Denmark

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1. SUMMARY

Base-year emissions of greenhouse gases are calculated using 1990 emissions for carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) and 1995 emissions for fluorinated gases (SF6, HFCs and PFCs).

Sectoral projections[1] indicate that emissions from the energy sector in 2010 will be 3.6% below base year levels. Emissions from waste will have decreased by 12.3% and in agriculture by 27.6%. Transport and industrial processes are the only sectors expected to experience increases of 33.9% and 8.5% respectively.

2010 With Existing Measures projections[1] present a 13 Mt CO2–eq gap from the Kyoto target of 54.8 Mt CO2–eq. Denmark intends to use carbon sinks (2.3 Mt CO2–eq) and flexible mechanisms (4.2 Mt CO2–eq) to partially bridge that gap in order to meet its targets. However, after sinks and flexible mechanism have been taken into account, projections would 12% below base year and therefore, exceed the Kyoto target by 9 % points.[2] Sectoral projections show that most savings are expected to be made in the energy sector, then waste and finally transport (Table 5).

Total GHG emissions are projected to decrease slightly from 2010 to 2015 and more so by 2020 (Figure 1)[1]. When comparing projections figures reported in 2006, with those reported in 2007, a slight downward trend is noticeable. This is explained by the introduction of savings from carbon sinks in 2007, a slight reduction in the Kyoto base year and reduced With Existing Measures projections for 2010, which may be the result of expected structural effects or policy changes.

[1] Based on the information on projections, policies and measures including sinks and flexible mechanisms submitted on 15 March 2007. Updated projections and other information will not be available until the next due date for the reporting of projections (15 March 2009).
[2] In Denmark's Second National Allocation Plan approved by the Commission in August 2007, additional measures to be implemented in order to close the gap have been identified. In February 2008, a political agreement on the implementation of additional energy measures was reached in Denmark.

2. GHG PROJECTIONS AND PROGRESS TO KYOTO TARGETS

The report only presents a "with existing measures" scenario as Denmark estimates it already has many significant measures in place and there is little scope for additional cost-effective domestic measures. Projections for a without measures scenario are presented by sector but not by gas.

Table 1 shows, for all gases and main sectors:

- GHG emission projections for the scenario "with existing measures" (WEM);
- Historic emissions (in the "reference year") as reported together with projections.

For Denmark, the reference year is the Kyoto base-year: 1990 for CO_2, CH_4 and N_2O, and 1995 for fluorinated gases (F-gases).

Table 1. Summary of reported projections by sector and by gas in 2010* (Mt CO_2–eq.)

	Carbon dioxide			Methane			Nitrous oxide			F-gases			Total		
	Reference year	2010 WEM	2010 WAM	Reference year	2010 WEM	2010 WAM	Reference year	2010 WEM	2010 WAM	Reference year	2010 WEM	2010 WAM	Reference year	2010 WEM	2010 WAM
Energy (excl. transport)	41.1	39.3	NE	0.2	0.5	NE	0.3	0.3	NE	NA	NA	NA	41.6	40.1	NE
Energy supply	26.4	26.8	NE	0.1	0.3	NE	0.1	0.2	NE	NA	NA	NA	26.6	27.2	NE
Energy – industry, construction	5.4	5.7	NE	0.0	0.0	NE	0.1	0.1	NE	NA	NA	NA	5.5	5.8	NE
Energy – other (commercial, residential, agriculture)	9.3	6.8	NE	0.1	0.2	NE	0.1	0.1	NE	NA	NA	NA	9.5	7.1	NE
Transport (energy)	10.3	13.5	NE	0.1	0.0	NE	0.1	0.5	NE	NA	NA	NA	10.5	14.1	NE
Industrial processes	1.1	1.8	NE	NE	NE	NE	1.0	NE	NE	0.3	0.9	NA	2.5	2.7	NE
Waste	NE	NE	NE	1.5	1.3	NE	0.1	0.1	NE	NA	NA	NA	1.5	1.4	NE
Agriculture	NE	NE	NE	4.0	3.6	NE	9.0	5.9	NE	NA	NA	NA	13.0	9.4	NE
Other	0.1	0.1	NE	NA	NA	NE	NA	NA	NE	NA	NA	NA	0.1	0.1	NE
Total (excl. LULUCF)	52.7	54.7	NE	5.7	5.5	NE	10.6	6.8	NE	0.3	0.9	NA	69.3	67.8	NE

Key:
Reference year: base-year under the Kyoto Protocol (1990 for carbon dioxide, methane and nitrous oxide, and 1995 for F-gases).
WEM: 'with existing measures' projection
WAM: 'with additional measures' projection

*Note that data for 2010 is actually average for 2008-2012.

Source: Denmark's national report submitted to the European Commission under Article 3(2) of the Monitoring Mechanism, Decision 280/2004/EC. Report dated 15 March 2007 and updated 31 May 2007. Projection of Greenhouse Gas Emissions – 2005 to 2030 National Environmental Research Institute, Denmark.

Table 2 shows, for all gases and main sectors:

- 1990 GHG emissions as reported in the latest (2008) GHG emissions inventory (1990-2006);

- Adjusted GHG emission projections for the WEM scenario. This adjustment of the projections reported in Table 1 is carried out to allow consistency and comparability between projections and the latest (2008) GHG inventory data[3].

Table 2. Summary of projections by sector and by gas in 2010* compared to 1990 emissions ($MtCO_2$-eq.)

