UNITED
NATIONS

UNFCCC Framework Convention on Climate Change

Distr.
GENERAL

FCCC/ARR/2006/NLD
31 October 2007

ENGLISH ONLY

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

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

CONTENTS

			Paragraphs	*Page*
I.	OVERVIEW		1–25	4
	A.	Introduction	1–2	4
	B.	Inventory submission and other sources of information	3–4	4
	C.	Emission profiles and trends	5–6	4
	D.	Key categories	7–10	7
	E.	Main findings	11–13	7
	F.	Cross-cutting topics	14–22	8
	G.	Areas for further improvement	23–25	9
II.	ENERGY		26–65	10
	A.	Sector overview	26–32	10
	B.	Reference and sectoral approaches	33–45	11
	C.	Key categories	46–60	13
	D.	Non-key categories	61–65	15
III.	INDUSTRIAL PROCESSES AND SOLVENT AND OTHER PRODUCT USE		66–90	16
	A.	Sector overview	66–69	16
	B.	Key categories	70–83	16
	C.	Non-key categories	84–90	19
IV.	AGRICULTURE		91–105	20
	A.	Sector overview	91–96	20
	B.	Key categories	97–102	21
	C.	Non-key categories	103–105	21
V.	LAND USE, LAND-USE CHANGE AND FORESTRY		106–120	22
	A.	Sector overview	106–111	22
	B.	Key categories	112–115	23
	C.	Non-key categories	116–120	24
VI.	WASTE		121–140	24

A. Sector overview 121–125 24
B. Key categories 126–136 25
C. Non-key categories 137–140 26
VII. CONCLUSIONS AND RECOMMENDATIONS 141–143 27

Annex

Documents and information used during the review 28

I. Overview

A. Introduction

1. This report covers the in-country review of the 2006 greenhouse gas (GHG) inventory submission of the Netherlands, 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 Utrecht, the Netherlands, and was conducted by the following team of nominated experts from the roster of experts: generalist – Mr. Newton Paciornik (Brazil); energy – Mr. Ralph Harthan (Germany); industrial processes – Mr. Menouer Boughedaoui (Algeria); agriculture – Ms. Tajda Mekinda-Majaron (Slovenia); land use, land-use change and forestry (LULUCF) – Mr. Sandro Federici (Italy); waste – Mr. Amr Osama Abdel-Aziz (Egypt). Mr. Amr Osama Abdel-Aziz and Mr. Sandro Federici were the lead reviewers. The review was coordinated by Mr. Sergey Kononov (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" (the UNFCCC review guidelines), a draft version of this report was communicated to the Government of the Netherlands.

B. Inventory submission and other sources of information

3. In its 2006 submission, the Netherlands submitted a complete set of common reporting format (CRF) tables for the years 1990–2004 and a national inventory report (NIR). Where needed, the expert review team (ERT) also used the previous year's submission, 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.

4. On 1 June 2007, after the ERT's in-country visit, the Netherlands resubmitted a complete set of CRF tables and, based on the resubmitted tables, a document on recalculation of its assigned amount and commitment period reserve. This report is based on the resubmitted tables and the document on recalculations.

C. Emission profiles and trends

5. In 2004, the most important GHG in the Netherlands was carbon dioxide (CO_2), contributing 83.3 per cent to total[1] national GHG emissions expressed in CO_2 equivalent, followed by nitrous oxide (N_2O), 7.9 per cent, and methane (CH_4), 7.8 per cent (see figure 1). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) taken together contributed 1.0 per cent to total GHG emissions. The energy sector accounted for 79.9 per cent of total GHG emissions, followed by agriculture (8.3 per cent), industrial processes (7.2 per cent) and waste (3.3 per cent) (see figure 2). Total GHG emissions in 2004 amounted to 218,097.8 Gg CO_2 equivalent and had increased by 3.0 per cent from the base year (1990) to 2004.

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

[1] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LULUCF, unless otherwise specified.

Figure 1. Shares of gases in total GHG emissions, 2004

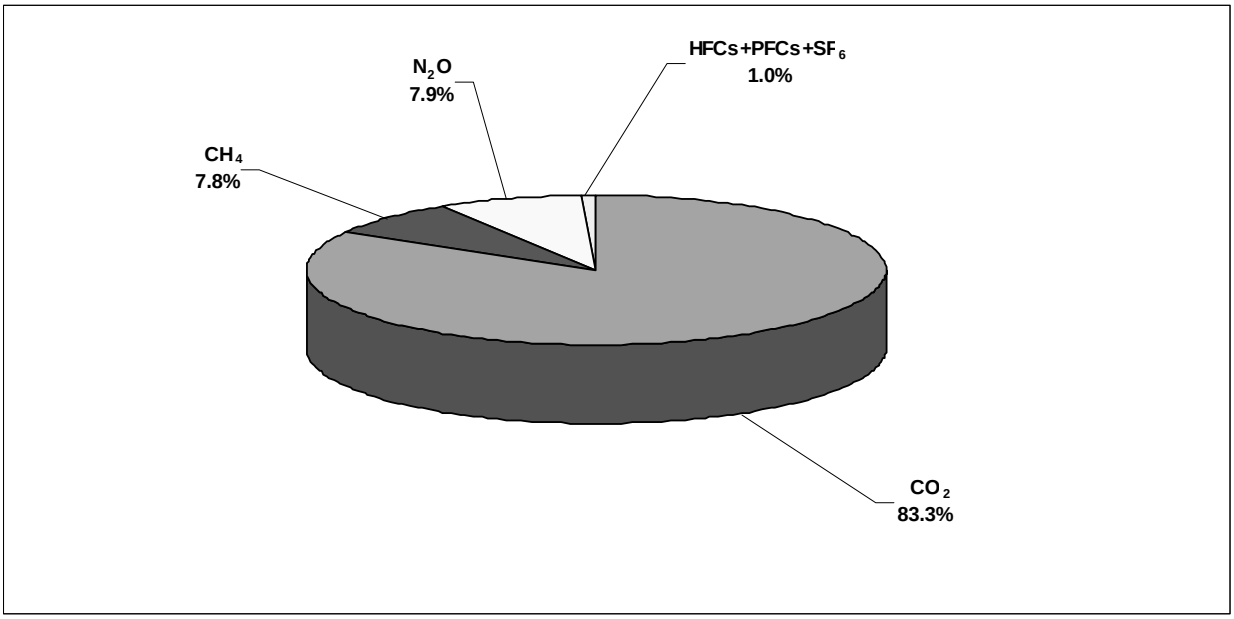
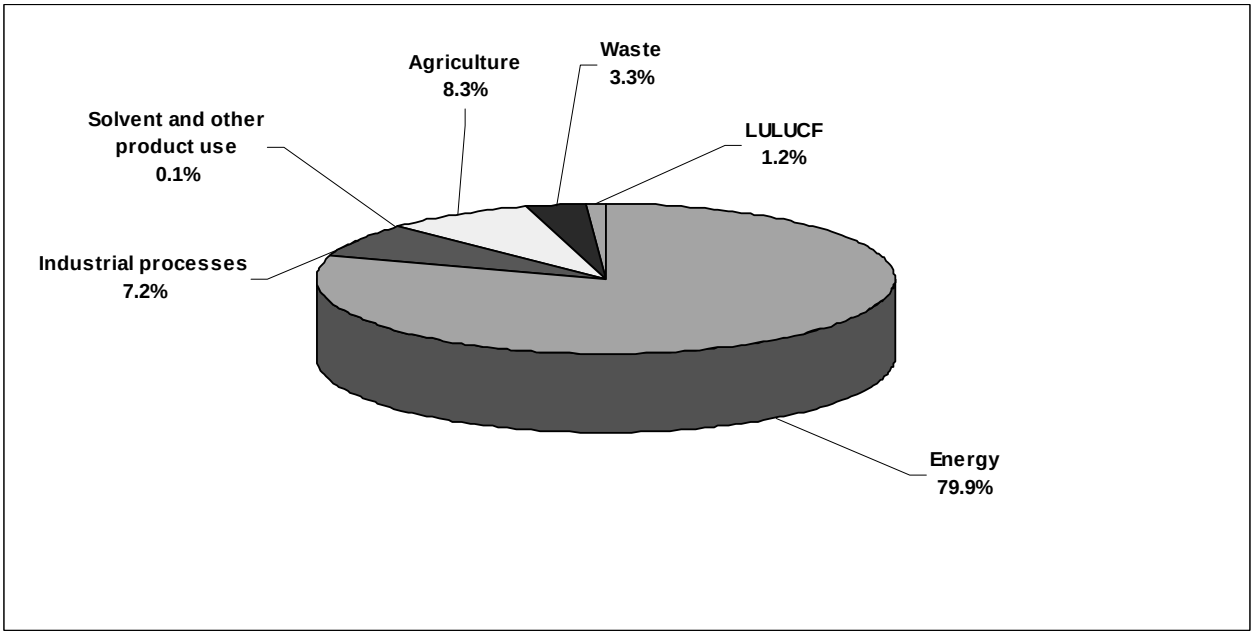


Figure 2. Shares of sectors in total GHG emissions, 2004



FCCC/ARR/2006/NLD
Page 6

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

GHG emissions	Gg CO_2 equivalent								Change
	Base year (Convention)	1990	1995	2000	2001	2002	2003	2004	BY (Convention)–2004 (%)
CO_2 (with LULUCF)	162 023.1	162 023.1	173 075.8	172 274.2	177 829.9	178 358.0	182 266.7	183 917.2	13.5
CO_2 (without LULUCF)	159 355.8	159 355.8	170 610.6	169 605.6	175 191.9	175 728.4	179 648.2	181 319.0	13.8
CH_4	25 437.8	25 437.8	23 793.6	19 248.7	18 859.1	17 990.6	17 544.9	17 298.8	–32.0
N_2O	19 943.6	19 943.6	21 308.3	19 038.1	17 954.0	17 104.1	16 830.2	17 352.3	–13.0
HFCs	4 432.0	4 432.0	6 019.5	3 823.6	1 469.3	1 541.4	1 379.6	1 514.6	–65.8
PFCs	2 264.5	2 264.5	1 937.8	1 580.6	1 488.6	2 185.5	619.5	284.7	–87.4
SF_6	217.3	217.3	301.3	335.1	356.3	332.3	309.2	328.4	51.1

