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Report of the individual review of the greenhouse gas inventory of Lithuania 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

I. Overview

A. Introduction

1. This report covers the in-country review of the 2006 greenhouse gas (GHG) inventory submission of Lithuania, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 21 to 26 May 2007 in Vilnius, Lithuania, and was conducted by the following team of nominated experts from the roster of experts: generalist – Mr. Mario Contaldi (Italy); energy – Mr. Joost Huurman (the Netherlands); industrial processes – Mr. Marius Tăranu (Moldova); agriculture – Mr. Steen Gyldenkaerne (Denmark); land use, land-use change and forestry (LULUCF) – Mr. Atsushi Sato (Japan); waste – Mr. Qingxian Gao (China). Mr. Mario Contaldi and Mr. Marius Tăranu were the lead reviewers. The review was coordinated by Mr. Matthew Dudley (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention", (hereinafter referred to as the UNFCCC review guidelines), a draft version of this report was communicated to the Government of Lithuania.

B. Inventory submission and other sources of information

3. In its 2006 submission, Lithuania submitted a complete set of common reporting format (CRF) tables for the years 1990–2004 and a national inventory report (NIR). Lithuania submitted a revised GHG inventory on 1 August 2007 in response to questions raised by the ERT during the course of the in-country visit. The submission of 1 August 2007 is used as the basis for this review.

4. Where needed the expert review team (ERT) also used previous years' submissions, additional information provided during the review and other relevant information. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

5. In 2004, the most important GHG in Lithuania was carbon dioxide (CO_2), contributing 62.5 per cent to total[1] emissions expressed in CO_2 equivalent, followed by N_2O, 22.0 per cent, and CH_4, 15.3 per cent. Hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.2 per cent of the overall GHG emissions. The energy sector accounted for 57.7 per cent of the total emissions while agriculture, industrial processes, waste and solvent and other product use accounted for 19.8, 15.1, 7.1 and 0.4 per cent, respectively. Total emissions amounted to 21,753.6 Gg CO_2 equivalent and decreased by 55.9 per cent between 1990 and 2004.

6. In this period Lithuania reports the biggest percentage emission reduction of all Annex I Parties with economies in transition (EIT Parties), and as with other EIT Parties, the decrease in emissions is noticeable for CO_2, CH_4 and N_2O. The decrease in emissions is also evident for HFCs, which is less common when compared to the trend for other Parties, and is attributed to the reduced output of a single factory that produces appliances. Meanwhile, SF_6 emissions have increased due to its use in electrical switches. As for many other EIT Parties, a decrease in the 1990–1998 period was noticed in all sectors; moreover, this decrease is most relevant in the energy and industrial processes sectors. Over the period 2000–2004 emissions increased due to the expansion of economic activities.

7. 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.

Table 1. Greenhouse gas emissions by gas, 1990–2004[a]

GHG emissions	Gg CO_2 equivalent								Change BY–2004 (%)
	Base year Convention	1990	1995	2000	2001	2002	2003	2004	
CO_2 (with LULUCF)	25 411.3	25 411.3	7 283.9	3 375.2	4 384.2	5 007.7	4 631.3	4 946.3	–80.5
CO_2 (without LULUCF)	36 168.8	36 168.8	15 158.4	12 084.8	12 865.4	12 938.6	12 977.9	13 597.1	–62.4
CH_4	6 133.9	6 133.9	3 652.9	3 231.9	3 214.3	3 190.1	3 322.4	3 325.6	–45.8
N_2O	7 085.5	7 085.5	3 143.2	4 042.6	4 262.4	4 543.9	4 694.9	4 812.5	–32.1
HFCs	NA,NO	NA,NO	44.6	30.1	14.0	34.5	21.9	36.8	NA
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA
SF_6	NA,NO	NA,NO	0.0	0.2	0.3	0.4	1.9	0.9	NA

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

[a] Lithuania submitted revised estimates for all years of the time series in the course of the review on 1 August 2007. These estimates differ from the Party's GHG inventory submitted in 2006.

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

Sectors	Gg CO_2 equivalent								Change BY–2004 (%)
	Base year Convention	1990	1995	2000	2001	2002	2003	2004	
Energy	33 639.7	33 639.7	14 203.1	11 077.8	11 814.6	11 839.9	11 919.9	12 551.6	–62.7
Industrial processes	4 165.7	4 165.7	1 965.7	2 783.7	2 975.2	3 157.2	3 159.8	3 274.9	–21.4
Solvent and other product use	100.5	100.5	98.2	94.7	94.4	94.0	93.6	93.0	–7.5
Agriculture	9 463.4	9 463.4	4 077.7	3 840.9	3 967.1	4 170.5	4 323.0	4 296.6	–54.6
LULUCF	–10 739.0	–10 739.0	–7 855.0	–8 690.0	–8 462.7	–7 908.9	–8 326.3	–8 631.5	–19.6
Waste	2 000.5	2 000.5	1 635.0	1 572.8	1 486.6	1 423.9	1 502.4	1 537.6	–23.1
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**38 630.7**	**38 630.7**	**14 124.7**	**10 680.0**	**11 875.2**	**12 776.5**	**12 672.4**	**13 122.1**	**–66.0**
Total (without LULUCF)	**49 369.7**	**49 369.7**	**21 979.7**	**19 370.0**	**20 337.9**	**20 685.4**	**20 998.7**	**21 753.6**	**–55.9**

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

[a] Lithuania submitted revised estimates for all years of the time series in the course of the review on 1 August 2007. These estimates differ from the Party's GHG inventory submitted in 2006.

D. Key categories

8. Lithuania has reported a key category tier 1 analysis, based on level assessment, as part of its 2006 submission. It has not included the LULUCF sector in its key category analysis. Lithuania informed the ERT that the key category analysis is used as a tool to support and guide the improvement of the inventory. The ERT commends the efforts made by the Party to investigate the possibility of using higher-tier methods for those categories identified as key.

