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**Report of the individual review of the greenhouse gas inventory of  
Denmark submitted in 2006\***

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\* In the symbol for this document, 2006 refers to the year in which the inventory was submitted, and not to the year of publication.

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## **I. Overview**

### **A. Introduction**

1. This report covers the in-country review of the 2006 greenhouse gas (GHG) inventory submission of Denmark, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 16 to 21 April 2007 in Copenhagen, Denmark, and was conducted by the following team of nominated experts from the roster of experts: generalist – Ms. Mirja Kosonen (Finland); energy – Mr. Michael Strogies (Germany); industrial processes – Mr. Masato Yano (Japan); agriculture – Ms. Hongmin Dong (China); land use, land-use change and forestry (LULUCF) – Mr. Nijavalli Ravindranath (India); waste – Mr. Philip Acquah (Ghana). Ms. Hongmin Dong and Mr. Michael Strogies were the lead reviewers. The review was coordinated by Ms. Astrid Olsson (UNFCCC secretariat).

2. In accordance with the “Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention”, (hereinafter referred to as UNFCCC review guidelines), a draft version of this report was communicated to the Government of Denmark, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

3. Most comments indicating that the Party will address the remarks made by the expert review team (ERT) in its future submissions are not specifically recorded in this report. In many comments, the Party provides explanations of issues and plans for future short-term improvements for issues raised by the ERT in the draft review report. In such cases, the ERT has left the relevant paragraphs unchanged since the ERT’s recommendation to include such explanations in the national inventory report remains valid, and in many cases the Party has indicated its intention to do so in the next submission. In addition, the ERT noted that a few recommendations provided in this report have already been partly addressed by Denmark in its 2007 submission.

### **B. Inventory submission and other sources of information**

4. In its 2006 submission, Denmark submitted a complete set of common reporting format (CRF) tables for the years 1990–2004 and a national inventory report (NIR). The CRF tables and the NIR were originally submitted on 12 April 2006. The review team used the CRF tables resubmitted on 26 January 2007, the NIR submitted on 12 April 2006 and resubmitted on 22 August 2006 and NIR annexes 6.1 and 6.2 on the Greenland and Faroe Islands emissions resubmitted on 28 March 2007. The Kingdom of Denmark comprises Denmark, Greenland and the Faroe Islands. Where needed the ERT also used the previous year’s submission (2005), additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

### **C. Emission profiles and trends**

5. In 2004, the most important GHG in Denmark was carbon dioxide (CO<sub>2</sub>), contributing 79.6 per cent to total<sup>1</sup> national GHG emissions expressed in CO<sub>2</sub> equivalent, followed by nitrous oxide (N<sub>2</sub>O), 11.0 per cent, and methane (CH<sub>4</sub>), 8.3 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) taken together contributed 1.2 per cent of the overall GHG emissions in the country. These emissions are dominated by HFCs, which contributed 93.9 per cent. The energy sector accounted for 76.9 per cent of the total GHG emissions followed by agriculture (14.4 per cent), industrial processes (4.4 per cent), other (sector 7) (2.2 per cent), waste (2.0 per cent), and solvent and other product use (0.2 per cent). Total GHG emissions amounted to 69,633.09 Gg CO<sub>2</sub> equivalent and

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<sup>1</sup> In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO<sub>2</sub> equivalent excluding LULUCF, unless otherwise specified.

decreased by 1.2 per cent from 1990 to 2004. Reductions were achieved for N<sub>2</sub>O and SF<sub>6</sub> but all other greenhouse gases had increasing trends over time. The trends of emissions for sectors are given in the sectoral part of the review report. The ERT noted large reductions from 1990 to 2004 in the sectors solvent and other product use (–17.1 per cent), agriculture (–23.4 per cent), LULUCF (–513.2 per cent) and waste (–9.9 per cent) while the emissions increased in the sectors energy (+2.7 per cent), industrial processes (+39.8 per cent) as well as total emissions of the Faroe Islands and Greenland (+9.7 per cent).

6. Tables 1 and 2 show the greenhouse gas emissions by gas and by sector, respectively.

#### **D. Key categories**

7. In 2006 Denmark reported a tier 1 key category analysis for the year 2004, both level and trend assessment, as part of its annual inventory submission. During the review a key category analysis for the base year was provided. The key category analysis performed by the Party and the secretariat<sup>2</sup> produced slightly different results. Denmark has not included the LULUCF sector in its key category analysis and Greenland and the Faroe Islands are also excluded from the Party's analysis, while the secretariat has included both Greenland and the Faroe Islands in one aggregate category: other (CO<sub>2</sub>). These differences in scope, as well as the use of a higher level of disaggregation in the data on the energy sector in the Party's key category analysis are the main reasons for the differences in the results. The key category assessment is used to prioritize inventory improvement. The Party is encouraged to provide the key categories analysis according to 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" (hereinafter referred to as the UNFCCC reporting guidelines), including LULUCF categories. In addition the ERT encourages Denmark to apply a tier 2 analysis using the available data on uncertainties. In response to the draft review report, Denmark stated that it has initiated efforts to include the LULUCF sector in its key category analysis and will include it in the 2008 submission. The inclusion of the LULUCF sector in its key category analysis is a prioritized activity for the Party. In addition, Denmark stated that it will consider the possibility of applying a tier 2 key category analysis.

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<sup>2</sup> The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for those Parties that provided a full set of CRF tables for the base year. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

**Table 1. Greenhouse gas emissions by gas, 1990–2004**

GHG emissions	Gg CO <sub>2</sub> equivalent								Change BY–2004 (%)
	Base year Convention	1990	1995	2000	2001	2002	2003	2004	
CO <sub>2</sub> (with LULUCF)	54 603.10	54 603.10	59 866.23	56 083.08	55 325.55	53 671.65	58 946.65	53 121.49	–2.7
CO <sub>2</sub> (without LULUCF)	54 051.45	54 051.45	61 530.60	54 441.05	56 082.43	55 636.76	60 887.08	55 401.13	2.5
CH <sub>4</sub>	5 726.07	5 726.07	6 060.51	5 914.68	6 061.06	6 018.77	6 000.62	5 799.83	1.3
N <sub>2</sub> O	10 624.55	10 624.55	9 547.15	8 583.93	8 336.83	7 983.37	7 937.41	7 628.84	–28.2
HFCs	NA, NE, NO	NA,NE,NO	217.75	606.49	650.25	675.91	700.17	754.30	NA
PFCs	NA, NE, NO	NA,NE,NO	0.50	17.89	22.13	22.17	19.34	15.90	NA
SF <sub>6</sub>	44.45	44.45	107.37	59.23	30.40	25.01	31.38	33.15	–25.4

*Note:* BY = Base year; LULUCF = Land use, land-use change and forestry; NA = Not applicable, NE = Not estimated; NO = Not occurring.

