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REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF NEW ZEALAND SUBMITTED IN THE YEAR 2000[1]

(In-country review)

A. OVERVIEW

1. Introduction

1. The Conference of the Parties (COP), at its fifth session, by its decision 6/CP.5, requested the secretariat to conduct, during the trial period, individual reviews of greenhouse gas inventories for a limited number of Annex I parties on a voluntary basis, according to the UNFCCC guidelines for the technical review of GHG inventories from Parties included in Annex I to the Convention.[2] In doing so, the secretariat was requested to coordinate the technical reviews and to use different approaches to individual reviews, including desk reviews, centralized reviews and in-country reviews.

2. New Zealand (NZ) volunteered for an individual in-country review. The review of New Zealand took place from 14 May to 18 May 2001 in Wellington. The individual review was carried out by a team of nominated experts from the roster of experts, and coordinated by the secretariat. Experts participating in the review were Mr. Javier Hanna (Bolivia), Ms Hongming Dong (China), Mr. Michael Gytarsky (Russian Federation), Ms Penny Reyenga (Australia), Mr. Martin Meadows (United Kingdom). The review was coordinated by Mr. Roberto Acosta (UNFCCC secretariat) and Ms. Katia Simeonova (UNFCCC secretariat). Ms Hongming Dong and Mr. Martin Meadows were lead-authors of this report**.**

3. At the beginning of the review, the host country officials provided a general overview of inventory preparation, followed by presentations by sector. Thereafter, sessions for each sector were conducted in parallel. During those sessions national inventory experts responsible for the respective sector clarified further the key issues related to inventory preparation followed by a question and answer session. The ERT was given an opportunity of asking as many questions as necessary. Where answers could not been provided immediately, written answers were provided in the course of the week.

[1] In the symbol of this document, 2000 refers to the year the inventory was submitted, and not to the year of publication. The number (2) indicates that for New Zealand this is an in-country review report.

[2] Document FCCC/CP/1999/7, in particular the UNFCCC review guidelines (pages 109 to 114), and decision 6/CP.5 (page 121 to 122).

4. For all sectors the preliminary findings identified in the synthesis and assessment report of greenhouse gas inventories submitted in 2000 were addressed during the respective sessions. Answers to these findings are given below in the corresponding sections of each sector. In the synthesis and assessment (S&A) report the secretariat had considered, for each individual Party, the source categories that are *key sources* 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 and Uncertainty Management in National Greenhouse Gas Inventories, hereafter referred to as Good Practice Guidance.[3]

5. In accordance with the UNFCCC review guidelines, a draft version of this report was communicated to the Government of New Zealand, which provided comments that have been considered and incorporated, as appropriate, into this final version of the report.

2. Emission profile and trends

6. New Zealand has a unique emission profile compared to the other Annex I Parties. The most important GHG is CH_4, which in 1998 accounted for 45 per cent of the total emissions, followed by CO_2, 39 per cent and N_2O, 14 per cent emissions[4]. By source, agriculture accounted for 55 per cent of the total emissions, energy 37 per cent, and industrial processes and waste both contributed 4 per cent.

7. Tables 1 and 2 provide data on emission trends, by gas and by sector. Emissions of CO_2, excluding land-use change and forestry (LUCF), grew by 13 per cent between 1990 and 1998 driven mainly by the growth of emissions from transport. N_2O emissions increased by 2 per cent only for the same period due to some slight increase of emissions from agricultural soils. The decline of emissions from enteric fermentation in agriculture due to a decreased number of sheep and non-dairy cattle underlined the decrease in the total emissions of CH_4 by 5 per cent. Two of the industrial gases, HFCs and SF_6, experienced significant growth, while PFCs dropped almost tenfold due to efficiency improvements in the aluminium industry.

[3] According to a conclusion of the SBSTA at its 12th session, Parties should apply the Good Practice Guidance as far as possible for inventories due in 2001 and 2002, and should use it for inventories due in 2003 and beyond.

Following the Good Practice Guidance the key source analysis has been performed by the Secretariat at the level of detail recommended in that guidance. For the 2001 inventory submissions, when Parties will start the application of this guidance, they may use a different level of category-disaggregation for the identification of their key sources according to the tier 1 Level Assessment (Chapter 7 of the Good Practice Guidance).

[4] In this report the term total emissions refers to the aggregate national emissions based on the CO_2 equivalents excluding LUCF, unless specified otherwise.

Table 1. GHG emissions by gas, 1990-1998 (Gg)

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998
	CO_2 equivalent (Gg)								
Net CO_2 emissions/removals	3,869	5,367	9,478	10,898	11,589	11,043	11,748	12,039	8,037
CO_2 emissions (without LUCF) (6)	25,398	25,881	27,761	27,136	27,197	27,206	28,277	30,209	28,933
CH_4	35,211	34,477	33,857	33,897	34,105	34,143	34,103	33,470	33,424
N_2O	11,852	11,725	11,742	11,887	12,048	12,097	12,044	12,062	12,077
HFCs	0	0	0	10	96	216	297	228	373
PFCs	603	650	636	228	230	183	183	209	62
SF_6	3	3	3	3	27	19	28	29	32
Total (with net CO_2 emissions/removals)	**51,537**	**52,223**	**55,716**	**56,922**	**58,094**	**57,701**	**58,402**	**58,037**	**54,005**
Total (without CO_2 from LUCF) (6)	**73,066**	**72,736**	**73,999**	**73,161**	**73,702**	**73,864**	**74,932**	**76,207**	**74,901**

Table 2. GHG emissions by sector, 1990-1998 (Gg)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998
	CO_2 equivalent (Gg)								
1. Energy	23,991	24,310	26,057	25,314	25,549	25,629	26,933	28,797	27,568
2. Industrial Processes	2,995	3,165	3,286	3,014	3,026	3,156	3,252	3,095	3,201
3. Solvent and Other Product Use	0	0	0	0	0	0	0	0	0
4. Agriculture	42,851	42,012	41,528	41,629	41,896	41,903	41,547	41,294	41,208
5. Land-Use Change and Forestry (7)	-21,432	-20,423	-18,181	-16,108	-15,461	-16,021	-16,371	-17,996	-20,757
6. Waste	3,132	3,159	3,025	3,073	3,084	3,034	3,041	2,848	2,785
7. Other	0	0	0	0	0	0	0	0	0

3. Data sources

8. The ERT reviewed the National Greenhouse Gas Emissions Inventory Report (NIR) and the Common Reporting Format (CRF) tables for all years from 1990 to 1998 submitted on 29 April 2000. The ERT was provided with supporting documents during the in-country visit and these are referenced under the individual sector sections in the report. The ERT also used for the review the Synthesis and Assessment report (S&A report) submitted in 2000 (FCCC/WEB/2000/1) and the key source analysis prepared by the secretariat.