9. The key category analyses performed by the Party and the secretariat[2] produced similar results for 2004. The main differences between the Party's and the secretariat's key category analysis arise from the fact that LULUCF is not included in the level assessment; the non-LULUCF key categories in the Party's and the secretariat's analysis agree. During the in-country visit Lithuania provided the ERT with a revised key category analysis that included level and trend assessments for 1990 and 2004. Lithuania is recommended to perform key category analysis in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) by including LULUCF in the assessment, as well as implementing the trend assessment, and to report the result of these analyses in its next inventory submission.

E. Main findings

10. Lithuania has made significant improvements since its 2005 submission, most of them in response to recommendations made during the review of the 2005 inventory submission. Some major improvements include: the inventory generally covers all categories for the whole period 1990–2004; submission of emission estimates for all years of the inventory time series; and improved transparency of the NIR in describing methodologies, activity data (AD) and emission factors (EFs). Lithuania submitted revised estimates in response to questions raised by the ERT during the in-country visit; however, the Party has not submitted emission estimates for a number of categories. The transparency of the inventory is inhibited by the limited transparency of the NIR and the common reporting format (CRF) tables. The ERT identified the following areas where the NIR can be improved: the structure of Lithuania's NIR should be presented in accordance with the structure outlined in the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines); documentation and description of the assumptions, methods and data used in the compilation of emission estimates; description of the completeness of the inventory; and information and explanation of time series consistency of the inventory, including underlying data (e.g. energy balance). The ERT recommends that the Party follow closely the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance), which recommends the use of higher-tier methods for key categories; uncertainty estimates for all source categories and for the overall inventory; and implementation of a quality assurance/quality control (QA/QC) plan.

[2] The secretariat identified, for each Party, those categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use, Land-use Change and Forestry* 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.

F. Cross-cutting topics

1. Completeness

11. The 2006 inventory submission covers all years from 1990 to 2004, and is generally complete in coverage of source categories and gases. Potential HFC emissions and actual SF_6 emissions are reported for 1995–2004. N_2O emissions from solvent and other product use are reported as "not estimated" ("NE") and "not applicable" ("NA"). The ERT noted several categories for which GHG emissions occur in Lithuania but for which no emissions have been estimated (e.g. CO_2 emission from limestone and dolomite use, CO_2 emission from road paving with asphalt, CO_2 emission from food and drink, CO_2 emission from solid waste disposal on land, N_2O emission from wastewater handling (except for human sewage), N_2O emission from waste incineration, and CH_4 emission from waste incineration). Also, carbon stock change of soil in land converted to forest land was not reported. The ERT recommends Lithuania to provide estimates for all categories where emissions occur in the country, even if they are minor, by using simple but reasonable approaches, and using expert judgement as necessary, in its next inventory submission.

2. Transparency

12. Lithuania has improved the transparency of the NIR since its 2005 submission. The ERT encourages Lithuania to further improve the transparency of the inventory by using the structure as outlined in the UNFCCC reporting guidelines and including additional information in the NIR with regard to annexes on methodology and data for estimating CO_2 emissions from fossil fuel combustion, the CO_2 reference approach and comparison with the sectoral approach, and detailed information on methodologies and models (particularly for tier 2 methods). The organization of the NIR can be improved by the inclusion of an executive summary and the chapter on recalculations and improvements. The most relevant background material that is only available in Lithuanian should be included in the NIR in English. The ERT noted that emission estimation methodologies and data sources have been appropriately referenced in the NIR.

13. During the review Lithuania provided the ERT with all the additional information it requested and explained all calculations. The use of confidentiality is fairly limited. The ERT noted that there is a lack of transparency regarding the methodologies used for estimating emissions and removals for the LULUCF and agriculture sectors. Lithuania is encouraged to reference the methodologies used for estimation of emissions (e.g. carbon stock change in drained organic forest soils), country-specific data (e.g. average annual increment in volume (table 7.4), and what parts of trees were included in the annual increment values (figure 7.5)), and rationales should be provided for the selection of specific default EFs. Lithuania is also encouraged to improve the transparency of the reporting of the agriculture sector in the NIR by including all relevant AD and definitions of the actual country-specific conditions and parameters. Moreover, greater clarity is needed on AD and the sources of data for the whole time series for all sectors of the inventory. The CRF tables are generally transparent, although table 9(a) gives only a limited explanation of the use of the notation keys. The ERT noted that the use of the notation keys is not always consistent across all the CRF tables. Lithuania is encouraged to provide an explanation of the use of the notation keys and to use them in accordance with the UNFCCC reporting guidelines.

3. Recalculations and time-series consistency

14. The ERT noted that recalculations of the time series from 1990 to 2003 had been undertaken to take into account recommendations of the in-country review of the 2005 submission. The Party informed the ERT that recalculations reported in CRF table 8(a) in the 2006 submission are incorrect. Lithuania's 2005 submission only included the 2003 CRF (using the CRF Excel application) and an NIR that included a table with aggregate emission estimates for all years of the time series. The ERT has used the

time series from the 2005 NIR as the basis to review recalculations. The major changes are the inclusion of additional sources and the use of revised methodology for a number of source categories. The rationale for these recalculations is provided in the NIR. The recalculation of the 2003 inventory resulted in an 18.0 per cent increase in total GHG emissions.

15. Lithuania submitted revised estimates in response to questions raised by the ERT during the in-country visit. The ERT noted that not all identified improvements were implemented by the Party in the revised estimates, and recommends that Lithuania address these in its next inventory submission, including subsequent recalculations.

16. The ERT recommends Lithuania to establish a reliable data management system to receive and archive all the information used in compiling the inventory. This would enable it to reconstruct any inventory, and enable the reporting of recalculations for the entire time series using the CRF Reporter.