**Table 2. Greenhouse gas emissions by sector, 1990–2004**

Sectors	Gg CO <sub>2</sub> equivalent								Change BY–2004 (%)
	Base year Convention	1990	1995	2000	2001	2002	2003	2004	
Energy	52 121.25	52 121.25	59 983.88	52 601.14	54 231.34	53 853.28	59 197.37	53 525.10	2.7
Industrial processes	2 188.81	2 188.81	2 675.71	3 366.99	3 293.06	3 190.01	3 212.82	3 059.95	39.8
Solvent and other product use	136.90	136.90	123.29	119.58	112.57	106.33	107.24	113.48	–17.1
Agriculture	13 047.91	13 047.91	11 983.37	10 610.97	10 576.71	10 258.35	10 031.13	10 000.29	–23.4
LULUCF	551.74	551.74	–1 664.28	1 642.08	–756.80	–1 965.04	–1 940.36	–2 279.57	–513.2
Waste	1 547.35	1 547.35	1 548.12	1 478.30	1 479.04	1 502.41	1 515.45	1 393.63	–9.9
Other	1 404.22	1 404.22	1 149.44	1 446.22	1 490.30	1 451.53	1 511.91	1 540.65	9.7
<b>Total (with LULUCF)</b>	<b>70 998.18</b>	<b>70 998.18</b>	<b>75 799.52</b>	<b>71 265.27</b>	<b>70 426.22</b>	<b>68 396.88</b>	<b>73 635.56</b>	<b>67 353.52</b>	<b>–5.1</b>
<b>Total (without LULUCF)</b>	<b>70 446.44</b>	<b>70 446.44</b>	<b>77 463.80</b>	<b>69 623.19</b>	<b>71 183.02</b>	<b>70 361.92</b>	<b>75 575.92</b>	<b>69 633.09</b>	<b>–1.2</b>

*Note:* BY = Base year; LULUCF = Land use, land-use change and forestry.

## **E. Main findings**

8. Denmark's 2006 GHG inventory submission is in line 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" (hereinafter referred to as the UNFCCC reporting guidelines); the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines); the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance); and the *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). It shows extensive recalculations and improvements in estimates and in transparency in the NIR, especially in the energy and agriculture sectors, which reflect the recommendations of earlier reviews. The quality assurance/quality control (QA/QC) procedures within the National Environmental Research Institute (NERI) have also progressed. Institutional arrangements for the preparation of the inventory have changed after NERI was separated from the Ministry of Environment and became a research institute under of the University of Aarhus on 1 January 2007. The ERT noted that negotiations between NERI and the Ministry of Environment are ongoing to ensure continuity in the inventory arrangements. During the review Denmark presented a comprehensive plan to meet the requirements for reporting under the Convention, in particular for more complete data collection in the LULUCF sector, which is the most urgent area for inventory improvement. The ERT recommends that Denmark improve transparency in the inventory by providing category-level information (especially in the energy sector), including information on trends and underlying assumptions. This would improve understanding particularly in the energy sector, where the description is oriented around the selected nomenclature for sources of air pollution (SNAP) categories from CORINAIR, rather than the IPCC categories.

## **F. Cross-cutting topics**

### **1. Completeness**

9. The inventory submitted is generally complete. Some LULUCF categories are reported as not estimated in the inventory. Apart from these missing categories, the inventory covers all years and sectors and is fairly complete in terms of categories and gases. The emissions of Greenland and the Faroe Islands are small – approximately 1.0 per cent and 1.2 per cent, respectively, of total national GHG emissions. They are reported as total emissions for Greenland and the Faroe Islands under sector 7, other, in the CRF tables. In the NIR, however, further information is provided on the emission estimates for Greenland and the Faroe Islands. Denmark is recommended to include all inventory data for Greenland and the Faroe Islands in the relevant categories instead of under other.

### **2. Transparency**

10. The ERT noted a need for more transparency in the NIR. Detailed recommendations for improvement are included in the sectoral sections of this report. The ERT recommends the use of concise illustrations of background data at category level in the NIR, such as graphs describing the energy sector subcategories which would improve transparency and not unnecessarily expand the NIR.

### **3. Recalculations and time-series consistency**

11. The current institutional arrangements, where NERI has the main responsibility for compiling the inventory, can ensure that recalculations of previously submitted estimates of GHG emissions by sources and removals by sinks are prepared in accordance with the IPCC good practice guidance. NERI's documentation database stores all outside inventory inputs in an electronic format, and allows the retrieval of original inputs. The ERT noted that recalculations reported by the Party for the years 1990 to 2003 had been undertaken to take into account new activity data (AD) and changes in modelling,

especially in the energy and industrial processes sectors. Emission estimates for soda ash use as well as for limestone and dolomite use are added as new categories. The major changes include a decrease in CO<sub>2</sub> emissions in the transport sector as well as a decrease in N<sub>2</sub>O emissions in energy industries. The effect on total GHG emissions as reported in the 2006 submission is a decrease of 0.41 per cent for the year 1990 excluding LULUCF, and an increase of 0.08 per cent for 2003. The rationale for these recalculations is provided in the NIR. Recalculations have improved the inventory, for example, through the inclusion of more accurate AD.

#### 4. Uncertainties

12. A tier 1 uncertainty analysis is presented, excluding the LULUCF categories. The Party has used some very high values, notably in N<sub>2</sub>O emission factor (EF) estimates in the energy sector, as was the case in the 2005 review. The ERT recommends Denmark to include the LULUCF categories in its future uncertainty analysis. It also encourages Denmark to proceed to tier 2 uncertainty estimates, in order to gain information for further improvements of the inventory.

#### 5. Verification and quality assurance/quality control approaches

13. Denmark is in the process of developing a QA/QC plan, which is currently mainly limited to NERI activities. NERI is preparing a quality management (QM) manual according to International Organization for Standardization (ISO) standard 9000. QC in NERI is supported by IT procedures and includes tier 1 and tier 2 QC procedures, but has not yet been implemented for all categories. Some inventory partners, notably the Danish Energy Authority, have their own QA/QC systems, which have improved the quality of input data. As part of the QA procedures national experts not directly involved in the inventory preparation have systematically reviewed parts of the inventory. For the QA/QC inventory plan and activities NERI QA/QC experts are the main actors. NERI alone is responsible for the preparation of the NIR. The ERT encourages NERI to develop practices that will enable the inventory partners to participate in the preparation of the NIR in order that it might benefit fully from the expertise of such partners.

#### 6. Follow-up to previous reviews

14. In response to earlier reviews Denmark has included new categories in the industrial processes sector, such as estimates for soda ash use as well as for limestone and dolomite use. Institutional arrangements for inventory compilation have progressed and formal agreements between NERI and the Ministry of Environment, as well as between NERI and inventory partners, have been signed, but the changes in the status of the responsible organization, NERI, require further follow-up.