4. General issues

4.1. Institutional arrangements

9. NZ uses a multi agency approach to compile the inventory. The Ministry for the Environment (MfE) coordinates the reporting process and has overall responsibility for compiling and submitting the CRF and NIR to the UNFCCC. The MfE compiles emissions estimates for agriculture, LUCF and waste and non-CO_2 greenhouse gases from industrial processes. The MfE oversees the implementation of Good Practice Guidance and funds research for inventory development and improvements. The Ministry for Economic Development (MED) compiles data and emissions estimates for the energy sector and CO_2 emissions from industrial

processes. The Ministry of Agriculture and Forestry (MAF) provides agriculture and forestry activity data and also funds research for inventory development and improvement.

4.2. Record keeping

10. A complete electronic copy of the CRF and the NIR for each year is kept on the computer network at the MfE. Paper copies of the CRF and the NIR and some supporting documentation, are kept at the MfE. The MED keeps paper copies of supporting material for the energy sector emissions estimates and CO_2 from industrial processes .

4.3. Verification and QA/QC approaches

11. NZ has no formal QA/QC procedures for the inventory. Comprehensive verification processes are undertaken for statistical data in the agriculture and LUCF sector.

4.4. Recalculations

12. In accordance with UNFCCC reporting guidelines, NZ included nearly all information regarding recalculations for the period 1990-1997 in the CRF information. Minor exceptions are noted under individual sections later in this report.

4.5. Transparency

13. The NIR was broadly similar in its treatment of all sectors. The ERT noted that it was informative and concise, containing summary information on:

(a) methodologies used and references to any detailed reports;

(b) where the methodologies diverge from IPCC methodology;

(c) changes since the previous inventory and information on recalculations;

(d) uncertainty estimates;

(e) calculation tables for 1998; and

(f) references to detailed methodology and supporting information.

14. The ERT noted, however, that the NIR lacks:

(a) calculation tables for 1990 to 1997. NZ informed the ERT that these had been provided in the previous NIR and referenced in the reviewed NIR;

(b) clear indication in most cases of the rationale and complexity of the methodologies used (IPCC default, tier 1, tier 2, etc);

(c) information in a separate section on verification and any QA/QC approaches implemented;

(d) information on anticipated future improvements in methodologies; and

(e) clear descriptions of all assumptions used in developing country-specific emission factors.

15. The ERT recommends that NZ adds the last three elements to future NIRs.

4.6. Completeness

16. The ERT identified no major omissions in the national inventory. The inventory covered all major sources and sinks, as well as all direct and indirect gases, included in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, hereafter referred to as the IPCC Guidelines.

4.7. Uncertainties

17. Uncertainties were provided for all sources on a gas by gas basis, except for nitrous oxide emissions from soil. Uncertainties were estimated by expert judgment and are summarized within each section of the NIR. Uncertainty estimates were broadly consistent with IPCC default values.

4.8. Areas for further improvement

18. The ERT found that the NZ inventory was well reported and that the emissions were broadly well estimated. It noted the following issues for further improvement:

19. *Verification*: The ERT encourages NZ to consider implementing and reporting a formal system of verification for the whole national inventory, consistent with IPCC Guidelines and Good Practice Guidance. This will help overcome some existing inconsistencies and gaps in the current inventory.

20. *Methodologies*: NZ is encouraged to consider developing where appropriate tier 2 approaches for key source categories, particularly in the agriculture, energy and waste sectors. This is consistent with Good Practice Guidance that Annex I Parties should apply from 2001.

21. *Emission factors*: A number of key source emission factors were derived some years ago. NZ may wish to consider a review of some emission factors, particularly in the energy, agriculture and LUCF sectors, to reflect recent research or technological developments.

22. *Reporting:* NZ may wish to consider including (i) an executive summary in the NIR that summarizes emissions profiles for NZ, emissions trends and any major developments since the last report and (ii) a summary at the beginning of each section describing emissions profiles and trends. This is not a requirement of IPCC or UNFCCC guidelines but would aid understanding of national circumstances. In addition, the ERT noted that the information reported in both CRF and NIR should be consistent, and notation keys should be used according to the guidelines requirements.

23. *Completeness:* NZ may wish to consider in its future inventories some small sources missing in the current inventory. These sources include fugitive emissions from crude oil production and distribution, from production and processing of gas and from small geothermal sources. These also include CH_4 emissions from pigs, llamas, mules and asses, as well as CO_2 emissions and removals from soils source categories, and accounting for abandonment of managed lands.

24. *Record-keeping*: The ERT recommends that NZ implements a formal system for record keeping and for collecting and gathering all the information and supporting documentation at a single inventory facility.

25. *Confidentiality*: NZ may wish to consider implementing procedures to allow companies to provide commercially sensitive information to MfE or MED to better estimate emissions from industrial sources. This information may be provided in confidence to ERTs but would not necessarily be published in the NIR or CRF.

4.9. Consistency with IPCC and UNFCCC guidelines

26. The NIR and CRF were mostly consistent with IPCC and UNFCCC guidelines for estimating and reporting emissions. Both IPCC Guidelines and country-specific methodologies were used to estimate emissions. Good Practice Guidance was not required for this submission and was not applied.

4.10. Conclusion

27. The ERT considers that NZ provided adequate information to the COP on its greenhouse gas inventory and greenhouse gas emissions trends.

B. ENERGY SECTOR

1. General overview

28. Energy accounted for around 37 per cent of New Zealand's total GHG emissions and contributed around 90 per cent of CO_2 emissions in 1998. The ERT reviewed seven key source categories: mobile combustion, road vehicles and aircraft; stationary combustion, gas, coal and oil; and fugitive emissions from oil and gas operations and coal mining and handling.

29. During 1990 to 1998 the total CO_2 equivalent emissions from energy increased by 14.9 per cent, while CO_2 emissions increased by 13.9 per cent, CH_4 by 43.2 per cent and N_2O by 23.9 per cent. CO_2 emissions growth was driven mainly by a 32 per cent emissions growth of the transportation sector for the same period.

1.1. Verification and QA/QC approaches

30. Comparisons of the results of the reference and sectoral approaches were undertaken but there were no further verifications or QA/QC arrangements.

1.2. Completeness

All gases and sources of emissions from the energy sector recommended by the IPCC Guidelines are estimated, with a few exceptions[5].