4. Uncertainties

17. The Party has provided an uncertainty analysis for each key category and for the inventory in total, following the IPCC good practice guidance. Lithuania reports a tier 1 uncertainty analysis for 2004 in the NIR. Uncertainty estimates on source data are based on expert judgement, made by sector experts. Documentation supporting the underlying assumptions is not provided in the NIR. A copy of the calculation sheet used to estimate the uncertainty of 33 sources, including key categories, was provided to the ERT during the in-country visit; however, the LULUCF sector is not included in the uncertainty analysis. The ERT concluded that the main data supplier (Statistics Lithuania) is not formally involved in the estimation of the uncertainty of AD, but information to assist in determining uncertainties is provided by staff in Statistics Lithuania who are not directly involved in the inventory preparation. The result of the analysis in the energy sector shows a rather low uncertainty compared to that of other Parties. The ERT recommends Lithuania in its next inventory submission to include LULUCF in the uncertainty analysis; provide information on how the uncertainty analysis is used to prioritize improvements to the inventory; provide documentation in the NIR on the underlying assumptions; and establish in the institutional arrangements a process for obtaining uncertainty information from key data providers.

5. Verification and quality assurance/quality control approaches

18. Lithuania submitted to the ERT a QA/QC plan on 1 August 2007. The ERT notes that it has been prepared in accordance with the IPCC good practice guidance. The plan outlines QC procedures and identifies the responsible entities for QA/QC activities.

19. The ERT noted that QC procedures are performed during the inventory preparation by sector experts. The ERT recommends that these procedures be improved to ensure that discrepancies identified by the ERT between the CRF and NIR are identified by the Party during the compilation of the GHG inventory. Lithuania is also encouraged to use data from the European Union (EU) emissions trading scheme (ETS) to verify the emission estimates.

6. Follow-up to previous reviews

20. Following the recommendations of previous reviews, Lithuania has made improvements to cross-cutting areas, such as uncertainty estimates for key categories, submission of a complete inventory for all years of the time series, including LULUCF, providing recalculations where appropriate, and implementing higher-tier methods for a number of source categories.

21. The ERT noted that Lithuania has not improved the consistency of reporting between the NIR and the CRF and within the NIR, but has taken steps to improve the transparency of the inventory.

G. Areas for further improvement

1. Identified by the Party

22. In its response to the issues raised during the review, Lithuania indicated that it is working to improve its estimates for a number of sectors by updating country-specific EFs for energy, coordinating with the National Forestry Service for improving the reporting on LULUCF, and to improve the pre-1990 time series for solid waste generation data. Lithuania also informed the ERT that it intends to improve the resources dedicated to inventory preparation and management.

2. Identified by the ERT

23. The ERT identifies the following cross-cutting issues for improvement. The Party should:

(a) Implement a QA/QC plan in accordance with the IPCC good practice guidance;

(b) Submit an NIR in accordance with the structure outlined in the UNFCCC reporting guidelines;

(c) Document expert judgement and uncertainty estimates in accordance with the IPCC good practice guidance for the uncertainty analysis;

(d) Provide more detailed description of methodologies in the NIR, particularly for higher-tier methods, including assumptions, country-specific EFs and rationales for choice of method and default EFs;

(e) Improve the consistency of the time series;

(f) Include LULUCF in the key category analysis;

(g) Report explanations for recalculations in CRF table 8(b) and use of notation keys in table CRF table 9(a). Information on recalculations should be provided in the NIR at the category level.

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

II. Energy

A. Sector overview

25. In 2004, total GHG emissions from the energy sector accounted for 12,551.6 Gg of CO_2 equivalent, contributing 57.7 per cent to total national GHG emissions. Emissions from this sector have declined by 62.7 per cent between 1990 and 2004, representing the greatest decrease of any Annex I Party over this time period. This decrease is to a large extent related to the independence from the former Soviet Union in 1990. The energy industry was the largest emitting category in 2004, contributing 45.6 per cent to total sectoral emissions, while transport, other sectors and manufacturing industries and construction contributed 31.6, 10.8 and 10.1 per cent, respectively. CO_2 is the dominant gas, contributing 95.5 per cent to total sectoral emissions and 55.1 per cent of total national GHG emissions in 2004. Fugitive emissions contributed 1.8 per cent to total sector emissions. Compared to 2003, emissions have increased 5.3 per cent. The main reason for this increase is the growth of the Lithuanian economy.

26. Revised estimates were submitted by the Party in response to questions raised by the ERT on energy industries (public electricity and heat production) – CO_2 (1.A.1a) and oil and natural gas – CO_2 and CH_4 (1.B.2). The revisions were based on improved methods, new EFs and revised AD.

27. The ERT commends Lithuania on implementing a revised energy balance for all years of the time series. Together with the explanations provided in the NIR and to the ERT during the in-country visit, the revised energy balance has improved the completeness and comparability of the emission estimates, and resulted in a time series that is consistent. However, the underlying rationale for the revision, including the methodology used, is neither documented in the NIR nor described in any other document. The ERT recommends that Lithuania include information on this in its next inventory submission.

28. The recalculations performed in the energy sector arise from implementation of the revised energy balance and the use of a consistent set of EFs on a detailed level for all years of the time series. The impact of the recalculations in 2003 was a decrease of 1.0 per cent in total sectoral GHG emissions, and a 0.6 per cent decrease in total national GHG emissions.

29. Tier 2 methods have been used for all but one key category and most non-key categories. A tier 1 method was used for the fugitive key category oil and gas (CH_4). Lithuania uses country-specific EFs obtained from a study undertaken in 1997, and the Party indicated to the ERT during the in-country visit that these factors are to be reviewed by the end of 2007. The ERT encourages Lithuania to complete this review in its next inventory submission and to include in the NIR the outcome of the review and the impact of the revised EFs on the relevant years of the time series. In addition, Lithuania is recommended to include a description of the new EFs in its next inventory submission.