### **G. Areas for further improvement**

#### 1. Identified by the Party

15. The NIR identifies as areas for improvement: in industrial processes, the preparation of better uncertainty estimates and more detailed information on EFs, and continued work on collecting AD; in the agriculture sector, improved transparency through improved use of national data and national methodologies; and in the solvents and other product use and LULUCF sectors, improvement of data availability, which was raised in the 2005 review report. During the review, inventory partners indicated their plans to further develop data supply, models and estimates. These plans are linked to the partners' other activities but through cooperation between NERI and the partners most of the activities will be beneficial for the development and the quality of the inventory. One example is a European Community harmonization study, which aims for consistent reporting on energy consumption.

#### 2. Identified by the ERT

16. The ERT identified the following cross-cutting issues for improvement. The Party should:



- (a) Increase transparency by providing information on the institutional arrangements for inventory preparation in the next NIR, including the legal basis of the institutional arrangements and a clear statement on the status of agreements between NERI and the inventory partners, as well as between the Ministry of Environment and NERI;
- (b) Compile an annual QA/QC plan and enhance integration with the QM systems of inventory partners;
- (c) Enhance the cooperation between NERI and other inventory partners in the compilation of the NIR in order to benefit fully from outside expertise, and for verification of the NIR;
- (d) Increase the amount of concise background information in the NIR without unnecessarily expanding the volume of the report, notably in energy sector;
- (e) Provide tier 2 uncertainty estimates in order to effectively focus the improvement of the inventory;
- (f) Undertake a tier 2 key category analysis;
- (g) Improve reporting of emission estimates for Greenland and the Faroe Islands by including them in the relevant categories instead of reporting under the sector other, and update the estimates on an annual basis;
- (h) Improve transparency in the inventory by structuring the NIR following the IPCC category structure instead of the SNAP structure. This applies both to the description of emission trends and the background AD and EF data. This is particularly relevant for the energy sector.

17. Recommended improvements relating to specific source/sink categories are presented in the relevant sector sections of this report.

## **II. Energy**

### **A. Sector overview**

18. In 2004, the energy sector in Denmark accounted for 76.9 per cent of total national GHG emissions. CO<sub>2</sub> comprised 97.3 per cent of emissions from the energy sector, while CH<sub>4</sub> and N<sub>2</sub>O contributed 1.3 per cent and 1.4 per cent, respectively. Fuel combustion accounted for 98.7 per cent of the sectoral emissions, and fugitive emissions for the remaining 1.3 per cent. Energy industries were clearly the largest contributor to the sectoral total (48.3 per cent in 2004), followed by transport (24.9 per cent), other (13.9 per cent) and manufacturing industries and construction (11.1 per cent).

19. Total GHG emissions from the energy sector increased by 2.7 per cent over the period 1990–2004. The trend of energy-related emissions is mainly influenced by the fuel consumption of coal-fired power plants. The variation over time for this particular category is linked to the amount of exported or imported electricity within the Nordic electricity market. There is a correlation that depends on weather conditions. During wet years electricity production is based on hydro energy produced in Nordic countries (e.g. Norway) and Denmark is a net importer, whereas in years with dry weather conditions power plants in Denmark are fully operational and Denmark becomes a net exporter of electricity.

20. The Party's reporting includes all the information necessary to assess the quality of the inventory for the energy sector. However, the ERT recommends a more detailed discussion at the level of subcategories in future NIRs, for example, energy industries, manufacturing industries and construction,

and so on, instead of, as currently happens, grouping these together under stationary combustion. It would be possible to provide a short description of the categories included; a graphic presentation of the emissions trends; and a detailed discussion of the emissions trends, main drivers and underlying assumptions. The NIR includes only an aggregated description of stationary combustion in total with cross references to the CORINAIR-oriented SNAP categories. This is not really transparent. During the review the Danish experts provided and discussed with the ERT their first proposals for improving transparency through more category-oriented discussions and descriptions and a future restructuring of the energy chapter. In response to the draft review report, Denmark announced its intention to implement these proposals as first approach in its 2008 reporting.

21. The ERT observed that a border trade adjustment for the consumption of liquid fuels is included in the official Danish energy balance. During the review the ERT checked that, as requested in the Revised 1996 IPCC Guidelines, total fuel sales are applied in the inventories.

22. The Danish GHG inventory, specifically for the energy-related emissions, includes detailed estimates for mainland Denmark and more aggregated estimates for Greenland and the Faroe Islands. Greenland and the Faroe Islands contribute only to a very small extent to the national energy-related emissions (Greenland 1.3 per cent in 2004 and the Faroe Islands 1.5 per cent, as described in annex 6.2 of the NIR). The ERT noted that the estimates were made for the Faroe Islands until 2001 and then reported as a constant for subsequent years because of a lack of data. During the review Denmark provided a detailed study on the emission inventories of the Faroe Islands for the years 1990 to 2001. It would be more appropriate to use this information to make a trend extrapolation for these emissions, and the ERT recommends a change in methodology for future reporting. The best solution would be to gather the required background data for the Faroe Islands. In response to the draft review report, Denmark indicated that if there is a lack of emissions data for the Faroe Islands, the Faroese authorities will base the gap filling on trend extrapolation for the 2008 submission. The energy-related emissions for Greenland are estimated for all years based on data provided annually by official institutions and major energy suppliers.

23. The Danish emission inventory for the energy sector has been improved in recent years. The ERT noted that recommendations made in previous reviews have been considered and included in the estimation process (e.g. reallocation of fuels in the reference approach, harmonization of energy data for national and international transport and exclusion of fugitive emissions from storage). The GHG inventory for energy-related emissions is of good quality.

24. The estimates for energy-related emissions are based on detailed information in the energy balance provided annually by the Danish Energy Authority. These data were restructured by the Danish Energy Authority, based on plant-specific information, into a detailed direct energy data input format for the estimation process, according to CORINAIR categories. The ERT recommends that future NIRs include a short description of the procedures behind the Danish energy balance and the data transfer to the SNAP codes, including the underlying assumptions used as a basis for the estimates. In addition the ERT recommends the use of IPCC categories as the structure for the presentation of the methods and results and for the category-specific trend discussion of the reference and sectoral approaches.

## **B. Reference and sectoral approaches**

### **1. Comparison of the reference approach with the sectoral approach and international statistics**

25. The CO<sub>2</sub> emissions are estimated using both approaches (sectoral and reference) for the entire time series. The difference in 2004 is 1.5 per cent. Over time the results obtained using the reference approach are between 0.4 and 1.6 per cent lower than the results from the sectoral approach. Only in 1998 did the reference approach result in higher emissions than the sectoral approach. The ERT suggests that, if possible, a detailed description should be included in future NIRs of the underlying reasons for

this happening in this specific year. In principle the deviations between the reference and the sectoral approach are within the given and accepted ranges of the Revised 1996 IPCC Guidelines.