	Carbon dioxide			Methane			Nitrous oxide			F-gases			Total		
	1990	2010 WEM	2010 WAM	1990	2010 WEM	2010 WAM	1990	2010 WEM	2010 WAM	1990	2010 WEM	2010 WAM	1990	2010 WEM	2010 WAM
Energy (excl. transport)	40.9	39.2	NE	0.2	0.5	NE	0.3	0.3	NE	NA	NA	NA	41.4	40.1	NE
Energy supply	26.4	26.8	NE	0.1	0.3	NE	0.1	0.2	NE	NA	NA	NA	26.6	27.2	NE
Energy – industry, construction	5.4	5.7	NE	0.0	0.0	NE	0.1	0.1	NE	NA	NA	NA	5.5	5.8	NE
Energy – other (commercial, residential, agriculture)	9.1	6.8	NE	0.1	0.2	NE	0.1	0.1	NE	NA	NA	NA	9.3	7.1	NE
Transport (energy)	10.5	13.5	NE	0.1	0.0	NE	0.1	0.5	NE	NA	NA	NA	10.7	14.1	NE
Industrial processes	1.1	1.8	NE	0.0	NE	NE	1.0	NE	NE	0.0	0.9	NA	2.2	2.7	NE
Waste	NE	NE	NE	1.5	1.3	NE	0.1	0.1	NE	NA	NA	NA	1.5	1.4	NE
Agriculture	NE	NE	NE	4.0	3.6	NE	9.0	5.9	NE	NA	NA	NA	13.0	9.4	NE
Other	0.1	0.1	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	0.1	0.1	NE
Total (excl. LULUCF)	52.7	54.6	NE	5.7	5.5	NE	10.6	6.8	NE	0.0	0.9	NA	69.0	67.8	NE

Key:
WEM: 'with existing measures' projection
WAM: 'with additional measures' projection

Source: Denmark's national report submitted to the European Commission under Article 3(2) of the Monitoring Mechanism, Decision 280/2004/EC. Report dated 15 March 2007 and updated 31 May 2007. Projection of Greenhouse Gas Emissions – 2005 to 2030 National Environmental Research Institute, Denmark. Denmark's annual greenhouse gas inventory 1990 - 2006 and inventory report, dated 15 April 2008.

[3] The adjustment consists in applying an adjustment factor to projections from Table 1. This factor is the ratio between total emissions in the reference year as reported in the 2008 GHG inventory report (or, if the reference year is the base-year under the Kyoto Protocol, in the report of the review of the initial report under the Kyoto Protocol) and total emissions in the reference year as reported by the country with projections (Table 1).

*Note that data for 2010 is actually average for 2008-2012.

Table 3. Summary of projections by sector and by gas in 2010* compared to 1990 emissions (index 100 = 1990)

	Carbon dioxide			Methane			Nitrous oxide			F-gases			Total		
	1990	2010 WEM	2010 WAM	1990	2010 WEM	2010 WAM	1990	2010 WEM	2010 WAM	1990	2010 WEM	2010 WAM	1990	2010 WEM	2010 WAM
Energy (excl. transport)	100	95.8	NE	100	314.6	NE	100	117.4	NE	100	NA	NA	100	96.9	NE
Energy supply	100	101.3	NE	100	436.4	NE	100	136.3	NE	100	NA	NA	100	102.2	NE
Energy – industry, construction	100	105.1	NE	100	276.4	NE	100	113.8	NE	100	NA	NA	100	105.6	NE
Energy – other (commercial, residential, agriculture)	100	74.5	NE	100	236.2	NE	100	97.8	NE	100	NA	NA	100	76.4	NE
Transport (energy)	100	128.4	NE	100	83.8	NE	100	449.9	NE	100	NA	NA	100	131.7	NE
Industrial processes	100	161.6	NE	100	NE	NE	100	NE	NE	100	2044.7	NA	100	122.4	NE
Waste	100	NE	NE	100	88.7	NE	100	69.6	NE	100	NA	NA	100	87.6	NE
Agriculture	100	NE	NE	100	89.4	NE	100	64.8	NE	100	NA	NA	100	72.4	NE
Other	100	76.3	NE	100	NE	NE	100	NE	NE	100	NA	NA	100	76.3	NE
Total (excl. LULUCF)	100	103.7	NE100	100	95.8	NE	100	64.1	NE	100	NA	NA	100	98.2	NE

Key:
WEM: 'with existing measures' projection
WAM: 'with additional measures' projection

Source: Denmark's national report submitted to the European Commission under Article 3(2) of the Monitoring Mechanism, Decision 280/2004/EC. Report dated 15 March 2007 and updated 31 May 2007. Projection of Greenhouse Gas Emissions – 2005 to 2030 National Environmental Research Institute, Denmark. Denmark's annual greenhouse gas inventory 1990 - 2006 and inventory report, dated 15 April 2008.

*Note that data for 2010 is actually average for 2008-2012.

Table 4. Summary of projections in 2010 compared to base year emissions under the Kyoto Protocol