30. The inventory is largely complete with the exception of emissions from oil distribution that are reported as "not occurring" ("NO"), while emissions from other leakage from natural gas are reported as "NE". The ERT recommends that Lithuania assess whether emissions from these source categories can be reported in its next inventory submission. If they cannot be estimated, then Lithuania should use the appropriate notation key and include in the NIR and CRF table 9(a) rationale for use of the notation key "NE".

B. Reference and sectoral approaches

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

31. In 2004, the difference between the reference and sectoral approaches was 3.2 per cent. The explanation for this difference provided in the NIR is that it is caused by statistical differences and fuel losses (in transformation). The ERT identified that some differences are caused by the use of derived fuels in the sectoral approach and the emissions from feedstock use (stored carbon). The difference in energy consumption between the approaches is smaller, which is expected since both approaches are based on the same energy statistics. Lithuania has corrected the misallocation of the refinery gas as a gaseous fuel.

32. It was not possible for the ERT to compare the data reported in the CRF tables with statistics of the International Energy Agency (IEA) as the 2006 CRF submission of Lithuania was received after the IEA analysis was completed.

2. International bunker fuels

33. Bunker fuels are reported for international aviation and navigation. The split between national and international navigation is made using the energy statistics, which are based on company reports. The use of lubricants is reported as "NO". The ERT recommends that Lithuania change this notation key

to "NE" in its next inventory submission, and investigate a method for estimating the use of lubricants by international navigation.

34. The split between national and international aviation is made on the basis of fuel type. Aviation gasoline is presumed to be used for national aviation and jet fuel for international aviation. However, the energy statistics highlight that there is inland jet fuel use. Lithuania is encouraged to review the jet fuel allocation from 2001 (the split between gasoline- and kerosene-based fuels is not possible before 2001), and to investigate the use of a weighted EF based on the split in the fuels in recent years, to be applied between 1990 and 2001.

3. Feedstocks and non-energy use of fuels

35. The reporting of feedstocks and non-energy use is generally in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines). Lithuania is recommended to rectify the incorrect reporting of refinery feedstock, and the overestimation of the use of natural gas as feedstock that arises from an error in the energy statistics.

36. The storage fraction used for natural gas is not consistent with the default value included in the Revised 1996 IPCC Guidelines. Lithuania is encouraged to improve the documentation on the country-specific storage factor, or alternatively to use the IPCC default.

C. Key categories

1. Stationary combustion: liquid – CO_2

37. CO_2 emissions from stationary combustion of liquid fuels are calculated in accordance with the IPCC good practice guidance using a tier 2 methodology. Emissions decreased from 14,303.7 Gg to 3,085.1 Gg between 1990 and 2004, mostly due to the changes in the Lithuanian economy after the country gained independence. Lithuania is encouraged to provide more information in the NIR on the EFs used and the trends.

38. Lithuania is encouraged to review its reporting on the use of lubricants and its allocation of emissions between the energy and waste sectors. The Party informed the ERT that used lubricants are either incinerated or partly stored (which the waste statistics confirm). When sales of lubricants in the energy statistics are compared with the AD in the CRF there is a difference in quantities. The Party is encouraged to assess the end-use of used lubricants and to take into account potential illegal combustion of waste lubricants for energy purposes. In response to questions raised by the ERT during the course of the review, the Party assessed the end-use of used lubricants, and submitted to the ERT revised estimates for all GHGs in energy industries.

2. Stationary combustion: gas – CO_2

39. CO_2 emissions from stationary combustion of gas are calculated in accordance with the IPCC good practice guidance using a tier 2 methodology and a country-specific EF. Emissions decreased from 9,515.7 Gg to 4,242.5 Gg between 1990 and 2004. Compared to 2003 emissions increased 3.6 per cent (147.0 Gg). The rationale supporting the selection of the country-specific EF and information on the decreasing long term trend in the emissions can be enhanced by providing more information in the NIR.

40. Lithuania is encouraged to improve the documentation on the statistics on final energy use which underlie the allocation of emissions between the energy and industrial processes sectors in relation to the chemical industry. During the in-country visit Lithuania provided to the ERT information showing that total final consumption in 2004 attributed to the single ammonia plant in the country was reported as non-energy use. The ERT noted that the calculation method used for process emissions from ammonia production is independent from the calculation of combustion emissions (and uses the correct feedstock

use of natural gas), and concluded that this has resulted in an underestimation of combustion emissions. As the revised energy balance is time-series consistent, the ERT concluded that the 1990 emission estimate is likely to be an underestimate. The ERT recommends that the Party review this reporting of natural gas and revise the energy statistics and emissions accordingly, and include the outcome of the review in its next inventory submission.

3. Road transportation: liquid – CO_2

41. Lithuania estimates CO_2 emissions using a tier 2a method, based on fuel sales and country-specific EFs. In contrast to the situation in most Parties, these emissions show a downward trend from 5,652.2 Gg to 3,891.5 Gg between 1990 and 2004. During the in-country visit, the Party provided the ERT with explanations of the trend in emissions for all gases. The ERT recommends that the Party include this information in its next inventory submission, particularly information pertaining to the relationship between vehicle parameters (vehicle stock, fuel consumption rates, etc.) and the emission trend.

42. The Party informed the ERT during the in-country visit that the impact on total fuel sales of illegal sales of fuel was significant for several years, especially in the mid-1990s, and could still have had an influence in 2004. As a result of these activities, energy statistics are likely to underestimate total fuel sales and subsequent emissions. Lithuania is recommended to assess the magnitude of the illegal sale of fuel and if appropriate, include this amount in the energy statistics.

D. Non-key categories

1. Stationary combustion: liquid – CH_4, N_2O

43. The ERT encourages Lithuania to use appropriate CH_4 and N_2O EFs for off-road vehicles instead of the EFs for stationary combustion, and to review the determination of fuel use by off-road vehicles.