26. Like previous review teams the ERT noted the use of an estimation approach underlying the full oxidation of the carbon content in the fuels. An oxidation factor of 1.0 has been applied for both estimation approaches (sectoral and reference) and for the entire time series. This results in a slight overestimation of the CO<sub>2</sub> emissions. The Danish experts expressed an intention to analyse the verified data provided by the operators under the European Union (EU) emissions trading scheme (ETS) for detailed information on the oxidation of the carbon content. The ERT recommends that Denmark continue to use the full oxidation approach, because this is in line with the latest scientific literature available.

## 2. International bunker fuels

27. Aviation and marine emissions are allocated to the domestic or international category on the basis of statistics on the start and end of journeys. The Faroe Islands and Greenland are counted as domestic destinations, which is in line with the Revised 1996 IPCC Guidelines. The ERT noted that, as was recommended in previous reviews, the use of AD for international and domestic consumption has been harmonized between the reference and the sectoral approaches.

## 3. Feedstocks and non-energy use of fuels

28. The problems of feedstocks and non-energy use of fuels were discussed during the review. The ERT noted that the CO<sub>2</sub> emissions from the non-energy use of fuels are based on data provided by the Danish Energy Authority. Industrial processes which use fuels as feedstocks (which are mainly part of the chemical industry) do not occur in Denmark. The ERT recommends that a more detailed description of this aspect be included in the next NIR.

## C. Key categories

### 1. Stationary combustion: all fuels – CO<sub>2</sub> and CH<sub>4</sub>

29. The estimates for CO<sub>2</sub> for stationary combustion are based partly on EFs provided and/or approved by the relevant companies which are based on plant-specific measurements and/or fuel analysis, for example, for petroleum coke and incinerated waste. According to QA/QC procedures, in order to improve transparency these factors should be documented and compared to default values provided in the Revised 1996 IPCC Guidelines. Any differences should be explained.

30. In line with previous reviews, the ERT recommends that work be prioritized on an improved documentation of the CO<sub>2</sub> EFs. These have been applied as constant values for the entire time series for most of the fuels (except natural gas and waste). The influence of different fuel characteristics and the origins of the fuels used should be elaborated and documented in the NIR or an explanation for the use of a constant EF should be provided. In response to the draft review report, Denmark announced its intention to include in the inventory new information on CO<sub>2</sub> EFs based on the monitoring of the EU ETS.

31. The NIR states that data on the use of town gas are included as natural gas in the estimation process. During the review the Danish experts indicated their intention to provide further explanations for this (including fuel characteristics and EFs for CO<sub>2</sub> and CH<sub>4</sub>). The ERT commends this work towards improved documentation and transparency in the inventory and recommends that Denmark report progress with it in future NIRs. In response to the draft review report, Denmark indicated its intention to include an improved documentation in the 2008 submission.

## 2. Road transportation: liquid fuels – CO<sub>2</sub>

32. The estimated figures on fuel consumption are based on a detailed COPERT III model approach. In accordance with the Revised 1996 IPCC Guidelines, a comparison of fuel use between the model approach and the energy balance is implemented for all years to ensure that the emissions are based on the amount of fuel sold. The results of the comparison match well for gasoline use but differ significantly (by 61 per cent) for the use of diesel in 2004. A correction factor for this “fuel-use gap” is applied to include all emissions based on fuel sold within Denmark in the inventory. The ERT recommends more analysis of the explanations for the large differences in the underlying diesel use parameters in the model compared to the data provided by the Danish Energy Authority. In response to the draft review report, Denmark informed the ERT that it has included the required information in its 2007 submission.

### **D. Non-key categories**

#### Other sectors: liquid fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

33. The ERT noted the efforts made by the Danish experts to improve the detailed model approach used for the estimation of emissions released from off-road machinery for agriculture, forestry and fisheries. The ERT encourages the Danish experts to realize the proposed improvements, in particular the verification of the underlying fuel consumption data.

## **III. Industrial processes and solvent and other product use**

### **A. Sector overview**

34. In 2004, emissions from the industrial processes sector in Denmark amounted to 3,059.95 Gg CO<sub>2</sub> equivalent, or 4.4 per cent of national total GHG emissions. From 1990 to 2004, GHG emissions from this sector increased by 39.8 per cent. However, emissions have decreased since 2000, mostly due to the end of nitric acid production in Denmark. In 2004 cement production contributed 50.3 per cent to sector emissions, nitric acid production contributed 17.3 per cent and consumption of halocarbons and SF<sub>6</sub> contributed 26.1 per cent.

35. In 2004, emissions from the solvent and other product use sector in Denmark amounted to 113.48 Gg CO<sub>2</sub> equivalent, or 0.2 per cent of national total GHG emissions. From 1990 to 2004, GHG emissions from this sector decreased by 17.1 per cent.

36. Emissions from the industrial processes sector were revised to include some new categories such as limestone and dolomite use, asphalt roofing and road paving with asphalt. In addition, more accurate information such as company-specific data for catalyst/fertilizer production was taken into account in the chemical industry.

37. In estimating emissions many country-specific data sources and methodologies were used. However, some relevant information was not provided (e.g. the data used to estimate EFs for cement production, and consumption of halocarbons and SF<sub>6</sub>). The ERT noted that detailed information, such as underlying data, equations, assumptions and references, could be better described in the NIR, and encourages Denmark to do so in its next submission.

### **B. Key categories**

#### 1. Cement production – CO<sub>2</sub>

38. Denmark applies a method based on the production of cement and explains that it is the best estimate based on the available data. However, there is a variation in the CO<sub>2</sub> implied emission factor (IEF) across the years (the 2004 value is 1.2 per cent lower than 1990). Denmark provided additional

information which stated that two different types of AD are used to estimate emissions. Denmark also provided additional data and the equations used to estimate EFs for 1990–1997. The ERT recommends that Denmark provide additional information on how the emissions are derived, including background data and assumptions, and provide more information on how it ensures time-series consistency in the NIR.

## 2. Nitric acid production – N<sub>2</sub>O

39. In response to the 2005 review report, Denmark provided the EF value used for 1990–2004 (0.007 t/t) and information on the ending of nitric acid production (in the middle of 2004) in the NIR. The ERT acknowledged that this EF value is within the range of IPCC default values (0.002–0.019 t/t).

## 3. Consumption of halocarbons – HFCs, PFCs and SF<sub>6</sub>

40. In some subcategories, the emission trend is irregular. For example, HFC-134a emissions from foam blowing substantially increased in 1996 and 1998. Denmark explained that this was caused by exports of foams in chest freezers. The ERT encourages Denmark to provide more information to describe emission trends in future NIRs.

41. Detailed information on EFs is not provided in the NIR. The ERT recommends that Denmark provide more information on the choice of EFs and the specific model approaches.

42. Denmark reports some subcategories as not applicable (“NA”). For example, HFC-32 emissions from foam blowing for 1990–2004 (excluding 2001) are reported as “NA” because emissions were not occurring even though foam blowing was conducted. However, the ERT was informed that HFC-32 was not used in foam blowing. The ERT recommends that Denmark provide a description of the actual status of the usage of HFCs in the NIR and amend the notation key to “NO”.