[5] For example, fugitive emissions from crude oil production and distribution, fugitive emissions from the production and processing of gas, fugitive emissions from small geothermal sources and disaggregated information by sub sector for some sectors, manufacturing industries.

1.3. Transparency and use of indicators

31. Information presented in both the CRF and NIR was mostly transparent but the ERT considered that the NIR could have contained some more information on methodologies and underlying assumptions. The use of indicators followed the guidelines.

1.4. Recalculations

32. Recalculations resulted in marginal changes in emission estimates for CO_2. The CRF provided the recalculated estimates and summarized changes for 1990 to 1997. The NIR explained the recalculations, referring to the most recent source of activity data[6]. In most years, recalculations for CO_2 and CH_4 resulted in increased emissions estimates[7]. The information on N_2O contains some gaps in the recalculation tables.

1.5. Uncertainties

33. NZ used the IPCC approach to estimate uncertainties in emission factors and activity data. Uncertainties were around 5 per cent for CO_2 estimates, and around 50 per cent for N_2O and CH_4 estimates, based on expert judgement.

1.6. Confidentiality

34. Some information concerning natural gas use is considered confidential in NZ (production of methanol, synthetic petrol, ammonia and urea), and in order to maintain this, correspondent emission factors were not reported. Other information considered confidential includes activity data on coal export, coal stock changes, some types of coal production and landfill gas used for energy.

2. Consistency with the IPCC and UNFCCC guidelines

35. Estimation of emissions and the presentation of information in the CRF and NIR broadly followed the IPCC Guidelines (tier 1 approach) and were consistent with UNFCCC Guidelines on reporting. The ERT noted that emissions estimates were based on Gross Calorific Values of fuels but Net Calorific Values were reported in the CRF.

3. Reference and sectoral approaches

36. Worksheets provided for the sectoral approach were consolidated in some places (combining sheets or only showing relevant categories, excluding categories not relevant to NZ). The emissions were generally estimated by applying emission factors to energy activity data (fuel consumption).

37. CO_2 emissions obtained using the reference approach and the sectoral approach differed by only -0.02 per cent for 1998. For 1990 to 1996, this difference was greater than 2 per cent. Reference approach estimates were lower than the sectoral approach for all years 1990 to 1998 with the exception of 1996, when the reference approach estimates were 2 per cent higher than those in the sectoral approach. No explanation was provided.

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[6] New Zealand Energy Greenhouse Gas Emissions 1990-1999, Ministry of Economic Development, June 2000.

[7] For example in the base year 1990 the emission estimates were revised from 22,855 Gg to 23,012.

38. Feedstocks were accounted for in the reference approach following the guidelines.

3.1. Results from previous reviews

39. The S&A report noted for the reference approach that the quantities of coking coal exported in 1997 and 1998 were higher compared to the sum of the amount produced, amount imported and stock changes. This resulted in a negative apparent consumption for primary solid fuels. NZ officials explained that information on coking coal was aggregated with other bituminous fuel for confidentiality reasons. In addition, no stock changes for the solid fuels were provided in the CRF.

40. The S&A report also noted – and NZ officials agreed - that LPG production in the CRF should probably be shown in LNG since theoretically LPG should only be a secondary product.

3.2. Comparison with international data

41. The reference approach energy data for 1998 corresponded very closely to IEA data.

4. Key sources

42. Activity data for energy sources were compiled from New Zealand's energy balances.[8] Virtually in all cases, emission factors for CO_2 were derived from information in the New Zealand Energy Information Handbook (1993). Otherwise IPCC default factors were used unless indicated below.

4.1. Stationary combustion – CO_2 emissions from gas, coal and oil

43. Stationary combustion emissions sources contributed 18.5 per cent to national emissions in 1998. CO_2 emissions from these sources increased by 2.6 per cent between 1990 and 1998.

Methodologies, activity data and emission factors

44. A tier 1 methodology was used. This source category included emissions from mobile combustion in the agricultural sector. For two sources, which represent the two major gas streams, the carbon content and daily gas composition data were used to calculate the annual emission factor.

Results from previous reviews

45. The S&A report noted that in petroleum refining the CO_2 implied emission factor (IEF) from liquid fuels for 1998 has a higher value (74.82 t/TJ) compared to the IEF for other activities of the energy sector (range: 60.70 to 69.40 t/TJ). This factor is consistently reported as higher than 73 t/TJ for the years 1990 to 1998. No explanation for this was provided.

46. The largest emission factor mentioned in the NIR is 72.9 t/TJ for "other liquids". NZ officials noted that this high value is attributed to the consideration of asphalt and fuel oil in a single category of "other liquids".

[8] Energy Data File, 2000.

47. The S&A report also noted that CO_2 emissions from gaseous fuels used in manufacturing industries and construction excluded carbon stored in final products (methanol, synthetic petrol, ammonia and urea). This appeared to be the reason for lower values of IEF for CO_2 (range: 31.25 - 39.69 t/TJ for the years 1990 to 1998), which are the lowest among the values reported by the other Parties and lower compared to the IEF calculated for energy industries and other activities.

48. In addition, the CO_2 IEF from solid fuels used in 1998 for the same category had a lower value (90.43 t/TJ) compared to the IEF for the years 1990 to 1997 and compared to the IEF for other activities of the energy sector (91.2 t/TJ, also mentioned in the NIR). NZ officials acknowledged the need for additional research on these issues.

4.2. Mobile combustion – CO_2 emissions from road vehicles

49. Road transport emissions contributed 14.2 per cent to national emissions in 1998. Emissions of CO_2 increased by 36 per cent from 1990 to 1998.

Methodologies, activity data and emission factors

50. A tier 1 methodology was used. No breakdown of activity data by sub sector was provided in the CRF, although the relevant information was reported in the NIR. The ERT noted the need for consistent reporting information in both documents.

51. The ERT noted that the same country specific emission factors for diesel and aviation fuels were used, while the IPCC recommends emission factors that differ by 3.5 per cent. In addition, the ERT noted the need to consider updating some emission factors, as in many instances the handbook is based on data from 1986 or earlier.

4.3. Mobile combustion – CO_2 emissions from aircraft

52. Aircraft contributed 1.1 per cent to total national emissions in 1998. CO_2 emissions increased by 7.7 per cent between 1990 and 1998.

Methodologies activity data and emission factors

53. A tier 1 methodology was used. The ERT noted that it is possible with the data available to use a more elaborate approach to include different emissions arising from different LTO stages.

