NE	NE	NE	NE	NE	NE#	NE#
Total with LULUCF [f]	**74193**	**74193**	**79790**	**71453**	**68630**	**60743**	**53583**	NE#	NE#
Total without LULUCF	**68720**	**68720**	**76141**	**68235**	**63934**	**61217**	**56248**	NE#	NE#

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

[b] Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

[c] 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

[d] In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 17 of those guidelines, namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry, agriculture, forestry and waste management.

[e] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

[f] Parties may choose to report total emissions with or without LULUCF, as appropriate.

* Denmark without Greenland and the Faroe Islands.

** The IPCC category "Energy" excluding the subcategory "Transport".

*** Including the IPCC category "Solvent and Other Product Use".

\# The overall climate and energy objectives of the Danish Government referred are to implement measures to ensure that Denmark can meet its greenhouse gas reduction obligations under the Kyoto Protocol and the EU's Burden Sharing agreement – both in the period 2008-2012 and in the period 2013-2020, the latter being implemented in the EU through the Effort Sharing Decision according to which Denmark is committed to a 20 % reduction of greenhouse gas emissions from 2005 to 2020 in the non-ETS sectors. As the overall result of the latest "with measures" projection - with the effect of all adopted and implemented policies and measures and with the effect of projected credits from sinks and the use of the Kyoto Mechanisms - is that Denmark will achieve both its 2008-2012 target under the Kyoto Protocol and the EU Burden Sharing and its 20013-2020 target under the EU Effort Sharing Decision, there has not been a need for a "with additional measures" projection. In relation to the government's domestic 40 per cent reduction target in 2020, a catalogue of potential additional measures for the purpose of achieving this target was published in August 2013 in parallel with the government's Climate Policy Plan. However, it is not possible for the time being to say which, if any, of these potential measures are "having a realistic chance of being adopted and implemented in the future" cf. footnote 1 to paragraph 14 in the UNFCCC reporting guidelines on National Communications.

Calculations for the CTF Table 6(a)	Base year	1990	1995	2000	2005	2010	20XX[c]-3 =2011	2020	2030
Energy (including Transport)	52111	52111	60165	52875	50317	48717	43554	NE#	NE#
Transport	10778	10778	12124	12355	13339	13223	12865	NE#	NE#
Energy**	**41333**	**41333**	**48042**	**40520**	**36978**	**35494**	**30689**	NE#	NE#
2. Industrial Processes	2240	2240	2726	3384	2441	1685	1854	NE#	NE#
3. Solvent and Other Product Use	116	116	137	154	189	187	167	NE#	NE#
Industry/industrial processes***	**2356**	**2356**	**2863**	**3537**	**2630**	**1872**	**2021**	NE#	NE#

TABLE 7: PROVISION OF PUBLIC FINANCIAL SUPPORT: SUMMARY INFORMATION IN 20XX-3 AND 20XX-2

ision of public financial support: Summary information in the year 2011 (2014-3) and 2012 (2014-2)[a]

Year: 2011

Allocation channels		*Domestic currency*					*USD[b]*			
	Core /general[c] DKK MIO.	*Climate specific[d]*				*Core /general[c] USD MIO.*	*Climate specific[d]*			
		Mitigation	*Adaptation*	*Cross-cutting[e]*	*Other[f]*		*Mitigation*	*Adaptation*	*Cross-cutting[e]*	*Other[f]*
Total contributions through multilateral channels: Multilateral climate change funds[g]	100	NA	NA	NA	NA	19	NA	NA	NA	NA
Other multilateral climate change funds[h]	130	NA	NA	NA	NA	24	NA	NA	NA	NA
Multilateral financial institutions, including regional development banks	862	NA	NA	NA	NA	161	NA	NA	NA	NA
Specialized United Nations bodies	440	NA	NA	NA	NA	82	NA	NA	NA	NA
Total contributions through bilateral, regional and other channels	NA	589	47	86	NA	NA	110	9	16	NA
Total	**1,532**	**589**	**47**	**86**	**N/a**	**286**	**110**	**9**	**16**	**NA**

Abbreviations: USD = United States dollar. DKK = Danish Kroner

[a] Parties should fill in a separate table for each year, namely 20XX-3 and 20XX-2, where 20XX is the reporting year.

[b] Parties should provide an explanation on methodology used for currency exchange for the information provided in table 7, 7(a) and 7(b) in the box below.

[c] This refers to support to multilateral institutions that Parties cannot specify as climate specific.

[d] Parties should explain in their biennial reports how they define funds as being climate specific.

[e] This refers to funding for activities which are cross-cutting across mitigation and adaptation.

[f] Please specify.

[g] Multilateral climate change funds listed in paragraph 17(a) of the UNFCCC biennial reporting guidelines for developed country Parties in decision 2/CP.17.

[h] Other multilateral climate change funds as referred in paragraph 17(b) of the UNFCCC biennial reporting guidelines for developed country Parties in decision 2/CP.17.

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and (b).
Documentation box: According to the reporting requirements Annex II parties shall clarify how they have determined if resources are new and additional. When the terminology "new and additional" was used in Article 4.3 of the UNFCCC, the intent was to ensure that no development assistance funds would be diverted by Annex II developed country Parties to meet their obligations under the Convention. There is still not any agreement on a definition of new and additional. The Danish development assistance related to the UNFCCC is not diverted away from other priorities and is contained in the Danish ODA beyond the UN target of 0.7 per cent of GNI. Currency exchange (2011): USD100 = DKK 536,04 Currency exchange (2012): USD100 = DKK 578,99

Year: 2012										
Allocation channels		*Domestic currency*					*USD[b]*			
	Core /general[c] DKK MIO.	*Climate specific[d]*				*Core /general[c] USD MIO.*	*Climate specific[d]*			
		Mitigation	*Adaptation*	*Cross-cutting[e]*	*Other[f]*		*Mitigation*	*Adaptation*	*Cross-cutting[e]*	*Other[f]*
Total contributions through multilateral channels:	100					17				
Multilateral climate change funds[g]		N/a	N/a	N/a	N/a		N/a	N/a	N/a	N/a
Other multilateral climate change funds[h]	47	N/a	N/a	N/a	N/a	8	N/a	N/a	N/a	N/a
Multilateral financial institutions, including regional development banks	983	N/a	N/a	N/a	N/a	170	N/a	N/a	N/a	N/a
Specialized United Nations bodies	397	N/a	N/a	N/a	N/a	69	N/a	N/a	N/a	N/a
Total contributions through bilateral, regional and other channels	1,882	389	111	381	N/a	326	67	19	66	N/a
Total	**3,409**	**389**	**111**	**381**	**N/a**	**590**	**67**	**19**	**66**	N/a

Abbreviations: USD = United States dollar. DKK = Danish Kroner
[a] Parties should fill in a separate table for each year, namely 20XX-3 and 20XX-2, where 20XX is the reporting year.
[b] Parties should provide an explanation on methodology used for currency exchange for the information provided in table 7, 7(a) and 7(b) in the box below.
[c] This refers to support to multilateral institutions that Parties cannot specify as climate specific.
[d] Parties should explain in their biennial reports how they define funds as being climate specific.
[e] This refers to funding for activities which are cross-cutting across mitigation and adaptation.
[f] Please specify.
[g] Multilateral climate change funds listed in paragraph 17(a) of the UNFCCC biennial reporting guidelines for developed country Parties in decision 2/CP.17.
[h] Other multilateral climate change funds as referred in paragraph 17(b) of the UNFCCC biennial reporting guidelines for developed country Parties in decision 2/CP.17.

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and (b).
Documentation box: According to the reporting requirements Annex II parties shall clarify how they have determined if resources are new and additional. When the terminology “new and additional” was used in Article 4.3 of the UNFCCC, the intent was to ensure that no development assistance funds would be diverted by Annex II developed country Parties to meet their obligations under the Convention. There is still not any agreement on a definition of new and additional. The Danish development assistance related to the UNFCCC is not diverted away from other priorities and is contained in the Danish ODA beyond the UN target of 0.7 per cent of GNI. Currency exchange (2011): USD100 = DKK 536,04 Currency exchange (2012): USD100 = DKK 578,99

TABLE 7(A): PROVISION OF PUBLIC FINANCIAL SUPPORT: CONTRIBUTION THROUGH MULTILATERAL CHANNELS IN 20XX-3

Provision of public financial support: Contribution through multilateral channels in the year 2011 (2014-3)[a]									
Donor funding	*Total amount*				*Status[b]*	*Funding source*	*Financial instrument*	*Type of support*	*Sector[c]*
	Core /general[d]		*Climate specific[e]*		*Provided Committed Pledged*	*ODA OOF Other[f]*	*Grant Concessional loan Non-concessional loan Equity Other[f]*	*Mitigation Adaptation Cross-cutting[g] Other[f]*	*Energy Transport Industry Agriculture Forestry Water and sanitation Cross-cutting Other[f] Not applicable*
	Domestic currency DKK MIO.	*USD MIO.*	*Domestic currency*	*USD*					
Multilateral climate change funds									
1. Global Environment Facility	100	19							
2. Least Developed Countries Fund	0	0							
3. Special Climate Change Fund	0	0							
4. Adaptation Fund	0	0							
5. Green Climate Fund	0	0							
6. UNFCCC Trust Fund for Supplementary Activities	0	0			Committed	ODA	Grant	N/a	N/a
7. Other multilateral climate change funds	0	0							
Subtotal	100	19							
Multilateral financial institutions, including regional development banks									
1. World Bank	537	100							
2. International Finance Corporation	16	3							
3. African Development Bank	246	46							
4. Asian Development Bank	25	5							
5. European Bank for Reconstruction and Development	0	0							
6. Inter-American Development Bank	0	0							
7. Other	0	0			Committed	ODA	Grant	N/a	N/a
Subtotal	824	154							
Specialized United Nations bodies									
1. United Nations Development Programme (specific programmes)	405	76							
2. United Nations Environment Programme (specific programmes)	35	7			Committed	ODA	Grant	N/a	N/a
3. Other	0	0							
Subtotal	440	83							
Total	**1,364**	**256**							

Abbreviations: ODA = official development assistance, OOF = other official flows.

[a] Parties should fill in a separate table for each year, namely 20XX-3 and 20XX-2, where 20XX is the reporting year.

[b] Parties should explain, in their biennial reports, the methodologies used to specify the funds as provided, committed and/or pledged. Parties will provide the information for as many status categories as appropriate in the following order of priority: provided, committed, pledged.

[c] Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under “Other”.

[d] This refers to support to multilateral institutions that Parties cannot specify as climate specific.

[e] Parties should explain in their biennial reports how they define funds as being climate specific.
[f] Please specify.
[g] This refers to funding for activities which are cross-cutting across mitigation and adaptation.

TABLE 7(A): PROVISION OF PUBLIC FINANCIAL SUPPORT: CONTRIBUTION THROUGH MULTILATERAL CHANNELS IN 20XX-2

Provision of public financial support: Contribution through multilateral channels in the year 2012 (2014-2)[a]									
Donor funding	*Total amount*				*Status[b]*	*Funding source*	*Financial instrument*	*Type of support*	*Sector[c]*
	Core /general[d]		*Climate specific[e]*		*Provided Committed Pledged*	*ODA OOF Other[f]*	*Grant Concessional loan Non-concessional loan Equity Other[f]*	*Mitigation Adaptation Cross-cutting[g] Other[f]*	*Energy Transport Industry Agriculture Forestry Water and sanitation Cross-cutting Other[f] Not applicable*
	Domestic currency DKK MIO.	*USD MIO.*	*Domestic currency*	*USD*					
Multilateral climate change funds									
1. Global Environment Facility	100	17							
2. Least Developed Countries Fund	0	0							
3. Special Climate Change Fund	0	0							
4. Adaptation Fund	0	0							
5. Green Climate Fund	0	0							
6. UNFCCC Trust Fund for Supplementary Activities	3	0.5	N/a	N/a	Committed	ODA	Grant	N/a	N/a
7. Other multilateral climate change funds	0	0							
Subtotal	103	17.5							
Multilateral financial institutions, including regional development banks									
1. World Bank	658	114							
2. International Finance Corporation	9	2							
3. African Development Bank	291	51							
4. Asian Development Bank	25	4							
5. European Bank for Reconstruction and Development	0	0							
6. Inter-American Development Bank	0	0							
7. Other	0	0	N/a	N/a	Committed	ODA	Grant	N/a	N/a
Subtotal	983	171							
Specialized United Nations bodies									
1. United Nations Development Programme (specific programmes)	36	6							
2. United Nations Environment Programme (specific programmes)	3	0.5	N/a		Committed	ODA	Grant	N/a	N/a
3. Other	0	0							
Subtotal	39	6.5							
Total	**1,125**	**195**							

Abbreviations: ODA = official development assistance, OOF = other official flows.

[h] Parties should fill in a separate table for each year, namely 20XX-3 and 20XX-2, where 20XX is the reporting year.

[i] Parties should explain, in their biennial reports, the methodologies used to specify the funds as provided, committed and/or pledged. Parties will provide the information for as many status categories as appropriate in the following order of priority: provided, committed, pledged.

[j] Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under "Other".

[k] This refers to support to multilateral institutions that Parties cannot specify as climate specific.

[l] Parties should explain in their biennial reports how they define funds as being climate specific.

[m] Please specify.
[n] This refers to funding for activities which are cross-cutting across mitigation and adaptation.