## C. Non-key categories

### 1. Lime production – CO<sub>2</sub>

43. All the values for the CO<sub>2</sub> IEF (0.15–0.20 t/t) are the lowest of reporting Parties and lower than the IPCC default range (0.59–0.86 t/t). Denmark explains that this category includes CO<sub>2</sub> emissions from the production of lime and of yellow bricks. The ERT was provided with additional information including CO<sub>2</sub> emissions which split the emissions into lime and yellow bricks and acknowledged that the methodologies used are adequate. The ERT recommends that Denmark report only CO<sub>2</sub> emissions from lime production in this category. The ERT also recommends that Denmark report emissions from yellow bricks in category other (mineral products (2.A.7)) and provide relevant information in the CRF and the NIR.

### 2. Iron and steel production – CO<sub>2</sub>

44. From 1990 to 2001, CO<sub>2</sub> emissions from this category increased by 64.1 per cent because consumption of metallurgical coke increased during this period. Denmark reported this category as “NA, NO” for 2002–2004 because the electro-steelworks ceased operation. The ERT noted that the electro-steelworks was reopened in 2004/2005 and Denmark will report emissions from this category in the next inventory.

45. There is a variation in the CO<sub>2</sub> IEF. During the in-country visit, Denmark explained that the calculation of CO<sub>2</sub> emissions is based on consumption of metallurgical coke for two different kinds of semi-manufactured goods. Shares of the two kinds of products are different and data on production of semi-manufactured goods and production/sale of final goods are inconsistent inter-annually due to stockpiling. The ERT recommends that Denmark provide such additional information in the NIR.

## IV. Agriculture

### A. Sector overview

46. In 2004 the agriculture sector contributed 10,000.29 Gg CO<sub>2</sub> equivalent or 14.4 per cent of Denmark's total national GHG emissions. Agricultural soils contributed 57.0 per cent to sector emissions, followed by enteric fermentation and manure management (27.1 and 15.9 per cent, respectively).

47. From 1990 to 2004, agricultural emissions decreased by 23.4 per cent. N<sub>2</sub>O emissions fell by 30.7 per cent because of legislation to increase the utilization of manure nitrogen (N). CH<sub>4</sub> emissions from enteric fermentation decreased by 16.8 per cent because of a decrease in the number of cattle. CH<sub>4</sub> emissions from manure management increased by 37.0 per cent because of the use of more slurry stable systems.

48. Denmark submitted a complete agriculture inventory covering all gases, all categories and all years. The additional information tables in CRF tables 4.A and table 4.B(a) were provided to the ERT during the review. The ERT recommends that Denmark include these tables in future submissions. There is no rice cultivation or field burning of agricultural residues in Denmark, so the corresponding categories are reported as "NO". According to the NIR, prescribed burning of savannas does not occur in Denmark. However, GHG emissions from prescribed burning of savannas are reported as "NA" in the CRF. The ERT recommends that Denmark check the use of the notation keys and reports emissions from prescribed burning of savannas as "NO".

49. CH<sub>4</sub> emissions from enteric fermentation were recalculated to reflect the change of fodder practice from use of sugar beet to use of maize for cattle. Due to changes in the methodology for calculating emissions from organic soils in the LULUCF sector, N<sub>2</sub>O emissions in the agricultural sector from histosols have been recalculated. The recalculations increased GHG emissions from the agricultural sector by 1.6 per cent for 1990, and 1.3 per cent for 2003, respectively.

50. Enhanced animal characteristics, country-specific parameters and EFs have been applied in the related categories (enteric fermentation, manure management and agricultural soils). Sixty subcategories of cattle and 17 of swine were classified according to animal type, age, weight and type of stabling. This is consistent with the IPCC good practice guidance. The NIR provides useful information on the methods, basic parameters and IEFs used to estimate emissions. During the review, the ERT noted that extensive tabular data on livestock characteristics and stabling systems are available. This information was useful for the review of the Danish inventory. The ERT recommends that Denmark further improve transparency by including in the NIR more tables on the key parameters (such as animal population, gross energy intake (GE), CH<sub>4</sub> conversion rate (Y<sub>m</sub>), volatile solid excretion (VS), digestible energy (DE) and nitrogen (N) excretion) and EFs for subcategories. In response to the draft review report, Denmark indicated that more tables on key parameters have been included in the 2007 NIR.

### B. Key categories

#### 1. Enteric fermentation – CH<sub>4</sub>

51. Tier 2 methods and country-specific gross energy intake have been applied to estimate CH<sub>4</sub> emissions from enteric fermentation for dairy cattle and heifers. The IPCC default Y<sub>m</sub> has been applied for all other livestock categories except dairy cattle and heifers. This is in line with the IPCC good practice guidance.

52. Little information on the country-specific Y<sub>m</sub> is provided in the NIR. During the review, Denmark provided Excel tables with information on the development of the country-specific Y<sub>m</sub> over time. The Y<sub>m</sub> decreased from 6.39 per cent in 1990 to 5.95 per cent in 2004, reflecting the changes in

fodder practices for dairy cattle and heifers. The ERT recommends Denmark to include a table with information on the development of country-specific  $Y_m$  in the NIR to facilitate comparison between the Danish  $Y_m$  and the IPCC  $Y_m$ . In response to the draft review report, Denmark indicated that a table showing the trend for gross energy intake (GE), for the methane conversion rate ( $Y_m$ ), for volatile solid excretion (VS–kg dm/head/day) and for digestible energy (DE) for the years 1990–2005 is included in the 2007 NIR.

## 2. Manure management – CH<sub>4</sub>

53. CH<sub>4</sub> emissions from manure management were estimated based on tier 2 methodology, country-specific VS, IPCC default values for methane-producing capacity (Bo) and a CH<sub>4</sub> correction factor. The ERT was provided with detailed descriptions of livestock allocation to stable type and this was helpful for the ERT and the review. The ERT encourages Denmark to include this information in the NIR in future submissions. In response to the draft review report, Denmark indicated that a detailed description of stable types and a table on the country specific methane conversion rate ( $Y_m$ ) are included in the 2007 NIR

54. The ERT noted that annual VS values have been used instead of daily values to fill in the cells in CRF table 4.B (a). This resulted in VS values in CRF table 4.B (a) and VS values in the NIR that were more than 300 times higher than the IPCC default. However, during the review, Denmark provided data to support the fact that the EF was calculated based on correct data. The ERT recommends Denmark to correct this in the next submission.

55. Denmark states in the NIR that the amount of manure treated in biogas plants was 7 per cent in 2004, which is reflected in a reduction in CH<sub>4</sub> emissions by 2 per cent from manure management in 2004. No information is provided in the NIR on how the number was derived and the underlying assumptions for this value. The ERT encourages Denmark to include this information in the next submission.