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

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

Sectors	Gg CO_2 equivalent								Change
	Base year (Convention)	1990	1995	2000	2001	2002	2003	2004	BY (Convention)–2004 (%)
Energy	154 005.2	154 005.2	165 512.7	164 269.2	170 397.3	170 983.7	174 789.5	176 317.8	14.5
Industrial processes	22 191.4	22 191.4	23 560.2	20 261.6	16 683.9	17 072.3	15 529.7	15 963.6	–28.1
Solvent and other product use	541.2	541.2	439.9	306.9	268.5	248.6	230.2	231.2	–57.3
Agriculture	22 097.8	22 097.8	23 138.7	19 923.2	19 589.3	18 560.9	18 290.9	18 326.0	–17.1
LULUCF	2 667.3	2 667.3	2 465.2	2 668.6	2 638.0	2 629.7	2 618.5	2 598.1	–2.6
Waste	12 815.4	12 815.4	11 319.7	8 870.8	8 380.1	8 016.9	7 491.3	7 259.2	–43.4
Other	NA	NA	NA	NA	NA	NA	NA	NA	
Total (with LULUCF)	214 318.3	214 318.3	226 436.3	216 300.3	217 957.2	217 512.0	218 950.2	220 695.9	3.0
Total (without LULUCF)	211 651.0	211 651.0	223 971.2	213 631.7	215 319.2	214 882.3	216 331.7	218 097.8	3.0

BY = Base year; LULUCF = Land use, land-use change and forestry; NA = Not applicable.

Note: Tables 1 and 2 reflect the revised estimates submitted by the Netherlands in the course of the 2006 review on 1 June 2007. These estimates differ from the Netherlands' GHG inventory submitted in 2006. More information is provided in this report.

.

D. Key categories

7. The Netherlands has reported a key category tier 1 and tier 2 analysis, both level and trend assessment, as part of its GHG inventory submitted with the initial report. The results of that key category analysis are used for choosing methodologies (on the application of tier 2 and higher-tier methods for key categories) and for prioritizing improvements, revisions of the methodologies, recalculations, and more focused uncertainty assessment. For the key categories, more detailed descriptions are provided in the NIR.

8. The tier 1 level key category analyses performed by the Party and the secretariat[2] produced similar results. The main reason for the differences, which are minor, is that the Party used a more disaggregated list of categories. In consequence, more key categories are included in the Party's key category analysis, such as N_2O emissions from caprolactam production, manure management and animal production on agricultural soils. All the key categories identified by the secretariat are, at least partially, included in the Party's analysis. The Netherlands has not reported a key category analysis for the base year. In the secretariat's level key category analysis for the base year, fugitive emissions of CH_4 in oil and gas operations are identified as key. This category is not, however, identified as key in 2004, either by the Party or by the secretariat. The tier 1 trend analyses performed by the Party and the secretariat also produced similar results. All the key categories identified by the trend analysis that were not already identified as key categories on the level assessment are small categories for which emissions have been much reduced since 1990.

9. The Netherlands also reports a tier 2 key category analysis, for both level and trend assessments. As it is designed to do, the tier 2 analysis identified further key categories which have a low level of emissions but a high uncertainty, such as emissions of N_2O in the agriculture sector. For these categories priority should be given to better estimation and reduction of the uncertainty. The Netherlands informed the ERT that the results of the tier 2 key category analysis are taken into account in the improvement programme of the Netherlands (as part of the quality assurance/quality control (QA/QC) programme).

10. The Netherlands has performed a key category analysis with and without the LULUCF sector. However, the key category tables presented in section A1.2 of the NIR do not include LULUCF. The ERT recommends that the tables including the LULUCF sector should also be included in the NIR.

E. Main findings

11. The Netherlands' inventory is at an advanced stage of development, is of good quality and is overall consistent with the UNFCCC reporting requirements and the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). The Netherlands' institutional arrangements meet the requirements for implementation of the general functions as well the specific functions of inventory planning, inventory preparation and inventory management. During the review process the staff involved demonstrated a high level of competence and were available to the ERT as needed.

12. The land-use change matrix is inconsistent since it has been made by comparing maps produced using different (and not coherent) methodologies of land classification. Moreover, a serious problem of

[2] 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 Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) for the base year or base year period as well as the latest inventory year. Key categories according to the tier 1 trend assessment were also identified. 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.

data quality was found for the estimates of net CO_2 emissions from deforestation, since the Netherlands provided eight different sets of data during this review.

13. The Netherlands declares activity data (AD) as confidential in several sources of the industrial processes sector. The ERT believes that more could be done to facilitate an assessment of the estimates for such sources.

F. Cross-cutting topics

1. Completeness

14. The inventory submitted is in general complete in terms of geographical coverage,[3] years, sectors, source and sink categories, and gases. Some small categories or gases within a category are still missing due to lack of AD or assumed size. The Netherlands explains in the NIR that the justification for missing sources will be improved in the future.

15. The CRF tables are generally complete. However, some gaps have been identified, such as incomplete background tables in the agriculture sector or missing data for some years in the energy sector. Some of the notation keys are wrongly or inconsistently applied. Inconsistencies were identified between the CRF tables and the NIR, and the CRF table for key categories has not been updated with the results of the key category analysis presented in the NIR. The Netherlands informed the ERT that consistency as between the CRF and the NIR, and key category analysis in the NIR, will be given special attention in the NIR of the 2008 inventory submission.

2. Transparency

16. The NIR has in general been well prepared but it does not provide all the information needed to enable the ERT fully to assess the inventory. The Netherlands makes the "protocols" (used as guidance in developing the emission estimates for each category of the inventory) available in the form of annexes to the NIR. However, the ERT came to the conclusion that the protocols do not provide enough information on the background data and intermediate parameters, and that the data presented are often inconsistent with the data in the NIR. The ERT recommends the Netherlands to revise the structure of the report, either by increasing the amount of information in the NIR or by redesigning the annexes. Moreover, the large amount of confidential data (mainly in the industrial processes sector) meant that the ERT was not able fully to assess how far the emission estimates for such categories conform to the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC good practice guidance.

3. Recalculations and time-series consistency

17. The Netherlands inventory was assessed as overall consistent. However, some important inconsistencies were identified in the LULUCF sector. These include the fact that the time series for the past 20 years has not been reconstructed and the inconsistency of the methodologies of the land classification applied to the two maps that were used to calculate the land-use change matrix which the Party reports.

18. The ERT noted that recalculations for the whole time series from the base year to 2004 had been undertaken to take into account error correction, improvements in data, methodological changes and reallocation of categories. The major changes relate to: (a) CO_2 emissions from fuel combustion, due to a revised emission factor (EF) for natural gas and revised data for manufacturing industries and construction; (b) fugitive emissions from the oil and gas sector, due to the use of a new methodology; and (c) CH_4 emissions from enteric fermentation due to a new country-specific methodology. The rationale

[3] In ratifying the Climate Change Convention, the Netherlands declared that the ratification relates to its territory in Europe. Accordingly, the GHG inventory of the Netherlands does not covers Dutch territories outside Europe.

for these recalculations is provided in the NIR. The effect of the recalculations for the base year is an increase of 0.6 per cent in total estimated emissions excluding LULUCF and an increase of 0.4 per cent for total estimated emissions including LULUCF. For the year 2003 the effect was an increase of 0.4 per cent for total emissions excluding LULUCF and of 0.7 per cent for total emissions including LULUCF. As a result of the recalculations the change in total national emissions from 1990 to 2003 has decreased from 1.5 per cent to 1.3 per cent.

4. Uncertainties

19. The Netherlands has provided a tier 1 uncertainty analysis in the NIR. A tier 2 analysis was implemented during 2006 and a report on the relevant study was provided to the ERT. The ERT found, however, that some of the basic uncertainty data could be overestimated and inconsistent with the methodology applied to estimate the emissions of some sectors (expert judgement was used for measured emissions in the industrial processes sector), and could be updated. This is particularly recommended for the categories identified as key in the tier 2 key category analysis.

5. Verification and quality assurance/quality control approaches

20. The Netherlands has developed a QA/QC plan which is in accordance with the IPCC good practice guidance. This QA/QC plan is updated annually as part of its inventory improvement and inventory planning functions. This includes general QC procedures (tier 1) as well as source/sink category-specific procedures (tier 2) for key categories and for those individual categories in which significant methodological and/or data revisions have occurred, to be applied periodically. However, no information on the QC sectoral procedures is reported in the NIR for each sector or in the monitoring protocols. The ERT recommends that this information be included in the Party's future submissions as well as information on the tier 2 QC procedures recently applied.

21. QC procedures are applied by the Emissions Registration project and by the institutions responsible for the inventory preparation. Before submission of the inventory, a review procedure is performed that includes an internal check and peer review of the NIR by experts who have not been involved in the preparation process. Periodic audits are performed as part of the inventory management and improvement functions. Inconsistencies between the CRF tables and the NIR have been identified (see the sectoral sections of this report below), and the CRF table for key categories has not been updated with the results of the key category analysis presented in the NIR. The ERT suggested that the QA/QC procedures could be improved to ensure consistency between the CRF and the NIR.

6. Follow-up to previous reviews

22. The NIR describes the improvements that have been made in response to the centralized review of the 2005 inventory submission. Major improvements include the recalculation of CO_2 emissions from fuel combustion because of a revised emission factor for natural gas and revised data for manufacturing industries and construction; new estimates for fugitive emissions from oil and gas because of the use of a new methodology; and new estimates for CH_4 emissions from enteric fermentation because of the use of a new country-specific methodology.