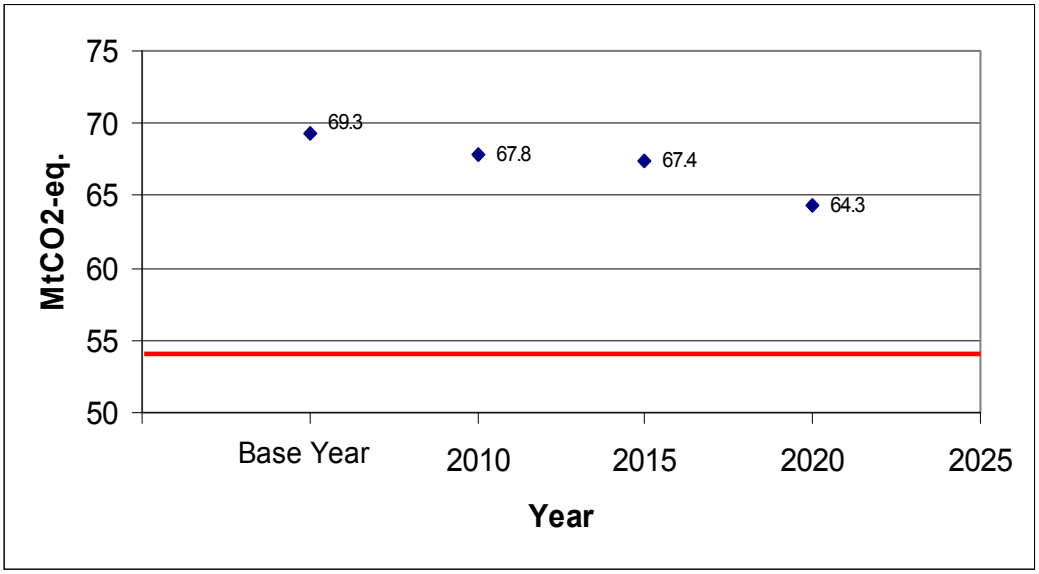
	Unit	Base-year emissions under the Kyoto Protocol	2010 projections 'with existing measures'	2010 projections 'with additional measures'
Total GHG emissions (excluding LULUCF)	Mt CO_2-eq.	69.3	67.8	NE
	Index (base-year emissions = 100)	100	97.8	NE

Source: Denmark's national report submitted to the European Commission under Article 3(2) of the Monitoring Mechanism, Decision 280/2004/EC. Report dated 15 March 2007 and updated 31 May 2007. Projection of Greenhouse Gas Emissions – 2005 to 2030 National Environmental Research Institute, Denmark. Denmark's annual greenhouse gas inventory 1990 - 2006 and inventory report, dated 15 April 2008. Kyoto Protocol Base-year emissions for Denmark, excluding Greenland, from the UNFCCC website http://unfccc.int/resource/docs/2007/irr/dnk.pdf.

In Figure 1, the same correction factor used in Table 2 has been applied to the projections for 2010, 2015 and 2020. Figure 1 presents the "with existing measures" scenario.

The red lines in Figure 1 and 2 indicate the Kyoto target of 54.8 Mt CO_2-eq., based on the revised Kyoto base year, 2008.

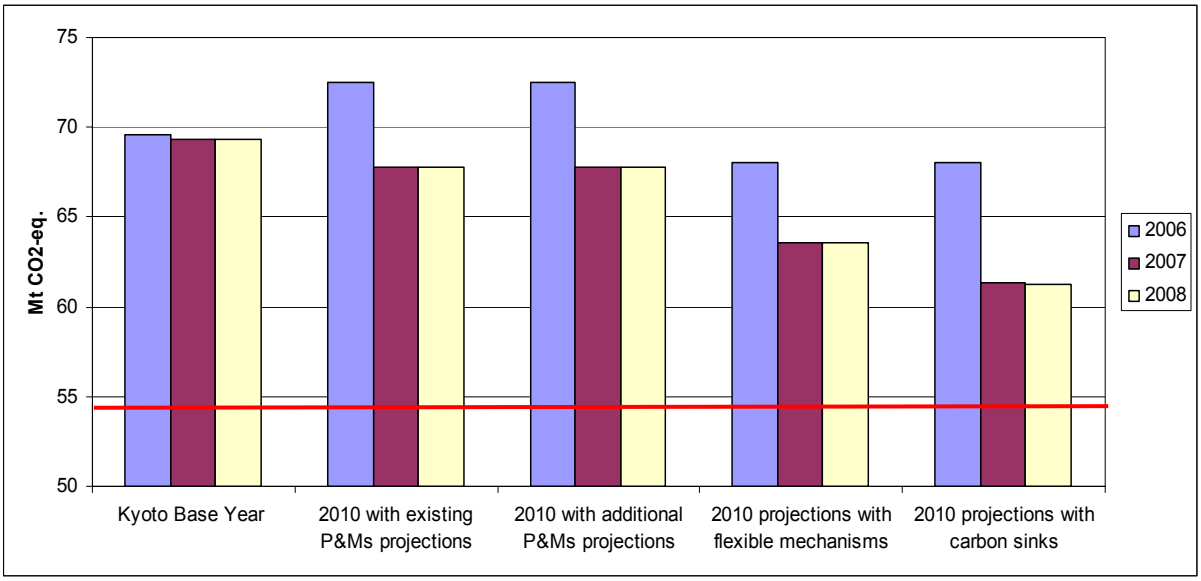
Figure 1. Greenhouse gas projections in 2010*, 2015* and 2020 (Mt CO2–eq.)



Source: Denmark's national report submitted to the European Commission under Article 3(2) of the Monitoring Mechanism, Decision 280/2004/EC. Report dated 15 March 2007 and updated 31 May 2007. Projection of Greenhouse Gas Emissions – 2005 to 2030 National Environmental Research Institute, Denmark. Denmark's annual greenhouse gas inventory 1990 - 2006 and inventory report, dated 15 April 2008. Kyoto Protocol Base-year emissions for Denmark, excluding Greenland, from the UNFCCC website http://unfccc.int/resource/docs/2007/irr/dnk.pdf.

*Note that data for 2010 is actually average for 2008-2012 and data for 2015 is average of 2013-2017.

Figure 2. Comparison of 2010 projections reported in 2006, 2007 and 2008



Source: Denmark's national report submitted to the European Commission under Article 3(2) of the Monitoring Mechanism, Decision 280/2004/EC. Report dated 15 March 2007 and updated 31 May 2007. Projection of Greenhouse Gas Emissions – 2005 to 2030 National Environmental Research Institute, Denmark. Denmark's annual greenhouse gas inventory 1990 - 2006 and inventory report, dated 15 April 2008. Kyoto Protocol Base-year emissions for Denmark, excluding Greenland, from the UNFCCC website http://unfccc.int/resource/docs/2007/irr/dnk.pdf.