54. Activity data and IEF were not reported in the CRF. Activity data (aviation fuels) were reported as aggregate data (together with fuel oil and LPG) under “other fuels”. However, the NIR provided information on the amount of fuel consumed and the emission factors for 1998.

4.4. Fugitive emissions from oil and gas operations

55. Oil and gas operations contributed 0.8 per cent of the total national emissions in 1998. A tier 1 methodology was used to estimate emissions. The emission estimates did not cover emissions associated with some activities, for example production of crude oil, distribution of oil products, and production and processing of natural gas. Estimations of these sources may be

important, as New Zealand is a producer of oil and natural gas. New Zealand also reports fugitive emissions from geothermal electricity generation in this category.

56. Activity data were not provided in the CRF, but the NIR included this information for 1998. NZ officials informed the ERT that some very small part of geothermal activities might not be covered by official statistics. IPCC default emission factors were used for CH_4 emissions estimates.

Results from previous reviews

57. The S&A report noted that the majority of CO_2 and CH_4 fugitive emissions from oil and natural gas come from flaring and geothermal activities. Activity data and IEF for these categories were not provided in the CRF. However, such information was provided in the NIR for 1998.

4.5. Fugitive emissions from coal mining and handling

58. Coal mining and handling emissions contributed 0.7 per cent to national emissions in 1998. CH_4 emissions increased by 109 per cent between 1990 and 1998, whereas coal production increased by 34 per cent only for the same period. IPCC default emission factors for CH_4 for surface mines were used. Emission factors for underground mines were country specific (Beamish and Vance, 1992), with the exception of post-mining activities where the emission factors are IPCC default.

Results from previous reviews

59. The S&A report noted that the aggregate CH_4 IEF for underground mines subcategory mining activities (24.43 kg/t) has the largest value among the reporting Parties higher than the default maximum value suggested by the IPCC. NZ officials explained that this factor reflects the effect of two types of coal extracted, bituminous with a country specific factor of 35.3 Gg CH_4/Mt and sub-bituminous with 12.1 Gg CH_4/Mt.

5. Non-key sources

60. The methodology for estimating emissions from energy non-key sources was broadly the same as that used for the key sources (tier 1). Activity data were consistent and emission factors were either IPCC default or country specific. Emission factors for N_2O for mobile sources using petrol and diesel in agriculture and in domestic transport were from MfE. All other transport non-CO_2 emission factors were from the Ministry of Transport

61. The S&A report noted that CH_4 IEF from road traffic (gasoline vehicles) was among the highest reported by Parties. In addition the ERT noted that the same country-specific N_2O emission factors for the road transport sector of 3 kg N_2O/TJ were used for both petrol and diesel, while the IPCC recommends a factor of 0.6 kg N_2O/TJ for uncontrolled petrol and diesel. Moreover, the same emission factor for N_2O was used for 1990 to 1998, assuming a fixed modal split between different technologies.

62. Given that there are probably a significant number of gasoline cars with 3-way catalysts in New Zealand, this factor could be much higher (IPCC refer to a value of 43 kg N_2O/TJ for US gasoline cars with 3-way catalysts).

63. Considering that for CO_2 emissions road transport is a key source, a more comprehensive approach for N_2O and CH_4 emission estimates, which depend on the technology mix and the distribution of vehicles into age classes, could lead to more precise emission estimates consistent with the tier 2 IPCC approach. This may also lead to this sector's becoming a key source for non-CO_2 emissions.

6. Areas for further improvements

6.1. Identified by the Party

64. The ERT did not receive specific information on ongoing activities in the energy sector.

6.2. Identified by the ERT

65. NZ may wish to consider implementing tier 2 approaches for CH_4 and N_2O emission estimates, particularly for road transport and aviation.

66. Many of the emission factors used for the energy sector are country specific. NZ may wish to consider updating some of these, for example CO_2 emission factors for diesel and aviation fuels. It should also consider updating some non-CO_2 emission factors for the energy sector, particularly for road transport, that date from 1991 and 1993.

67. In addition, information on energy balances contains some gaps mentioned above, that need to be considered for future work, for example the lack of reporting on coal stock changes.

68. The use of the tier 2 approach and the update of emission factors will help to reduce the uncertainty of estimates of non-CO_2 emissions from energy, which are currently relatively high. More effort is also necessary to move from expert judgement of non-CO_2 uncertainty of emissions to the approaches suggested by the Good Practice Guidance.

69. The S&A report and the ERT identified a number of inconsistencies between the information reported in the CRF and the NIR. Strengthening of the institutional framework of the inventory preparation, and introducing QA/QC procedures, will help to address these inconsistencies. The ERT considered that there was scope for increased coordination between MED and other institutions providing energy-related data.

C. INDUSTRIAL PROCESSES

1. General overview

70. Emissions from industrial processes represented around 4 per cent of total greenhouse gas emissions in 1998. The industrial processes sector has two key sources: (i) CO_2 from iron and steel production (2 per cent of total greenhouse gas emissions) and (ii) CO_2 from aluminium production (1 per cent of total greenhouse gas emissions).

71. There are no verification and QA/QC procedures in place for this sector.

1.1. Completeness

72. All CRF tables were completed for 1990 to 1998. With one exception, potential emissions only were reported in the CRF for HFCs and PFCs for all years. Actual emissions of

PFCs from aluminium manufacture were reported for each year from 1990 to 1998. Actual and potential emissions of SF_6 were reported for 1994 to 1998. Potential emissions only were reported for 1990 to 1993.

1.2. Transparency

73. Mostly, companies provide emissions estimates and little information is reported on the methodologies used to estimate emissions, with the exception of actual emissions of SF_6. NZ officials provided to the ERT the consultants' reports of non-CO_2 emissions from industrial processes.

74. In some cases, companies do not provide information on methods used to estimate emissions for reasons of commercial sensitivity. This hampered the ERT's ability to assess the estimates.

1.3. Use of indicators

75. There is a misuse of notation keys in the CRF in some cells in some tables. For example, industrial sources that are not present in NZ, e.g. by product emissions of HFC 23, are reported as "0". They should be reported as "NO". Additionally, in the background tables the notation "NA" is sometimes used where "NO" is appropriate.

1.4. Uncertainties

76. Uncertainty ranges were estimated by expert judgement. The uncertainty for CO_2 emissions (5 per cent) and uncertainty ranges for the non-CO_2 gases (80 per cent for CH_4, 5 per cent for HFCs, 25 per cent for PFCs and 10 per cent for SF6) are generally consistent with IPCC Guidelines.