TABLE 7(B): PROVISION OF PUBLIC FINANCIAL SUPPORT: CONTRIBUTION THROUGH BILATERAL, REGIONAL AND OTHER CHANNELS IN 20XX-3

Provision of public financial support: Contribution through bilateral, regional and other channels for the year 2011 (2014-3)[a]								
Recipient country/ region/project/programme[b]	*Total amount*		*Status[c]*	*Funding source*	*Financial instrument*	*Type of support*	*Sector[d]*	*Additional information[e]*
	Climate Specific[f]		*Provided, Committed, Pledged*	*ODA OOF Other[g]*	*Grant Concessional loan Non-concessional loan Equity Other[g]*	*Mitigation Adaptation Cross-cutting[h] Other[g]*	*Energy Transport Industry Agriculture Forestry Water and sanitation Cross-cutting Other[g]*	
	Domestic currency	*USD*						
Bilateral total	589	110	Provided	ODA	Grant	Mitigation	Total	
Bilateral total	47	9	Provided	ODA	Grant	Adaptation	Total	
Bilateral total	86	16	Provided	ODA	Grant	Cross-cutting	Total	

Abbreviations: ODA = official development assistance, OOF = other official flows; USD = United States dollar.

[a] Parties should fill in a separate table for each year, namely 20XX-3 and 20XX-2, where 20XX is the reporting year.

[b] Parties should report, to the extent possible, on details contained in this table.

[c] Parties should explain, in their biennial reports, the methodologies used to specify the funds as provided, committed and/or pledged. Parties will provide the information for as many status categories as appropriate in the following order of priority: provided, committed, pledged.

[d] Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under “Other”.

[e] Parties should report, as appropriate, on project detail and implementing agency.

[f] Parties should explain in their biennial reports how they define funds as being climate specific.

[g] Please specify.

[h] This refers to funding for activities which are cross-cutting across mitigation and adaptation.

TABLE 7(B): PROVISION OF PUBLIC FINANCIAL SUPPORT: CONTRIBUTION THROUGH BILATERAL, REGIONAL AND OTHER CHANNELS IN 20XX-2

Provision of public financial support: Contribution through bilateral, regional and other channels for the year 2012 (2014-2)[a]								
	Total amount		*Status[c]*	*Funding source*	*Financial instrument*	*Type of support*	*Sector[d]*	*Additional information[e]*
Recipient country/ region/project/programme[b]	*Climate Specific[f]*		*Provided, Committed, Pledged*	*ODA OOF Other[g]*	*Grant Concessional loan Non-concessional loan Equity Other[g]*	*Mitigation Adaptation Cross-cutting[h] Other[g]*	*Energy Transport Industry Agriculture Forestry Water and sanitation Cross-cutting Other[g]*	
	Domestic currency	*USD*						
Bilateral total	389	67	Provided	ODA	Grant	Mitigation	Total	
Bilateral total	111	19	Provided	ODA	Grant	Adaptation	Total	
Bilateral total	381	66	Provided	ODA	Grant	Cross-cutting	Total	

Abbreviations: ODA = official development assistance, OOF = other official flows; USD = United States dollar.

[i] Parties should fill in a separate table for each year, namely 20XX-3 and 20XX-2, where 20XX is the reporting year.

[j] Parties should report, to the extent possible, on details contained in this table.

[k] Parties should explain, in their biennial reports, the methodologies used to specify the funds as provided, committed and/or pledged. Parties will provide the information for as many status categories as appropriate in the following order of priority: provided, committed, pledged.

[l] Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under "Other".

[m] Parties should report, as appropriate, on project detail and implementing agency.

[n] Parties should explain in their biennial reports how they define funds as being climate specific.

[o] Please specify.

[p] This refers to funding for activities which are cross-cutting across mitigation and adaptation.

TABLE 8: PROVISION OF TECHNOLOGY DEVELOPMENT AND TRANSFER SUPPORT

Provision of technology development and transfer support [a,b]							
Recipient country and/or region	Targeted area	Measures and activities related to technology transfer	Sector [c]	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information [d]
	Mitigation Adaptation Mitigation and adaptation		Energy Transport Industry Agriculture Water and sanitation Other	Private Public Private and public	Private Public Private and public	Implemented Planned	
							Information on Denmark's provision of technology development and transfer support is available in Chapter VI of the textual part of Denmark's First Biennial Report.

[a] To be reported to the extent possible.

[b] The tables should include measures and activities since the last national communication or biennial report.

[c] Parties may report sectoral disaggregation, as appropriate.

[d] Additional information may include, for example, funding for technology development and transfer provided, a short description of the measure or activity and co-financing arrangements.

TABLE 9: PROVISION OF CAPACITY-BUILDING SUPPORT

Provision of capacity-building support [a]			
Recipient country/ region	**Targeted area**	**Programme or project title**	**Description of programme or project [b,c]**
	Mitigation Adaptation Technology development and transfer Multiple areas		
			Information on Denmark's provision of capacity building support is available in Chapter VI of the textual part of Denmark's First Biennial Report.

[a] To be reported to the extent possible.

[b] Each Party included in Annex II to the Convention shall provide information, to the extent possible, on how it has provided capacity-building support that responds to the existing and emerging capacity-building needs identified by Parties not included in Annex I to the Convention in the areas of mitigation, adaptation and technology development and transfer.

[c] Additional information may be provided on, for example, the measure or activity and co-financing arrangements.

Annex E Results and supplementary information concerning greenhouse gas projections

This Annex consists of the following four sub-annexes:

Annex E1: The results of Denmark's September 2012 'with measures' projection of greenhouse gas emissions 2011-2035, cf. *Nielsen O.-K. et al.,* (DCE, February 2013).

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 (CH_4), nitrous oxide (N_2O) and the F-gases (HFCs, PFCs and SF_6) respectively. Calculation of the emissions for the various IPCC categories are described in chapters 2-13 in Projection of greenhouse gases 2011-2035, Aarhus University, DCE – Danish Centre for Environment and Energy, Scientific Report No. 48, February 2013 (http://www2.dmu.dk/Pub/SR48.pdf).

[#] KP BY is Denmark's base year emissions included in the base year of the EU Burden Sharing Agreement (i.e. without Greenland's base year emissions) and as established in 2007 for the first commitment period under the Kyoto Protocol (i.e. without later recalculations).

Notes to Table E1-8:
* Emissions from the IPCC category "Solvent and Other Product Use" is included here.

** Corresponds to the IPCC category "Agriculture". Agriculture's energy consumption is included under "Energy (excluding Transport)".

*** Projections of emissions and removals in the IPCC category LULUCF (land-use, land-use change and forestry) include all emissions by sources and removal by sinks in the category. However, under the Kyoto Protocol only emissions by sources and removal by sinks related to activities under Articles 3.3 and 3.4 of the Kyoto Protocol can be included in the accounting towards targets under the Kyoto Protocol as described in Chapter 5.

**** Also includes emissions from wastewater treatment, cf. the IPCC guidelines.

Annex E2: A brief description of the work involved in preparing the energy projections.

Annex E3: Data for the August 2013 MAC-curve.

Annex E4: A comparison of the latest reported greenhouse gas inventory with the "with measures" projections of Denmark's total greenhouse gas emissions included in Denmark's first to sixth national communication.

TABLE E1-1: THE RESULT OF DENMARK'S 'WITH MEASURES' GREENHOUSE GAS PROJECTION 2012-2035 AS REGARDS CO2

Source: Nielsen O.-K. et al., (DCE, February 2013).

CO2 emissions and projections (Gg)	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
Total (including LULUCF)	52712	58309	64566	56941	55810	48324	39407	45978	33560	33488	30720	29742	30904	31857
Total (excluding LULUCF)	52712	52853	60932	53737	51128	48811	43139	47035	37246	37154	34409	33359	34447	35370
1. Total Energy	51474	51567	59281	51873	49331	47791	42025	45851	36048	35992	33137	32049	33077	33928
A Fuel Combustion Activities (Sectoral Approach)	51211	51242	58831	51153	48788	47434	41812	45554	35857	35807	32958	31870	32905	33756
1 Energy Industries	26173	26146	32163	25542	22720	23596	19343	22069	14566	14100	13183	12090	12705	12869
a Public Electricity and Heat Production	24736	24695	30032	23082	20164	21250	16989	19656	12342	11947	10903	9343	9610	9798
b Petroleum Refining	897	906	1384	998	938	854	900	909	900	900	900	900	900	900
c Manufacture of Solid Fuels and Other Energy Industries	540	545	746	1461	1619	1492	1454	1504	1324	1253	1380	1847	2195	2172
2 Manufacturing Industries and Construction	5423	5385	5853	5965	5461	4372	4271	4392	3455	3725	2771	2632	2503	2417
3 Transport	10336	10619	11940	12173	13166	13072	12444	13059	12800	12707	12494	12885	13633	14566
a Civil Aviation	243	243	199	154	135	156	146	152	149	148	153	155	152	152
b Road Transportation	9241	9284	10589	11203	12214	12081	11532	12093	11885	11793	11575	11964	12715	13648
c Railways	297	297	303	228	232	242	106	213	106	106	106	106	106	106
d Navigation	555	796	850	588	585	593	660	601	660	660	660	660	660	660
e Other Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other non-specified	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Other Sectors	9159	8974	8623	7363	7170	6287	5600	5891	4883	5122	4356	4110	3911	3750
a Commercial/Institutional	1403	1486	1221	985	1113	1052	928	994	841	864	783	749	714	682
b Residential	5084	5003	4983	4029	3681	3057	2818	2810	2200	2377	1786	1585	1427	1293
c Agriculture/Forestry/Fisheries	2673	2485	2418	2349	2376	2179	1854	2086	1841	1881	1787	1776	1770	1775
5 Other	119	119	252	111	271	107	153	144	153	153	153	153	153	153
B Fugitive Emissions from Fuels	263	325	449	720	543	357	213	297	191	185	179	179	172	172
1 Solid Fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	263	325	449	720	543	357	213	297	191	185	179	179	172	172
a Oil	0	2	4	7	7	5	4	5	3	3	3	3	3	3
b Natural Gas	0	0	0	0	0	0	3	1	2	2	2	2	2	2
c Venting and Flaring	263	322	446	713	536	352	206	291	185	180	174	174	168	168
d. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Total Industrial Processes	1101	1152	1496	1696	1603	829	1035	1029	1123	1086	1200	1242	1305	1379
A Mineral Products	1072	1069	1404	1611	1542	792	998	992	1085	1049	1162	1203	1266	1340
B Chemical Industry	1	1	1	1	3	2	2	2	2	2	3	3	3	3
C Metal Production	28	28	39	41	16	0	0	0	0	0	0	0	0	0
D Other Production	0	4	4	4	4	2	2	2	2	2	2	2	3	3
E Production of Halocarbons and SF6														
F Consumption of Halocarbons and SF6														
G Other	0	50	49	40	38	33	33	33	33	33	33	33	33	33
3. Total Solvent and Other Product Use	137	115	135	150	176	173	60	136	55	57	52	49	46	43
4. Total 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														
E Prescribed Burning of Savannas														
F Field Burning of Agricultural Residues														
G Other														
5. Total Land-Use Categories (LULUCF)	0	5456	3634	3204	4682	-487	-3732	-1058	-3686	-3667	-3689	-3617	-3543	-3513
A Forest Land	0	119	-962	-771	667	-4362	449	-3229	463	497	418	426	434	442
B Cropland	0	5046	4362	3733	3654	3530	-3807	1955	-3759	-3780	-3706	-3666	-3587	-3547
C Grassland	0	183	152	159	203	217	-210	144	-214	-212	-216	-220	-224	-229
D Wetlands	0	91	60	56	114	75	-11	60	-6	-8	-2	46	54	60
E Settlements	0	16	21	27	44	54	-152	12	-169	-164	-183	-202	-221	-240
F Other Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Total Waste	0	18	20	19	18	18	20	20	19	19	20	20	20	20
A Solid Waste Disposal on Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Waste Water Handling														
C Waste Incineration	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Other	0	18	20	19	18	18	20	20	19	19	20	20	20	20
7. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (not included above):														
International Bunkers	4823	4741	6843	6517	4926	4484	4864	4639	5128	5001	5392	5503	5297	5297
Aviation	1736	1736	1867	2350	2574	2421	2610	2497	2873	2746	3137	3248	3042	3042
Marine	3087	3005	4976	4168	2352	2063	2255	2142	2255	2255	2255	2255	2255	2255
Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2 Emissions from Biomass	4641	4662	5725	6899	10728	14902	NE	NE	NE	NE	NE	NE	NE	NE

TABLE E1-2: THE RESULT OF DENMARK'S 'WITH MEASURES' GREENHOUSE GAS PROJECTION 2012-2035 AS REGARDS METHANE (CH4)

Source: Nielsen O.-K. et al., (DCE, February 2013).