3. CLIMATE CHANGE MITIGATION POLICIES AND MEASURES

Sectoral projections[1] indicate that emissions from energy supply in 2010 will be 3.6% below base year levels. Emissions from waste will have decreased by 12.3% and in agriculture by 28%. Transport and industrial processes are the only sectors expected to experience increases, 33.9% and 8.5% respectively.

Projections for 2010[1] that include measures, carbon sinks and flexible mechanism indicate Denmark's emissions will still be 6.5 Mt CO2–eq above the country's Kyoto target[2]. Denmark estimates it already has many significant domestic measures in place and there is little scope for additional cost-effective domestic measures. However, beside additional measures such as cuts in quotas under the EU ETS, the use of flexible mechanisms and sinks, additional domestic measures have been identified in Denmark's Second National Allocation Plan submitted in March 2007 and approved by the European Commission in August 2007.

Table 5. Summary of the effect of policies and measures included in the 2010 projections (Mt CO2–eq.)

	Top down calculation		Bottom Up calculation	
	Existing Measures	Planned Measures	Existing Measures	Planned Measures
Energy (total, excluding transport)	NE	NE	11.9 or 16.0*	NE
Energy supply	NE	NE	NE	NE
Energy – industry, construction	NE	NE	NE	NE
Energy – other (commercial, residential, agriculture)	NE	NE	NE	NE
Energy – other (not sector)	NE	NE	NE	NE
Transport (energy)	NE	NE	1.7	NE
Industrial processes	NE	NE	0.4	NE
Waste	NE	NE	1.9	NE
Agriculture	NE	NE	0.5	NE
Cross-sectoral	NE	NE	NE	NE
Total (excluding LULUCF)	NE	NE	15.5 or 20.5*	NE

Source: Denmark's national report submitted to the European Commission under Article 3(2) of the Monitoring Mechanism, Decision 280/2004/EC. Report dated 15 March 2007 and updated 31 May 2007.

Note: The effects of measures detailed above are calculated firstly by determining the difference between total projections in each scenario ('top down calculation') and secondly by summing the reported effect of individual measures ('bottom up calculation'). A top down calculation of measures was not possible as a 'without measures' projection was not provided.

* The Danish Energy Authority estimates that approximately 5.0 of the 20.6 million tonnes CO2 annually will be offset by increased electricity exports based on the calculation assumptions of the climate strategy.

Table 6. Detailed information on Existing Policies and measures

Sector	Name	Type	GHG	Status	Absolute Reduction [kt CO_2 eq. p.a.]			Costs [EUR/t]
					2005	2010	2020	
Agriculture	Action Plan for the Aquatic Environment I and II and Action Plan for Sustainable Agriculture	Economic Information Regulatory	N20	Implemented				
Agriculture	Ban on burning of straw on fields	Regulatory	CH4 CO2 N2O	Implemented				
Agriculture	Ammonia action plan and the new statutory order on manure: Optimisation of manure handling during housing.	Regulatory	N2O	Implemented				
Agriculture	Action Plan for the Aquatic Environment III	Economic Regulatory	N20	Implemented		Cluster value		
Agriculture	Planting of windbreaks	Economic	CO2	Implemented		140		
Agriculture	Ammonia action plan and the new statutory order on manure: Rules on covering storage facilities.	Regulatory	N2O	Implemented		Cluster value		

Agriculture	Ammonia action plan and the new statutory order on manure: Ban on surface spreading of manure	Regulatory	N2o	Implemented		Cluster value		
Agriculture	Ammonia action plan and the new statutory order on manure: Reduction of the time on field surfaces.	Regulatory	N2O	Implemented		Cluster value		
Agriculture	Ammonia action plan and the new statutory order on manure: Ban on ammonia treatment of straw.	Regulatory	N2O	Implemented		Cluster value		
Cross-cutting	Mineral-oil tax act	Fiscal	CO2	Implemented		Cluster value		
Cross-cutting	Gas tax act	Fiscal	CO2	Implemented		Cluster value		
Cross-cutting	Coal tax act	Fiscal	CO2	Implemented		Cluster value		
Cross-cutting	Electricity tax	Fiscal	CO2	Implemented		Cluster value		
Cross-cutting	Carbon dioxid tax on energy products	Fiscal	CO2	Implemented		Cluster value		
Cross-cutting	EU-CO2-allowances for electricity and district heat production and certain industrial processes (incl. Business)	Economic	CO2	Implemented	6000			

Cross-cutting	Purchase CO2 credits from JI and CDM projects	Voluntary/ negotiated agreement	CH4 CO2 HFC N2O PFC SF6	Implemented				
Energy consumption	Energy labelling of small and large buildings (incl. public sector and business)	Information Regulatory	CO2	Implemented				
Energy consumption	Electricity Saving Trust - campaigns and A club to promote energy efficient appliances	Economic Information	CO2	Implemented				
Energy consumption	Energy labelling of electric appliances	Information	CO2	Implemented				
Energy consumption	Savings activities by elec. grid, gas and district heating companies (incl. for the domestic and public sectors)	Information Regulatory	CO2	Implemented				
Energy consumption	Circular on energy-efficiency in state institutions	Regulatory	CO2	Implemented				
Energy consumption	Agreements on energy efficiency with business	Economic Voluntary/ negotiated agreement	CO2	Implemented				
Energy supply	Biomass Agreement	Economic Research	CO2	Implemented				
Energy supply	Energy research	Research	CO2	Implemented				
Energy supply	Price supplement for suppliers of environmental friendly electricity	Economic	CO2	Implemented				
Energy supply	Tender for off-shore wind turbines	Economic Regulatory	CO2	Implemented				