1.5. Recalculations

77. All activity data were updated by a new survey for the 2000 submission. Recalculations were reported in table 8b of the CRF but were not quantified in table 8a.

2. Consistency with the IPCC and UNFCCC guidelines

78. The NIR and CRF are mostly consistent with IPCC and UNFCCC guidelines. Nonetheless, little methodological information for the key source categories was provided in the NIR, supporting documentation or to the ERT. This is mainly because estimates of emissions are provided directly by the industrial producers and methodological information had not been requested. This lack of methodological information is inconsistent with IPCC and UNFCCC guidelines.

79. The methodologies for estimating emissions from non-key sources are provided in a consultants report and are consistent with IPCC and UNFCCC guidelines.

3. Comparison with international data

80. Steel production data reported in the CRF and NIR for 1998 are 6 per cent higher than data published in the 1998 UN Industrial Commodity Statistics Yearbook, hereafter referred to as the yearbook. Data on aluminium production agree with those in the yearbook. The CRF estimate for ammonia production is 51 per cent higher than in the yearbook.

4. Key sources

4.1. CO_2 emissions from iron and steel

81. The key source carbon dioxide from iron and steel production contributed 2 per cent to the total greenhouse gas inventory in 1998. There was an overall 9 per cent increase from 1990 to 1998, but emissions have varied year on year.

Methodology, activity data and emission factors

82. The two steel producers provided emissions estimates and activity data to MED. Information on the methodology used to estimate emissions was neither provided in the NIR nor available to the ERT.

83. The steel producers provide activity data annually to MED. There is no verification of the data although the aggregated 1998 activity data differ by 7 per cent from that provided in the yearbook.

84. The IEF in 1998 (2.0 tonne CO_2 per tonne product) is higher than the IPCC default value of 1.6 t/t. No reason is given for this in the NIR, and NZ officials were not able to explain this difference.

Results from previous reviews

85. The S&A report notes that the IEF varied from year to year within a range 1.8064 t/t to 2.0714 t/t for the period 1990 to 1998. NZ officials responded that this was due to variations in the reporting of coal sources in the energy sector but is not clear how this would effect the IEF for iron and steel.

4.2. Carbon dioxide from aluminium production

86. Emissions contributed around 1 per cent to total greenhouse gas emissions in 1998. Emissions were constant from 1990 to 1996 and then decreased by 6.4 in 1997 and increased by 4.9 per cent in 1998. There was an overall 1.7 per cent decrease from 1990 to 1998.

Methodology activity data and emission factors

87. There is one aluminium production plant in NZ. The producer provided activity data and emissions estimates to MED. The NIR does not include information about the methodology used by the producer to estimate emissions. The producer also reports emissions to the Regional Council under a discharge to air permit and using a methodology approved by the Council. The

ERT was provided with a copy of the report but this does not describe the method used to estimate emissions.

88. The emissions estimate reported to the Regional Council for 1998 is 585 Gg whereas the CRF and the NIR report 541 Gg for 1998.

89. Activity data reported in the CRF and NIR were provided by the producer and match other internationally reported data. The IEF in 1998 was 1.7 tonnes CO_2 per tonne product. This is within the range of the IPCC default of 1.5 to 1.8 t/t.

Results from previous reviews

90. The S&A report notes that the IEF was lower in 1997 and 1996 than the reported values for 1990 to 1996. NZ officials explained that this was due to changes in the production process and provided documentary information from the company explaining this change.

5. Non-key sources

91. NZ reported emissions for cement and lime production, ammonia production, ferroalloys production, potential HFC and PFC emissions, actual PFC emissions from aluminium production and actual and potential SF6 emissions. The following non-key sources were reviewed at a summary level.

5.1. PFCs from aluminium production

92. PFC emissions were reported to the Regional Council using a method approved by the Council and the data used for the CRF. The emissions estimation method is not described in the NIR but the company report was provided to the ERT. The method is not described clearly and does not appear to be based on direct measurement or on any other method consistent with IPCC Guidelines.

5.2. SF_6 emissions

93. NZ uses a country specific methodology to estimate actual SF_6 emissions. The method was developed by a consultancy and described in a report provided to the ERT. The method is a country level mass balance approach similar to the Good Practice Guidance tier 3c methodology. The NZ method assumes that actual annual emissions are total sales of SF_6 minus the amount of SF6 purchased and used to charge new switchgear. It is not clear however from the description of the method whether emissions from retiring equipment are included in the estimate.

6. Areas for further improvement

6.1. Identified by Party

94. Although the NIR did not identify any areas for improvement, the ERT noted that NZ provided actual emissions for all fluorinated gases in the 2001 submission.

6.2. Identified by the ERT

95. The main issues identified in this sector relate to transparency and verification. NZ is encouraged to describe or reference the methodology used by companies to estimate emissions, particularly for key sources, and to indicate the level of complexity of the methodology. This will improve transparency and enable review of the methodologies;

96. NZ may also wish to consider implementing verification procedures for key source estimates. For example, activity data provided by steel producers could be totalled where appropriate and checked against national and international statistics;

97. Although not required under IPCC and UNFCCC guidelines applicable at the time of submission, NZ is encouraged to consider implementing QA/QC procedures consistent with Good Practice Guidance for future submissions;

98. Use of notation keys should be checked for consistency with the UNFCCC Guidelines.

C. AGRICULTURE

1. General overview

99. The agriculture sector is the largest contributor to the NZ inventory (55 per cent of the total national emissions in 1998). The agriculture sector includes four key sources: CH_4 enteric fermentation, agricultural soils and animal production, indirect and direct N_2O emissions and no emissions occur from rice production (4C) or savanna burning (4E)

1.1. Activity data

100. Statistics New Zealand collects data on livestock numbers, types, ages and sex as well as information on areas of crops and horticulture. These statistics are annual survey/census data collected through questionnaires undertaken on 30 June. Data on age and sex are not used to estimate emissions in the inventory.

101. Due to lack of funding, the agricultural census was not undertaken in 1997 and 1998. New Zealand Meat and Wool Economic Services provided the data used to compile the Inventory for these years.

102. MfE converts the 30 June activity data to calendar years by adding half of the current and half of the previous year's animal or crop numbers. MfE then converts the calendar year data into 3-year averages to calculate emissions in accordance with the IPCC guidelines.

103. Data on nitrogen fertiliser is supplied to MAF by the fertiliser importers. Estimates of crop production are based on regional experts' estimates of average yields. These estimates are then used to estimate total production using the area data collected by Statistics New Zealand.