CH4 emissions and projections (Gg CO2	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
Total (including LULUCF)	5692	6038	6131	5882	5652	5589	5355	5517	5052	5091	4920	4916	4969	5001
Total (excluding LULUCF)	5692	6037	6131	5882	5652	5589	5355	5517	5052	5091	4920	4916	4969	5001
1. Total Energy	222	222	516	633	608	547	524	523	400	396	367	390	448	481
A Fuel Combustion Activities (Sectoral Approach)	182	178	445	547	498	435	418	408	297	295	264	292	348	381
1 Energy Industries	23	14	239	307	262	233	270	220	160	159	127	153	207	234
a Public Electricity and Heat Production	22	14	238	306	260	231	269	218	159	158	126	152	206	232
b Petroleum Refining	1	0	1	0	0	0	0	0	0	0	0	0	0	0
c Manufacture of Solid Fuels and Other Energy Industries	0	0	0	1	1	1	1	1	1	1	1	1	1	1
2 Manufacturing Industries and Construction	15	8	10	25	21	14	11	13	23	18	35	37	39	42
3 Transport	53	48	48	39	28	15	12	16	9	10	8	7	7	8
a Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Road Transportation	52	47	47	38	27	14	12	15	9	9	7	7	7	7
c Railways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d Navigation	1	1	1	1	1	1	0	1	0	0	0	0	0	0
e Other Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other non-specified	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Other Sectors	91	108	148	176	188	173	124	159	104	109	94	94	95	97
a Commercial/Institutional	4	4	16	21	21	18	6	15	7	7	8	8	8	8
b Residential	68	78	96	101	120	123	98	116	73	80	59	54	48	49
c Agriculture/Forestry/Fisheries	20	26	35	54	48	31	19	28	24	22	27	32	38	40
5 Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Fugitive Emissions from Fuels	40	44	71	86	109	112	106	115	103	101	103	98	100	100
1 Solid Fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	40	44	71	86	109	112	106	115	103	101	103	98	100	100
a Oil	32	33	50	75	99	106	102	108	98	96	98	94	96	96
b Natural Gas	6	9	18	8	8	4	2	4	2	2	2	2	2	2
c Venting and Flaring	2	2	4	3	2	2	2	3	2	2	2	2	2	2
d. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Total Industrial Processes	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
B Chemical Industry	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
D Other Production														
E Production of Halocarbons and SF6														
F Consumption of Halocarbons and SF6														
G Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Total Solvent and Other Product Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Total Agriculture	4011	4242	4239	4048	4043	4165	4050	4113	3988	3997	3967	4024	4082	4128
A Enteric Fermentation	3259	3247	3134	2861	2737	2862	2798	2831	2813	2795	2853	2935	3017	3098
B Manure Management	752	993	1103	1184	1303	1300	1250	1280	1172	1199	1111	1087	1062	1028
C Rice Cultivation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Agricultural Soils	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E Prescribed Burning of Savannas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Field Burning of Agricultural Residues	0	2	2	3	3	2	3	2	3	3	3	3	3	3
G Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Total Land-Use Categories (LULUCF)	0	1	0	0	0	0	0	0	0	0	0	0	0	0
A Forest Land	0	1	0	0	0	0	0	0	0	0	0	0	0	0
B Cropland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C Grassland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E Settlements	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Other Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Total Waste	1460	1573	1376	1200	1000	878	781	881	664	697	586	502	439	392
A Solid Waste Disposal on Land	1334	1478	1270	1062	856	720	625	725	500	536	415	321	248	192
B Waste Water Handling	126	66	69	74	74	75	75	75	76	76	77	78	79	80
C Waste Incineration	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Other	0	30	38	64	70	82	81	80	88	86	94	103	111	119
7. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (not included above):														
International Bunkers	2	2	3	3	1	1	1	1	1	1	1	1	1	1
Aviation	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Marine	1	1	2	2	1	1	1	1	1	1	1	1	1	1
Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2 Emissions from Biomass														

TABLE E1-3: THE RESULT OF DENMARK'S 'WITH MEASURES' GREENHOUSE GAS PROJECTION 2012-2035 AS REGARDS NITROUS OXIDE (N2O)

Source: Nielsen O.-K. et al., (DCE, February 2013).

N2O emissions and projections (Gg CO2	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
Total (including LULUCF)	10593	9803	8768	7946	6330	5975	5864	6055	5607	5662	5444	5392	5348	5303
Total (excluding LULUCF)	10593	9786	8753	7932	6317	5962	5847	6041	5590	5644	5427	5375	5331	5285
1. Total Energy	425	323	369	369	378	379	350	369	336	333	333	346	365	378
A Fuel Combustion Activities (Sectoral Approach)	424	322	368	367	376	378	349	368	335	332	332	345	365	378
1 Energy Industries	119	85	112	110	103	108	88	99	77	74	73	75	82	83
a Public Electricity and Heat Production	103	78	101	91	89	99	79	90	69	66	65	64	69	70
b Petroleum Refining	9	1	3	2	1	1	1	1	1	1	1	1	1	1
c Manufacture of Solid Fuels and Other Energy Industries	6	6	9	17	12	8	8	8	7	7	7	10	12	12
2 Manufacturing Industries and Construction	54	54	47	45	40	36	35	36	34	34	34	34	34	34
3 Transport	141	111	135	144	145	136	134	137	136	134	139	150	162	172
a Civil Aviation	3	3	3	2	3	3	2	2	2	2	2	2	2	2
b Road Transportation	125	91	114	129	130	120	119	122	121	119	124	135	147	157
c Railways	3	3	3	2	2	2	1	2	1	1	1	1	1	1
d Navigation	10	15	16	11	10	11	12	11	12	12	12	12	12	12
e Other Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other non-specified	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Other Sectors	109	71	71	67	86	98	91	93	87	89	84	84	85	87
a Commercial/Institutional	12	8	10	8	10	11	10	10	9	10	9	8	8	8
b Residential	57	28	29	29	43	54	52	51	49	50	46	46	47	47
c Agriculture/Forestry/Fisheries	40	34	32	30	33	33	29	32	29	30	29	30	31	32
5 Other	1	1	2	1	3	1	2	2	2	2	2	2	2	2
B Fugitive Emissions from Fuels	1	1	1	2	1	1	0	1	0	0	0	0	0	0
1 Solid Fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	1	1	1	2	1	1	0	1	0	0	0	0	0	0
a Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Natural Gas														
c Venting and Flaring	1	1	1	2	1	1	0	1	0	0	0	0	0	0
d. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Total Industrial Processes	1043	1043	904	1004	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
B Chemical Industry	1043	1043	904	1004	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
D Other Production														
E Production of Halocarbons and SF6														
F Consumption of Halocarbons and SF6														
G Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Total Solvent and Other Product Use	0	1	2	4	13	14	15	15	15	15	15	15	15	15
4. Total Agriculture	9037	8303	7353	6423	5809	5449	5348	5532	5100	5159	4936	4864	4794	4730
A Enteric Fermentation														
B Manure Management	685	600	566	537	512	423	385	418	308	336	243	206	170	133
C Rice Cultivation														
D Agricultural Soils	8352	7702	6787	5885	5295	5026	4962	5113	4791	4822	4692	4657	4624	4597
E Prescribed Burning of Savannas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Field Burning of Agricultural Residues	0	1	1	1	1	1	1	1	1	1	1	1	1	1
G Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Total Land-Use Categories (LULUCF)	0	16	15	14	13	13	17	14	17	17	17	17	17	17
A Forest Land	0	16	15	14	13	12	12	12	12	12	12	12	12	12
B Cropland	0	0	0	0	0	0	5	1	5	5	5	5	5	5
C Grassland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E Settlements	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Other Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Total Waste	88	117	125	132	117	119	134	125	139	137	144	150	156	162
A Solid Waste Disposal on Land														
B Waste Water Handling	88	105	108	90	84	76	91	84	92	92	92	93	94	95
C Waste Incineration	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Other	0	12	16	41	32	43	42	42	47	46	51	56	61	66
7. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (not included above):														
International Bunkers	78	77	117	107	73	66	79	70	82	81	86	87	85	85
Aviation	18	18	20	25	28	26	35	28	38	37	42	44	41	41
Marine	60	59	97	81	46	40	44	42	44	44	44	44	44	44
Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2 Emissions from Biomass														

TABLE E1-4: THE RESULT OF DENMARK'S 'WITH MEASURES' GREENHOUSE GAS PROJECTION 2012-2035 AS REGARDS HFCS

Source: Nielsen O.-K. et al., (DCE, February 2013).

HFCs emissions and projections (Gg CO_2	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
Total (including LULUCF)	218	0	218	607	802	804	667	776	323	438	73	62	61	61
Total (excluding LULUCF)	218	0	218	607	802	804	667	776	323	438	73	62	61	61
1. Total Energy	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A Fuel Combustion Activities (Sectoral Approach)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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														
3 Transport														
a Civil Aviation														
b Road Transportation														
c Railways														
d Navigation														
e Other Transportation														
Other non-specified														
4 Other Sectors														
a Commercial/Institutional														
b Residential														
c Agriculture/Forestry/Fisheries														
5 Other														
B Fugitive Emissions from Fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Solid Fuels														
2 Oil and Natural Gas														
a Oil														
b Natural Gas														
c Venting and Flaring														
d. Other														
2. Total Industrial Processes	218	0	218	607	802	804	667	776	323	438	73	62	61	61
A Mineral Products														
B Chemical Industry														
C Metal Production														
D Other Production														
E Production of Halocarbons and SF6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Consumption of Halocarbons and SF6	218	0	218	607	802	804	667	776	323	438	73	62	61	61
G Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Total Solvent and Other Product Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Total 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														
E Prescribed Burning of Savannas														
F Field Burning of Agricultural Residues														
G Other														
5. Total Land-Use Categories (LULUCF)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A Forest Land														
B Cropland														
C Grassland														
D Wetlands														
E Settlements														
F Other Land														
G Other (please specify)														
6. Total 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	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (not included above):														
International Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation														
Marine														
Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2 Emissions from Biomass														

TABLE E1-5: THE RESULT OF DENMARK'S 'WITH MEASURES' GREENHOUSE GAS PROJECTION 2012-2035 AS REGARDS PFCS

Source: Nielsen O.-K. et al., (DCE, February 2013).

PFCs emissions and projections (Gg CO2	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
Total (including LULUCF)	1	0	1	18	14	13	12	13	10	10	9	7	6	6
Total (excluding LULUCF)	1	0	1	18	14	13	12	13	10	10	9	7	6	6
1. Total Energy	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A Fuel Combustion Activities (Sectoral Approach)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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														
3 Transport														
a Civil Aviation														
b Road Transportation														
c Railways														
d Navigation														
e Other Transportation														
Other non-specified														
4 Other Sectors														
a Commercial/Institutional														
b Residential														
c Agriculture/Forestry/Fisheries														
5 Other														
B Fugitive Emissions from Fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Solid Fuels														
2 Oil and Natural Gas														
a Oil														
b Natural Gas														
c Venting and Flaring														
d. Other														
2. Total Industrial Processes	1	0	1	18	14	13	12	13	10	10	9	7	6	6
A Mineral Products														
B Chemical Industry														
C Metal Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Other Production														
E Production of Halocarbons and SF6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Consumption of Halocarbons and SF6	1	0	1	18	14	13	12	13	10	10	9	7	6	6
G Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Total Solvent and Other Product Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Total 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														
E Prescribed Burning of Savannas														
F Field Burning of Agricultural Residues														
G Other														
5. Total Land-Use Categories (LULUCF)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A Forest Land														
B Cropland														
C Grassland														
D Wetlands														
E Settlements														
F Other Land														
G Other (please specify)														
6. Total 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	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (not included above):														
International Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation														
Marine														
Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2 Emissions from Biomass														

TABLE E1-6: THE RESULT OF DENMARK'S 'WITH MEASURES' GREENHOUSE GAS PROJECTION 2012-2035 AS REGARDS SF6

Source: Nielsen O.-K. et al., (DCE, February 2013).

SF6 emissions and projections (Gg CO2 e	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
Total (including LULUCF)	107	44	107	59	22	38	117	59	100	125	61	14	8	8
Total (excluding LULUCF)	107	44	107	59	22	38	117	59	100	125	61	14	8	8
1. Total Energy	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A Fuel Combustion Activities (Sectoral Approach)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Energy Industries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a Public Electricity and Heat Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Petroleum Refining	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c Manufacture of Solid Fuels and Other Energy Industries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Manufacturing Industries and Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Road Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c Railways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d Navigation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
e Other Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other non-specified	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a Commercial/Institutional	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c Agriculture/Forestry/Fisheries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Fugitive Emissions from Fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Solid Fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a Oil	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
c Venting and Flaring	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Total Industrial Processes	107	44	107	59	22	38	117	59	100	125	61	14	8	8
A Mineral Products	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
C Metal Production	36	31	36	21	0	0	0	0	0	0	0	0	0	0
D Other Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E Production of Halocarbons and SF6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Consumption of Halocarbons and SF6	71	13	71	38	22	38	117	59	100	125	61	14	8	8
G Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Total Solvent and Other Product Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Total Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A Enteric Fermentation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Manure Management	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C Rice Cultivation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Agricultural Soils	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E Prescribed Burning of Savannas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Field Burning of Agricultural Residues	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Total Land-Use Categories (LULUCF)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A Forest Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Cropland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C Grassland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E Settlements	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Other Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Total Waste	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
B Waste Water Handling	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C Waste Incineration	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (not included above):														
International Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marine	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2 Emissions from Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE E1-7: THE RESULT OF DENMARK'S 'WITH MEASURES' GREENHOUSE GAS PROJECTION 2012-2035 AS REGARDS THE TOTAL INVENTORIES (GHG)

Source: Nielsen O.-K. et al., (DCE, February 2013).