Energy supply	Biogas plant	Economic	CH4 CO2 N2O	Implemented		500		
Energy supply	Scrapping sheme for old wind turbines	Economic	CO2	Implemented				
Industrial Processes	Tax on HFCs, PFCs and SF6	Fiscal	HFC PFC SF6	Implemented		Cluster value		
Industrial Processes	Regulation on the use of industrial gases (HFCs, PFCs and SF6)	Regulatory	HFC PFC SF7	Implemented		Cluster value		
Industrial Processes	Enterprise sheme on HFCs	Economic	HFC	Implemented				
Forestry	Subsidy scheme for private afforestation on agricultural land	Economic	CO2	Implemented		Cluster value		
Forestry	Public afforestation	Regulatory Voluntary/ negotiated agreement	CO2	Implemented		Cluster value		
Transport	Green owner tax on motor vehicles	Fiscal	CO2	Implemented				
Transport	Information campaign on new cars' fuel consumption	Information	CO2	Implemented		Cluster value		
Transport	Energy correct driving techniques	Information	CO2	Implemented				
Transport	Initiative on enforcing speed limits	Economic Information	CO2	Implemented				
Transport	Establishment of intermodal installations	Economic	CO2	Other				
Transport	Promotion of environment-friendly freight transport	Economic Information	CO2	Implemented				
Transport	Reduced travelling time for public	Regulatory	CO2	Implemented		Cluster value		

	transport							
Transport	Spatial planning	Regulatory	CO2	Implemented				
Transport	Registration tax act	Fiscal	CO2	Implemented		600		
Waste	Obligation to send combustibel waste for incineration	Regulatory	CH4	Implemented		333		
Waste	Waste tax	Fiscal	CH4	Implemented				
Waste	Weight and volume based packaging taxes	Fiscal	CH4 CO2	Implemented				
Waste	Implementation of the EU landfill directive	Regulatory	CH4	Implemented				
Waste	Subsidy programme - Enterprise Scheme (special scheme for businesses)	Economic	CH4	Implemented				
Industrial Processes	Combined emission reduction of DK-IND-02 DK-IND-03	Fiscal Regulatory	HFC PFC SF6	Implemented		400		
Transport	Combined emission reduction of DK-TRA-01 DK-TRA-02 DK-TRA-03 DK-TRA-10	Fiscal Information Regulatory	CO2	Implemented		600		
Agriculture	Combined emission reduction of DK-AGR-03 DK-AGR-06 DK-AGR-07 DK-AGR-08 DK-AGR-09	Regulatory	N2O	Implemented		30		
Forestry	Combined emission reduction of DK-LUC-01 DK-LUC-03	Economic Regulatory Voluntary/ negotiated agreement	CO2	Implemented		262		

Cross-cutting	Combined emission reduction of DK-CRS-01 DK-CRS-02 DK-CRS-03 DK-CRS-04 DK-CRS-05	Fiscal	CO2	Implemented		2700		

Source: Öko Institut, (accessed 19/06/2008), ECCP Policies and Measures database, http://www.oeko.de/service/pam/index.php

Table 7. Detailed information on Planned Policies and measures

Sector	Name	Type	GHG	Status	Absolute Reduction [kt CO_2 eq. p.a.]			Costs [EUR/t]
					2005	2010	2020	
Waste	Increased recycling of waste plastic packaging	Regulatory	CO2	Planned		5		

Source: Öko Institut, (accessed 19/06/2008), ECCP Policies and Measures database, http://www.oeko.de/service/pam/index.php

Table 8. Status of national policies and measures (PAM) in relation to European common and coordinated policies and measures (CCPM)

Status	CCPM	Sector
National policies and measures already in force **before** CCPM was adopted	Taxation of energy products 2003/96/EC	Energy supply
	Promotion of electricity from RE sources 2001/77/EC	Energy supply
	Promotion of cogeneration 2004/8/EC	Energy supply
	Directives on energy labelling of appliances	Energy consumption
	Efficiency of hot water boilers 92/42/EEC	Energy consumption
	End-use efficiency and energy services 2006/32/EC	Energy consumption
	Environmental performance freight transport (Marco Polo Programme)	Transport
	Integrated European railway area (2nd + 3rd Railway package) (COM(2002)18 final)	Transport
	F-gas regulation (Regulation No 842/2006)	Industrial Process
	Packaging and packaging waste (Directive 94/62/EC, 2004/12/EC, 2005/20/EC)	Waste
	Directive on waste 2006/12/EC	Waste
	Landfill directive 1999/31/EC	Waste
	Integrated pollution prevention and control 96/61/EC	Cross-cutting
Existing national policies and measures **reinforced** by CCPM	Internal electricity market 2003/54/EC	Energy supply
	Internal market in natural gas 98/30/EC	Energy supply
	Energy performance of buildings (Directive 2002/91/EC)	Energy consumption
	Transport modal shift to rail 2001/12/EC etc.	Transport
	Consumer information on cars 1999/94/EC	Transport
	Nitrates 91/676/EEC	Agriculture
New national policies and measures implemented after CCPM was adopted	Emissions trading 2003/87/EC	Cross-cutting
	Kyoto Protocol project mechanisms 2004/101/EC	Cross-cutting
	Eco-management & audit scheme (EMAS) EC 761/2001	Energy consumption
	Energy-efficiency labelling for office equipment Regulation No. 2422/2001	Energy consumption
	Efficiency fluorescent lighting 2000/55/EC	Energy consumption
	Motor challenge, voluntary EC programme	Energy consumption
	Eco-management & audit scheme (EMAS) EC 761/2001	Energy consumption
	Promotion of biofuels for transport 2003/30/EC	Transport
	Agreement with car manufacturers ACEA etc.	Transport
	Industrial Process: HFC emissions from air conditioning in motor vehicles 2006/40/EC	Industrial Process
	Support under CAP (1782/2003)	Agriculture
	Support under CAP - amendment (1783/2003)	Agriculture
Status of national policy or measure **not reported**	Transition to rural development support No 2603/1999	Agriculture

	Pre-accession measures for agriculture and rural development (1268/1999)	Agriculture
	Rural development support and CAP(2603/1999, 1698/2005 and 1290/2005)	Agriculture
	Support for rural development from EAGGF (1257/1999)	Agriculture
	Support scheme for energy crops under CAP (795/2004)	Agriculture

Source: MS responses to the CCPMs questionnaire, 2005. Personal communications.