G. Areas for further improvement

1. Identified by the Party

23. The NIR describes the improvements that have been made in response to the centralized review of the 2005 submission. It also identifies planned improvements such as a new tier 2 uncertainty analysis and updates of methodology protocols for the categories identified as key as a consequence of the tier 2 key category analysis. This includes examining the possibility of including anaerobic treatment in the methodology for calculating N_2O emissions from manure management and of conducting further research on N_2O emissions from soils.

2. Identified by the ERT

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

(a) Improve the transparency of the inventory by revising the structure of the NIR, either by increasing the information given in the NIR or by redesigning the annexes;

(b) Improve the archiving procedures of the inventory to allow for fully centralized access to the inventory data and related information.

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

II. Energy

A. Sector overview

26. In 2004, the energy sector accounted for 79.9 per cent of total GHG emissions in the Netherlands. The subsector energy industries is the major source category in the sector, contributing 39.9 per cent to sectoral emissions and 32.3 per cent to total national emissions. The subsectors manufacturing industries and construction, transport, and other sectors accounted for 15.4 per cent, 20.1 per cent and 23.0 per cent, respectively, of energy emissions in 2004. Between 1990 and 2004, emissions from the energy sector increased by 14.5 per cent, mainly due to increased emissions from energy industries and transport.

27. The CRF tables for 2004 are largely complete. Some cells have been left blank in tables 1.A(b), 1.A(c) and 1.A(d). The Party is encouraged to fill these gaps with values or notation keys, as applicable.

28. The Netherlands has improved its inventory since the most recent (2005) submission. Major improvements involve the revision of the CO_2 emission factor of natural gas and the revision of the determination of emissions in the gas sector (related to transmission, distribution, venting and flaring).

29. The ERT noted that the emission estimates for the energy sector are lacking in transparency where methodologies and data sources are concerned. This is due to the fact that the information given in the NIR is often limited and has to be complemented by the monitoring protocols, which are referred to in annex 6 of the NIR as information that should be considered as part of the NIR submission, and background documents for individual source categories. Some of the information provided in these additional documents appears not to be up to date, which leads to inconsistencies between different documents. During the review, the Party provided all the information needed to explain the actual methodologies and data sources used. The Netherlands is encouraged to improve the transparency of its inventory for future submissions by compiling one stand-alone NIR with relevant extracts of those background documents which are needed in order to explain the methodologies and data sources used. Additional information may still be made available in protocols and other background documents.

30. Recalculations have been performed since the 2005 inventory submission. They relate in particular to fugitive emissions in the gas sector (the use of newly developed country-specific emission factors and updated data for transmission, distribution, venting and flaring) as well as to a revised CO_2 EF for natural gas combustion. In the NIR and during the review, the Party provided all relevant information for these recalculations. The ERT acknowledged that the recalculations have improved the quality of the inventory.

31. QA/QC procedures are in place and are to some extent described in the NIR. The Party is encouraged to include more information in the NIR with respect to QA/QC measures in place for data handling and for validation using different sources (e.g. cross-checks of the AD and EFs in energy industries and manufacturing industries and construction, as described during the review visit).

32. The ERT acknowledges the significant efforts made by the Party to provide an inventory using the best information available. In particular, the Netherlands uses many company- and country-specific activity data and emission factors to improve accuracy and to reduce uncertainties. Major efforts have been made to streamline the national energy statistics and preparation of the GHG inventory. A good-quality data handling system, using a detailed database with company-specific data, is in place. The staff involved are highly qualified and motivated.

B. Reference and sectoral approaches

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

33. Energy consumption and CO_2 emissions in the base year are 17.1 per cent and 3.8 per cent higher, respectively, for the reference approach than for the sectoral approach. In 2004, the difference between the two approaches for energy consumption increased in comparison to the base year (to 19.4 per cent), while it decreased for CO_2 emissions (to 0.3 per cent). The difference in fuel consumption is the largest for liquid and solid fuels (31.4 per cent and 22.5 per cent, respectively, in the base year, and 42.9 per cent and 26.9 per cent, respectively, in 2004). The NIR gives four main reasons for the differences between the two approaches:

(a) CO_2 from the incineration of waste that contains fossil carbon is not included in the reference approach;

(b) The fossil-fuel related emissions reported as process emissions and fugitive emissions are not included in the sectoral approach;

(c) The country-specific carbon storage factors used in the reference approach are multi-annual averages, while the carbon storage factors in the sectoral approach are calculated for the specific mix of feedstock and non-energy use in each year;

(d) Plant-specific emission factors were used in the sectoral approach, whereas country-specific EFs were used in the reference approach.

34. In the NIR a correction to the inherent differences identified has been made by adding relevant fugitive emissions in the energy sector and process emissions from the industrial sector to the sectoral approach, and by including emissions from the incineration of fossil waste in the reference approach. As a result the overall difference of CO_2 emissions between the reference and the sectoral approach decreases in the base year (the difference between the two approaches becomes 0.6 per cent) and increases in 2004 (to 1.6 per cent).

35. The ERT noted that CO_2 emissions from liquid fuels are lower in the reference approach than in the sectoral approach for many years, which is not plausible. In addition, the difference between the reference approach and the sectoral approach for liquid fuels increased over time, while it decreased for solid and gaseous fuels. During the review, the Party provided the following explanations for this effect:

(a) Due to a confusion in the questionnaires for energy statistics, some chemical products were reported by companies as fuels, for example, as liquefied petroleum gas (LPG) instead of naphtha, which leads to *increasing* CO_2 emissions in the reference approach;

(b) LPG is included in the energy statistics, and companies partly export it. As a result of the export of LPG, apparent consumption of LPG decreases, which leads to *decreasing* emissions in the reference approach;

(c) The export-related effect under (b) is larger than the reporting-related effect under (a), so that the overall emissions are smaller in the reference approach than in the sectoral approach;

(d) These discrepancies increase over time, since companies' reporting is increasingly incorrect.

36. The Party believes that these problems only affect the reference approach (apparent consumption) and not the sectoral approach, since process emissions in the sectoral approach are calculated using a carbon balance and company-specific storage factors. The errors in reporting in the energy surveys have already been identified and corrected by the Party. In 2005 an improvement project started in the national energy statistics. Correct reporting can be expected for the 2007 data. The Party is encouraged to describe these discrepancies in its NIR.

2. International bunker fuels

37. Emissions of CO_2 from international aviation increased by 131.3 per cent between 1990 and 2004, and those from international navigation increased by 36.3 per cent over the same period. As a result, the share of aviation bunkers in international bunker emissions increased from 11.7 per cent in 1990 to 18.3 per cent in 2004.

38. Default IPCC emission factors have been used for estimating CH_4, N_2O and CO_2 emissions from residual fuel oil (heavy fuel oil), lubricants and jet kerosene. The CO_2 EF for gas/diesel oil is based on measured carbon content for fuel distributed for road transport.

39. International bunker fuel use is defined in the national energy statistics according to the Netherlands' tax definition (as the fuels for which a tax exemption for international transport applies). Since some international bunker sales are also partly used for national aviation and navigation, the Party calculates the following fuel consumption data from other sources and corrects the estimates for international bunkers accordingly:

(a) Fuel use by fisheries according to the IPCC definition has been calculated using information on shipping movements;

(b) Fuel use for military aviation and navigation according to the IPCC definition has been calculated using data provided by the Ministry of Defence;

(c) Fuel consumption from domestic navigation has been based on ship movements for national cargo transport and on a survey for national passenger transport;

(d) Fuel consumption for domestic aviation has been estimated based on figures from the Civil Aviation Authority Netherlands.

40. The ERT considers that emissions from international bunker fuels are appropriately dealt with by the Netherlands inventory. The Party is encouraged to update the data that are based on surveys or studies on a regular basis.

3. Feedstocks and non-energy use of fuels

41. The share of total feedstock-related emissions, including the combustion of residual chemical gas and waste combustion, in national total CO_2 emissions was about 12 per cent in 2004. The largest part of these emissions (64 per cent in 1990 and 80 per cent in 2004) is reported in the energy sector. This relates especially to emissions from blast furnace gas and residual chemical gas.

42. Because of erroneous reporting (see also paragraph 35) some chemicals were allocated to fuels used as feedstock, which has led to incorrect values for non-energy use of some fuels. However, the Party considers that this misallocation does not affect the emissions reported under energy or process emissions reported under industrial processes, since only the reference approach is affected. This issue has already been recognized by the Party and is being addressed.

43. In refineries not all the refinery gas or all the products are completely reported by the companies. For that reason, a fuel called "unaccounted for liquid fuel", calculated from a mass balance, is included in the inventory. According to information provided during the review visit, most of this fuel will be accounted for as pure CO_2 emissions from a hydrogen plant in the Netherlands' future submissions. The remaining emissions will be included under refinery gas (and the corresponding emission factor will be adapted accordingly). Correspondingly, in future submissions there will be a shift from 1.A (fuel combustion) to 1.B (fugitive emissions) due to the reallocation of the pure CO_2 emissions.

44. During the review the Party provided sufficient evidence to substantiate the validity of the accounting of feedstocks and non-energy use of fuels. However, the Party is encouraged to improve the relevant documentation in the NIR.

45. Also during the review process, the Party provided a revised estimate for "other petroleum products" as feedstocks and non-energy use for 2004 (table 1.A(d)), which had not been requested by the ERT. The Party explained that this change reflects improvements and corrections made for the 2007 inventory submission. The ERT accepted this change and acknowledged that it represents an improvement.

C. Key categories

1. Stationary combustion: all fuels – CO_2, CH_4 and N_2O[4]

46. GHG emissions from stationary combustion accounted for 57.8 per cent of total national emissions in the base year and 63.6 per cent in 2004. These emissions increased by 11.8 per cent between 1990 and 2004. More than 99 per cent of overall emissions in stationary combustion are of CO_2.