GHG emissions and projections (Gg CO2	KP BY#	1990	1995	2000	2005	2010	2012	2008-12	2013-20	2015	2020	2025	2030	2035
Total (including LULUCF)	69323	74193	79790	71453	68630	60743	51422	58398	44652	44813	41226	40134	41296	42236
Total (excluding LULUCF)	69323	68720	76141	68235	63934	61217	55137	59442	48320	48463	44898	43733	44822	45731
1. Total Energy	52121	52111	60165	52875	50317	48717	42898	46742	36784	36721	33836	32784	33891	34787
A Fuel Combustion Activities (Sectoral Approach)	51817	51742	59644	52067	49663	48247	42579	46330	36490	36434	33554	32507	33618	34514
1 Energy Industries	26315	26246	32514	25959	23085	23936	19701	22388	14803	14333	13383	12318	12994	13186
a Public Electricity and Heat Production	24861	24786	30371	23479	20513	21580	17337	19964	12569	12171	11093	9559	9884	10100
b Petroleum Refining	908	908	1388	1001	939	855	901	910	901	901	901	901	901	901
c Manufacture of Solid Fuels and Other Energy Industries	546	552	756	1480	1632	1501	1463	1513	1332	1261	1389	1858	2209	2185
2 Manufacturing Industries and Construction	5493	5446	5910	6035	5521	4422	4318	4441	3513	3776	2841	2703	2576	2493
3 Transport	10529	10778	12124	12355	13339	13223	12590	13212	12945	12850	12641	13042	13802	14746
a Civil Aviation	246	246	202	157	138	158	147	155	151	149	155	156	153	153
b Road Transportation	9418	9421	10750	11369	12371	12216	11664	12230	12015	11922	11707	12107	12869	13813
c Railways	300	300	306	230	234	244	107	215	107	107	107	107	107	107
d Navigation	566	811	867	600	597	604	672	613	672	672	672	672	672	672
e Other Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other non-specified	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Other Sectors	9359	9152	8841	7606	7444	6558	5815	6143	5074	5320	4534	4288	4091	3934
a Commercial/Institutional	1419	1499	1247	1014	1144	1081	944	1020	858	880	799	766	730	698
b Residential	5208	5109	5108	4159	3843	3234	2969	2977	2322	2507	1891	1684	1522	1389
c Agriculture/Forestry/Fisheries	2732	2545	2486	2433	2457	2243	1902	2146	1894	1933	1844	1838	1839	1847
5 Other	120	120	254	112	274	108	155	146	155	155	155	155	155	155
B Fugitive Emissions from Fuels	304	369	522	808	653	470	319	412	294	286	283	277	273	273
1 Solid Fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	304	369	522	808	653	470	319	412	294	286	283	277	273	273
a Oil	32	35	54	82	106	111	105	113	102	99	102	97	99	99
b Natural Gas	6	9	18	8	8	4	5	5	4	5	4	4	4	4
c Venting and Flaring	267	325	451	718	539	355	209	295	188	183	177	177	170	170
d. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Total Industrial Processes	2470	2240	2726	3384	2441	1685	1831	1877	1555	1660	1342	1325	1380	1454
A Mineral Products	1072	1069	1404	1611	1542	792	998	992	1085	1049	1162	1203	1266	1340
B Chemical Industry	1044	1044	905	1004	3	2	2	2	2	2	3	3	3	3
C Metal Production	64	60	74	62	16	0	0	0	0	0	0	0	0	0
D Other Production	0	4	4	4	4	2	2	2	2	2	2	2	3	3
E Production of Halocarbons and SF6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Consumption of Halocarbons and SF6	290	13	290	663	838	856	796	848	432	573	142	83	75	76
G Other	0	50	49	40	38	33	33	33	33	33	33	33	33	33
3. Total Solvent and Other Product Use	137	116	137	154	189	187	75	151	70	72	67	64	61	58
4. Total Agriculture	13048	12545	11592	10471	9852	9614	9399	9645	9088	9156	8903	8889	8876	8859
A Enteric Fermentation	3259	3247	3134	2861	2737	2862	2798	2831	2813	2795	2853	2935	3017	3098
B Manure Management	1437	1593	1669	1722	1816	1723	1635	1698	1480	1536	1354	1293	1232	1161
C Rice Cultivation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Agricultural Soils	8352	7702	6787	5885	5295	5026	4962	5113	4791	4822	4692	4657	4624	4597
E Prescribed Burning of Savannas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Field Burning of Agricultural Residues	0	3	3	4	4	3	4	3	4	4	4	4	4	4
G Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Total Land-Use Categories (LULUCF)	0	5473	3649	3218	4695	-474	-3715	-1044	-3668	-3649	-3671	-3599	-3526	-3495
A Forest Land	0	136	-947	-757	680	-4350	461	-3217	475	510	430	438	446	454
B Cropland	0	5047	4362	3733	3654	3530	-3802	1957	-3754	-3775	-3700	-3661	-3581	-3542
C Grassland	0	183	152	159	203	217	-210	144	-214	-212	-216	-220	-224	-229
D Wetlands	0	91	61	56	115	75	-11	60	-6	-8	-2	46	54	60
E Settlements	0	16	21	27	44	54	-152	12	-169	-164	-183	-202	-221	-240
F Other Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Total Waste	1547	1709	1521	1351	1135	1015	934	1026	823	854	749	671	615	574
A Solid Waste Disposal on Land	1334	1478	1270	1062	856	720	625	725	500	536	415	321	248	192
B Waste Water Handling	213	171	177	164	159	152	166	159	168	167	169	172	174	176
C Waste Incineration	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D Other	0	60	74	125	120	143	143	142	155	151	164	178	192	206
7. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (not included above):														
International Bunkers	4904	4820	6963	6627	5001	4552	4945	4711	5211	5083	5479	5592	5383	5383
Aviation	1755	1755	1888	2376	2602	2447	2645	2526	2912	2783	3179	3292	3083	3083
Marine	3149	3065	5076	4251	2400	2105	2300	2185	2300	2300	2300	2300	2300	2300
Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2 Emissions from Biomass	4641	4662	5725	6899	10728	14902	NE	NE	NE	NE	NE	NE	NE	NE

TABLE E1-8: THE RESULT OF DENMARK'S 'WITH MEASURES' GREENHOUSE PROJECTION 2012-2035 IN THE FORMAT RECOMMENDED UNDER THE UNFCCC

Source: Nielsen O.-K. et al., (DCE, February 2013).

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:	(2008-2012)/5, where 2012 only is projected						
Sector	Emissions and removals (in Gg CO2 equivalents)						
	CO2	CH4	N2O	HFCs	PFCs	SF6	Total
Energy (excl. Transport)	32792	507	231				**33530**
Transport	13059	16	137				**13212**
Industrial processes*	1165	0	15	776	13	59	**2029**
Agriculture**		4113	5532				**9645**
LULUCF***	-1058	0	14				**-1044**
Waste****	20	881	125				**1026**
Total (including LULUCF*)**	**45978**	**5517**	**6055**	**776**	**13**	**59**	**58398**
Total (excluding LULUCF*)**	**47035**	**5517**	**6041**	**776**	**13**	**59**	**59442**

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						
Sector	Emissions and removals (in Gg CO2 equivalents)						
	CO2	CH4	N2O	HFCs	PFCs	SF6	Total
Energy (excl. Transport)	23285	386	199				**23870**
Transport	12707	10	134				**12850**
Industrial processes*	1143	0	15	438	10	125	**1731**
Agriculture**		3997	5159				**9156**
LULUCF***	-3667	0	17				**-3649**
Waste****	19	697	137				**854**
Total (including LULUCF*)**	**33488**	**5091**	**5662**	**438**	**10**	**125**	**44813**
Total (excluding LULUCF*)**	**37154**	**5091**	**5644**	**438**	**10**	**125**	**48463**

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 (excl. Transport)	20643	359	194				**21195**
Transport	12494	8	139				**12641**
Industrial processes*	1252	0	15	73	9	61	**1409**
Agriculture**		3967	4936				**8903**
LULUCF***	-3689	0	17				**-3671**
Waste****	20	586	144				**749**
Total (including LULUCF*)**	**30720**	**4920**	**5444**	**73**	**9**	**61**	**41226**
Total (excluding LULUCF*)**	**34409**	**4920**	**5427**	**73**	**9**	**61**	**44898**

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 (excl. Transport)	19164	383	195				**19742**
Transport	12885	7	150				**13042**
Industrial processes*	1290	0	15	62	7	14	**1388**
Agriculture**		4024	4864				**8889**
LULUCF***	-3617	0	17				**-3599**
Waste****	20	502	150				**671**
Total (including LULUCF*)**	**29742**	**4916**	**5392**	**62**	**7**	**14**	**40134**
Total (excluding LULUCF*)**	**33359**	**4916**	**5375**	**62**	**7**	**14**	**43733**

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 (excl. Transport)	19444	441	204				**20089**
Transport	13633	7	162				**13802**
Industrial processes*	1350	0	15	61	6	8	**1441**
Agriculture**		4082	4794				**8876**
LULUCF***	-3543	0	17				**-3526**
Waste****	20	439	156				**615**
Total (including LULUCF*)**	**30904**	**4969**	**5348**	**61**	**6**	**8**	**41296**
Total (excluding LULUCF*)**	**34447**	**4969**	**5331**	**61**	**6**	**8**	**44822**

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:	2035						
Sector	Emissions and removals (in Gg CO2 equivalents)						
	CO2	CH4	N2O	HFCs	PFCs	SF6	Total
Energy (excl. Transport)	19362	473	206				**20041**
Transport	14566	8	172				**14746**
Industrial processes*	1422	0	15	61	6	8	**1512**
Agriculture**		4128	4730				**8859**
LULUCF***	-3513	0	17				**-3495**
Waste****	20	392	162				**574**
Total (including LULUCF*)**	**31857**	**5001**	**5303**	**61**	**6**	**8**	**42236**
Total (excluding LULUCF*)**	**35370**	**5001**	**5285**	**61**	**6**	**8**	**45731**

Annex E2

Annex E2: A brief description of the work involved in preparing the energy projections.

Energy projections in Denmark

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

EMMA and ADAM

General

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.

Business and domestic sectors

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.

Transport

The projections of the use of energy by the transportation sector is based on projected road work from the Department of Transport taking into account economic projections from the Department of Finance. Assumptions are made with respect to the development in energy efficiency, share of biofuels as well as the penetration of electrical cars. Projected energy use by rail transport, domestic sea shipping and domestic aviation is based on the average energy used in the past three years. Energy use by foreign aviation is projected according to the growth rates from the EU primes baseline, 2009.

Strengths and weaknesses

As mentioned, the foundation for the forecast on energy consumption is the economic projections from the Department of Finance. This is the official long term economic forecast from the Danish government. The economic forecast is based on detailed projections of structures within the economy linked with econometric analyses on time series spanning 50 years on the behavior of economic agents. The projections suffer from the standard range of weaknesses connected with econometric modeling as well as uncertainty with regards to projections of exogenous variables, such as international energy prices and international growth. The economic projections are linked to an econometric energy consumption model that is based on estimation of behavioral patterns in consumption of energy. The energy consumption modeling suffers from rigidity in technological change, and as such, is not well equipped to forecasts in the very long term.

The strength of the approach used for the transport projection is that it is simple and transparent. The weakness of the transport model is that it doesn't take energy prices into account and that it does not allow for modal shift in transport.

RAMSES

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.

Ramses 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.

Strengths and weaknesses

The model's strength is also its weakness, in the sense that the model is very detailed. The detailed model makes it possible to create simulations that are relatively close to reality/observations. However, the detailed model also requires maintenance of a lot of data for the model.

Annex E3: Data for the August 2013 MAC-curve

In parallel with the Climate Policy Plan a catalogue of potential additional measures has been drawn up by an inter-ministerial working group and published in August 2013. The results in terms of greenhouse gas reduction potentials and socio-economic costs expressed as CO_2-shadow prices for 53 of the 78 measures analysed have been used to construct the MAC-curve (Marginal Abatement Cost curve) in Figure 4.7. These results are shown in the table below.