1.2. Verification and QA/QC approaches

104. Comprehensive verification procedures are undertaken on the agricultural statistics provided by Statistics New Zealand. These include some micro-edit checks at the farm level

(inter-period, stocking rate, relation checks), and macro-edit checks using the aggregated data at the regional and national level (land area reconciliation by region, livestock reconciliation with data such as slaughter numbers, breeding rates and export statistics). If anomalies in the aggregate numbers are found, numbers may be adjusted. There is no verification procedure for N fertiliser or crop production estimates.

105. MfE checks activity data for anomalies (for example, significant change compared with previous years) and will seek clarification from MAF if problems are identified. No other quality control processes are in place.

1.3. Completeness

106. All emission sources for sheep, dairy and non-dairy cattle and goats are reported. In addition, all emissions from deer are estimated and reported under 'Other" in the CRF tables. These livestock categories represent the most significant animal populations and hence emissions in New Zealand.

107. For the minor livestock categories, emissions from pigs and poultry have not been reported for all source categories and gases as required in the IPCC guidelines, and no emissions are estimated for horses, llama/alpacas, mules and asses.

108. For the estimated source categories, emission estimates are available for all years 1990 - 1998. The NIR and CRF explain that the reason for the 'not estimated' categories is a lack of country-specific emission factors; however, IPCC default emission factors are available for most. The NIR does not describe plans to fill these gaps. During the review the NZ officials have indicated that they will investigate the possibility of using IPCC defaults where available. Emission reporting in the CRF was complete. All sources not estimated are noted appropriately in the CRF sectors tables and in table 9. Buffalo are reported as NE but should be reported as NO if there are no buffalo.

1.4. Transparency

109. The NIR includes information on methodologies and emission factors used in inventory calculations. Although the NIR provides references for the source of the emission factors, some of the assumptions used in developing the emission factors, particularly for enteric fermentation, are not fully transparent.

110. Because tier 1 methodologies have been used, additional information was not supplied in CRF Tables 4A and 4B. However, provision of data on average milk production, feed digestibility and liveweight that exist in New Zealand would assist in comparison with other countries' inventory submissions.

1.5. Recalculations

111. Emissions from enteric fermentation and CH_4 manure management were recalculated for 1995, 1996 and 1997 because of the use of preliminary animal numbers used to estimate the 1997 and 1996 inventories. The 1995 recalculation of CH_4 manure management does not show up in CRF table 8 because the difference is less than 0.01 per cent.

112. In estimating emissions of N_2O from manure management and agricultural soil, data on poultry previously included data only on layers. Data for broilers are included in the inventory for all years 1990-1998. This resulted in significantly higher emissions, e.g. manure management emissions for 1997 are now about 0.41 Gg compared to a previous value of 0.13 Gg.

2. Consistency with IPCC and UNFCCC guidelines

113. The methodologies used to estimate emissions are consistent with the requirement of IPCC Guidelines. Emissions of CH_4 and N_2O are estimated for all significant source categories using tier 1 methodologies with a mix of IPCC default and country-specific emission factors. The CRF Tables and NIR are largely consistent with the UNFCCC reporting guidelines. All CRF tables are reported appropriately. However, a better explanation of the assumption underlying the development of NZ-specific emission factors is needed in the NIR.

3. Key sources

3.1. Enteric fermentation

114. Enteric methane emissions contributed 39 per cent of the total national emissions in 1998. Enteric emissions have declined by 5.8 per cent between 1990 and 1998. This is due to the reduction in sheep (18 per cent) and non-dairy numbers (1 per cent). Dairy cattle (27 per cent) and deer (49 per cent) have increased significantly.

Methodology and emission factors

115. Emissions were estimated using a tier 1 approach with NZ-specific emission factors.

116. The emission factors were developed based on work undertaken by Ulyatt et al. (1991). Ulyatt et al. used a tier 2 approach to estimate total emissions from animals in 1990. NZ-specific data regarding the chemical composition of pastures and animal intakes were used as input for the Baldwin et al (1987) rumen digestion model which was used to estimate methane emissions. The Baldwin model was selected because it had been originally developed for sheep, and Ulyatt had been involved in the model's development.

117. The emission factors used by NZ were calculated by dividing the total CH_4 emissions estimated by Ulyatt with the number of animals at June 30 1990. However, Ulyatt included lambs/calves that were slaughtered during the year in the emission estimate and these animals are not included in the 30 June data. This process results in the NZ IEF (Sheep = 15.1 kg/hd/year) being the highest value across all Parties.

118. The process of converting the Ulyatt emission data to the emission factors is not clearly explained in the NIR. The NIR text provides an explanation of the Ulyatt work but does not indicate that the implied emission factors for 1990 are used for all subsequent years.

119. While using the same emission factor for 1990 to 1998 may give a reasonable emissions estimate if there are no changes in productivity or the flock/herd age structure, NZ officials indicated that these characteristics had changed significantly in some cases (for example milk fat content increased by 14 per cent between 1990 and 1998). This causes uncertainty in emissions

to increase over time. The change of productivity may effect the enteric CH_4 emission change amplitude.

120. The NIR report compared the NZ emission factor with some data from SF_6[9] field studies; however, these emission factors are not comparable because of the influence of slaughtered juveniles in the inventory emission factors. It is notable that the field study emission factor for sheep (7.4kg/hd/yr) is very similar to the IPCC default of 8/kg/hd/yr. NZ officials indicated that they would continue to use the current emission factors until new data from the SF_6 studies are published and assessed.

Uncertainty

121. Estimated uncertainty of 20 per cent for enteric methane is in line with the Good Practice Guidance estimate. Given that a fixed emission factor is used, however, the uncertainty may be higher in 1998 than 1990.

Response to previous reviews

122. The S&A report noted that the IEF for CH_4 from enteric fermentation was high. The country response indicated that the implied emission factors are high because the NZ EF takes into account part of the year when adults are accompanied by young which are not captured in the annual statistics (see discussion above).

123. The S&A report notes that CH_4 emissions from pigs, llamas, mules and asses are not estimated. The NZ officials have indicated that they will rectify this gap in future.

Areas for further improvement

Identified by the Party

124. NZ is currently funding work with the SF_6 technology to develop a new methodology for estimating CH_4 from enteric fermentation. These studies will be used to develop a multiple regression model relating CH_4 to body weight, milk production, feed digestibility and other feed characteristics. This work will be published shortly. This work is important due to the significance of this source to NZ emissions as well as having potential to improve the IPCC methodology, particularly for sheep.

125. Once the research is published, NZ officials will undertake a cost/benefit analysis to determine whether they will implement the new model and whether it would be used as a tier 2 or tier 1 approach.