2. Road transportation: liquid – CH_4, N_2O

44. Lithuania estimates CH_4 and N_2O emissions using a tier 2a method, based on fuel sales and country-specific EFs. In recent years the Party has used the COPERT model to compare the emission estimates. The Party informed the ERT during the in-country visit that this comparison (proxy verification) cannot be carried back to 1990 due to the paucity of data for that year. The ERT recommends that Lithuania review the estimation of N_2O emissions from road vehicles, and investigate how it can use the COPERT model for all years of the inventory time series either as the primary model used for estimating emissions or as a basis for verification.

III. Industrial processes and solvent and other product use

A. Sector overview

45. In 2004, total GHG emissions from the industrial processes sector accounted for 3,274.9 Gg CO_2 equivalent, contributing 15.1 per cent to total national GHG emissions. Emissions from this sector have declined 21.4 per cent between 1990 and 2004, mainly driven by decrease in emissions from lime production, cement production, methanol production, soda ash use and ammonia production. Nitric acid production was the largest emitting category in 2004, contributing 52.6 per cent to the total sectoral emissions, while the other major sources were represented by ammonia production and cement production, contributing 32.8 per cent and 10.1 per cent, respectively. In 2004, N_2O and CO_2 were the dominant GHG gases, contributing 52.6 and 46.2 per cent, respectively, to total sectoral emissions.

46. The industrial processes sector is generally complete, however, actual emissions of HFCs are not reported by the Party. The ERT noted from the statistical yearbooks that Lithuania has industrial

activities in the polyethylene, polystyrene, fertilizer, synthetic resin and plastic, pharmaceutical, sulphuric acid, steel and cast iron industries. The ERT also noted that emission estimates from limestone and dolomite use, asphalt roofing, road paving with asphalt, pulp and paper and food and drink (between 1990 and 2000) are not reported by the Party. N_2O emissions from solvent and other product use are reported as "NE" and "NA". Lithuania submitted revised estimates during the review for CO_2 emissions arising from production of bricks, ceramics and mineral wool, as well as CO_2 emissions from the solvent and other product use sector. The ERT recommends Lithuania to provide estimates for all categories where emissions occur in the country, even if they are minor, by using simple but reasonable approaches, and using expert judgement as necessary, in its next inventory submission, and to investigate the reporting of actual HFC emissions.

47. Lithuania has reported emission estimates from glass production as "IE" in the category soda ash use. During the in-country visit the Party informed the ERT that the main reason for this is that soda ash (Na_2CO_3) is used as a raw material in the glass manufacturing process. However, other major raw materials used in glass manufacture emit CO_2 during the melting process: these are limestone ($CaCO_3$) and dolomite ($CaMg(CO_3)_2$). Lithuania submitted revised estimates to the ERT that included CO_2 emissions arising from use of these raw materials in the glass manufacturing process, and a tier 2 (from recently published recognized international scientific literature) calculation of CO_2 emissions from other – glass production (2.A.7) (float glass, glass containers and television panels glass).

48. Lithuania has estimated potential emissions for HFCs following a tier 1a approach by using aggregated data based on consumption of HFCs. During the in-country visit the Party informed the ERT that it was not possible to collect data at a more disaggregated level. Actual HFC emissions were not calculated due to a paucity of data on each individual chemical. Fluorinated gases are not produced in the country and all consumption is based on imports. Only imports of HFCs and SF_6 are recorded in the statistics included in Lithuania's Chemical Registry (which also includes information received from the Customs Department). Actual SF_6 emissions from electrical equipment have been calculated following a tier 2b approach; however, CRF table summary 3 indicates the use of a tier 1 methodology. The ERT recommends that Lithuania check the consistency of its reporting of methodologies between the NIR and CRF summary table 3 for its next submission.

49. In general, Lithuania provides justification for the assumption made and the choice of data and methods. Most categories are reported with the detail required by the CRF, with few exceptions; emissions from some categories (ammonia and nitric acid production) have been reported as "confidential" ("C"). During the in-country visit the Party provided the ERT with access to all confidential data. The CRF tables and the NIR provide limited transparency and the ERT was not able fully to assess the data used and methodologies applied. Lithuania is recommended to include in its next inventory submission all relevant AD and information on rationale for choices of methodology, country-specific EFs, AD and assumptions.

50. Lithuania is commended for performing major recalculations in this sector in response to recommendations from the 2005 review report. These recalculations are due to changes of the AD data set (e.g. for ammonia and nitric acid production), methodological changes (e.g. for cement and ammonia production), and the inclusion of new source categories (e.g. CO_2 emissions from soda ash use and SF_6 emissions from electrical equipment). The impact of the recalculations in 2003 was an increase of 96.2 per cent in total sectoral GHG emissions, and an increase of 7.4 per cent in the estimate of total national emissions.

51. An uncertainty analysis has been reported by Lithuania for each category within the industrial processes sector, except for 'methanol production'. The information on uncertainties provided in Chapter 4 of the NIR is not fully consistent and as required by the UNFCCC reporting guidelines: the quantification of uncertainties is not properly documented, and no qualitative discussions are provided.

The ERT encourages the Party to include in its next inventory submission sector-specific qualitative discussions on uncertainties, at least for those categories identified as key.

B. Key categories

1. Nitric acid production – N_2O

52. There is only one plant in Lithuania that produces nitric acid, and AD and the EF for this category are treated as confidential. Following the recommendations of the 2005 review report, the Party has recalculated N_2O emissions for the whole time series by converting AD from nitrogen (N) production units to nitric acid production units. Lithuania is encouraged to include in its next inventory submission an explanation of emission trends for this category, and to explain any unusual increases or decreases in an emission profile for a particular gas over the time series.

2. Ammonia production – CO_2

53. There is only one plant in Lithuania that produces ammonia and data for this category are reported as confidential. Following the recommendations of the 2005 review report, the Party recalculated the CO_2 emissions for the whole time series following an IPCC tier 1a methodology based on natural gas input. Emission estimates are provided by the producer company, SC Achema.