TABLE E3-1: DATA FOR THE AUGUST 2013 MAC-CURVE

Step No. on MAC-curve	Sector	Analysed potential additional measure included in the MAC-curve	GHG reduction in 2020 - in Gg CO2-eq.	Socio-economic costs including side effects (*except for N-reducing measures above 10,000 tonnes) - in DKK per tonne CO2-eq. (negative number means net benefits)	GHG reduction in 2020 accumul. - in Gg CO2-eq.
1	Agriculture	Demands for cooling of pig manure in livestock buildings*	6	-16083	6
2	Agriculture	Requirements for catch crops on an additional 177,000 ha, sandy soils	110	-3375	116
3	Agriculture	Reduction of nitrogen quota by 10%	175	-1810	291
4	Agriculture	Stricter requirements for nitrogen utilization for gasified livestock manure	48	-1663	339
5	Agriculture	Stricter requirements for nitrogen utilization for selected types of livestock manure	17	-1608	356
6	Transport	Subsidy to and certification of private-municipal collaboration on green commercial transport	30	-585	386
7	Agriculture	Requirement for acidification of pig slurry in livestock buildings	65	-483	451
8	Energy	Stricter energy requirements for new windows	59	-360	510
9	Agriculture	Requirement for acidification of cattle slurry in livestock buildings	32	-350	542
10	Energy	Expansion of RE process scheme to include new technologies	75	-201	617
11	Agriculture	Optimisation of dairy production through prolonged lactation period	17	-25	634
12	Energy	Public Service Obligation subsidy to construct 200MW onshore wind turbines	450	55	1084
13	Waste	Requirements and subsidy for biocover at certain landfills	390	77	1474
14	Transport	Requirements for public procurement of transport	42	235	1516
15	Energy	Subsidy for energy-efficiency improvement in business combined with ambitious implementation of the Energy Efficiency Directive	75	265	1591
16	Agriculture	Subsidy for afforestation of 19,000 hectares of land (mineral soils), sandy soils*	232	305	1823
17	Agriculture	Feed with fat for conventional dairy cows promoted through taxes	128	414	1951
18	Agriculture	Tax on livestock manure not used in biogas production (scenario 4)	140	453	2091
19	Energy	Public Service Obligation subsidy to construct 200MW nearshore wind farm	500	489	2591
20	Agriculture	Subsidy for establishment of 10,000 hectares of energy willow for use as fuel, with carbon sequestration, clay soils*	18	516	2609
21	Agriculture	Requirements for catch crops on an additional 63,000 ha, clay soils*	46	560	2655
22	Agriculture	Subsidy for establishment of 80,000 hectares of energy willow for use as fuel, with carbon sequestration, sandy soils*	145	561	2800
23	Agriculture	Subsidy for conversion of 35,000 ha of organic soils with termination of drainage*	481	603	3281
24	Energy	Public Service Obligation subsidy for use of straw as fuel in CHP (without catch crops)	151	624	3432
25	Agriculture	Requirements for short-term catch crops of an additional 110,000 ha, clay soils*	78	810	3510
26	Agriculture	Requirements for short-term catch crops of an additional 130,000 ha, sandy soils*	89	841	3599
27	Energy	Reduced reimbursement of electricity charges for the trade and service sector	1111	886	4710
28	Energy	Public Service Obligation subsidy to construct 100MW photovoltaic solar modules in large installations	77	933	4787
29	Transport	Promotion of natural gas for the transport sector through subsidies for natural gas powered heavy goods vehicles	0.317	941	4787
30	Energy	Requirements for separation of plastic in waste	226	989	5013
31	Transport	Compulsory driving lessons in energy-efficient driving	17	1189	5030
32	Agriculture	Subsidy for conversion of 50,000 ha of arable land (mineral soils) to permanent grassland, sandy soils*	92.38	1323	5123
33	Agriculture	Subsidy for afforestation of 31,000 hectares of land (mineral soils), clay soils*	242	1424	5365
34	Transport	Increase of blend requirements in 2020 for biofuels	159	1499	5524
35	Energy	Expansion of the RE process scheme to include space heating	100	1525	5624
36	Transport	Subsidies to heavy goods vehicles using blends with higher concentrations of biofuel blends	39	1581	5663
37	Agriculture	Requirement for fixed cover on pig slurry tanks (revised analysis)	53	1652	5716
38	Transport	Tax relief on natural gas for heavy transport	2	1798	5718
39	Agriculture	Tax on artificial fertiliser without nitrification inhibitors	335	1844	6053
40	Transport	Green Development Tax on fossil fuels	182	2409	6235
41	Transport	Increase in fuel taxes	730	2663	6965
42	Agriculture	Requirement for fixed cover on cattle slurry tanks (revised analysis)	25	2989	6990
43	Agriculture	Reduced tax breaks on fuel for agricultural machinery	36	3073	7026
44	Agriculture	Subsidy for conversion of 50,000 ha of arable land (mineral soils) to permanent grassland, clay soils*	55.48	3074	7081
45	Agriculture	Changed animal feed for cattle other than dairy cows promoted by taxes (or subsidies: 11;3849)	11	3646	7092
46	Transport	Abolition of tax deductions for transport to and from work	120	4167	7212
47	Transport	Kilometre based road tax for cars, vans and motorcycles	1184	4181	8396
48	Transport	Legal Requirements to blend 1 per cent second generation bioethanol in gasoline from 2020	82	4455	8478
49	Transport	Extended tax exemption for electric cars after 2015	16	4462	8494
50	Transport	Tax exemption for plug-in hybrid cars 2013-2015	7	5012	8501
51	Agriculture	Feed with fat for organic dairy cows promoted through taxes	12	5413	8513
52	Energy	Requirements for energy savings in public buildings	12	7482	8525
53	Transport	Reduction of maximum speed on motorways from 130km/h to 110km/h	60	13460	8585

Annex E4

Annex E4: A comparison of the latest reported greenhouse gas inventory with the "with measures" projections of Denmark's total greenhouse gas emissions included in Denmark's first to sixth national communication.

In this annex, a comparison of the latest reported greenhouse gas inventory with the "with measures" projections of Denmark's total greenhouse gas emissions included in Denmark's first to sixth national communication is shown.

In Figure E4.1 the "raw" data for projections of Denmark's total greenhouse gas emissions from NC1(1994), NC2(1997), NC3(2003), NC4(2005), NC5(2009) and NC6(2013) are shown together with Denmark's total greenhouse gas emissions in the inventory reported in April 2013 for the period 1990-2011. As it can been seen no clear conclusion can be drawn from this figure.

However, if the data are normalised to take into account the improvements made in inventory reporting over the same period, the deviations in historic data are diminished as shown in Figure E4.2.

In figure E4.3 also inter-annual variations in temperature and electricity trade is taken into account since CO_2 emissions in Denmark from heat and electricity production are highly sensitive to inter-annual variations in unpredictable climate parameters such as temperature and precipitation, the latter primarily precipitation in Norway and Sweden due to these countries' hydro power based production of electricity for the Nordic electricity market.

Figure E4.3 shows:

- A good correlation between the inventory data and the projection until 2005 in NC1 and the projection until 2010 in NC2, and

- A significant deviation in the projections for 2011 in the NC3, NC4 and NC5 from the inventory data for 2011.

A closer look into the detailed level of sectors and source categories in the projections in NC1 and NC2, however, reveal major differences. But outliers in both directions seem to even out each other in the total due to the relatively high number of separately projected sub-categories.

FIGURE E4.1 "RAW" DATA FOR PROJECTIONS OF DENMARK'S TOTAL GREENHOUSE GAS EMISSIONS FROM NC1(1994), NC2(1997), NC3(2003), NC4(2005), NC5(2009) AND NC6(2013) SHOWN TOGETHER WITH DENMARK'S TOTAL GREENHOUSE GAS EMISSIONS IN THE INVENTORY REPORTED IN APRIL 2013 FOR THE PERIOD 1990-2011 (GG CO2 EQUIVALENTS).

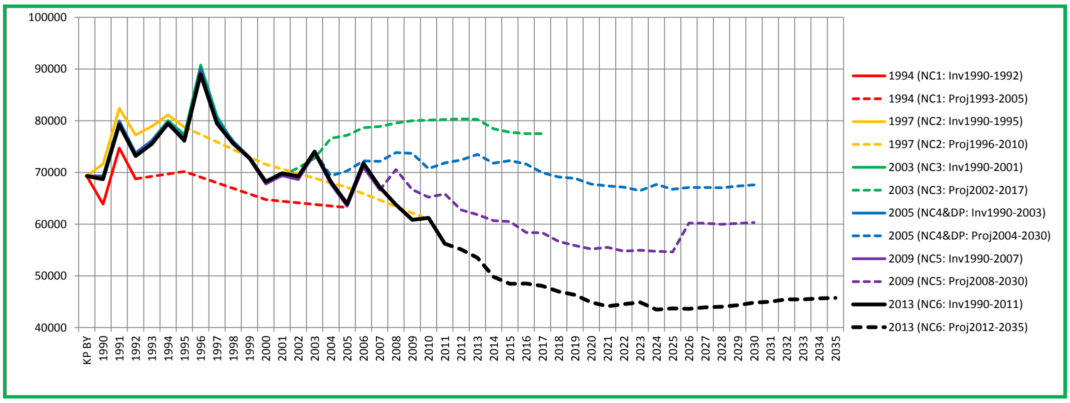


FIGURE E4.2 THE DATA SHOWN IN FIGURE E4.1 NORMALISED TO TAKE INTO ACCOUNT THE IMPROVEMENTS MADE IN INVENTORY REPORTING FROM 1992 TO 2013(GG CO2 EQUIVALENTS).

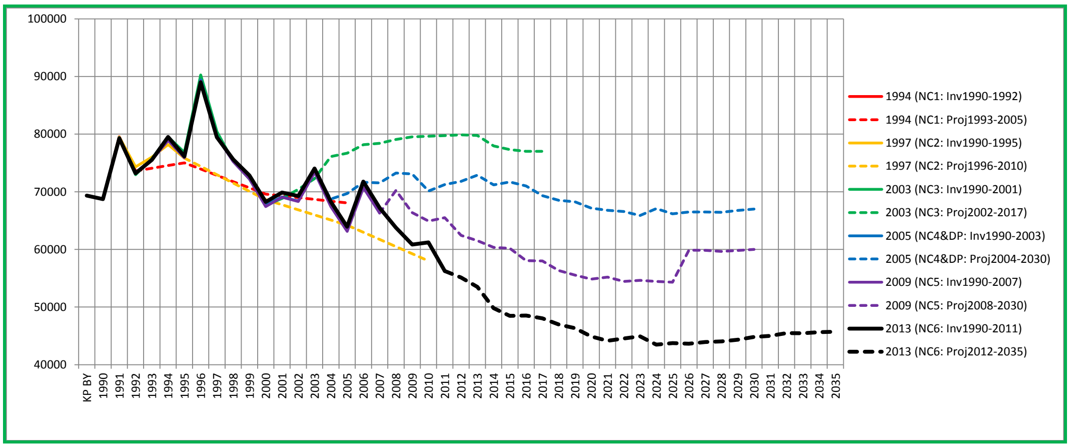
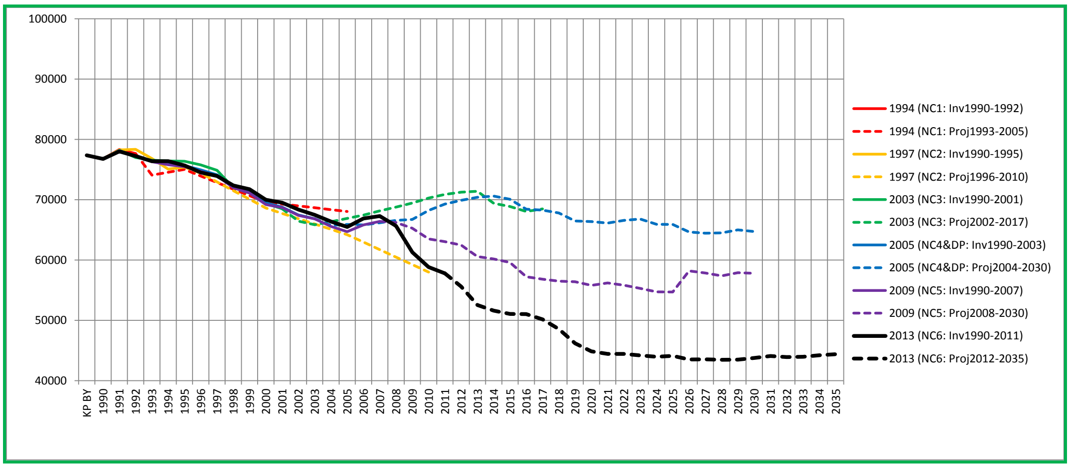


FIGURE E4.3 THE DATA SHOWN IN FIGURE E4.2 WITH ALSO INTER-ANNUAL VARIATIONS IN TEMPERATURE AND ELECTRICITY TRADE TAKEN INTO ACCOUNT (GG CO2 EQUIVALENTS).



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.

Project/programme title: Sector programme for energy in Burkina Faso			
Purpose: Improved energy sector in Burkina Faso			
Recipient country	**Sector**	**Total funding**	**Years in operation**
Burkina Faso	Energy	369 million DKK	2000-2010
Description: Seven areas received support: 1) Building of sub-sector for sustainable utilisation of fire wood. 2) Production and distribution of low-cost electricity for towns and rural areas. 3) Improved electricity supply and promotion of environmental concerns to economic centres. 4) Re-organising the national electricity supply. %) Institutional strengthening of the directorate general for energy. 6) Capacity building for private sector actors within energy. 7) Integration of HIV/AIDS concerns within all activities.			
Electrical associations have been trained in technical and financial administration. Environment Ministry's knowledge of how the country can use the Kyoto Protocol support mechanism for adaptation to climate change has been improved. Two forest areas are now under sustainable forest management by 70 forest user associations as planned, although the process took longer than expected. Especially the female members have learned to take advantage of the forest's secondary products, which has increased their profit base. This is an important part of adaptation to climate change, as more extreme weather increases the risk of declining agricultural production. The sector for sustainable use of fire wood now covers a large forest area. Associations of fire wood transporters have been strengthened and have led campaigns against overloading, which damage the roads. The studies of sustainably produced firewood is finalized and presented to stakeholders in the sector.			
Technology transferred: Both soft and hard technologies relating to different fields like production of electricity and forest management has been transferred.			
Impact on greenhouse gasses emissions/sinks (optional): Sustainable forest management.			

Project/programme title: Environmental Programme			
Purpose: Supporting Indonesia in tackling issues related to environment and climate while keeping high levels of economic growth and poverty reduction.			
Recipient country	Sector	Total funding	Years in operation
Indonesia	Environment (Forest, Energy and Climate)	730 million DKK (Third phase: 270 million DKK)	2005-2017
Description: This programme is now into its third phase. The third phase of Denmark's environmental, energy and climate programme in Indonesia aims to consolidate the results achieved in second phase at the national policy level relating to environment, energy and natural resource management and improving the implementation of national and local environmental, energy and climate policies. The goal is to create greater coherence between the establishment of policies, plans and instruments and specific activities. As part of a gradual transition, Denmark's support in this phase also aims to pave the way for new opportunities for cooperation in the future and include strengthen the capacity of key institutions, pilot and demonstration projects on environment and energy that can provide clear results at the local level, and address the challenges of natural resource management area, which characterizes the concrete feasibility company of Indonesia's climate commitments.			
Indicate factors which led to the project’s success: Many of the current program's results cannot yet be seen as concrete changes in Indonesia's environmental situation, as the programme mainly has supported basic work at the political and legislative level. Here, the program has, however, had significant influence and has led the Indonesian Environmental Assessments now ranks in line with Thailand and Malaysia, and to the use of strategic environmental assessments has grown significantly.			
Technology transferred: Support the Indonesian government's own ambitions to foster a sustainable, green economy and not least to support the government's climate action plans.			
Impact on greenhouse gasses emissions/sinks (optional): The results achieved at the national policy level relating to environment, energy and natural resource management will be positive for reducing emissions of greenhouse gasses. On the ground the improved management of the Harapan Rainforest will result in reduced greenhouse gas emissions.			