Identified by the ERT

126. To improve transparency, the NIR should clearly explain how the EF was calculated based on the Ulyatt report, noting that the EF is not comparable with the IPCC defaults.

[9] SF_6 is used as a trace gas to test the methane emissions from the enteric fermentation from animal grazing under field conditions.

127. If the completion of the new model is significantly delayed, then the host country should consider revising the Ulyatt et al. study to update the fixed EF for the next submission. In the interim, the uncertainty estimate could be revised.

128. As this is a key source, it is recommended that all efforts, recognizing national circumstances, be made to implement a tier 2 approach for sheep, dairy and non-dairy cattle in line with Good Practice Guidance.

129. Missing source categories should be included where IPCC defaults are available.

130. NZ may consider including data such as average milk production, liveweight and feed digestibility in tables 4A and 4B of CRF to allow comparisons between countries.

3.2. Agricultural soils

131. Nitrous oxide emissions from agricultural soils contributed 15 per cent of the total national emissions in 1998. Nitrous oxide emissions from soils have increased by 1.2 per cent from 1990-1998. Emissions from grazing animals contributed 51 per cent of agricultural soil N_2O emissions in 1998. Other key source subcategories include direct soil emissions associated with the application of nitrogen and the indirect emissions associated with atmospheric deposition and leaching.

Methodologies and emission factors

132. Emissions are estimated using the IPCC tier 1 methodologies with a mixture of NZ and IPCC default emission factors. The methodology is described in sufficient detail in the NIR.

Animal production

133. Country-specific emission factors, N excretion rates and manure management systems are used. The emission factors and other parameters are given in the NIR tables. IPCC defaults are used to estimate emissions from pig and poultry.

134. The emission factor for animal excreta (0.01 kg N_2O-N/kg N) is lower than the IPCC default (0.02 kg N_2O-N/kg N). The NZ EF is based on soil cover technique studies in various regions of NZ under different fertility conditions (Carran et al. 1995, Muller et al. 1995 and Clough et al. 1996).

Other

135. The leaching emission factor was based on two NZ studies (Ledgard et al. 1996, Heng et al. 1991) which indicated that nitrogen leaching does not generally exceed 15 per cent of total N input. The IPCC default is currently 30 per cent.

Uncertainty

136. No estimate of uncertainty was given.

Results from previous reviews

137. The S&A report notes that there are annual fluctuations of ±10 per cent in the area of N-fixing crops. NZ officials explained that this was because these are secondary crops and production by farmers is sensitive to price signals.

Areas for further improvement

Identified by the Party

138. NZ has funded research into N_2O from agricultural soils. In the short term the work is focusing on development of emission factors for animal production emissions. Preliminary results suggest significant variation between different soil types with emission factors ranging from less than 0.5 per cent to more than 2.5 per cent of N applied.

139. The long-term objective is to develop a process-based model for estimating all agricultural soil N_2O emissions on a regional and seasonal basis. Further funding is required to complete the work.

Identified by the ERT

140. The ERT would encourage further work in this area. This is very valuable research due to the importance of this source for NZ; additionally this data would assist in improving the IPCC methodology.

141. The ERT would suggest that the recent N_2O research be used to develop an uncertainty range for the current default emission factor for animal production.

4. Non-key sources

142. Non-key sources include CH_4 and N_2O from manure management (4B) and residue burning (4F). The sources are estimated using tier 1 IPCC methodologies with a mixture of country-specific and default emission factors and other parameters.

143. Methane emissions from manure management declined by 5 per cent from 1990-1998 while N_2O emissions increased by 27 per cent over the same period. This occurred because the decline in sheep numbers reduced the CH_4 emissions while the increase in dairy and poultry reduced the N_2O emissions.

4.1. CH_4 emission factors for manure management

144. There is a significant difference between the NZ EF and the IPCC default. The NZ EF is based on Joblin and Waghorn (1994) who estimated potential CH_4 emissions from sheep manure of 1.7 ml CH_4 per gram dry weight. This was then used to estimate the EF for sheep and cattle. The sheep EF is a similar order of magnitude to the IPCC default (0.178 vs. 0.19 – 0.28 kg/hd/yr); it is, however, significantly different for cattle where there is an order of magnitude difference (dairy 0.889 vs. ~30 kg/hd/yr and non-dairy 0.909 vs. ~6kg/hd/yr). It is not possible to explain differences in the emissions factor for cattle manure. The selection of the emission factor for cattle may affect whether CH_4 manure management becomes a key source. Host country officials have agreed to investigate further.

145. The estimated uncertainty is -50 to -90 per cent. The NIR indicated that CH_4 emissions from manure management were very likely overestimated because the maximum potential methane yield is used. The ERT notes that due to possible problems with the cattle EF the methodology may actually be underestimating emissions.

4.2. Areas for further improvement

Identified by the ERT

146. There is a possible underestimation of CH_4 manure management emission for cattle. It is suggested that the cattle EF be reviewed.

147. CH_4 manure management emissions are not calculated from pigs. Treatment of pig manure is usually in anaerobic lagoons, which can produce significant quantities of CH_4. It is suggested that the IPCC default methodology be used.

D. LAND-USE CHANGE AND FORESTRY (LUCF)

1. General overview

148. LUCF is an important sector for the NZ inventory that constitutes a net sink, offsetting almost 28 per cent of total GHG emissions in 1998. Changes in forest and other woody biomass stocks constituted a large sink of CO_2 (29 per cent), whereas forest and grassland conversion was a source of CO_2 and non-CO_2 emissions equivalent to 1 per cent of the GHG emissions in 1998.

1.1. Verification and QA/QC approaches

149. Arrangements are in place to control the quality of the initial data and flow modelling process used to estimate emissions and removals in the LUCF sector. These included independent internal review and cross checking of activity data and calculation results. Model verification included backward calculations and subsequent comparison with actual harvesting results provided by forest owners.

1.2. Completeness

150. Estimates of GHG emissions and removals were provided for 1990 to 1998. The CRF sectoral table 5 provided an overall report on the LUCF sector, including changes in forest and other woody biomass stocks (Category A) and forest and grassland conversion (Category B). Sectoral background tables 5.A and 5.B were not completed due to the use of country-specific methodology that does not exactly fit these tables. Abandonment of managed lands (Category C) and CO_2 emissions and removals from soil (Category D) are not reported due to lack of data. Data on GHG emissions and sinks were incorporated in country-specific reporting worksheets attached to the NIR.