Denmark has been proactive when it comes to implementing national policies and measures to reduce greenhouse gas emissions. On at least 13 occasions, national policies were already implemented before related CCPMs were adopted. Eight national policies were reinforced by the implementation of a CCPM and thirteen policies were implemented following the adoption of the CCPM.

4. METADATA

Sources of information

Base-year emissions for Denmark, excluding Greenland, from the UNFCCC website, http://unfccc.int/ghg_data/kp_data_unfccc/base_year_data/items/4354.php

Denmark's national report submitted to the European Commission under Article 3(2) of the Monitoring Mechanism, Decision 280/2004/EC. Report dated 15 March 2007 / updated 31 May 2007.

Denmark's annual greenhouse gas inventory 1990 - 2006 and inventory report, dated 15 April 2008

European Climate Change Programme (ECCP), Database on Policies and Measures in Europe http://www.oeko.de/service/pam/index.php

Projection of Greenhouse Gas Emissions – 2005 to 2030 National Environmental Research Institute, Denmark.

Kyoto base-year emissions

Kyoto base-year emissions are presented throughout, except Table 1, which presents projections reference year emissions (see below)[4]. Kyoto base year emissions of greenhouse gases were calculated using 1990 emissions for carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) and 1995 emissions for fluorinated gases (SF_6, HFCs and PFCs).

Kyoto base-year emissions have now been reviewed and set for all EEA countries.

Projections reference year emissions

Projections reference year emissions are presented in Table 1.

Projections reference year emissions are defined as projections-consistent emissions data for a given historic year, as chosen by the Member State. Inventory recalculations from year to year may mean that latest inventory data cannot be compared with projections based on older inventory data. Where such an inconsistency has arisen, MS projections have been corrected by applying the following formula, in Table 2:

Corrected projection = reported projections * latest inventory total GHG emissions / Table 1 reported total GHG emissions for the same reference year

Quality of Reporting

[4] However, in the case of Denmark, the base year shown in projections is the Kyoto Protocol Base Year.

Member State reporting in the sources detailed above was assessed semi-qualitatively. Scoring was attributed according to the level of detail and clarity: from o (representing not reported) to +++ (representing very detailed and/or clear reporting). Guidance used for this assessment included the reporting requirements laid down in:

- EU legislation: Monitoring Mechanism (280/2004/EC) and Implementing Provisions (2005/166/EC)
- UNFCCC reporting guidelines for national communications available in English, French, Spanish ("Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications - FCCC/CP/1999/7")

The following tables detail reporting considered to be best practice for the purposes of this assessment.

Information provided	**Example of good practice**
Policy names	Clear names and description provided with unique identifier.
Objectives of policies	Good description of objectives
Types of policies	Type of policy instrument specified e.g. regulatory, fiscal
Which greenhouse gases?	Specifies which gases each PAM affects
Status of Implementation	Clear for each PAM: planned, adopted, implemented, expired
Implementation body	Clear which authorities are responsible for implementation
Quantitative assessment of emission reduction effect and cost of policies	Almost all PAMs are actually quantified. Total effect of all PAMs specified. WOM projection provided.
Interaction with other national and EU level policies	Detailed discussion and analysis of policy interactions.
Measures implementing community legislation	Report details which national policies are implementing individual pieces of EU legislation.
Arrangements for flexible mechanisms	Details arrangements for use of flexible mechanisms.
Balance between domestic action and flexible mechanisms	Regarding reductions required to meet Kyoto target, details proportion to result from domestic action and flexible mechanisms.

Category of Information	**Example of good practice**
Projection scenarios	"With existing measures" and "with additional measures" projections required, "without measures projection" optional.
Policies included in each projection	Clear presentation of the policies included in each projections scenario.
Expressed relative to historic reference year data	Projections are presented alongside consistent historic emissions.
Starting year	Starting year and emissions used as basis for projections is detailed.
Split of projections	Projection split by all 6 gases (or F-gases together), all sectors and years
Presentation of results	Clear, both tables and graphs provided and/or used excel reporting template.
Description of methodologies	Description of approach, model and assumptions

Sensitivity analysis	Was an analysis carried out to determine the sensitivity of projections to variance in the input parameters? Are high medium and low scenarios presented?
Discussion of uncertainty	Is an uncertainty range for the projections provided?
Details of parameters and assumptions	Are parameters as required under Monitoring Mechanism 280/2004/EC reported?
Indicators for projections	Are indicators for projections as required under Monitoring Mechanism 280/2004/EC reported?