47. The activity data in the national energy statistics for stationary combustion are determined as follows:

(a) Energy consumption for stationary combustion in energy industries (1.A.1) and manufacturing industries (1.A.2) is calculated using a bottom-up approach using detailed plant-specific data;

(b) Energy consumption in the residential sector (1.A.4(b)) is estimated based on a survey on energy consumption in households;

(c) Energy consumption in agriculture, forestry and fisheries (1.A.4(c)) is estimated based on a survey on energy consumption and on other data sources;

(d) Energy consumption in the subsector commercial and institutional services (1.A.4(a)) is determined by subtracting the energy consumption under other categories (1.A.1, 1.A.2, 1.A.3, 1.A.4(b) and 1.A.4(c)) from total energy consumption.

48. Emissions from stationary combustion in energy industries and manufacturing industries are calculated using a bottom-up approach and company-specific, sector-specific, country-specific and default data. Company-specific data from energy statistics and default sector-specific emission factors are compared with the data in environmental reports to yield best estimates of activity data, notably for "derived" fuels, and CO_2 EFs. The ERT acknowledges the significant effort the Netherlands has invested in putting this high-quality system in place and in reconciling data from the energy statistics and inventory preparation.

49. Due to the appearance of joint ventures in the 1990s, many industrial plants reporting under manufacturing industries and construction (category 1.A.2) have shifted to energy industries (1.A.1). Consequently, a reallocation between the two sectors has taken place.

[4] It should be noted that not all emissions related to all fuels and gases under this category are key categories. However, since the calculation procedure for stationary combustion is common for many sources, individual source categories are difficult to separate.

50. The calculation of emissions in the residential sector includes a differentiation with respect to cooking, space heating and hot water.

51. The ERT encourages the Party to investigate the possibility of introducing technology-specific information for stationary combustion in order to increase accuracy with respect to CH_4 and N_2O emissions, where pertinent, since emission factors may differ between boiler types, turbine types and so on.

52. Planned improvements by the Party include checking whether data obtained from the monitoring of the European Union (EU) emissions trading scheme (ETS) can be used to further improve data quality.

53. Also during the review process, the Party submitted several new estimates for 2004 which had not been requested by the ERT. These were for CH_4 emissions in public electricity and heat production (1.A.1(a)), CO_2 emissions in petroleum refining (1.A.1(b)), CH_4 and N_2O emissions in the pulp, paper and print industries (1.A.2(d)) and other (1.A.2(f)), as well as CO_2 emissions from biomass (a memo item). Moreover, related background data (fuel consumption) were changed in the subcategories 1.A.1(a), 1.A.1(b), 1.A.2(d) and 1.A.2(f). The Party explained that these changes reflect improvements and corrections made for the 2007 inventory submission. The ERT accepted these changes and acknowledged that they represent an improvement.

2. Road transportation: liquid fuels – CO_2, CH_4 and N_2O[5]

54. CO_2 emissions from road transportation accounted for 15.7 per cent of total national CO_2 emissions in the base year and 18.5 per cent in 2004. These emissions increased by 32.9 per cent between 1990 and 2004.

55. The estimates of CO_2, CH_4 and N_2O emissions from transport are in line with the IPCC good practice guidance and the Revised 1996 IPCC Guidelines. The overall basis for the calculation of emissions is fuel consumption. In addition, for CH_4 and N_2O a bottom-up model is used to incorporate differences of emission factors depending on vehicles, abatement measures and so on. The ERT appreciated the availability of many country-specific data (EFs of fuels and vehicles).

56. Nitrogen oxide (NO_X) emissions from road transportation are reported. (In the industrial processes sector (2.G) these emissions are used to calculate indirect N_2O emissions from NO_X deposition.) During the review the ERT concluded that the calculation of NO_X emissions from road transportation is not in line with the IPCC good practice guidance, since these guidelines require a fuel-based calculation, while NO_X emissions in the transport sector are calculated on the basis of a bottom-up approach using vehicle kilometres. The Party agreed to recalculate these NO_X emissions in accordance with the IPCC good practice guidance. During the review process, the Party provided to the ERT revised NO_X emission estimates for the transport sector calculated in accordance with the IPCC good practice guidance. Furthermore, the Party decided no longer to report N_2O emissions from NO_X deposition. The ERT reviewed these revised values and concluded that they are correct and appropriate. In addition, the ERT accepts the Party's decision to stop reporting N_2O emissions from NO_X deposition.

57. Emissions from the use of biofuels in transport are not yet included in the inventory. The Party plans to include them in its future submissions.

[5] It should be noted that not all emissions related to all fuels and gases under this category are key categories. However, since the calculation procedure for road transportation is common for many sources, individual source categories are difficult to separate.

3. Oil and gas – CH_4 and CO_2[6]

58. CH_4 and CO_2 emissions in the oil and gas sector (1.B.2) have been calculated based on a tier 3 approach. This is in compliance with the Revised 1996 IPCC Guidelines.

59. The Netherlands has improved its estimates of activity data and emission factors significantly compared to previous submissions, in particular by using results from studies on CH_4 EFs for gas networks and by setting up a system to obtain emissions data on a very detailed level. The ERT acknowledges the efforts the Party has made to improve the methodology and the data used in this sector.

60. Also during the review process, the Party submitted revised estimates for CO_2 emissions from fugitive emissions from oil and natural gas (category 1.B.2) for 2004, which had not been requested by the ERT. The related activity data (CRF table 1.B.2) were also modified. The Party explained that this change reflects improvements and corrections made for the 2007 inventory submission. The ERT accepted these changes and acknowledged that they represent an improvement.

D. Non-key categories

Public electricity and heat production: biomass, other fuels – CO_2, CH_4, N_2O

61. According to the NIR, emissions from waste incineration are reported under energy industries (1.A.1) since all waste incinerators in the Netherlands also produce heat or electricity for energy purposes.

62. Emissions have been estimated by determining the amount of fossil carbon in the waste (for CO_2 emissions) and by multiplying the waste incinerated with an emission factor (for CH_4 and N_2O emissions).

63. During the review the ERT concluded that several of the data items provided do not match the actual values used for the calculation of emissions (the amount of waste incinerated, waste composition, fraction of fossil carbon). The ERT requested the Party to update the NIR with correct values in its future submissions. During the review process, the Party provided to the ERT a table including the revised values. The ERT reviewed these revised values and concluded that they are correct and appropriate.

64. The description of the methodology and the data sources used for the calculation of emissions is not fully transparent in the NIR. During the review, the Party was able to clarify the methodology and data sources used and to show that these emissions have been calculated correctly. Nevertheless, the Party is requested to improve the transparency of the NIR by documenting the methodology and data sources in sufficient detail.

65. For N_2O emissions from waste incineration with "other fuels", an IPCC default emission factor for coal has been used. However, this choice is not substantiated in the NIR. The ERT noted that N_2O EFs for waste incineration are available in the Revised 1996 IPCC Guidelines or in the IPCC good practice guidance, and recommends that the Party substantiate the choice of this EF or revise the estimate in accordance with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The Party indicated that national measurements of N_2O for waste incinerators had already been carried out. During the review process, the Party provided to the ERT revised emission estimates based on N_2O EFs stemming from two studies and further information. Data from measurements are reflected in these studies. The revised estimates also reflect different N_2O abatement technologies and the proportion of overall waste incinerated for which they have been installed. The ERT reviewed these revised values and concluded that they are correct and appropriate. However, the revised estimate for N_2O emissions

[6] Please note that CO_2 emissions related to oil and gas are not a key category. However, since the calculation procedure for oil and gas relates to CO_2 and CH_4 alike, CO_2 is not separated out here.

from public electricity and heat production (1.A.1(a)) for 2004 is 0.114 Gg higher than that in the previous submission, whereas according to the Party's response (of 1 June 2007) to the ERT's questions on this issue the difference should be 0.179 Gg. The Party explained this difference as being due to further improvements and corrections made in the 2007 inventory submission. The ERT accepted this explanation and acknowledged that the revised estimate represents an improvement. The Party is encouraged to document the new calculation procedure and related EFs in its future submissions. In addition, the ERT recommends that the Party validate and, if needed, update the EFs used in its future submissions.

III. Industrial processes and solvent and other product use

A. Sector overview

66. In the base year (1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6), emissions from the industrial processes sector contributed 11.7 per cent to total national emissions. CO_2 contributed 31.7 per cent to sectoral emissions; the contributions of the other gases were 34.1 per cent for N_2O, 1.2 per cent for CH_4 and 33.1 per cent for HFCs, PFCs and SF_6 taken together. In 2004, CO_2 accounted for 42.3 per cent of emissions from the sector, N_2O for 43.1 per cent, and HFCs, PFCs and SF_6 taken together for 12.7 per cent; the share of CH_4 emissions was low at 1.9 per cent.

67. The 2006 submission is essentially complete in terms of source categories covered and gases included. Although emissions from some sources such as lime production, asphalt roofing and road paving with asphalt are reported as not estimated ("NE"), all significant sources of direct and indirect GHG emissions are included. For the sake of completeness, the ERT suggests that the Netherlands estimate and include in its inventory emissions from asphalt roofing and road paving with asphalt.

68. The uncertainties in the annual emissions from nitric acid production (of 50 per cent), from caprolactam production (70 per cent) and from aluminium production (20 per cent), which remained unchanged after the recalculations of emissions based on new measurements, are considered by the ERT as either too high or inaccurate because plant-specific estimates have been used. The ERT suggests that the uncertainty estimates should be reconsidered.

69. The ERT noted that the transparency of the NIR in the chapter on industrial processes could be improved. In particular, process technologies and the methods used for estimating emissions should be described in sufficient degree to enable the ERT understand them, even if the AD and EFs are confidential. The Party is encouraged to improve transparency in this respect, and also to provide more information on how QA/QC procedures are applied for individual categories, including, if possible, those where AD and EFs are confidential.