## 3. Manure management – N<sub>2</sub>O

56. N excretion in manure has decreased by 7.0 per cent from 1990 to 2004. The NIR explains that this reduction is due to the improvement in fodder efficiency, especially for slaughter pigs. Animal N excretion for non-dairy cattle and swine are approximately 50 per cent of the IPCC defaults (38.64 kg/head/year versus 70 kg/head/year for non-dairy cattle and 9.41 kg/head/year versus 20 kg/head/year for swine). The NIR explains that the values are weighted for different subcategories of cattle and pigs, with lower weight, low feed intake, high utilization of N and lower part of suckling cattle. The published report and tables provided during the review showed that N excretion in kg/head/year for slaughter pigs decreased from 18.0 in 1990 to 14.0 in 2004. The ERT recommends that Denmark provide tables on N excretion and EFs for swine and non-dairy cattle in future submissions.

## 4. Direct emissions from agricultural soils – N<sub>2</sub>O

57. The IPCC tier 1a methodology has been used to calculate direct N<sub>2</sub>O emissions from agricultural soils. The Danish values for  $\text{Frac}_{\text{GASF}}$  ( $0.02 \text{ NH}_3 - \text{N} + \text{NO}_x - \text{N/kg}$  of synthetic fertilizer N applied) is lower than the IPCC default of  $0.1 \text{ NH}_3 - \text{N} + \text{NO}_x - \text{N/kg}$  of synthetic fertilizer N applied. The NIR states that the lower Danish values for  $\text{Frac}_{\text{GASF}}$  are due to the small consumption of urea (<1 per cent), which has a high EF.

## 5. Indirect emissions from agricultural soils – N<sub>2</sub>O

58. The  $\text{Frac}_{\text{LEACH}}$  value decreased from 0.38 kg N/kg of fertilizer or manure applied in 1990 to 0.34 kg N/kg of fertilizer or manure applied in 2004. Denmark states that the decrease is due to its regulation of manure and fertilizer application, where the amount of mineral fertilizer has been reduced by 50 per cent, and to a ban on the application of manure in the autumn. Manure application only takes place in the spring and early summer when there is no downward movement of soil water, which reduces

the leaching of nitrate into ground water and streams. During the review, a published paper was provided to the ERT to support this explanation. The ERT encourages Denmark to provide more information to support the decrease in  $\text{Frac}_{\text{LEACH}}$  in future submissions.

## **V. Land use, land-use change and forestry**

### **A. Sector overview**

59. The geographic area of Denmark is 4.36 million hectares. Cropland dominates and accounts for 2.64 million hectares (about 62 per cent) followed by forest land, which accounts for about 11 per cent of the geographic area (according to the NIR). The LULUCF sector was a net sink of 2,279.57 Gg in 2004, offsetting about 3.4 per cent of the total national GHG emissions. The LULUCF sector was a net source (551.74 Gg  $\text{CO}_2$ ) in 1990 but, except for the year 2000, it has been a net sink since 1991. The  $\text{CO}_2$  sink estimates have fluctuated over the years, and have ranged between 756.80 Gg in 2001 to 2,279.57 Gg in 2004. The LULUCF sector was a source of 1,642.08 Gg during 2000, an exceptional year, because of storm damage. Among the different land categories,  $\text{CO}_2$  emissions and removals are reported for forest land, cropland, grassland and wetlands. No emissions/removals are reported for settlements and other lands, which are reported as not estimated. Among the land categories, forest land has been a net sink for all the years 1990 to 2004 and cropland is the main source for all the years. These two categories are the dominant categories contributing to  $\text{CO}_2$  emissions and removals, with grassland and wetland contributing least to the inventory.

60. Total land use representation covering all IPCC land categories – forest land, cropland, grassland, wetland, settlements and other land – needs to be provided in the NIR. During the review, Denmark informed the ERT about its plan to improve the data for the LULUCF sector. The ERT welcomes this work, including the development of a detailed land use and land-use change matrix, using remote sensing techniques.

61. All CRF tables for the LULUCF sector have been completed. However, the inventory does not include the categories settlements and other land, reported as “NE”. Further, not all the carbon pools are included for the different categories. The geographic coverage is not clear from the NIR.

62. Denmark must be complimented for initiating some key improvements which include: first, the use of remote sensing data for 1990 and later years for estimating the land use pattern and land-use change matrix; second, initiating a National Forest Inventory; third, adopting the United Nations Food and Agriculture Organization (FAO) definition of forests; and, finally, for initiating soil carbon studies. In this regard the ERT recommends that Denmark continue to make use of remote sensing and to report area changes based on actual measurements or monitoring, instead of the previous practice where areas were identified through census surveys.

63. QA and QC procedures have not been fully implemented for the 2006 inventory of the LULUCF sector. Denmark must be complimented for initiating a plan to develop QA/QC for the LULUCF sector, which, according to the NIR, will be implemented for future inventories.

64. Uncertainty estimates are reported for cropland, grassland and wetlands for AD and EFs, but they are not estimated for the forest land category. Higher uncertainty is reported for EFs, which are reported to be low for cropland and grassland categories – at 0.5 per cent for cropland area estimates. The tier 1 method is adopted for the land categories for which uncertainty is reported. It is good practice to adopt higher-tier methodologies for uncertainty estimates for the key categories such as cropland and forest land.

65. Denmark has not included the LULUCF sector in its key category analysis so the rest of this section is based on the secretariat’s key category analysis. The ERT recommends Denmark to include the LULUCF sector in its key category analysis in future inventories. In response to the draft review



report, Denmark stated that it has initiated efforts to include the LULUCF sector in its key category analysis and will include it in its 2008 submission. The inclusion of the LULUCF sector in the key category analysis is a prioritized activity for the Party.

66. No recalculation is reported in the 2006 inventory and it is not clear from the NIR whether any recalculation was carried out in previous inventories.

## **B. Key categories**

### **1. Forest land remaining forest land – CO<sub>2</sub>**

67. Forest land is a net sink for all the years 1990–2004. An extreme fluctuation is reported for the year 2000 due to storm damage. Changes in forest area are reported to be due to an increased number of responses to a census survey. The survey approach may not involve use of a consistent definition of forests. Open wooded lands are not included as forests, even though they may qualify. Not all carbon pools are estimated. Soil organic carbon, deadwood and litter pools are not estimated and soil organic carbon is assumed to be stable. Recommended improvements for the forest land category include: inclusion of all land areas qualifying under the definition of forests; inclusion of dead organic matter and mineral soil carbon pools; measurement-based area estimates; development of country-specific EFs, biomass conversion and expansion factors; and more frequent measurement of carbon stocks. In response to the draft review report, Denmark stated that carbon stocks for woody biomass and dead wood are currently being carried out in a continuous sampling programme with a five-year rotation in the NFI. For litter and soil C pools it is well recognized that changes occur slowly and measurements with a frequency of less than 10 years are not likely to show any patterns due to large site- and sampling-related variability.