3. Cement production – CO_2

54. Lithuania has implemented the recommendations of the 2005 review report and has recalculated CO_2 emissions from cement production for the whole time series using the IPCC tier 2 methodology. Clinker production data and lime (CaO) content were provided by the producer company, Akmenes Cementas. Lithuania informed the ERT during the in-country visit that the significant fluctuations in the emission time series are explained by a sharp decline in cement production during the period 1990–1993 following independence from the Soviet Union, and by growth in the construction market in recent years. Lithuania is encouraged to explain these trends in its next inventory submission.

C. Non-key categories

1. Lime production – CO_2

55. The default EFs used by Lithuania for lime production (785 kg CO_2 per tonne of high calcium quicklime and 913 kg CO_2 per tonne of dolomite quicklime) correspond to 100 per cent of quicklime (CaO) or dolomitic lime (CaO·MgO) contents and can lead to an overestimation of emissions since the CaO and MgO content may be less (the default value is 95 per cent). Lithuania revised these values – to 750 kg CO_2 per tonne of high calcium quicklime and 860 kg CO_2 per tonne of dolomite quicklime – as part of the revised estimates it provided during the course of the review. The emission estimates are now in accordance with the IPCC good practice guidance.

2. Other: mineral wool, bricks and tiles – CO_2

56. During the in-country visit the ERT noted from the statistical yearbooks that Lithuania has industrial operations in the production of mineral wool, bricks and ceramics. Lithuania submitted revised estimates of CO_2 emissions from mineral wool, bricks and tiles production, calculated based on country-specific EFs and AD available in national statistics and scientific publications. The ERT commends Lithuania for improving the completeness of the inventory. The Party is recommended to provide with its next inventory submission all relevant AD and information on the rationale for choices of methodology, country-specific EFs and AD, and any assumptions used while estimating CO_2 emissions from this category.

IV. Agriculture

A. Sector overview

57. In 2004, emissions from the agriculture sector in Lithuania amounted to 4,296.6 Gg CO_2 equivalent, contributing 19.8 per cent of total national GHG emissions. Emissions decreased by 54.6 per cent between 1990 and 2004. This emission trend is explained by a recession in the Lithuanian agriculture sector, which has decreased the number of animals and fertilizer consumption. In 2004 the agricultural sector was the largest emitter of N_2O and the second largest emitter of CH_4.

58. Revised estimates were submitted by the Party in response to questions raised by the ERT on all agricultural categories and gases, based on improved methodology and corrections of identified errors.

59. The submission for the agriculture sector is complete and covers all major sources and years. There are a few instances of the notation keys not being used correctly, especially in table 4.B(a). The inventory for the sector has been improved substantially since the 2005 submission. Rice cultivation, savannas and field burning of crop residues do not occur in Lithuania.

60. The NIR includes only limited AD. The ERT recommends that Lithuania improve the transparency of this sector in its next inventory submission by including either in the main text of the report or as an annex to the NIR, AD and other parameters used to estimate emissions from this sector.

61. The NIR indicates that the Lithuanian Institute of Agriculture and the Lithuanian Institute of Agrarian Economics are data providers and that these institutions are included in the inventory group. During the review it was recognized that these institutions were not involved in the original 2006 submission; however, data from these institutions have been included in the revised emission estimates. The ERT recommends increased use of national data in deriving emission estimates.

62. The collection of data on animal populations by Statistics Lithuania is well documented and is done to a high standard with stratified sampling methodologies. No uncertainty estimates on the animal numbers were presented to the ERT. The animal numbers are the same as those reported by Eurostat. The number of horses includes only horses on farms. According to Statistics Lithuania there are no data on the number of privately-owned horses. The Party is encouraged to estimate the number of horses outside agriculture and include these in its next inventory submission.

63. The distribution of Animal Waste Management Systems (AWMS) is country-specific based on assumptions made by national experts. The same values are used for all years despite the fact that there have been significant changes in Lithuanian agriculture. The Party is encouraged to document these assumptions further by collecting data on stable type distribution and manure handling systems. This affects both the N_2O and CH_4 emissions from manure handling. During the review Statistics Lithuania informed the ERT that it was going to collect more agricultural statistics in 2010. The Party is recommended to speed up this data collection.

64. Following the recommendations from the previous ERT review (2005) and the current review team, Lithuania has performed major recalculations in the agriculture sector, due to changes of the AD dataset, methodological changes and the inclusion of missing sources. The impact of the recalculations in 2003 was an increase of 104.7 per cent in total sectoral GHG emissions and an increase of 10.5 per cent in total national GHG emissions.

B. Key categories

1. Direct soil emissions – N_2O

65. The Party has included nitrogen from the application of mineral fertilizer, animal manure, N-fixing crops, crop residues returned to soil and cultivation of organic soils in the emission estimates. Estimated emissions decreased from 19.0 Gg N_2O in 1990 to 9.2 Gg N_2O in 2004. The decrease is mainly due to decreases in the consumption of mineral fertilizer and the amounts of animal manure.

66. The reported consumption of mineral fertilizer in the CRF for 1990–1994 is based on data from Statistics Lithuania. From 1995 it is based on estimations made by the International Fertilizer Industry Association (IFA). The data from IFA is assumed to be a good estimate with regard to Lithuanian conditions. However, the Party is recommended to collect and publish national statistics on fertilizer consumption to be used in the inventory.

2. Enteric fermentation – CH_4

67. The Party has developed a country-specific tier 2 methodology for enteric fermentation from dairy cows and non-dairy cattle. For all other animal categories default East European values are used. Average milk production in 1990 was 3,734 kg/cow/yr, increasing to 4,176 kg/cow/yr in 2004. The effects of increased productivity in the Lithuanian dairy sector and altered slaughter weight are reflected in the emission estimates. To increase the transparency of the emission calculations Lithuania is encouraged to include more statistics on milk and slaughtering data in the NIR.