Project/programme title: Programme for sustainable energy in rural areas in Nepal (following Energy Sector Assistance Programme phase 1 & 2)			
Purpose: Sustainable development for rural population in Nepal through support to technologies within sustainable energy.			
Recipient country	Sector	Total funding	Years in operation
Nepal	Energy	2012: DKK 205 million. Phase 1 & 2: DKK 341 million	2012-2017 (1999-2017)
Description: Programme for sustainable energy in rural areas of Nepal will build of the success of Energy Sector Assistance Programme phase 1 & 2 and is expected to reach 1,4 million people in rural Nepal. 150,000 households will become connected to the local electricity grid. 600,000 household will get solar cell energy and 130,000 households will get biogas from gasifiers.			
Indicate factors which led to the project's success: ESAP II has achieved impressive results in terms of providing rural households with access to renewable energy and energy efficient (RE&EE) technologies. By December 2010, ESAP II has assisted the instalment of 191,000 improved cooking stoves (ICS), 157,000 solar home systems (SHS), 9,000 SSHS, and provided 63,000 households with access to electricity from mini-grids (includes households from MHP-projects presently under construction). This presents a higher level of annual installations than during ESAP I. ESAP II contributed to the formulation of Government of Nepal (GoN) policies for rural and renewable energy, including the national subsidy policy for RE and to getting RE incorporated in the Government's three-year development plans. ESAP II's pilot activities to promote credit finance of SHS and of MHP-projects by commercial banks have resulted in commercial credit finance of 3,000 SHS and 5 MHP-projects; the rational approach, which was developed and applied in the pilots, will yield an important expansion of commercial credits to RE in a few years.			
Technology transferred: Renewable energy and energy efficient (RE&EE) technologies.			
Impact on greenhouse gasses emissions/sinks (optional): Reduced emission as result of introducing sustainable energy.			

Annex G Information on the work of the Danish Low Carbon Transition Unit

The Low Carbon Transition Unit (LCTU) within the Danish Ministry for Climate, Energy and Building was established in 2012 to assist growth economies and developing countries in their implementation of comprehensive, real and measurable GHG reductions and Low Emission Development Strategies.

The work of LCTU consists of:

- Cross cutting analytical workstreams,
- Multilaterally cooperation, networks and partnerships and
- Bilaterally cooperation.

Cross cutting analytical workstreams

The LCTU aims to provide relevant knowledge, tools and advice that will enable countries to make credible GHG projections as a basis for LEDS, climate financing and for quantifiability of emission reduction pledges.

Baselines
The LCTU is engaged, together with the OECD and the UNEP Risoe Centre through dialogue and exchange of experiences in a group of developing countries, in the promotion of transparent, robust and credible GHG emissions baselines, inter alia by discussing commonalities and lessons learned across countries.

Successful policy-making hinges on robust analysis of expected future developments. Planning for GHG abatement policy is no exception. Baselines provide an important basis for the design of LEDS and for measuring the effects also of policies. The LCTU has in 2013, together with the OECD, UNEP Risoe and a group of developing countries, published a joint report on practices on national GHG emissions baseline setting. The report is available for free download through the LCTU website.

Reduction potentials
The LCTU conducts analyses of energy systems and reduction potentials in developing countries using the Danish Energy Agency's global carbon market model, COMPARE and the specially developed Emission Reduction Tool.

The LCTU can establish the extent of reduction potentials across countries and sectors by using the COMPARE model and the Emission Reduction Tool. For selected countries the LCTU can also analyse the reduction potential more in-depth in the form of a more precise assessment of the options and technologies available in the current country. This may serve as input to policies and measures within the energy sector, or in the development of NAMAs and LEDS. The LCTU contributes with knowledge and tools to evaluate cost efficient reduction potentials.

Energy Policy Toolkits
The LCTU shares tangible Energy Policy Toolkits to provide guidance and give recommendations to developing countries on how to design and implement GHG reduction measures as well as national and cross sector Low Emission Development Strategies (LEDS).

The LCTU focuses on areas, tools and measures where developing countries have expressed specific interest in the Danish case and experiences. The first two toolkits are about integration of wind power into the transmission and distribution grid and energy efficiency in new buildings. Next in line are toolkits on physical planning of wind power and energy efficiency in appliances. The toolkits are available for free download through the LCTU website; www.ens.dk/LCTU

Financing mechanisms

The LCTU works with various financing mechanisms in the bilateral country programmes to promote low carbon emissions investments in the energy sector. The LCTU is also engaged in a number of multilateral forums that address climate financing.

Multilaterally cooperation, networks and partnerships

Systematic underpinning of GHG reduction measures and initiatives (including NAMA and MRV)

The LCTU is engaged in a number of multilateral networks and partnerships with the aim of systematically underpinning GHG reduction measures. The engagements of the LCTU include: CCAP MAIN, UNEP FIRM, GGGI, the World Bank's Partnership for Market Readiness, Chile MAPS and the Nordic Pilot NAMA under the Nordic Partnership initiative.

Mobilisation of sufficient financing, both public and private, to successfully undertake a low carbon transition is a key global challenge. The LCTU seeks to address these challenges at multiple levels. First and foremost through addressing specific financing related challenges in the bilateral energy transition programs in Vietnam, South Africa, and Mexico. This is done through a combination of focused financing initiatives e.g. an energy efficiency financing facility for SMEs in Vietnam, as well as bringing the most innovative financing practices and knowhow to the bilateral programs. Beyond focusing on financing aspects of the bilateral programs, the LCTU is actively engaged in a number of multilateral forums that facilitate financing readiness for countries developing climate projects, through knowledge exchange, dissemination of best practices, and through critical analysis of barriers and alleviating instruments that pertain to climate financing in particular. The CCAP MAIN dialogue and the World Banks Partnership for Market Readiness are inter alia examples of multilateral cooperation that include financing challenges. The LCTU's engagement with global platforms such as 3GF, GGGI, the private sector, research organisations, and other climate financing funds provide an opportunity to coordinate Danish efforts with others as well as keep abreast of the latest developments in the area of climate finance mobilisation.

Bilaterally cooperation

South Africa

The LCTU works together with South Africa to promote increased integration of renewable energy – particularly wind power - in the national electricity supply. The LCTU also assists South Africa in the area of energy efficiency.

The Danish-South African energy sector programme has the objective to decouple economic growth in the Republic of South Africa from growth in GHG emissions through increased deployment of low carbon technologies in the energy sector. The programme builds on the present cooperation by means of the introduction of renewable energy and consists of three interrelated parts. The first part provides technical assistance to the South African Department of Energy in the development of more comprehensive energy planning capabilities, development of alternative scenarios for renewable energy deployment and in carrying out socio-economic analyses of renewable energy policies as well as a smaller sub-component on energy efficiency. The second part will assist the completion of the wind atlas that maps wind energy resources in coastal regions of South Africa. The third part provides technical assistance to the national power utility, Eskom, on decision support tools with the objective of achieving maximised carbon mitigation effect of renewable energy generation in South African through planning and technical integration. The Danish Government has allocated 40 mio. DKK to the energy sector programme in South Africa in the period 2013-2015.

Vietnam

The LCTU works together with Vietnam on low carbon transition within the energy sector, specifically targeting energy efficiency initiatives. The aim is helping small and medium-sized enterprises in Vietnam - with a focus on brickworks, ceramics and food processing industries. The LCTU also assists in implementing new requirements for energy-efficient buildings.

The objective of the energy programme in Vietnam is to improve energy efficiency in small and medium scale enterprises and buildings, thereby contributing to sustainable development and a transition to a low carbon economy in Vietnam. This objective is consistent with phase 2 of Vietnam's National Energy Efficiency Program (the VNEEP programme) and Vietnam's green growth strategy. The specific focus of the Danish support is on energy efficiency in the brickmaking, ceramics and food processing industries with the aim of demonstrating energy saving technologies in 150-250 specific projects. A financing mechanism will be set up for this purpose. The building component will focus on improving capacity for implementing energy efficiency in large, new buildings including support for the design of energy efficiency regulation (through the building code and supportive design guidelines) and a plan to roll out implementation of the building code in the country's many provinces. The Danish Government has allocated 65 mio. DKK to the energy sector programme in Vietnam in the period 2013-2015.

Mexico

The LCTU works together with Mexico to assist in their low carbon transition by addressing specific challenges in areas of climate change mitigation, renewable energy integration and planning, and energy efficiency in non-residential buildings and larger industry.

The climate and energy program, which is closely aligned with a number of Mexican institutions and national strategies, focuses on three main areas; analysis & policy development for climate change, integration of renewable energy in the power system, and energy efficiency in buildings and large industry. Danish assistance for analysis and policy development aims to enable Mexico in driving ambitious mitigation action in support of Mexico's low-carbon transition. In the power sector, the objective is to facilitate a low carbon transition through sharing of experience and policy, planning, regulatory and technical cooperation enabling the efficient large-scale integration of renewable energy and cogeneration into the Mexican power system. The Danish contributions also aim to assist the development of better framework conditions for increased energy efficiency and energy savings in buildings and industry through cooperation on policy, regulation and supporting measures.

Further information on the Low Carbon Transition Unit is available at the LCTU website (www.ens.dk/LCTU).

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 SIXTH NATIONAL COMMUNICATION UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

from

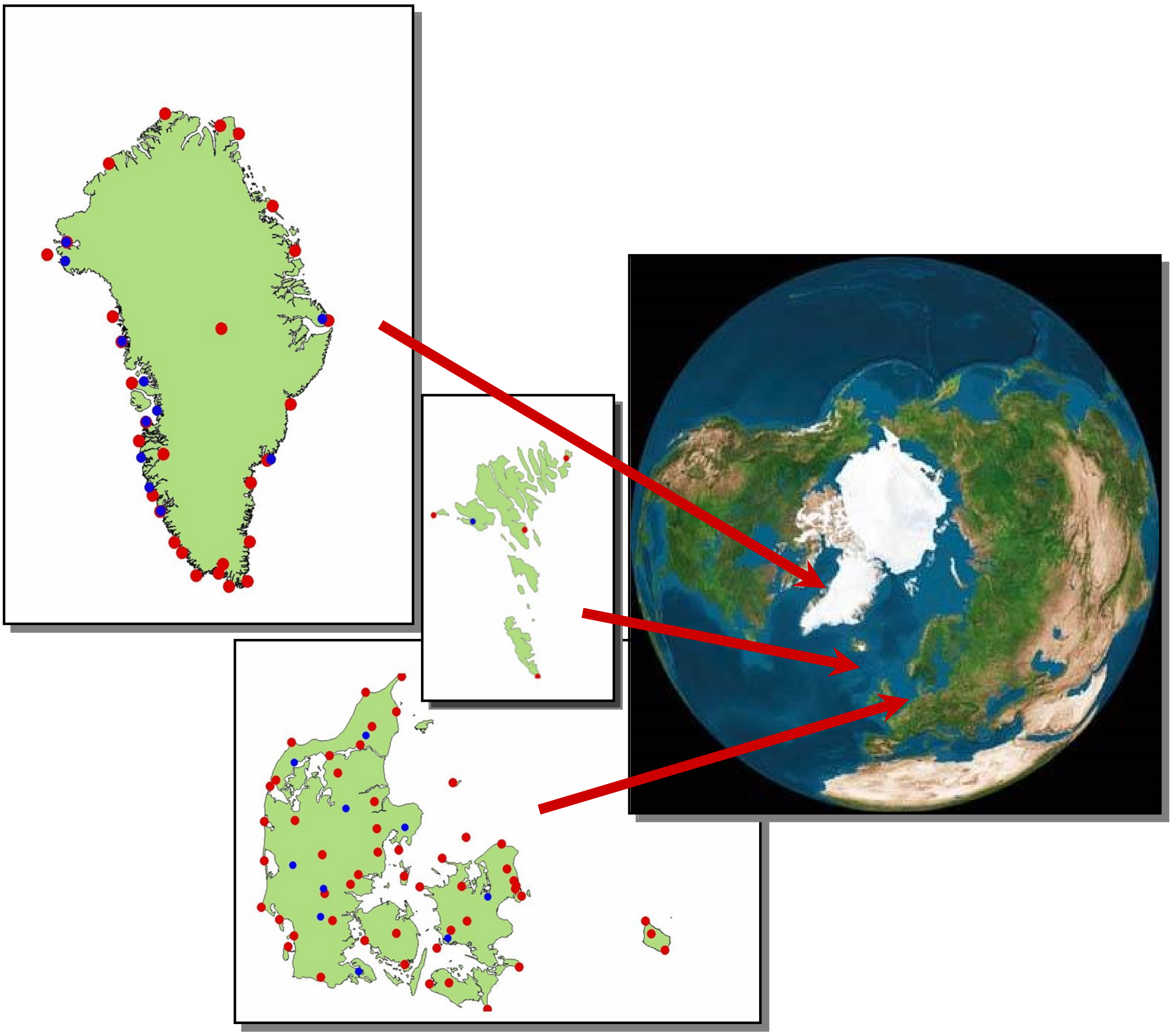
National Report on Global Climate Observing Systems (GCOS) in Denmark, Greenland and the Faroe Islands 2013

Status report on national GCOS activities

Compiled by Claus Kern-Hansen, Danish Meteorological Institute (DMI)

Danish Climate Centre Report 13-05

2013



Compiled by
Claus Kern-Hansen

Danish Meteorological Institute
Lyngbyvej 100
DK 2100 Copenhagen
Denmark

http: www.dmi.dk
e-mail: epost@dmi.dk

Contributing institutions:

Danish Meteorological Institute (DMI), Danish Ministry of Climate, Energy and Building Geological Survey of Denmark and Greenland (GEUS), Danish Ministry of Climate, Energy and Building DCE - Danish Centre for Environment and Energy & Department of Bioscience and the Department of Environmental Science (former National Environmental Research Institute (NERI), University of Aarhus)

Disclaimer

The information in this report represents the best knowledge available to the compiling editor by the time of issue.