### **2. Cropland remaining cropland – CO<sub>2</sub>**

68. Biomass carbon pools are reported for hedgerows and horticulture crops (soil carbon is reported as not applicable for hedgerows and horticulture). In response to the draft review report, Denmark explained that the notation key for soil carbon will be changed to “NE” in future submissions. The subcategory horticulture will be changed to orchards as it only includes fruit trees and berry plantations. Soil carbon pool is reported for cropland, according to mineral and organic soils. The limitations of the inventory for cropland remaining cropland are:

- (a) The NIR does not provide adequate explanation for changes in crop area;
- (b) Permanent grassland on mineral soils is included under cropland;
- (c) The total reported agricultural area (2.645 Mha) does not match the total area reported of organic and mineral soils (2.705 Mha)). In response to the draft report, Denmark explained that the figures are slightly different from NIR table 7.8 due to different data sources and years;
- (d) Subsidized hedgerows are included but privately planted hedgerows are not.

Denmark has plans to improve all these issues in future GHG submissions.

69. Some of the recommended improvements include: reporting land converted to cropland, if any; providing an explanation for different total area estimates in the NIR tables (table 7.8 and 7.9); and shifting grassland from the cropland category to grassland. In response to the draft review report, Denmark agreed that the NIR tables 7.8 and 7.9 are based on different datasets and therefore not quite comparable.

### **C. Non-key categories**

#### **1. Land converted to forest land**

70. The area brought under afforestation from cropland, about 1,839 hectares annually in Denmark, is reported. However, only the carbon stock change in living biomass is reported for the years 1991–2004; 1990 is reported as “NA”. Carbon stock change in dead organic matter and soils are reported as “NE”. The ERT recommends that Denmark estimate the carbon stock change in dead organic matter and soils.

71. The cropland area converted to forest land for the year 1990 is estimated to be 730 ha. CO<sub>2</sub> emissions and removals are not reported for any pools for this particular year, but are reported as “NA” and “NE”. The Party explained that the growth of biomass in the first year after planting is almost none as no felling takes place. The growth model used includes carbon stock change in living biomass for year two after planting and onwards. The ERT recommends that for the sake of completeness Denmark report CO<sub>2</sub> emissions and removals even if the land area involved is small.

72. Conversion of grassland, wetlands, settlements and other to forest land, as well as CO<sub>2</sub> emissions and removals are reported as not occurring.

#### **2. Grassland – CO<sub>2</sub>**

73. Inventory estimates are reported only for grassland remaining grassland. Furthermore, changes in soil carbon stocks are reported only for organic soils. Carbon stock change in living biomass and dead organic matter are reported as not applicable. Changes in soil carbon pools for mineral soils are reported in the cropland category. It is recommended that Denmark include the soil carbon stock changes from mineral soils under grassland remaining grassland and not under cropland.

74. Land converted to grassland is reported as not occurring.

#### **3. Wetlands – CO<sub>2</sub>, N<sub>2</sub>O**

75. CO<sub>2</sub> emissions from peat extraction are reported for wetlands remaining wetlands. Furthermore, CO<sub>2</sub> removal is reported for cropland and grassland converted to wetlands for mineral and organic soils. It is important to mention the tier adopted. According to the IPCC good practice guidance for LULUCF, only carbon stock change is expected to be reported if the tier 1 method is used. However, N<sub>2</sub>O emissions are also reported for peat land extraction.

#### **4. Settlements – CO<sub>2</sub>**

76. Inventory estimates for settlements are reported as not estimated and the NIR states that carbon stock changes are assumed to be negligible and thus not reported. The ERT recommends that settlements covering gardens, parks and trees in settlements should be included in future inventories for completeness.

#### **5. Fertilizer and lime application – CO<sub>2</sub>, N<sub>2</sub>O**

77. Fertilizer application in forests and other land categories is reported to be negligible and thus included under total fertilizer consumption. Lime application is reported under cropland, since its application to forest land and grassland is negligible.

#### **6. Biomass burning – CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O**

78. Biomass burning is banned in Denmark and is reported as not occurring. If any biomass burning is occurring despite the ban, it is recommended that the emissions be reported. Clarity is required about whether biomass burning is occurring.

## VI. Waste

### A. Sector overview

79. The waste sector contributed 2.0 per cent to total national GHG emissions in Denmark in 2004. CH<sub>4</sub> emissions from solid waste disposal on land contributed 77.0 per cent of the total sectoral emissions, representing 18.5 per cent of the total national CH<sub>4</sub> emissions. The sectoral emissions exclude the emissions estimated for the sector in Greenland and the Faroe Islands. Information on emissions from Greenland for 1990–2004 is included in the NIR.

80. The sectoral emissions have decreased by 9.9 per cent between 1990 and 2004. The trend is driven by the implementation of waste management policies and measures in a regulatory regime of compliance monitoring and enforcement. These have achieved recycling of 64 per cent and 24 per cent incineration with energy recovery, and have substantially reduced the proportion of waste sent to landfills from 30 per cent in 1990 to 8 per cent in 2004.

### B. Key categories

#### Solid waste disposal on land – CH<sub>4</sub>

81. Denmark uses a country-specific tier 2 approach based on the first order decay (FOD) methodology. Country-specific AD and EFs have been used. The consistency and transparency of the category were improved in the 2006 submission by detailed documentation of the model estimates, the sensitivity analysis of various parameters that affect the emissions estimates, and the uncertainty analysis as well as adequate reporting in the NIR based on previous review comments.

82. Denmark assumes constant waste composition over the years for the estimation of degradable organic content (DOC). The ERT noted that the uncertainty in DOC and in the k-values used in the country-specific FOD model may be reduced by the use of fractional composition of degradable components of the present waste type classification and the corresponding country-specific carbon content. Because of the changing characteristics of waste disposed at landfill sites as a result of increased recycling and incineration of both biogenic and non-biogenic fractions, Denmark is encouraged to undertake periodic waste generation studies and sampling of different solid waste disposal sites to obtain country-specific DOC values that reflect changing waste composition over time. In this regard the ERT recommends that a pre-survey analysis should be carried out to elucidate the sensitivity of the FOD model output to changing waste composition and DOC in order to determine the critical parameters and priorities of the survey. If undertaken, the survey data and sampling should be reported in future inventories.

83. Landfill gas capture and utilization increased over the period ranging from 0.5 kt in 1990 to 13.2 kt in 1998, and then reduced to reflect the decreasing amount of degradable waste sent to landfill as a result of the government's waste management policy and legislation. The emissions from the key category have consequently reduced significantly by 19.5 per cent between 1990 and 2004.