68. Default IPCC EFs are used by the Party to estimate emissions for sheep and goats. Lithuania is encouraged to verify if the chosen EFs reflect national conditions as the EFs depend on whether lambs and kids are included in the animal numbers or not, and to provide this information in its next inventory submission.

3. Manure management – N_2O

69. Lithuania uses default East European values from the IPCC good practice guidance for nitrogen excretion rate (N_{EX}) in lieu of national data. However, the productivity level in Lithuania is different from the default conditions, which means that N_2O emissions from dairy cows are likely to be underestimated and emissions from non-dairy cows are likely to be overestimated. The Party is recommended to collect data on N_{EX} for all animal categories and include these in its next inventory submission, along with relevant details about AWMS, to improve the accuracy of the inventory.

4. Indirect soil emissions – N_2O

70. The Party uses default ammonia emission values for mineral fertilizer and animal manure handling to estimate the ammonia emissions. The estimated emissions correspond quite well to the figure submitted under the Convention on Long-Range Transboundary Air Pollution (CLRTAP). Lithuania is encouraged to include more data in the NIR on the basic assumptions made for the calculations and to coordinate work on the inventory with work on the CLRTAP submission.

71. Lithuania uses the default value of 10 per cent for ammonia emissions from mineral fertilizer. The EF depends on the origin of the fertilizer. Only a small fraction of the consumption is urea, which has a high ammonia emission rate. The use of the default value is therefore probably not appropriate and the Party is recommended to improve its calculation methods.

72. The urea used as a fertilizer contains carbon which is emitted after application as CO_2. Lithuania has not reported these emissions. In the CRF it is not possible to report CO_2 emissions in the agriculture sector and Lithuania is encouraged to report these emissions in the industrial processes sector.

73. The Party uses the default $Frac_{LEACH}$ of 0.3 to estimate N_2O from leached N. Due to the national application rates and methodologies, as well as the climatic conditions in Lithuania, this value may not be appropriate. The Party is encouraged to improve the quality of the emission estimates by developing and applying country-specific leaching values as the default value may be too high.

5. Manure management – CH_4

74. The Party uses country-specific data for the allocation of manures to different AWMS. For all years of the time series Lithuania used the same AWMS distribution regardless of the fact that the agriculture sector has been restructured. The country-specific data on AWMS are based on expert judgement. The Party also uses default IPCC methane-producing potential (B_0) and methane conversion factors (MCFs) except for liquid-based systems where a MCF of 10 per cent is used. The 10 per cent factor is assumed to be a reasonable value for Lithuanian storage and climatic conditions. The Party is recommended to collect and include data on stable type distribution and manure management for all animal types including horses and goats in its next inventory submission.

V. Land use, land-use change and forestry

A. Sector overview

75. In 2004, the LULUCF sector in Lithuania's inventory amounted to a net sink of 8,631.5 Gg of CO_2 equivalent. The net sink from the LULUCF sector represented 65.8 per cent of national total emissions (13,122.1 Gg CO_2 equivalent) in 2004 and 27.8 per cent of total GHG emissions in 1990. The net sink decreased by 19.6 per cent between 1990 and 2004.

76. Revised estimates were submitted by the Party in response to questions raised by the ERT on forest land – CO_2 (5.A) and wetlands – CO_2 (5.D) following the correction of errors in the AD.

77. In its 2006 submission, Lithuania submitted for the first time a complete set of CRF tables for LULUCF for all years as well as information on this sector, in accordance with decision 13/CP.9. GHG emissions and removals from drained organic soil in forest land remaining forest land, peat extraction in wetlands remaining wetlands and biomass burning due to forest fire are estimated for the first time. The 2004 CRF includes estimates of CO_2 emissions/removals for forest land, cropland and wetlands categories in the LULUCF sector, and N_2O emissions from drainage of organic soils in forest land, as well as N_2O and CH_4 emissions from wildfires in forest land. Carbon stock changes in living biomass, dead organic matter and soils as well as CO_2 emissions from agricultural liming application are reported under the relevant categories.

78. Lithuania has classified its land under six broad land-use categories using "Approach 1" of the IPCC good practice guidance for LULUCF based on several official sources of statistics. Land-use changes have not been fully estimated, but other land converted to forest land is the only significant land-use change in Lithuania. The definitions of six broad land-use categories are matched against the definition in the IPCC good practice guidance for LULUCF. The NIR does not give information on the land-use definitions or describe how the definitions used in independent statistics are harmonized. In response to questions raised by the ERT during the in-country visit, Lithuania provided information on the national land-use definitions for all categories, a table summarizing the national land-use categories, and information on unmanaged area in the country. The ERT recommends Lithuania to include this information in its next inventory submission.

B. Key categories

1. Forest land remaining forest land – CO_2

79. Annual net CO_2 removals for forest land remaining forest land in 2004 amounted to 7,045.94 Gg CO_2. Carbon stock changes in living biomass are estimated in accordance with IPCC good practice guidance for LULUCF and are based largely on country-specific data provided by the national forest inventory of Lithuania. The ERT commends Lithuania for providing detailed information in the NIR on the estimation of area and emissions. The ERT encourages Lithuania to further improve the transparency of its reporting in this sector by including additional descriptions on the estimation of the annual net increment in volume in line with the explanation provided to the ERT during the review process. Also, the ERT recommends the Party to assess the use of the country-specific values for the percentages of needle and foliage biomass and branch biomass provided in the Global Forest Resources Assessment 2005 (FRA 2005) instead of the IPCC default biomass expansion factors.

80. Carbon stock changes in soils and dead organic matter for forest land remaining forest land are assumed to be zero based on the tier 1 method in the IPCC good practice guidance for LULUCF. The ERT recommends the Party to explore improving the estimates for the carbon stock changes in forest soils in future inventory submissions. The emissions due to carbon stock change in drained organic forest soils are estimated, and the ERT recommends that Lithuania document the method used in its next inventory submission.