Table 2. Information provided on policies and Kyoto flexible mechanisms

Information provided	Level of information provided	Comments
Policy names	+++	Policies are all named, and names are self-explanatory
Objectives of policies	++	The objectives for most policies are well described
Types of policies	+++	Type of policy instrument specified e.g. regulatory, fiscal
Which greenhouse gases?	++	Almost all the policies specify
Status of Implementation	++	The implementation status of the majority of policies is stated
Implementation body	+++	Implementation bodies are specified for all PAMs
Quantitative assessment of emission reduction effect and cost of policies	+	Quatitative assessments of the effects of implementation are provided for some PAMs
Interaction with other national and EU level policies	0	There is no discussion of interaction with other PAMs
Measures implementing community legislation	+++	Report details which national policies are implementing individual pieces of EU legislation.
Arrangements for flexible mechanisms	++	strategy for the use of the flexible mechanisms is described
Balance between domestic action and flexible mechanisms	+++	mechanisms was described

Table 3. Information provided on projections

Category of Information	Level of information provided	Comments
Projection scenarios	++	With existing measures. No With Additional Measure considered as Denmark estimates it already has many significant measures in place and there is little scope for additional cost-effective domestic measures
Policies included in each projection	NA	There is only one scenario with policies, WEM, so all policies are included

Expressed relative to historic reference year data	++	Projections are presented alongside consistent historic emissions.
Starting year	++	Projections start in 2005
Split of projections	+++	Split by gas and sector. Each gas also split by sector.
Presentation of results	+++	Clear presentation
Description of methodologies	++	Detailed information on approach, model and assumptions included in the referred report Projection of Greenhouse Gas Emissions – 2005 to 2030
Sensitivity analysis	+++	There are no new sensitivity analyses for the updated greenhouse gas projections, however the report refers to the sensitivity analysis carried out for the Fourth National Communication as being still valid for the purpose of the new projections.
Discussion of uncertainty	+	Uncertainty range for projections is not provided but uncertainty is discussed in several contexts in the MM
Details of parameters and assumptions	+++	Parameters and assumptions are reported
Indicators for projections	+++	Indicators are reported

Parameters for projections are presented in Table 10. Denmark has provided thorough information for all "mandatory parameters" for its "with existing measures" projections. None of the "recommended parameters" are provided.

Table 4. Parameters for Projections

1. Mandatory parameters on projections	2005	2010	2015	2020	Units
Assumptions for general economic parameters					
GDP (value at given years or annual growth rate and base year)	148.03	161.68	174.33	186.81	GDP, billion euro
Population (value at given years or annual growth rate and base year)	5.419	5.44	5.434	5.422	mill. Residents
International coal prices at given years in euro per tonne or GJ (Gigajoule)	50.12	45.92	45.78	45.53	EUR (2000)/tonne
International oil prices at given years in euro per barrel or GJ	42	39	39	39	EUR(2000)/barrel
International gas prices at given years in euro per m3 or GJ	3.82	4.9	4.86	4,82	EUR(2000)/GJ
Assumptions for the energy sector					
Total gross inland consumption (PJ) (split by oil, gas, coal, renewables, nuclear, other)	801.69	834.99	897.47	897.9	PJ
coal and coke	154.32	167.19	186.81	130.3	PJ
oil	316.17	318.01	322.53	330.63	PJ
gas	194.67	192.28	224.12	241.72	PJ
renewables	136.73	156.62	164.02	192.25	PJ
Total electricity production by fuel type (oil, gas, coal, renewables, nuclear, other)	32.67	37.98	42.37	41.76	PJ
coal and coke	10.28	17.2	19.54	13.45	PJ
oil	0.79	0.92	1.16	1.16	PJ
gas	9.43	5.98	5.4	7.77	PJ
renewables	12.18	13.87	42.37	41.76	PJ
Energy demand by sector split by fuel (delivered)	801.89	834.99	897.47	897.9	PJ
oil and gas sector	56.27	72.06	103.32	116.79	PJ
electricity and district heat sector	325.41	336.27	367.43	348.54	PJ
non energy purposes	11.95	10.82	10.82	10.62	PJ
transport	182.61	186.46	192.67	200.18	PJ
agriculture etc	31.31	34.15	33.72	32.87	PJ
manufacturing	76.38	87.24	87.96	88.52	PJ
construction	6.66	7.26	7.43	7.72	PJ
trade and service	19.06	18.04	17.36	17.19	PJ
households	88.04	80.68	76.75	75.29	PJ

Assumptions on weather parameters, especially heating or cooling degree days	2856	3023	2982	2941	degrees days
Assumptions for the industry sector					
For Member States using macroeconomic models:					
The share of the industrial sector in GDP and growth rate	0.135	0.135	0.134	0.134	share
	-2.22	1.73	1.45	1.29	*%pa*
For Member States using other models:					
The production index for industrial sector					
Assumptions for the transport sector					
For Member States using macroeconomic models:					
The growth of transport relative to GDP					
number of kilometres driven by passenger cars relative to GDP	276	284	277	273	Mkm/billion EUR (EF95)
goods transport (all forms of transport) relative to GDP	102	101	101	100	Mkm/billion EUR (EF95)
For Member States using other models:					
The growth of passenger person kilometres (number of kilometres driven by passenger cars relative to GDP)	40916	45886	48321	51024	Mkm/billion EUR (EF95)
The growth of freight tonne kilometres (goods transport (all forms of transport) relative to GDP)	15160	16432	17522	18705	Mtkm
Assumptions for buildings (in residential and commercial or tertiary sector)					
For Member States using macroeconomic models:					
The level of private consumption (excluding private transport)	77102	86068	96443	107167	Mill. EUR (EC95)
The share of the tertiary sector in GDP and the growth rate					
Share	0.676	0.679	0.678	0.677	share
Growth rate	2.14	1.87	1.51	1.36	%pa
For Member States using other models:					
The rate of change of floor space for tertiary buildings and dwellings		0.84	0.71	0.69	%pa
The number of dwellings and number of employees in the tertiary sector					
the number of dwellings (all-year roun)	2096	2191	2278	2359	in 1000s
Assumptions in the agriculture sector					
For Member States using macroeconomic models:					
The share of the agriculture sector in GDP and relative growth					
Share	.0.32	.0.31	.0.30	.0.30	
Growth Rate	-1.4	1.1	1.1	1.1	%pa
For Member States using other models:					
Livestock numbers by animal type (for enteric fermentation beef, cows, sheep, for manure management pigs and poultry)					
Cattle	2648	2445	2237	2140	in 1000s