84. Denmark has also investigated the sensitivity of the FOD model to the use of the k-values of respective waste types in accordance with the IPCC good practice guidance in response to previous review comments. The objective was to improve the comparability of the methodological choices. The initial results of the analysis showed that using the k-values of individual waste types gives lower estimates compared to the reported emissions based on aggregate k-values. The difference ranges from 8 per cent in 1990 to 20 per cent in 2004. The ERT notes that Denmark plans to report the outcome of its investigation in 2008 submission.

85. Denmark applies the oxidation factor to potential methane emissions before accounting for biogas recovery in the formulation of the FOD model methodology for the estimation of the residual

methane emissions from solid waste disposal on land. The 2005 review comments recommended that Denmark should consider accounting for biogas recovery before applying the oxidation factor in the FOD model in accordance with the IPCC good practice guidance. This is because CH<sub>4</sub> oxidation is considered to happen only in the top layer of the landfill and not before recovery.

86. In response to the review comments, Denmark has subsequently investigated the impacts of the recommended methodology on methane emissions from the category. The initial results indicate that the methodological change made little difference in 1990 and produced relatively small increments over time, ranging from 0.08 per cent in 1990 to 2.38 per cent in 1998. For 2004 the increase was 2.03 per cent. This methodological change was carried out for the 2007 submission.

### **C. Non-key categories**

#### Wastewater handling – CH<sub>4</sub> and N<sub>2</sub>O

87. Denmark currently reports domestic and commercial, and industrial wastewater handling as one category. This is because country-specific AD are not collected for the industrial wastewater load to municipal wastewater treatment plants. The ERT notes that Denmark is preparing an improvement plan, in response to 2005 review comments, to quantify the contributions of the two subcategories separately. The plan will involve further work on AD and the development of EFs for the separate wastewater characteristics. The outcome of the implementation of the plan should be reported in a future submission.

88. CH<sub>4</sub> and N<sub>2</sub>O emissions from wastewater handling systems contributed only 0.5 per cent of the national total in 2004, representing 22.8 per cent of total sectoral emissions. N<sub>2</sub>O emissions decreased significantly by 39.3 per cent between 1990 and 2004. This achievement has been driven by upgrades to and the installation of improved wastewater treatment plant with biological nitrogen removal systems – up from 10 per cent in 1989 to 85 per cent in 2004 – as well as compliance enforcement of environmental standards legislation on pollution reduction in the aquatic environment.

89. However, Denmark registered a net increase in CH<sub>4</sub> emissions in the category despite increased recovery from biogas from anaerobic treatment of sludge. This is due to an increase in the total load of industrial effluent discharged to municipal treatment plants from 0.5 per cent (1984–1993) to 39 per cent (1999–2004).

90. Completeness was improved by a comprehensive study of wastewater handling in 2005 and the development of country-specific tier 2 methodologies, country-specific EFs, and AD for estimating and reporting CH<sub>4</sub> and N<sub>2</sub>O emissions from industrial, domestic and commercial wastewater handling in 2005. Transparency was also increased by Denmark's response to previous review comments, and through adequate summary of the methodologies, recalculations and uncertainty estimates in the NIR as well as improved use of notation keys in the CRF.

## **VII. Other**

91. Denmark reports emissions from Greenland and the Faroe Islands as aggregated estimates in sector 7 in the CRF tables. The way information for Greenland and the Faroe Islands is presented is not transparent. The ERT recommends a more detailed overview of these emissions and that Denmark report them in the relevant sectors. Information on emissions from Greenland and the Faroe Islands is included in annex 6.2 of the NIR. A more detailed presentation of the emissions, at least in a format similar to CRF table summary 2, would significantly increase transparency. A more detailed trend discussion of Greenland's emissions should be included in the NIR. The ERT noted that Denmark submitted a revised table summary 2 for the entire time series in its Kyoto Protocol inventory, including emissions from Greenland in the relevant sectors instead of sector 7. The ERT welcomes this development and recommends that Denmark does the same for its Convention inventory.

## VIII. Conclusions and recommendations

92. Denmark has submitted a complete set of CRF tables for the years 1990–2004 and an NIR which is complete in terms of geographic coverage, years and sectors, and fairly complete in terms of categories and gases. Its 2006 inventory submission is in line with the Revised 1996 IPCC guidelines and IPCC good practice guidance and shows evidence of extensive recalculations and improvements in estimates as well as in transparency in the NIR.

93. However, there is room for improvement in the quality of the inventory report. During the review the ERT formulated a number of recommendations relating to completeness, transparency and institutional arrangements. The key recommendations<sup>3</sup> are that Denmark:

- (a) Include information on the institutional arrangements for inventory preparation in the next NIR, including the legal basis of the institutional arrangements and a clear statement on the status of agreements between NERI and the inventory partners, as well as between the Ministry of Environment and NERI;
- (b) Compile an annual QA/QC plan and enhance integration with the QM systems of inventory partners;
- (c) Enhance the cooperation between NERI and other inventory partners in the compilation of the NIR in order to fully benefit from available outside expertise, and for verification of the NIR;
- (d) Increase the amount of concise background information in the NIR without unnecessarily expanding the volume of the report, notably in energy sector;
- (e) Provide tier 2 uncertainty estimates in order to effectively focus the inventory improvement;
- (f) Undertake a tier 2 key category analysis;
- (g) Improve reporting of emissions estimates for Greenland and the Faroe Islands by including them in the relevant categories instead of reporting under the sector other, as well as updating the estimates on an annual basis;
- (h) Improve transparency in the inventory by structuring the NIR following the IPCC category structure instead of the structure used by SNAP. This also applies to the description of emission trends and background data (AD and EFs) and is particularly relevant for the energy sector;
- (i) In the energy sector, provide methodological information for stationary combustion on a category by category basis instead of grouping it under stationary combustion, and provide more information on the plant-specific EFs used;
- (j) In the industrial processes sector, describe in more detail the underlying data, equations, assumptions and references in the NIR;
- (k) In the agriculture sector, provide tables with information on the underlying parameters used to derive country-specific EFs;
- (l) In the LULUCF sector, provide land-use matrices and include missing categories and carbon pools;
- (m) In the waste sector, report CH<sub>4</sub> and N<sub>2</sub>O emissions from industrial, and domestic and commercial wastewater separately.

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<sup>3</sup> For a complete list of recommendations, the relevant sections of this report should be consulted.

Annex**Documents and information used during the review****A. Reference documents**

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories, 2000. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gp/english/>>.

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

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UNFCCC secretariat. Synthesis and assessment report on the greenhouse gas inventories submitted in 2006. FCCC/WEB/SAI/2006. Available at <[http://unfccc.int/resource/docs/webdocs/sai/sa\\_2006.pdf](http://unfccc.int/resource/docs/webdocs/sai/sa_2006.pdf)>.

UNFCCC secretariat. Denmark: Report of the individual review of the greenhouse gas inventory of Denmark submitted in 2005. FCCC/WEB/ARR/2005/DNK. Available at <<http://unfccc.int/resource/docs/2006/arr/dnk.pdf>>.

**B. Additional information provided by the Party**

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