B. Key categories

1. Nitric acid production – N_2O

70. Emissions of N_2O from nitric acid production decreased by 20.1 per cent between 1990 and 2003 and then increased by 11.0 per cent from 2003 to 2004. The NIR does not explain these changes satisfactorily. During the in-country visit, the Party explained that the reduction from 2001 to 2003 was obtained only by optimization of the converter, and that as yet no abatement technology is used at any of the plants of the three companies in the Netherlands, although such technologies are planned in the future. The increase of emissions between 2003 and 2004 is explained in the NIR as being due to an increase in production. However, there is no information to explain why emissions are stable between 1990 and 1998 (except for 1993, when they increased). As the AD are confidential, the ERT suggests that the Party explain qualitatively the increase of emissions during 1993 and 2004 and improve the transparency of the NIR by reporting in greater detail the plant-specific methodology used to estimate these emissions.

71. The ERT noted in particular that emissions are estimated by plants using the methodology described in the monitoring protocols, which is based on a plant-specific EF and the AD for each plant. However, appendix 2 of the protocol entitled "2B2: N_2O emissions resulting from the production of nitric acid" states that emissions from one plant which uses a non-selective catalytic reduction (NSCR) technology have been estimated using an EF of 9 kg/t instead of 2 kg/t, which the ERT considers to be an error. The Party has carried out recalculations since its previous inventory submission but this information is not reported in the NIR or in the protocol. The ERT recommends the Party to report in its next submission that this error has been corrected and recalculations carried out, and to report on the plants which stopped production in 1999 and 2000, which could be responsible for the fluctuations in emissions.

2. Other (chemical industry) – N_2O

72. The Netherlands reports emissions from caprolactam production as constant (4 kt) over the whole period 1990–2002. This estimate is based on a plant-specific methodology and plant-specific EFs. AD and the EF are reported as confidential.

73. The ERT considers that production could not be so stable over that the whole period 1990–2002 for the country's Geleen plant as the global production of the group fluctuates. The AD of the group for many years are published on a website and fluctuations in production are noticeable.[7] The emissions should also fluctuate accordingly. The ERT therefore considers this estimate as not sufficiently justified, and this could lead to an adjustment for the base year when the emissions may be overestimated. If the EF obtained by measurement is too uncertain or potentially inaccurate, the ERT suggests that the Netherlands consider using the default factor of 9 kg/t from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

74. The ERT encourages the Netherlands to check with the plant the AD and EF used in order to investigate why emissions are constant over this period. The emission estimates should then be either confirmed (and better documented) or recalculated. After the in-country review, the Party recalculated its emissions on the basis of real production and EFs based on measurements by the plant, which yielded a better estimate of emissions and a decrease in estimated emissions in the base year. The ERT wishes to highlight the transparency with which the Party acted in this particular instance, where the data are confidential.

3. Aluminium production – PFCs

75. Emissions from all aluminium production plants have been recalculated in the 2006 submission based on new measurements which were made prior to a technology switch – made in 1998 for the smallest company and in 2002/2003 for the largest company – from side worked prebaked (SWPB) to centre worked prebaked (CWPB) in the two plants of the Netherlands. PFC emissions increased during the period 1996–1997 and no explanation is provided in the NIR. The ERT recommends the Party to give more information about the increase of emissions during these years bearing in mind the decreasing trend between 1990 and 1995.

76. After recalculation, estimated base year emissions increased from 2,097.07 Gg CO_2 equivalent (in the 2003 inventory, submitted in 2005) to 2,246.21 Gg CO_2 equivalent as reported in the 2006 submission. During the in-country visit, the Party explained the methodology applied and the new ratio used for recalculation for both aluminium plants; this information should be reported in detail in the NIR of the next submission. In 2006 the Party also recalculated the emissions of PFCs using a new ratio of tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6) for one of the two plants, and recalculated emissions of C_2F_6 based on the new ratio determined by plant measurements. This led to an increase in estimated emissions in the base year. However, the ERT believes that the new ratios of C_2F_6 to CF_4 are

[7] See, for example, <http://www.dsm.com/en_US/html/dfi/cpl_home.htm>.

either too high or too low, as they fluctuate in the range of 0.14–0.20 for CWPB and 0.16–0.17 for SWPB, which is not in line with the values of 0.12 for CWPB and 0.25 for SWPB given in the Revised 1996 IPCC Guidelines. The ERT recommends the Party to check the methodology and the calculation with the company, and to report further on the C_2F_6 : CF_4 ratio in its next submission in order to improve transparency.

77. After the in-country review, the Party's national experts gave the ERT more details about the methodology used to split the PFC emissions into CF_4 and C_2F_6 for the two companies. They explained that estimates for one of the two companies were previously missing, and that the addition of these had contributed to the increase in estimated emissions in the 2006 submission. The Party will improve its estimates by using an appropriate emission factor for CWPB for C_2F_6 for the period 1999–2004. The ERT recommends the Party to include all the relevant information in the NIR of its next submission for the sake of greater transparency, and to carry out recalculations as the EF used will change.

4. Production of halocarbons and SF_6 – HFCs

78. Emissions of HFC-23 from HCFC-22 production decreased by 55.8 per cent between 1998 and 1999 and no explanation is given in the NIR to explain the decrease. During the in-country visit the Party explained that in 1998 the plant installed a thermal afterburner which reduces emissions. The ERT recommends that in its future submissions the Netherlands specify the year of installation of the afterburner in order to clearly identify the reason for the reduction in emissions during 1998–1999.

79. For HFC emissions from handling activities, a sudden decrease is observed in 1995, after which estimated emissions return to their pre-1995 level. This is unusual because handling activities occur regularly. In its response to the ERT's questions, the Party explained the sudden fluctuation in emissions for the two companies as being due to the great variation in handling activities during that period. The ERT recommends that the Party improve the explanation of trends in its future submissions.

5. Other (industrial processes) – N_2O

80. The Netherlands estimates indirect emissions of N_2O from NO_X deposition and reports them under the category other (2.G). The methodology used is the methodology used for estimating indirect N_2O emissions from agriculture, which, in the opinion of the ERT, is supported by the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

81. However, the methodologies used for estimating NO_X emissions from all sources are not described in the NIR, which is not in line with the IPCC good practice guidance because N_2O emissions are calculated from NO_X emissions and these N_2O emissions are part of a key category. Accordingly, the ERT recommends that the Party provide sufficient information about the methodologies used to improve transparency. After the in-country review, the Party decided not to include indirect N_2O emissions from NO_X deposition. As a consequence, the category became a non-key source category.

82. NO_X emissions from almost all sources (2.B.1, 2.B.2, 2.C.1, 2.C.2, 2.C.3) are estimated and aggregated under the category other (2.G), and the notation key "included elsewhere" ("IE") is used in the CRF table cells (2.B.1, 2.B.2, 2.C.1, 2.C.2, 2.C.3); NO_X emissions from the category road paving with asphalt (2.A.6) and from glass production (2.A.7) have not been estimated. To improve transparency, the ERT encourages the Party to estimate NO_X emissions from all sources and to report them accordingly under each category separately, which will bring the estimates into line with the Revised 1996 IPCC guidelines and the IPCC good practice guidance.

83. The ERT noted that for 2004 the value of total NO_X emissions reported in CRF table 2(I)A-Gs2 is 429.86 Gg, whereas sectoral NO_X emissions are reported in table 2(I)S1 as 1.08 Gg for industrial processes and in table 1S1 as 352.46 Gg for the energy sector, which makes a total of 353.54 Gg instead of 429.86 Gg. Similarly, for the base year total NO_X emissions are reported in table 1AS1 as 543.93 Gg

and in table 2(I)S1 as 12.03 Gg, making a total of 555.42 Gg instead of 595.49 Gg as reported in table 2(I)A-Gs2. This means that there may be an overestimation in emissions – by 40.07 Gg in 1990 and 76.32 Gg in 2004. The ERT recommended that the Party check the CRF tables and either explain the difference or correct the figure for NO_X emissions, with a subsequent recalculation of N_2O emissions. In the Party's response to the ERT after the in-country review, the Party revised the numbers in the CRF tables and the value has been corrected.

C. Non-key categories

1. Cement production – CO_2

84. The NIR and the relevant protocol provide no information on the methodology used by the plant to estimate CO_2 emissions from clinker production. The CO_2 implied emission factor (IEF) is among the highest of all reporting Parties.

85. During the in-country visit the Party explained that the plant (there is only one in the country) conducts measurements to estimate CO_2 emissions and that natural gas is the fuel used. The ERT recommends the Party to describe the measurements undertaken and the methodology applied to estimate emissions. The technology process should be described and the fuels used in the kiln or material added as combustible should be reported. The chemical content data of lime (CaO) in clinker and the methodology used by the plant to estimate emissions should be described to justify the relatively high IEF for the whole time series (e.g. the CO_2 IEF was 0.555 t/t in 2004). In the Party's response to the ERT's comments, the methodology used by the plant to estimate emissions from this category is described and further information is given to clarify the high value of the EF used by the Netherlands. The Party will update the monitoring protocols.

2. Lime production – CO_2

86. Lime emissions are reported as "NE" in the CRF tables and emissions are considered to be negligible. Nevertheless, the Party reports in the NIR that there are four production plants in the Netherlands. Activity data are not provided and emissions are not estimated because of lack of consistent AD from the four lime production sites.

87. During the in-country visit, the Party explained that lime production no longer exists in the Netherlands but without giving any more detailed information related to the behaviour of the four plants or the year when each of them ceased production. As no AD are available for this category, the ERT was not able to determine the order of magnitude of emissions from this source since 1990. The Party should give more information about this subcategory for the years when lime production existed in order to improve both completeness and transparency. For the years when lime production did not occur, the notation key "not occurring" ("NO") should be used in the CRF tables instead of "NE".

3. Other (mineral products) – CO_2

88. The Netherlands accounts for CO_2 emissions from glass production using the EF of 0.16 t/t, which is a three-year average of EFs obtained from measurements conducted at plants. The plant's emission estimates are available for 1990 (0.13 t/t), 1995 (0.15 t/t) and 1997 (0.18 t/t). Available data from plants for other years (1996, 1998, 1999, 2000) have not been considered.