Content

Introduction

This status report has been prepared to give an update on the Danish contribution to the systematic climate observations in the Global Climate Observing System (GCOS) as of 1th of January 2013

The present report is an update of the first report based on the reporting guidelines contained in decision 11/CP.13, by the United Nations Framework Convention on Climate Change (UNFCCC) Subsidiary Body for Scientific and Technological Advice (SBSTA) focussing on Essential Climate Variables. The report was issued in 2008 titled "National Report on Global Climate Observing Systems (GCOS) in Denmark, Greenland and the Faroe Islands 2008" and reprinted in 2013 in the DMI report series "Danish Climate Centre Report" as nr 11-04.

The purpose of this report is to provide an overview of the national Global Climate Observing Systems (GCOS) for the use of the Secretariat of CGOS for its detailed progress report on the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC.

1 Common Issues

1.1 National coordination

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.

In its capacity as National Meteorological Service, The Danish Meteorological Institute (DMI) represents Denmark at World Meteorological Organization (WMO), and therefore currently undertakes the role as national focal point/coordinator for GCOS (NFP-GCOS), with the Terms of Reference to undertake GSN and GUAN issues related to data availability, exchange and quality.

Currently, no national GCOS secretariat has been established in Denmark.

1.2 Efforts undertaken to ensure high-quality climate data records.

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 procedure.

In this report relevant climate observations for Denmark, Greenland and the Faroe Islands will be described.

1.3 Efforts undertaken to ensure the data exchange and availability

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.

2. Atmospheric Essential Climate Variables (ECV)

2.1 General information

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).

2.2 Contributions to the GCOS Networks from International relevant stations

2.2.1 Contributions to the GCOS Surface Network (GSN)

The seven designated GSN stations in Denmark, Greenland and on the Faroe Islands are all run by DMI and include (Numbers are WMO station numbers):

Greenland:	4211 Upernarvik, 4250 Nuuk, 4320 Danmarkshavn
	4360 Tasiilaq, 4390 Prins Christian Sund;
The Faroe Islands:	6011 Tórshavn;
Denmark:	6186 Copenhagen.

All of these stations currently meet the required standard for surface observation.

2.2.2 Contributions to the GCOS Upper Air Network (GUAN)

Only one GUAN station is designated for Denmark, Greenland and the Faroe Islands:

WMO nr. 4270 Narsarsuaq, Greenland.

The station is run by DMI and is operated in accordance with the required standard.

2.2.3 Contributions to the Global Atmosphere Watch (GAW)

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 Greenland are: Kangerlussuaq, Pituffik and Illoqqortoormiut
The station in Denmark is located in Copenhagen

The stations in Greenland are Arctic stations in the Network for the Detection of Atmospheric Composition Change (NDACC) that is supported by the International Ozone Commission

TABLE H-1A. NATIONAL CONTRIBUTIONS TO THE SURFACE-BASED ATMOSPHERIC ESSENTIAL CLIMATE VARIABLES

Contributing networks specified in the GCOS implementation plan	ECVs[a]	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2015	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
GCOS Surface Network (GSN)	Air temperature	7	7	7	7	7
	Precipitation	7	7	7	7	7
Full World Weather Watch/Global Observing System (WWW/GOS) surface network (RBSN stations)	Air temperature, air pressure, wind speed and direction, water vapour	37	37	37	37	37
	Precipitation	15	15	15	15	Not known
Baseline Surface Radiation Network (BSRN)	Surface radiation	0	0	0	0	0
Solar radiation and radiation balance data (RBSN stations)	Surface radiation	7	7	7	7	Not known
Ocean drifting buoys	Air temperature, air pressure	0 (note1)	0 (note1)	0 (note1)	0 (note1)	0 (note1)
Moored buoys	Air temperature, air pressure	0	0	0	0	0
Voluntary Observing Ship Climate Project (VOSClim)	Air temperature, air pressure, wind speed and direction, water vapour	0	0	0	0	0
Ocean Reference Mooring Network and sites on small isolated islands	Air temperature, wind speed and direction, air pressure	0	0	0	0	0
	Precipitation	0	0	0	0	0

Note 1: Denmark (DMI) participates in the EUMETNET programme SURFMAR, which operates approximately 80 drifting buoys

TABLE H-1B. NATIONAL CONTRIBUTIONS TO THE UPPER-AIR ATMOSPHERIC ESSENTIAL CLIMATE VARIABLES

Contributing networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2015	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
GCOS Upper Air Network (GUAN)	Upper-air temperature, upper-air wind speed and direction, upper-air water vapour	1	1	1	1	1
Full WWW/GOS Upper Air Network	Upper-air temperature, upper-air wind speed and direction, upper-air water vapour	5	5	5	5	5

TABLE H-1C. NATIONAL CONTRIBUTIONS TO THE ATMOSPHERIC COMPOSITION

Contributing networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2015	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
World Meteorological Organization/ Global Atmosphere Watch (WMO/GAW) Global Atmospheric CO_2 & CH_4 Monitoring Network	Carbon dioxide	0	0	0	0	0
	Methane	0	0	0	0	0
	Other greenhouse gases	0	0	0	0	0
WMO/GAW ozone sonde network[a]	Ozone	2	2	2	2	2
WMO/GAW column ozone network[b]	Ozone	3	3	3	3	3
WMO/GAW Aerosol Network[c]	Aerosol optical depth	3	3	3	3	3
	Other aerosol properties	0	0	0	0	0

2.3 *Satellite observations as base for atmosphere related ECV observations*

Denmark is member state in EUMETSAT and ESA.

Especially through EUMETSAT Denmark takes functional part in activities related to the utilization of satellite data in analyses related to ECVs and climate monitoring.

The table below is indicating **in blue** areas where the Danish participation is more significant.

Table H-2. Global products requiring satellite observations – atmospheric essential climate variables

ECVs/ Global products requiring satellite observations	**Fundamental climate data records required for product generation (from past, current and future missions)**
Surface wind speed and direction Surface vector winds analyses, particularly from reanalysis	Passive microwave radiances and scatterometry
Upper-air temperature Homogenized upper-air temperature analyses: extended MSU-equivalent temperature record, new record for upper-troposphere and lower-stratosphere temperature using data from radio occultation, temperature analyses obtained from reanalyses **EUMETSAT GRAS-SAF/CM-SAF**	Passive microwave radiances, GPS radio occultation, high-spectral resolution IR radiances for use in reanalysis
Water vapour Total column water vapour over the ocean and over land, tropospheric and lower stratospheric profiles of water vapour **EUMETSAT GRAS-SAF/CM-SAF**	Passive microwave radiances, UV/VIS radiances, IR imagery and soundings in the 6.7um band, microwave soundings in the 183 GHz band
Cloud properties Cloud radiative properties (initially key ISCCP products)	VIS/IR imagery, IR and microwave soundings
Precipitation Improved estimates of precipitation, both as derived from specific satellite instruments and as provided by composite products	Passive microwave radiances, high-frequency geostationary IR measurements, active radar (for calibration)
Earth radiation budget Top-of-atmosphere Earth radiation budget on a continuous basis	Broadband radiances, spectrally-resolved solar irradiances, geostationary multi spectral imagery
Ozone Profiles and total column of ozone **EUMETSAT O2M-SAF**	UV/VIS and IR microwave radiances
Aerosol properties Aerosol optical depth and other aerosol properties	VIS/NIR/SWIR radiances
Carbon dioxide, methane and other long-lived greenhouse gases Distribution of greenhouse gases, such as CO_2 and CH_4, of sufficient quality to estimate regional sources and sinks	NIR/IR radiances
Upper-air wind Upper-air wind analyses, particularly from reanalysis	VIS/IR imagery, Doppler wind lidar
Atmospheric reanalyses	Key FCDRs and products identified in this report, and other data of value to the analyses

2.4.1 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.

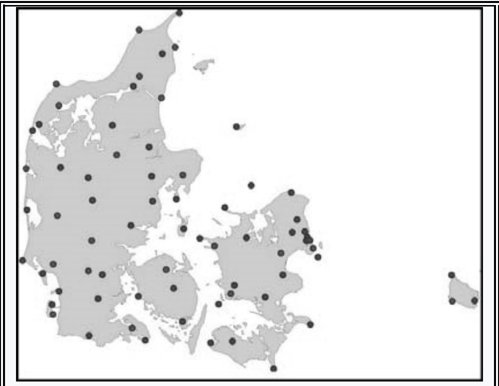
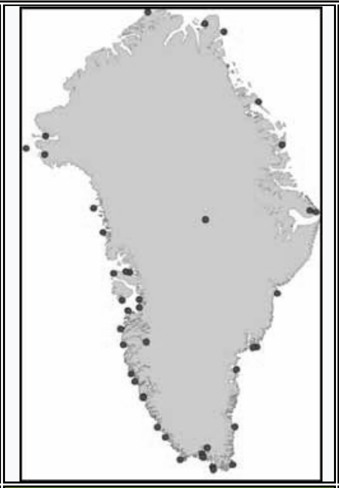
	

Fig. H-1 – DMIs network of weather stations in Denmark	Fig. H-2 – DMIs network of weather stations in Greenland	Fig. H-3– DMIs network of weather stations on the Faroe Islands

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. The daily inflow of data from Denmark, Greenland and the Faroe Islands is around 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.

2.4.2 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 250 stations, all automatic. Half of this network is jointly operated by DMI and The Water Pollution Committee of the Society of Danish Engineers (Spildevandskomitéen - SVK), the other half is owned and operated by DMI.

Information on precipitation can also be obtained from weather radar data. In Denmark, DMI runs a network of five 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.

During wintertime, a network of 75 manual snow depth stations is operated in Denmark, reporting once a day.

In Greenland and the Faroe Islands, precipitation is primary measured at the automatic weather stations.

2.4.3 Surface radiation observation networks

Radiation is measured as 10- minute mean values of global radiation at the DMI operated weather station.

2.4.4 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, DMI performs daily measurements of total ozone at Copenhagen, Kangerlussuaq, and Pittuffik, and weekly ozone soundings at Illoqqortoormiut as well as sporadic ozone soundings at Pituffik during the winter months. DMI provides near real time global UV-indices as part of the EUMETSAT O3M-SAF.

2.4.5 Upper air strata measurements – Radio sounding observations

DMI runs radio sounding stations at the following six locations: Tórshavn (the Faroe Islands), Danmarkshavn, Illoqqortoormiit, Tasiilaq, Narsarsuaq and Aasiaat (Greenland). Two soundings are made every day at these stations.

2.4.6 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 140 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 1999 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.

2.4.7 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 as well as precipitation and temperatures for two Greenland Stations 1874-2012

The long monthly time series include: temperatures, precipitation, atmospheric pressure, cloud cover and snow for stations in Denmark, Greenland and on the Faroe Islands

The long annual time series include: temperature for a number of stations in Denmark, Greenland and on the Faroe Islands (1873-2012), as well as temperatures, precipitation, hours of sunshine and cloud cover given as national averages for Denmark

All the above mentioned datasets are freely available through the annual updates of DMI Technical Reports at www.dmi.dk

2.4.8 Air quality monitoring

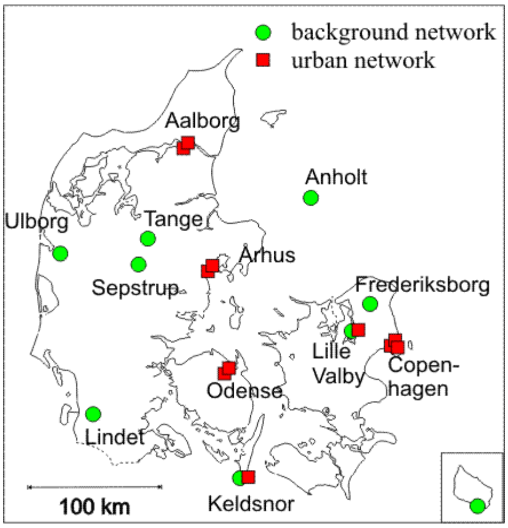
Air pollution is automatically monitored in both urban and rural areas across Denmark. This monitoring network is operated by DCE - Danish Center for Environment and Energy at Aarhus University (formed in 2011 to replace the former National Environmental Research Institute (NERI) and measures a wide 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)
- Carbon monoxide (CO)

Furthermore, at a number of NERI stations deposition of air pollution via precipitation is monitored.