2. Land converted to forest land – CO_2

81. Carbon stock changes in dead wood and litter in land converted to forest land are estimated by using the country-specific data provided in FRA 2005. Carbon stock changes in soil for this category are reported as "NE". The ERT encourages Lithuania to investigate the use of data in the FRA 2005, particularly the carbon storage data of forest litter and the data of forest soil, to improve the quality of its emission estimates by using the same methodology used for dead organic matter.

C. Non-key categories

Cropland remaining cropland – CO_2

82. Perennial woody biomass such as horticultural plantain exists in cropland remaining cropland in Lithuania, but carbon stock changes of this perennial woody biomass are reported as "NE" because reliable data are not available at present. Lithuania is planning to investigate this issue further in the near future. The ERT encourages Lithuania to consider whether it can report carbon stock changes in perennial woody biomass when the findings of this field investigation are available.

83. Carbon emissions from agricultural lime application are estimated by using the IPCC tier 2 method and a country-specific EF. Information on the methodology used and on how the country-specific EF was calculated is not provided in the NIR, but was provided to the ERT during the in-country visit. The ERT encourages Lithuania to include this information in its next inventory submission.

VI. Waste

A. Sector overview

84. In 2004, the waste sector accounted for 7.1 per cent (1,537.6 Gg CO_2 equivalent) of total national GHG emissions. Emissions decreased by 23.1 per cent between 1990 and 2004. Solid waste disposal on land contributed 61.8 per cent of total waste sector emissions, while wastewater handling and waste incineration accounted for 38.0 and 0.2 per cent, respectively. CH_4 is the dominant gas, contributing 94.8 per cent of emissions from this sector.

85. Revised estimates were submitted by the Party in response to questions raised by the ERT on solid waste disposal on land – CH_4 based on improved AD on waste generation and waste composition.

86. CH_4 emissions from solid waste disposal on land and wastewater handling were identified as key categories by both the Party and the secretariat.

87. The reporting of the waste sector by Lithuania is generally complete, with the exceptions of CH_4 and N_2O emissions from waste incineration, and N_2O emissions from both industrial wastewater and domestic and commercial wastewater. All these categories are reported as "NE".

88. The impact of the recalculations in 2003 was an increase of 2.7 per cent in sectoral GHG emissions. Information on the uncertainties of emission estimates in the waste sector is provided in the NIR. Lithuania is encouraged to improve the reporting of uncertainty analysis by including information in the NIR on the methodology and its result. Lithuania is also encouraged to develop sector-specific QA/QC procedures and to describe these in the NIR.

B. Key categories

1. Solid waste disposal on land – CH_4

89. Lithuania has used the tier 2 first order decay (FOD) model from the IPCC good practice guidance with country-specific degradable organic carbon (DOC) data and a methane correction factor (MCF) derived from expert judgement. Statistics on solid waste disposal to land are provided by the Lithuanian Environmental Protection Agency (EPA) for the years 1991–2004. However, the transparency of the rationale for the derivation of the AD could be improved in the NIR. Prior to 1990 these AD (waste generation) were estimated based on expert judgement (an annual increase of 2 per cent from 1950 to 1990, to reach the 1991 level). Lithuania is encouraged to reassess the 1990–2004 waste data time series for consistency and to review expert judgement using data on population and gross domestic product from 1950 to 1990.

2. Wastewater handling – CH_4, N_2O

90. A tier 1 method with country-specific MCFs has been used to estimate the emissions from wastewater handling. Data on the total chemical oxygen demand (COD) for industrial wastewater and biochemical oxygen demand (BOD) for domestic wastewater were obtained from the EPA waste database, but the transparency of the derivation of the AD (DOC for industrial waste water and BOD for domestic/commercial wastewater) could be improved in the NIR. Lithuania is encouraged to provide more information about the trend in CH_4 emissions from wastewater handling in its next inventory submission.

VII. Conclusions and recommendations

A. Conclusions

91. Lithuania has made significant improvements since its 2005 submission, most of them in response to recommendations made during the review of the 2005 submission. Some major improvements include: improvements to the completeness of the GHG inventory; the submission of emission estimates for all years of the inventory time series; and improved transparency of the NIR in describing the methodologies, AD and EFs used.

92. The ERT concluded that emissions are generally estimated in accordance with the IPCC good practice guidance.

B. Recommendations

93. In the course of the review, the ERT formulated a number of recommendations relating to the completeness and transparency of Lithuania's GHG submission. The key recommendations[3] are that Lithuania:

(a) Further develop the QA/QC plan with a particular focus on QC procedures, roles and responsibilities, and resource considerations;

(b) Establish an inventory improvement plan that uses key category analysis and uncertainty analysis as tools to prioritize improvement of the inventory, and considers output from QA/QC procedures;

(c) Structure the presentation of all sectors in the NIR according to the UNFCCC reporting guidelines;

(d) Provide improved documentation on the methodologies, AD and EFs used for the specific categories that are mentioned in the corresponding sector sections of this report above, and include in its future NIRs elements of the extensive documentation that is already available;

(e) Revise and document underlining assumptions in the uncertainty analyses;

(f) Allocate sufficient resources for inventory planning, preparation and management to ensure timely provision of a high quality GHG inventory, including expertise to develop and implement high tier methods and for general improvement and QC of the inventory.

[3] For a complete set of recommendations, the relevant sections of this report should be consulted.

Annex

Documents and information used during the review

A. Reference documents

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

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B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Vytautas Krušinskas (Ministry of Environment), Ms. Jolanta Merkeliene (Ministry of Environment), Ms. Danguole Bernotiene (Ministry of Environment), Mr. Arvydas Andreikenas (Statistics Lithuania), Ms. Dalia Streimikiene (Lithuanian Energy Institute), Mr. Romas Lenkaitis (Center for Environmental Policy), Mr. Giedrius Mažūnaitis (Association of Lithuanian Chemical Industry Enterprises) and Mr. Ričardas Beniušis (State Forest Survey Service) including additional material on the methodologies and assumptions used.

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