89. Given that CO_2 emissions from glass production have been estimated on the basis of incomplete data, the ERT considered that the average EF used is not representative. Furthermore, the ERT considered that the use of a constant EF of 0.16 t/t leads to an overestimation of emissions for the base year, which could lead to an adjustment.

90. The ERT recommends the Party to reconsider the CO_2 estimate using all available data. The recalculation should be based on annual EFs and extrapolation for the years when EF values are not

available. In its response to the ERT's questions, after the in-country review, the Party carried out recalculations using plant-specific EFs when available, and estimating the missing data by interpolation, which improved the emission estimates and led to a decrease of estimated base year emissions.

IV. Agriculture

A. Sector overview

91. In 2004, total emissions from the agriculture sector in the Netherlands amounted to 18,326.0 Gg CO_2 equivalent, or 8.3 per cent of total national emissions; CH_4 emissions from the sector amounted to 8,813.3 Gg CO_2 equivalent (50.9 per cent of national CH_4 emissions), and N_2O emissions amounted to 9,512.7 Gg CO_2 equivalent (54.8 per cent of national N_2O emissions). From 1990 to 1995, sectoral emissions remained relatively stable, but they then started to decrease and in 2004 were 17.1 per cent lower than in 1990. The decrease was largely due to decreases in N_2O emissions from soil (by 19.4 per cent between 1990 and 2004) and in CH_4 emissions from enteric fermentation (by 15.6 per cent) as a result of reductions in livestock populations and in manure production. These reductions are a result of policies relating to milk production (milk quota) and policies relating to manure production and manure application.

92. The inventory submitted is complete in terms of gases, sources and years covered. The CRF tables, however, are not complete: the additional information tables and all other parameters – average gross energy intake (GE), average CH_4 conversion rate (Ym), animal mass, volatile solid excretion (VS), methane producing capacity (Bo) and nitrogen excretion (Nex) – have not been provided. For its future submissions the ERT recommends that the Netherlands fill in the additional information tables, such as sheet 2 in table 4.B(a) and sheet 2 in table 4.D, and also fill in other additional parameters for categories where country-specific EFs have been used.

93. The NIR describes well the trends in and reasons for the fluctuations in emissions, but only basic activity data and emission factors are provided. More information is found in the monitoring protocols, but many important data items are available only in the background papers. To improve the transparency of the inventory, the ERT recommends that the Netherlands include in the NIR all other essential data, in addition to the basic AD and EFs (e.g. the methane correction factor (MCF) for enteric fermentation, the distribution of manure management systems, VS, Bo and the MCF for methane emissions from manure management, etc.).

94. The most important recalculations done are those for enteric fermentation. In response to the comments of previous review teams, a comprehensive dynamic model for the calculation of CH_4 emissions from dairy cattle has been developed and the IPCC default EF for CH_4 emissions from goats has been applied. Some minor corrections have been made for other categories as well, in particular for agricultural soils. Altogether, the 2006 recalculations result in an increase in estimated emissions from this category by 0.65 per cent, or 141.1 Gg CO_2 equivalent, in the base year, leading to a corresponding increase in estimated base year emissions.

95. In all categories the IEFs fluctuate greatly between years even though constant EFs have been used. This happens because the Party has rounded the values of the AD and the final estimates of emissions before importing them into the CRF tables. During the review process, the Party resubmitted the CRF tables for the period 1990–2004 with more accurate import of data. The ERT reviewed these revised estimates and decided that this problem has been corrected.

96. The Netherlands plans to examine the possibility of including anaerobic treatment in the methodology for calculating CH_4 emissions from manure management and to conduct more research on N_2O emissions from soil, in particular with respect to emissions from leaching and run-off. The ERT supports this intention.

B. Key categories

1. Enteric fermentation – CH_4

97. CH_4 emissions have been estimated using a tier 2 method and country-specific EFs for cattle, and a tier 1 method and default EFs (for developed countries) for all other animals, which is in line with the IPCC good practice guidance, as the share in total CH_4 enteric fermentation emissions of other livestock categories is 10 per cent or less. Due to the lack of methodology and EFs, emissions from poultry are not estimated.

98. The country-specific EFs vary between 108 and 126 kg CH_4/head/year for dairy cattle, between 67 and 74 kg CH_4/head/year for non-dairy cattle, and between 35 and 39 kg CH_4/head/year for young cattle. Detailed data about feed intake and feed composition have been taken in account in calculating emissions from cattle and the main differences between these EFs and the IPCC default EFs are explained by the different feeding practices.

2. Manure management – CH_4

99. For calculating these CH_4 emissions the Netherlands has applied the IPCC tier 2 method and country-specific EFs, which is in line with the IPCC good practice guidance. The values of the CH_4 IEF for goats are among the highest of reporting Parties. The difference can be explained by the fact that in the Netherlands goats are mostly kept indoors and are bred for milk production, as goat milk is not included in the Party's milk quota.

3. Agricultural soils – N_2O

100. The most important sources of N_2O emissions from soils are direct emissions resulting from the application of synthetic fertilizers and animal manure to soil, and indirect emissions caused by nitrogen leaching and run-off. Country-specific emission factors have been used for the calculations relating to the emissions from animal production and direct N_2O emissions, and IPCC default EFs have been used to calculate indirect N_2O emissions from atmospheric deposition and nitrogen leaching and run-off.

101. In many cases the IEFs are much lower than the IPCC default EFs, and in some instances are the lowest of all reporting Parties. This happens because erroneous AD are reported in the CRF tables. To avoid this problem and enable comparability, the ERT recommends that the Netherlands insert the correct values of AD in the CRF tables of its future submissions. Nitrogen (N) in synthetic fertilizers and N in animal manure should be adjusted to the N that volatilizes as ammonia, and NO_X and (for leaching and run-off) all N from synthetic fertilizers and animal manure should be multiplied by $Frac_{LEACH}$.

102. Emissions from adding sewage sludge to soil have been reported in the CRF tables, but no information is provided in the NIR and the information available in the corresponding protocol appears unclear. Not enough data were provided to the ERT during the review to enable it to verify the calculations of N_2O emissions from this source. The ERT recommends the Netherlands to include more information on these emissions in its future NIRs.

C. Non-key categories

Manure management – N_2O

103. In estimating N_2O emissions from manure management, N from ammonia volatilization from manure has been subtracted, and default N_2O EFs for liquid or solid manure have been applied. According to the IPCC good practice guidance, N in manure should not be adjusted to the N that volatilizes as ammonia when estimating emissions from manure management. During the review process the Party provided the ERT with revised estimates for N_2O emissions from manure management for the

whole period 1990–2004. The ERT reviewed these revised estimates and decided that they are now consistent with the IPCC good practice guidance.

104. The notation key "IE" is used for nitrogen excretion per animal waste management system in many cases but no explanation is provided in the NIR or the CRF tables as to where these emissions are accounted for. The ERT recommends that the Netherlands reconsider the use of the notation keys in its future submissions and, in particular, provide an explanation in the NIR and the CRF tables whenever the notation keys "NE" or "IE" are used.

105. Total Nex from sheep in 2004 seems to be too low compared to the figures for previous years. The ERT recommends that the Netherlands address this issue in its future submissions and either reconsider the value or substantiate it.

V. Land use, land-use change and forestry

A. Sector overview

106. In 2004, the LULUCF sector in the Netherlands was a net source of 2,598.1 Gg of CO_2, which represents 1.2 per cent of total national CO_2 emissions. The sector has been a net source since 1990, when net CO_2 emissions amounted to 2,667.3 Gg. From 1990 to 2004, net CO_2 emissions by LULUCF decreased slightly, by 2.6 per cent; from 2003 to 2004, these emissions decreased by 0.8 per cent.

107. The Netherlands has reported carbon stock changes in living biomass only for the forest-related categories and net changes in dead organic matter only for the category forest land remaining forest land, although litter has been assumed to be constant. Net carbon stock changes in mineral soil consequent to land-use changes have been estimated only for conversion to and from other land. N_2O and CH_4 emissions have not been estimated.

108. The ERT noted that the time series from 1971 for each land-use change has not been reconstructed, although the Party agreed a 20-year period for stabilization of carbon stocks after conversion. Moreover, the Netherlands reports on page 146 of the NIR that "for soil carbon stock changes after land use change it is assumed that the average carbon stock in the soil under the new and old land use are the same (Groot et al., 2005)". However, the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) on page 3.14 states that "the basic default assumption is that land use changes have a linear impact on soil organic matter for 20 years before a new equilibrium is reached (Tier 1). This means that, when a piece of land changes use, then it is followed in that "changed status" ("land converted to . . . " categories) for 20 years, with each year 1/20 of the CO_2 and non-CO_2 effects reported. Tier 3 modelling approaches may utilize different assumptions". The ERT encourages the Party to make additional efforts to reconstruct the time series of each land-use change and recommends that the Party use linear extrapolation until additional data become available. The ERT also recommends that the Party report carbon stock changes in mineral soils where a land-use change occurs, or report in the NIR data and scientific evidence to show that such a change does not occur.

109. In CRF table 5 the Netherlands reports the notation key "not applicable" ("NA") for net CO_2 emissions/removals in the information item grassland converted to other land-use categories, although data on carbon stock changes are reported under the category grassland converted to other land. The ERT considers this to be an error and recommends that the Party correct table 5, to cover net CO_2 emissions/removals resulting from the sum of all the carbon stock changes reported in the categories relating to grassland converted to other land uses.

110. Also in CRF table 5 the Netherlands defines a category called "carbon stock change" as a subdivision of category G, although the CO_2 emissions reported there are related to lime application.

The ERT therefore recommends that the Party change this text, making clear the origin of the emissions reported; for instance, the term "total emissions from lime application to all land uses" could be used.

111. The ERT noted that the data in the land-use change matrix reported by the Party are inconsistent since the methodologies of classification applied to the two maps (1990 and 2000) differ. This inconsistency is clearly shown by the area (9.7 per cent in 10 years) which, according to the matrix reported by the Netherlands, has been converted from settlements to all the other uses (mainly grassland – 6.3 per cent); in practice, this would imply that the country's cities and infrastructure are being abandoned or disrupted by the inhabitants. The ERT recommends that the Party apply the same methodology of classification to each set of land-referred data in order to make it possible to compare them in a consistent manner and thus estimate land-use changes accurately.