Figure H-4 shows the types and distribution of air quality monitoring stations across Denmark.

FIGURE H-4 – NATIONAL NETWORK OF AIR QUALITY MONITORING STATIONS IN DENMARK OPERATED BY DCE (FORMER NERI)



3. Oceanic essential climate variables (Oceanic ECV)

3.1 NATIONAL CONTRIBUTION TO OCEANOGRAPHIC ECV

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 ASAP programmes as described in paragraph 3.2

TABLE H-3A. NATIONAL CONTRIBUTIONS TO THE OCEANIC ESSENTIAL CLIMATE VARIABLES – SURFACE

Contributing Networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2015	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
Global surface drifting buoy array on 5x5 degree resolution	Sea surface temperature, sea level pressure, position-change based current	0 **(note 2)**	0 **(note 2)**	0 **(note 2)**	0 **(note 2)**	0 **(note 2)**
GLOSS Core Sea-level Network	Sea level	0	0	0	0	0
Voluntary observing ships (VOS)	All feasible surface ECVs	0 **(note 2)**	0 **(note 2)**	0 **(note 2)**	0 **(note 2)**	0 **(note 2)**
Ship of Opportunity Programme	All feasible surface ECVs	0	0	0	0	0

Note 2: Denmark (DMI) participates in the EUMETNET programme SURFMAR, which operates approximately 80 drifting buoys and 10 voluntary observing ships (VOS) of which DMI maintains 4.

TABLE H-3B. NATIONAL CONTRIBUTIONS TO THE OCEANIC ESSENTIAL CLIMATE VARIABLES – WATER COLUMN

Contributing Networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2015	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
Global reference mooring network	All feasible surface and subsurface ECVs	0	0	0	0	0
Global tropical moored buoy network	All feasible surface and subsurface ECVs	0	0	0	0	0
Argo network	Temperature, salinity, current	0	0	0	0	0
Carbon inventory survey lines	Temperature, salinity, ocean tracers, biogeo-chemistry variables	0	0	0	0	0

3.2 *Automated Shipboard Aerological Programme (ASAP).*

The E-ASAP (Eucos 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 three ASAP units mounted on ships plying fixed routes from Denmark to Greenland.

3.3 *Satellite observations as base for oceanic ECV observations*

Denmark is member state in EUMETSAT and ESA.

Especially through EUMETSAT Denmark takes functional part in activities related to the utilization of satellite data in analyses related to ECVs and climate monitoring.

The Table H-4 below is indicating **in blue** areas where the Denmark participation is more significant.

Table H-4. Global products requiring satellite observations – oceans

ECVs/ Global products requiring satellite observations	Fundamental climate data records required for product generation (from past, current and future missions)
Sea Ice Sea ice concentration **EUMETSAT O&SI SAF**	Microwave and visible imagery
Sea Level Sea level and variability of its global mean	Altimetry
Sea Surface Temperature Sea surface temperature **EUMETSAT O&SI SAF**	Single and multi-view IR and microwave imagery
Ocean Colour Ocean colour and oceanic chlorophyll-a concentration derived from ocean colour	Multi-spectral VIS imagery
Sea State Wave height and other measures of sea state (wave direction, wavelength, time period)	Altimetry
Ocean Salinity Research towards the measurement of changes in sea surface salinity	Microwave radiances
Ocean Reanalyses Altimeter and ocean surface satellite measurements **EUMETSAT O&SI SAF**	Key FCDRs and products identified in this report, and other data of value to the analyses

3.4 Additional national oceanographic monitoring

3.4.1 Sea temperatures

Denmark has a network for the collection of sea temperatures at 24 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.

3.4.2 National tide gauge network

In Denmark an extensive national network of tide gauges are operated jointly by DMI, local authorities and the Danish Coastal Authority. The network consists of 86 automatic stations.

In Greenland a tide gauge station is operated by DTU-Space/National Space Institute.

Data are available from the responsible bodies.

3.4.3 Hydrographic and marine surveys

The Danish Centre for Environment and Energy (DCE) (former National Environmental Research Institute (NERI)) has the overall responsibility for surveillance of the Danish waters. Surveillance of fjords and coastal waters is carried our by the regional authorities, while DCE is responsible for mapping the open waters.

All of the surveys are part of the Danish nationwide monitoring programme NOVANA.

All marine NOVANA data (regional and state) are collected annually in the national marine database, MADS, by DCE.

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
- Monitoring of the oceanographic conditions along West Greenland
- Monitoring of currents in the Danish straits and water level along the Danish coastline.

4 Terrestrial Essential Climate Variables (ECV)

4.1 GENERAL INFORMATION

The terrestrial observation system is not as well established as the atmospheric or the oceanographic one. The reason is that most of the terrestrial observations are not part of international observation routines with a regular/daily exchange of data.

4.2 GLOBAL TERRESTRIAL NETWORK – HYDROLOGY (GTN-H)

The GTN-H is a joint effort of the World Meteorological Organization / Climate and Water
Department (WMO/CLW), the GCOS, and the Global Terrestrial Observing System (GTOS12), co-sponsored by WMO, UNESCO, ICSU, UNEP and FAO.

GTN-H represents the observational arm of the Group on Earth Observations / Integrated
Global Water Cycle Observations Theme (GEO/IGWCO).

The following hydrological variables have been identified as essential for the GTN-H13 network: Precipitation, river discharge, groundwater, water vapour, lake level/ area, isotopic
composition, soil moisture, water use, snow cover, glaciers and ice caps, evapotranspiration,
water quality/ biogeochemical fluxes.

For most of the variables a global network is defined and a contact established.

The **Global Precipitation Climate Centre (GPCC)** based at German Meteorological Insti-tute/Deutsche Wetterdienst (DWD) and operating under the auspices of the World Meteorological Organization (WMO), as well as

Global Runoff Data Centre (GRDC), based at the Bundesanstalt für Gewässerkunde (Federal Institute of Hydrology, BfG) in Koblenz, Germany, and operating under the auspices of the World Meteorological Organization (WMO), are both parts

of the GTN-H Panel and represent their respective networks on precipitation and river discharge.

DMI contributes to GPCC with precipitation data, and DCE is reporting to GRDC under GTN-R (see paragraph 4.3).

4.3 GLOBAL TERRESTRIAL NETWORK FOR RIVER DISCHARGE (GTN-R)

DCE is reporting to the Global Runoff Data Centre (GRDC), based at the Bundesanstalt für Gewässerkunde (Federal Institute of Hydrology, BfG) in Koblenz, Germany, and operating under the auspices of the World Meteorological Organization (WMO).

GTN-R is a GRDC contribution to the Implementation Plan for the Global Observing System for Climate and to GTN-H.

Denmark is reporting 14 stations as shown in Table H-5.

4.4 Global Terrestrial Network for Lakes (GTN-L)

As with several other data types, lake level data are recorded by both local authorities as well as at national level.

DCE is operating a database, from which national and part of local data from lakes may be available upon request.

4.5 Global Terrestrial Network on Glaciers (GTN-G)

The Geological Survey of Denmark and Greenland (GEUS), is mapping the mass-balance of the Greenlandic Icecap.

As part of these activities, a network of stations (PROMICE) is operated (http://promice.dk/about_us_uk/main.html). The PROMICE network operates 20 automatic mass balance stations in Greenland, as shown in Table H-5.

4.6 Global Terrestrial Network for Permafrost (GTN-P)

Soil or rock that is permanently frozen throughout the year is called permafrost.

Permafrost is present in Greenland, and monitored at selected sites as part of (primary) individual research projects.

There is no information on any nationwide monitoring or reporting, neither nationally or internationally.

TABLE H-5. NATIONAL CONTRIBUTIONS TO THE TERRESTRIAL DOMAIN ESSENTIAL CLIMATE VARIABLES

Contributing networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2015	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
GCOS baseline river discharge network (GTN-R)	River discharge	14	14	14	14	14
GCOS Baseline Lake Level/ Area/Temperature Network (GTN-L)	Lake level/area/ temperature	0	0	0	0	0
WWW/GOS synoptic network (RBSN stations)	Snow cover	3	3	3	3	Not known
GCOS glacier monitoring network (GTN-G)	Glaciers mass balance and length, also ice sheet mass balance	20	N/A	20	Data are presently available upon request	Not known
GCOS permafrost monitoring network (GTN-P)	Permafrost borehole temperatures and active layer thickness	0	0	0	0	0

4.7 SATELLITE OBSERVATIONS AS BASE FOR TERRESTRIAL RELATED ECV OBSERVATIONS

Denmark is member state in EUMETSAT and ESA.

Especially through EUMETSAT Denmark takes functional part in activities related to the utilization of satellite data in analyses related to ECVs and climate monitoring.

At present DMI does not operate any activities in the areas shown in Table H-6.

TABLE H-6. GLOBAL PRODUCTS REQUIRING SATELLITE OBSERVATIONS – TERRESTRIAL

ECVs/ Global products requiring satellite observations	**Fundamental climate data records required for product generation (from past, current and future missions)**
Lakes Maps of lakes, lake levels, surface temperatures of lakes in the Global Terrestrial Network for Lakes	VIS/NIR imagery and radar imagery, altimetry, high-resolution IR imagery
Glaciers and ice caps Maps of the areas covered by glaciers other than ice sheets, ice sheet elevation changes for mass balance determination	High-resolution VIS/NIR/SWIR optical imagery, altimetry
Snow cover Snow areal extent	Moderate-resolution VIS/NIR/IR and passive microwave imagery
Albedo Directional hemispherical (black sky) albedo	Multispectral and broadband imagery
Land cover Moderate-resolution maps of land-cover type, high-resolution maps of land-cover type, for the detection of land-cover change	Moderate-resolution multispectral VIS/NIR imagery, high-resolution multispectral VIS/NIR imagery
fAPAR Maps of fAPAR	VIS/NIR imagery
LAI Maps of LAI	VIS/NIR imagery
Biomass Research towards global, above ground forest biomass and forest biomass change	L band/P band SAR, Laser altimetry
Fire disturbance Burnt area, supplemented by active fire maps and fire radiated power	VIS/NIR/SWIR/TIR moderate-resolution multispectral imagery
Soil moisturea Research towards global near-surface soil moisture map (up to 10 cm soil depth)	Active and passive microwave

5 Additional information

5.1 DETAILED REPORTING

Denmark provided a detailed report as part of "Denmark's Fifth National Communication on Climate Change Under the United Nations Framework Convention on Climate Change and the Kyoto Protocol" to the UNFCCC in 2009.

5.2 EUROPEAN CLIMATE ASSESSMENT & DATASET (ECA&D).

Through DMI's active participation in the EUMETNET Expert Team Climate (former EUMETNET programme ECSN (European Climate Support Network)) Denmark contributes very actively to the European Climate Assessment & Dataset

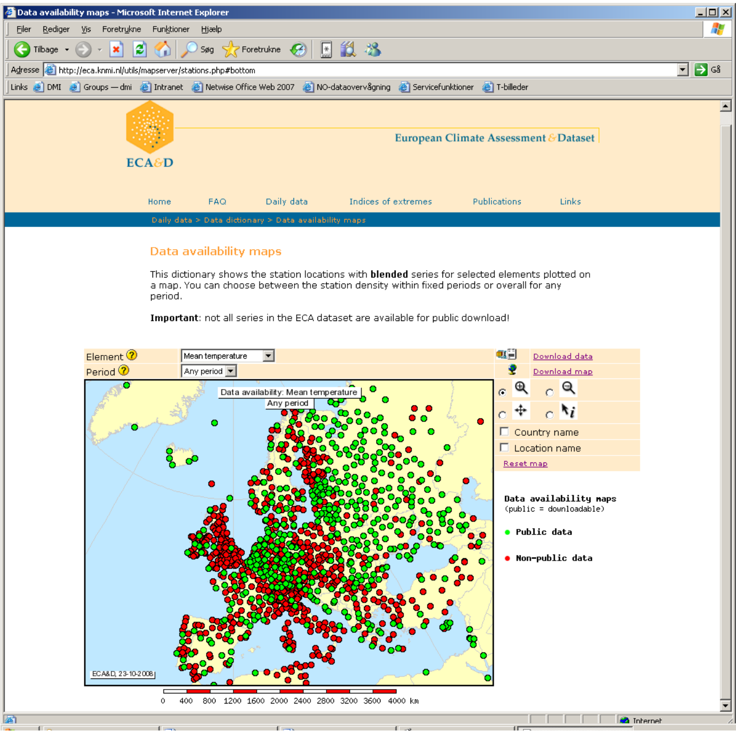
(ECA&D) http://eca.knmi.nl/ – at present the most comprehensive climate dataset and analysis for Europe.

ECA&D forms the backbone of the climate data node in the Regional Climate Centre (RCC) [“The Regional Climate Centre Node on Climate Data”] (RCC-CD for WMO Region VI (Europe and the Middle East)) since 2010.

In addition to the cooperation on data, DMI contributes active to The Regional Climate Centre Node on Climate Monitoring”] (RCC-CM for WMO Region VI (Europe and the Middle East)) providing national climate monitoring products and information.

The data and information products contribute to the Global Framework for Climate Services (GFCS).

FIGURE H-5 HOMEPAGE OF THE EUROPEAN CLIMATE ASSESSMENT & DATASET (ECA&D).



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The Ministry of Climate, Energy and Building
Stormgade 2-6 • DK-1470 Copenhagen K
Phone: +45 33 92 28 00
kebmin@kebmin.dk • Internet www.kebmin.dk