Mother Sheep	84	85	86	87	in 1000s
Goast	12	12	12	12	in 1000s
Pigs (differs from the annual census)	13295	14154	15069	15438	in 1000s
Poultry (differs from the annual census)	19744	21109	22475	22529	in 1000s
The area of crops by crop type					
pulses	31082	30396	29710	29198	ha
rootfruits	92818	90770	88722	87194	ha
industrial crops	105556	103228	100899	99160	ha
seeds	86430	84523	82616	81193	ha
feeding	230320	225239	220157	216364	ha
gras in rotation	210096	205460	200825	197365	ha
other areas	2289	2238	2188	2150	ha
vegetables	9696	9482	9269	9109	ha
permanent grassland	176081	172196	168311	165412	ha
set-aside	204777	200259	195741	192369	ha
total	2634456	2576331	2518206	2474825	ha
Emissions factors by type of livestock for enteric fermentation and manure management (t)					
CH4 -enteric fermentation - implied emissions factor					
cattle	40.88	42.19	42.78	42.83	kg per head per year
mother sheep	17.17	17.17	17.17	17.17	kg per head per year
goats	13.15	13.15	13.15	13.15	kg per head per year
pigs	1.06	1.04	0.97	0.96	kg per head per year
CH4-manure management - implied emission factor					
cattle	4.88	5.02	5.05	5.04	kg per head per year
mother sheep	0.32	0.32	0.32	0.32	kg per head per year
goats	0.26	0.26	0.26	0.26	kg per head per year
pigs	2.57	2.56	2.38	2.37	kg per head per year
poultry	0.014	0.014	0.014	0.014	kg per head per year
N2O					
mineral fertiliser	193	179	168	163	1000 ton N per year
manure	184	186	187	186	000 ton N ab storage per year
mineral fertiliser	0.0125	0.0125	0.0125	0.0125	fraction of N
manure	0.0125	0.0125	0.0125	0.0125	fraction of N
Assumptions in the waste sector					
Waste generation per head of population or tonnes of municipal solid waste					
total landfilled wasate per capita	197	235	248	254	kg/capita
The organic fractions of municipal solid waste					

% organic carbon	12.9	12.9	12.9	12.9	%
Municipal solid waste disposed to landfills, incinerated or composted (in tonnes or %)					
municipal solid waste disposed to landfills	315	400	421	431	1,000 tonnes
Assumptions in the forestry sector					
Forest definitions					
Areas of:					
managed forests	453884	463383	472884	482384	ha
unmanaged forests	0	0	0	0	ha

2. Recommended parameters on projections	**2005**	**2010**	**2015**	**2020**	**Units**
Assumptions for general economic parameters					
GDP growth rates split by industrial sectors in relation to 2000					
Comparison projected data with official forecasts					
Assumptions for the energy sector					
National coal, oil and gas energy prices per sector (including taxes)					
National electricity prices per sector as above (may be model output)					
Total production of district heating by fuel type					
Assumptions for the industry sector					
Assumptions fluorinated gases:					
Aluminium production and emissions factors					
Magnesium production and emissions factors					
Foam production and emissions factors					
Stock of refrigerant and leakage rates					
For Member States using macroeconomic models:					
Share of GDP for different sectors and growth rates					
Rate of improvement of energy intensity (1990 = 100)					
For Member States using other models:					
Index of production for different sectors					
Rate of improvement or index of energy efficiency					
Assumptions for buildings (in residential and commercial / tertiary sector)					
For Member States using macroeconomic models:					
Share of tertiary and household sectors in GDP					
Rate of improvement of energy intensity					
For Member States using other models:					
Number of households					
Number of new buildings					
Rate of improvement of energy efficiency (1990 = 100)					
Assumptions for the transport sector					
For Member States using econometric models:					
Growth of transport relative to GDP split by passenger and freight					
Improvements in energy efficiency split by vehicle type					
Improvements in energy efficiency split by vehicle type, whole fleet/new cars					
Rate of change of modal split (passenger and freight)					
Growth of passenger road kilometres					
Growth of passenger rail kilometres					
Growth of passenger aviation kilometres					

Growth of freight tonne kilometres on road				
Growth of freight tonne kilometres by rail				
Growth of freight tonne kilometres by navigation				
Assumptions for the agriculture sector				
For Member States using econometric models:				
Agricultural trade (import/export)				
Domestic consumption (e.g. milk/beef consumption)				
For Member States using other models:				
Development of area of crops, grassland, arable, set-aside, conversion to forests etc				
Macroeconomic assumptions behind projections of agricultural activity				
Description of livestock (e.g. by nutrient balance, output/animal production, milk production)				
Development of farming types (e.g. intensive conventional, organic farming)				
Distribution of housing/grazing systems and housing/grazing period				
Parameters of fertiliser regime:				
Details of fertiliser use (type of fertiliser, timing of application, inorganic/organic ratio)				
Volatilisation rate of ammonia, following spreading of manure on the soil				
Efficiency of manure use				
Parameters of manure management system:				
Distribution of storage facilities (e.g. with or without cover):				
Nitrogen excretion rate of manures				
Methods of application of manure				
Extent of introduction of control measures (storage systems, manure application), use of best available techniques				
Parameters related to nitrous oxide emissions from agricultural soils				
Amount of manure treatment				