B. Key categories

1. Forest land remaining forest land – CO_2

112. The Netherlands has estimated net carbon stock changes in litter and in soil organic matter using a tier 1 method (i.e., assuming that the stocks do not change) although the category has been identified as a key category. The ERT encourages the Party to estimate net carbon stock changes for these pools using a higher-tier method.

113. The Netherlands reports the areas of "trees outside forest" and "heather" as subdivisions of the forest land category; however, it reports in the NIR that the areas of "trees outside forest" and "heather" do not match the definition of forest land of the IPCC good practice guidance for LULUCF. The ERT therefore recommends that the Party allocate these areas to an appropriate category.

114. The ERT noted that the data on carbon stock changes in living biomass from 1990 to 2000 have been estimated using a model based on the data from two consecutive forest inventories (HOSP[8] 1990 and MFV[9] 2000), whereas the data from 2001 onwards are linearly extrapolated from 2000. As it is good practice to apply the same methodology throughout the whole time series, the ERT recommends that the Party use the data provided by the model for the years 2001 onwards.

2. Grassland remaining grassland – CO_2

115. The ERT noted that the emission factor for organic soils applied by the Netherlands (page 149 of the NIR) is 5.19 tonnes of carbon per year, whereas the EF reported in table 3.4.6 of the IPCC good practice guidance for LULUCF is either 0.25 (cold temperate climate) or 2.5 (warm temperate climate). Moreover, the good practice guidance for LULUCF (page 3.116) states that the contributions to subsidence of soil include erosion, compaction, burning, leaching and decomposition. In the light of (a) the inconsistency between the Dutch data and the data suggested by the IPCC good practice guidance for LULUCF, and (b) the uncertainties related to the methodology applied, the ERT recommends that the Party check the methodology used in order to exclude from the net measure of subsidence all effects that are not related to the mineralization of the organic matter, by means of discount factors if necessary. Moreover, the Party is recommended to include in the NIR information on the data and methodology used and to complement the website with a document (in English) specifically on the technical protocol applied for collecting data in order to demonstrate that the measurements have not been affected by any bias.

[8] HOSP = Timber Production Statistics and Forecast (in Dutch: "Hout Oogst Statistiek en Prognose oogstbaar hout").
[9] MFV = Measuring Network Functions (in Dutch: meetnet functievervulling).

C. Non-key categories

1. Land converted to forest land – CO_2

116. The ERT noted that the IEF reported for increases in carbon stock in living biomass grows continuously and rapidly along the time series up to the unrealistic value of 20.25 tonnes of carbon per hectare (i.e., circa 80 m^3 of wood increment per hectare!) for the year 2004. The ERT requests the Netherlands to revise its carbon stock change estimates for living biomass in afforested land.

2. Cropland remaining cropland – CO_2

117. The ERT noted that the Netherlands' 2006 inventory reports net carbon stock change in soil as "NE", while during the review data were presented demonstrating that carbon content in mineral soil under the category cropland remaining cropland remains constant due to the high level of organic fertilization (manure). The ERT therefore recommends that the Party use the notation key "NO" for reporting net carbon stock changes in soil organic matter and substantiate in the NIR the use of the notation key "NO".

3. Carbon emissions from agricultural lime application – CO_2

118. The ERT noted that carbon emissions from agricultural lime application are reported as "NE" for cropland and grassland, although these emissions are actually reported together under other. Moreover, in this category emissions decreased between 1990 and 2004 by 56.8 per cent. Since the Party reports that the methodology applied for collecting data is not able to discriminate between final uses, the ERT recommends that the Party use the notation key "NA". The ERT also recommends the Netherlands to provide in the NIR data and other relevant information that could justify the trend.

4. Biomass burning – CH4, N2O

119. The ERT noted that CH_4 and N_2O emissions are reported as "NO" for forest land. Considering that some small forest fires have occurred, the ERT recommends that the Party either report estimated data or use the notation key "NE".

5. Forest land converted to other land uses – CO2

120. The ERT noted that in the revised CRF tables the Netherlands has increased its emission factor for losses in living biomass, from –55.79 MgC/ha to –70.99 MgC/ha. The ERT considers this new EF too high in the light, for instance, of the data reported by the Netherlands to the Food and Agriculture Organization of the United Nations (FAO) for the Forest Resource Assessment (FRA) 2005[10] and those contained in the *Bosdata* report entitled *Aspecten van bos en bosbeheer in Nederland: Resultaten Houtoogststatistiek 1995–1999.*[11] The ERT therefore requests the Netherlands to reconsider the new EF.

VI. Waste

A. Sector overview

121. In 2004, the waste sector contributed 3.3 per cent to total national emissions in the Netherlands and emissions from the sector had decreased by 43.4 per cent since 1990. This is mainly attributed to increased recycling activities, a decrease in the amount of organic waste disposed in landfills and increased methane recovery from landfills. In 2004, solid waste disposal on land contributed 89.8 per cent of the total emissions from the sector, while wastewater handling contributed 8.6 per cent. Emissions from composting, a source category not required by the Revised 1996 IPCC Guidelines, contributed 1.6 per cent of the total emissions of the sector. Emissions from waste incineration are

[10] Netherlands Country Report, in *Global Forest Resource Assessment 2005, Country Report 028* (Rome, 2004).
[11] HOSP, Bosdata nr 4, 2000.

included in the energy sector. CH_4 emissions from solid waste disposal on land were identified as a key category on both the level and the trend assessments (tiers 1 and 2).

122. The CRF tables include estimates of all direct gases and all sources of emissions except for N_2O emissions from industrial wastewater. Moreover, non-methane volatile organic compounds (NMVOCs), NO_X, sulphur dioxide (SO_2) and carbon monoxide (CO) emissions from the sector have been estimated.

123. No recalculations have been carried out since the previous submission.

124. The uncertainties for AD and EFs are mainly based on expert judgement. The Party is encouraged to justify the choice of these uncertainties in its future submissions.

125. The Party relies mainly on activity data collected by SenterNovem for solid waste and incineration and on Statistics Netherlands for data on wastewater handling. Other sources of data are also used as a check for these sources. The Party is recommended to formalize this check as a source-specific QC procedure in the QA/QC plan.

B. Key categories

Solid waste disposal on land – CH_4

126. In estimating CH_4 emissions from this source category, the Party has assumed that all sites have been managed since 1945. During the review, the ERT suggested that this assumption may not be justified since the monitoring protocol (for CH_4 from managed landfill sites) clearly states that before 1970 sites were not managed in accordance with the definition of managed landfills. Moreover, the same protocol states that *most* landfills have been managed from 1970 onwards. The ERT recommended the Party to provide documentation to identify the management practices in sites prior to and post-1970. In response, the Party provided a translation of a report[12] which states that the method of "controlled tipping" became common practice in the Netherlands after 1930, resulting in waste being landfilled in defined layers and covered with ashes, soil or sand such as dirt from street sweeping. Moreover, the Party provided a copy of a sample permit that shows the management practices for landfills constructed after 1970, and follows the code of practice for landfilling that was issued in 1970. The Party also stated that the text in the monitoring protocol (to the effect that before sites 1970 were not managed in accordance with the definition of managed landfills) was most probably based on an old report from the early 1970s long before the IPCC definition of managed landfills was formulated. The Party is therefore of the view that the definition of "controlled" in that report cannot be compared with the term "managed" according to the IPCC definition, and it is accordingly considering revising the text in the monitoring protocol for its forthcoming submissions. The ERT concluded that the documents provided by the Party are sufficient to justify the use of an MCF value equal to unity associated with managed solid waste disposal sites (SWDS) according to the IPCC definitions, since the waste was disposed in a controlled manner and was covered.

127. In estimating CH_4 emissions from solid waste disposal on land, the normalization factor ($A = \frac{1 - e^{-k}}{k}$) has not been used in the first order decay (FOD) model, contrary to the IPCC good practice guidance. This normalization factor is introduced to correct for the mathematical error in the model. The ERT recommended the Party to use this factor in the model. The Party explained that the parameters used in the model were derived from a validation study where the model was fit to the actual annual generation of methane. The estimated parameters for methane rate constant (k) and the degradable organic carbon dissimilated (DOCf) therefore compensate for the mathematical error in the model. The ERT concluded that this explanation was sufficient and that the use of the normalization factor in this case is not needed.

[12] Background information to the *Advice for Long-Term Follow Up for Closed Landfill Sites*, NAVOS, April 2005.

128. Equation 3 in the monitoring protocol for estimating emissions from SWDS is not correct. During the review process, the Party acknowledged that an error had occurred during the translation of the protocol. The Party is recommended to correct the equation for its future submissions.

129. Measurements conducted to determine the share of methane in recovered landfill gas during the period 2002–2004 showed values below 60 per cent. According to the IPCC good practice guidance of 2000, this value should not be used as the share of methane in landfill gas generated. During the review, the Party clarified that the lower values for methane fraction in landfill gas were only used to estimate methane in the recovered biogas and not for that generated. The Party is recommended to add further explanation on this issue in its future submissions.

130. The NIR states that emissions from this source category decreased between 1990 and 2004 because of (a) a decrease in the amount of solid waste disposed of in landfills as a result of increased recycling, (b) an increase in the recovery of methane from landfills and (c) a decrease in the amount of organic waste disposed of in landfills. The NIR does not, however, provide documentation to support this reasoning, and this creates a transparency problem. The Party is encouraged to provide more information to support the explanation of the trend in its future submissions.

131. The methane rate constant (k) value is assumed to be 0.094 until 1990, and then decrease to 0.069 in 1994. The monitoring protocol for CH_4 emissions from landfills mentions that the 0.094 value was based on a local study. During the review, the Party clarified that the change after 1990 is due to the fact that the organic waste fraction is decreasing due to recycling policies adopted since the early 1990s and that the change in the k value was based on expert judgement. The Netherlands is recommended to provide additional explanation for the reasons behind this assumption in the NIR of its next submission.

132. During the review, the Party clarified that contaminated soils are not included in the amount of waste disposed to landfills after 1992. The Party is recommended to investigate the composition of these soils in order to verify the fraction of organic carbon present and to include this fraction in the estimation of CH_4 emissions.

133. The degradable organic carbon (DOC) values reported in the NIR are based on the composition of all waste types, including construction and demolition waste. The amount of waste disposed at SWDS reported in the CRF should exclude construction and demolition waste and other inorganic waste. The Netherlands is recommended to include the estimate of DOC excluding construction and demolition waste and to follow the guidelines included in the CRF tables.

134. In CRF table 6.A, the oxidation factor and the fraction of methane in landfill gas are not correctly reported. The oxidation factor is reported to be 0.58 instead of the value of 0.1 used in the NIR, while the fraction of methane in landfill gas is reported to be 0.05 instead of the value used in the NIR of 0.6. These values should be correctly reported.

135. The values of DOC degraded reported in the CRF tables need to be corrected. The percentage share should be related to the degradable organic carbon and not to the amount of municipal solid waste.

136. The Party has assumed a value of 58 per cent for the DOC dissimilated but the basis for adopting this value is not justified in the NIR. During the review, the Party provided a national study which was used as the source of this parameter. The Party is encouraged to explain the reason for assuming this value and cite the reference in its future submissions.

C. Non-key categories

1. Wastewater handling – CH_4 and N_2O

137. The activity data show that the quantities of wastewater treated decreased sharply in and after 2003. The Party explained this decrease as being due to the dry weather conditions during the year 2003.

However, no explanation was given for exactly the same volume of treated wastewater in 2004. During the review process, the Party acknowledged that there was a mistake in the AD for 2004 and agreed to correct this in its future submissions.

138. The rationale for the selection of emission factors for CH_4 and N_2O is not sufficiently explained, either in the NIR or in the relevant protocol. During the review, the Party provided background information on the sources of these factors. The Party should provide this explanation in the NIR of its future submissions.

139. The assumed split between households connected to septic tanks and those connected to the sewer system is not explained clearly in the NIR. During the review the Party provided background information which explained how the estimate for the amount of wastewater treated in septic tanks was arrived at. This explanation should be included in the Party's future NIRs.

2. Other – CH_4 and N_2O from composting

140. The Party is commended for reporting emissions from composting, which is not a source category in the Revised 1996 IPCC Guidelines. However, emissions from the application of composting to land are not reported elsewhere in the inventory. Since composting activities have been increasing in the Netherlands, the ERT recommends that the Party estimate and report emissions from the application of compost to land.

VII. Conclusions and recommendations

141. Overall, the Netherlands' inventory is of good quality and is generally consistent with the UNFCCC reporting requirements and the IPCC good practice guidance. The Netherlands' institutional arrangements meet the requirements for implementation of the general functions as well the specific functions of inventory planning, inventory preparation and inventory management. During the review process the involved staff demonstrated a high level of competence and were available to the ERT as needed.

142. The NIR is in general well prepared but it does not provide sufficient information to enable the ERT fully to assess the inventory. The ERT came to the conclusion that the monitoring protocols do not provide enough information on the background data and intermediate parameters, and that the data presented are in some cases inconsistent with the data in the NIR. The ERT recommends the Netherlands to revise the structure of the report by either increasing the information in the NIR or redesigning the annexes. The large amount of confidential data (mainly in the industrial processes sector) meant that the ERT had only limited opportunity to assess how far the emission estimates for such categories conform to the inventory guidelines. The Party is recommended to provide more detail in the NIR of its future submissions as well as greater transparency.

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

(a) Improve the transparency of the inventory through a revision of the report structure, by either increasing the information in the NIR or redesigning the annexes to increase transparency and consistency with the NIR;

(b) Improve the archiving procedures of the inventory in order that inventory data and information can be accessed in a fully centralized way.

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/>.

IPCC. Good practice guidance for land use, land-use change and forestry, 2003. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

IPCC/OECD/IEA. Revised 1996 IPCC Guidelines for national greenhouse gas inventories, volumes 1–3, 1997. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

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>.

UNFCCC. Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention. FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

UNFCCC secretariat. Status report for the Netherlands. 2006. Available at <http://unfccc.int/resource/docs/2006/asr/nld.pdf>.

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>.

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

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Dick Both (SenterNovem) and Mr. Harry Vreuls (SenterNovem) including additional material on the methodology and assumptions used. The following additional information was provided by the Netherlands during the review.[13]

Amstel AR van, Olivier JGJ and Ruyssenaars PG (eds). 2000. *Monitoring of Greenhouse Gases in the Netherlands: Uncertainty and Priorities for Improvement*, Proceedings of a National Workshop held in Bilthoven, the Netherlands, 1 September 1999. WIMEK report/RIVM report No. 773201003. Bilthoven.

Aspecten van bos en bosbeheer in Nederland: Resultaten Houtoogststatistiek 1995–1999. HOSP, Bosdata nr 4, 2000.

[1] This list does not include the presentations made by Dutch experts during the in-country visit. It includes only selected protocols with methodological descriptions; all protocols which describe the methodologies used to estimate emissions can be found at <http://www.greenhousegases.nl/>.

FAO. 2004. Global Forest Resources Assessment 2005: Netherlands Country Report, in *Global Forest Resources Assessment 2005, Country Report 028* (Rome, 2004). Forestry Department of the Food and Agriculture Organization (FAO) of the United Nations.

Groot, WJM de et al. 2005. *National System of Greenhouse Gas Reporting for Land Use and Land Use Change: Carbon stock changes in the Netherlands due to land use changes 1990–2000*. Alterra Report 1035-3. Alterra, Wageningen.

Harmelen, AK van and Koch WRR. 2002. *CO_2 Emission Factors for Fuels in the Netherlands*. Netherlands Organisation for Applied Scientific Research (TNO), Apeldoorn.

Hoek, KW van der et al. 2006. *Direct and Indirect Nitrous Oxide Emissions from Agricultural Soils, 1990–2003: background document on the calculation method for the Dutch National Inventory Report*. Netherlands Environmental Assessment Agency (MNP), National Institute for Public Health and the Environment (RIVM), RIVM Report 680125003/2006, MNP Report 500080003/2006.

Hoek, KW van der and Schijndel MW van. 2006. *Methane and Nitrous Oxide Emissions from Animal Manure Management, 1990–2003: background document on the calculation method for the Dutch National Inventory Report*, RIVM Report 680125002/2006, MNP report 500080002/2006. Netherlands Environmental Assessment Agency (MNP), National Institute for Public Health and the Environment (RIVM).

Kroeze C. 1994. *Nitrous Oxide (N_2O) Emission Inventory and Options for Control in the Netherlands*, Report 773001004. National Institute of Public Health and Environmental Protection (RIVM), Bilthoven.

Kuikman, PJ et al. 2003. *Stocks of C in Soils and Emissions of CO_2 from Agricultural Soils in the Netherlands*. Alterra Report 561. Alterra, Wageningen.

Kuikman, PJ et al. 2005. *Emission of N_2O and CO_2 from Organic Agricultural Soils*. Alterra Report 1035-2. Alterra, Wageningen.

Kuikman, PJ et al. 2006. *Update of Emission Factors for Direct Emissions of Nitrous Oxide from Agricultural Soils on the Basis of Measurements in the Netherlands*. Alterra Report 1217. Alterra, Wageningen.

MNP. 2004. *Memorandum on CO_2 Emission Factors for Petrol, Diesel and LPG*. Netherlands Environmental Assessment Agency (MNP), December 2004.

Nabuurs, GJ et al. 2005: *National System of Greenhouse Gas Reporting for Forest and Nature Areas under UNFCCC in the Netherlands - version 1.0 for 1990 – 2002*. Alterra Report 1035-I. Alterra, Wageningen.

Olsthoorn X and Pielaat A. 2003. *Tier-2 Uncertainty Analysis of the Dutch Greenhouse Gas Emissions 1999*, RIVM Report no. R03-06. Institute for Environmental Studies (IVM), Free University, Amsterdam.

Ramírez R et al. 2006. *Monte Carlo Analysis of Uncertainties in the Netherlands Greenhouse Gas Emission Inventory for 1990–2004*. Report NWS-E-2006-58. Copernicus Institute for Sustainable Development and Innovation.

RIVM. 2006. *Methods for Calculating the Emissions of Mobile Sources in the Netherlands*. Task Group Traffic and Transport of the Commission Registration Project, National Institute for Public Health and the Environment (RIVM), November 2006.

SenterNovem. 2005. *The Netherlands National System: QA/QC programme, Version 1.0, 22 December 2005*. SenterNovem, Utrecht.

Smink W et al. 2005. *Calculation of Methane Production from Enteric Fermentation in Dairy Cows*. SenterNovem, Utrecht.

TNO. 2004. *Uncertainty Assessment of NO_X, SO_2 and NH_3 Emissions in the Netherlands*. Netherlands Organisation for Applied Scientific Research (TNO), TNO Environment, Energy and Process Innovation, Apeldoorn.

TNO. 2006. *Memorandum on Recalculations as Presented in the CRF Submission 2006*. Netherlands Organisation for Applied Scientific Research (TNO), 31 August 2006.

Vreuls HHJ. 2006a. *Recommendation for a New CO_2 Emission Factor for Natural Gas (from 1990 onwards)*. SenterNovem, March 2006.

Vreuls HHJ. 2006b. *The Netherlands: list of fuels and standard CO_2 emission factors*. Steering Group for Emissions Registration, SenterNovem, August 2006.

Zeeman G. 1994. Methane Production/emission in Storages for Animal Manure. *Fertilizer Research* (Department of Environmental Technology, Agricultural University, Wageningen), 37, pp. 207–211, Kluwer Academic Publishers.

- - - - -