151. Emissions of CO_2 from liming were not included in the reporting on CO_2 emissions and removals from soils, because of its intermediate position in the IPCC Guidelines. Being an agricultural practice, it is reported under LUCF. The national experts informed the ERT that in 1996, liming with $CaCO_3$ caused a release of 132 Gg of CO_2.

1.3. Transparency

152. The NIR described the country-specific methodology and reporting worksheets used to compile estimates for GHG emissions and sinks for land-use change and forestry.

1.4. Recalculations

153. Emissions and removals for changes in forest and other woody biomass stocks and forest and grassland conversion were recalculated for 1990 to 1997 to include new data on changes in forest plantations. For the base year they resulted in minor changes in forest and other woody biomass stocks (by 0.5 per cent) and significant increases in forest and grassland conversion (by 39 per cent). The reasons for recalculation were documented in appropriate CRF tables and were clearly explained by the national experts.

1.5. Uncertainties

154. The general sensitivity analysis suggests that the overall uncertainty of carbon estimates could be ±25 per cent. The accuracy of activity data seems rather high (±5 per cent). The model provides more uncertain results of CO_2 emissions and removal estimates (±16 per cent). The ERT noted efforts of national experts to improve the accuracy of initial data and modelling results that are consistent with the Good Practice Guidance elaborated for other sectors.

2. Consistency with IPCC and UNFCCC guidelines

155. The NZ methodology for LUCF is country specific. In line with the IPCC Guidelines, NZ developed a mathematical model to account for CO_2 emissions and sinks, reflecting national circumstances. The IPCC tier 1 method was applied to report on national greenhouse gas emissions from forest and grassland conversion.

156. Inventory reporting in the CRF and NIR is consistent with UNFCCC reporting guidelines. The ERT noted however that descriptions in the NIR are insufficiently detailed to allow a full understanding of the method to estimate GHG emissions and removals in the LUCF sector.

157. Use of indicators differs in some cases from the provisions of UNFCCC reporting guidelines. Instead "NE", value "0" is provided for emissions that were not estimated.

3. Key sources

3.1. Changes in forests and other woody biomass

158. Changes in forests and other woody biomass offset 29 per cent of total GHG emissions in 1998. The estimates cover carbon stock changes in planted forests only. Planted production forests constitute 6 per cent of NZ land use. They are mainly composed from introduced Radiata pine and Douglas fir (90.5 and 5.0 per cent of total plantation area respectively). Native forests (24 per cent of the country land use) are not included in the calculation of sinks. However, harvesting in natural forest was included in the overall estimate of emissions.

159. Total CO_2 removals for the years 1990 and 1998 have changed insignificantly (2.4 per cent). However, the values display higher variations in mid-term, driven by annual

changes in areas of forest planting and harvesting due to actual practices performed by forest owners.

Methodology and activity data[10]

160. A set of three mathematical models (STANDPAK, C_Change, and FOLPI) have been developed and applied to account for CO_2 emissions and sinks in the LUCF sector. STANDPAK was designed for estimating growth rate and stock increase in a forest stand. The information on this model was not provided in the NIR, and national experts provided additional information during the in-country visit review. C_Change uses results of the previous model (STANDPAK) to estimate above- and below ground carbon biomass and the amount of carbon stored in the forest floor. The FOLPI model provides projections on forest biomass for harvesting purposes.

161. Model estimates include emissions of carbon from stemwood harvesting and non-stemwood decay onsite in a long-term perspective. The release of carbon from harvesting in natural and planted forests is calculated together. Stemwood removed at harvest from both natural and planted forests is assumed to become CO_2 emissions in the year of harvest. The latter is consistent with IPCC methodology.

162. The main source of activity data was the MAF National Exotic Forest Description (NEFD) survey. Areas of forest plantations and national yield tables form input data for model calculations of CO_2 sequestration. CO_2 emissions were calculated based on information from NEFD and the wood processing industry included harvesting records from both planted and natural forests.

Conversion and emission factors

163. Country-specific factors were used to convert stemwood volume to an oven-dry biomass weight and to obtain the total estimates accounting for age, spacing and site fertility on bark, branches, foliage, cones, stumps, roots, floor litter, and understorey species. The factors were based on actual measurements described in detail by Beets et al. (1999). Total biomass was converted to carbon with the use of the IPCC default conversion factor. The estimates assumed that Radiata pine makes up 100 per cent of the planted forests. The expansion factor (2.04) applied to account for CO_2 emissions for harvesting in natural forests was higher than the IPCC default value (1.75). National experts did not explain the choice of the factor.

3.2. Forest and grassland conversion

164. Forest and grassland conversion was about 1 per cent of total GHG emissions in 1998. The annual fluctuations of -55 to +56 per cent were found for the period from 1990 to 1998. The fluctuations are driven by year-by-year changes in the areas of scrub clearing and subsequent planting in response to a range of future market and non-market signals.

[10] The NIR did not include a detailed explanation of activity data collection and emission factor development. This was provided to the ERT.

Methodology and activity data

165. NZ used the IPCC tier 1 approach for LUCF. Due to limited data on forest and grassland conversion, only emissions from land clearing for new forest planting were reported. The emissions of non-CO_2 gases are reported for land clearing, prescribed burning of scrublands, and forest fires. With regard to the IPCC default method, carbon released from burning is assumed to be absorbed during the re-growth.

166. Annual reports from forest owners to MAF constitute the main source of activity data. The Rural Fire Authority and Fire Commission provide the data on forest wildfires.

Conversion and emission factors

167. It was assumed that 25 per cent of scrub biomass was burnt on-site and the remainder left to decay following the use of dessicant sprays. The NIR did not include clear evidence on what emission factors were applied for the portion of biomass left to decay. IPCC default emission factors were used to account for non-CO_2 emissions due to wildfires and prescribed burning.

Response to previous reviews

168. The S&A report identified annual fluctuations of -55 to +56 per cent for forest and grassland conversion. National experts explained that the fluctuations observed are the function of annual variations in areas of scrub clearing and subsequent planting.

4. Areas for further improvement

4.1. Identified by the Party

169. New Zealand has established the carbon monitoring system (CMS) to obtain an accurate account of changes in carbon stocks in soil and natural forests and report on the abandonment of managed lands and CO_2 emissions and removals from soil. This was to address the need to account for CO_2 emissions and removals in currently lacking category sources and in response to the first country in-depth review.

170. Three government departments (MfE, MAF, and the Department of Conservation) have overseen the development of the CMS by two Crown-owned research institutes (New Zealand Forest Research Limited and New Zealand Landcare Research Limited). The project has been under development for four years including a substantial international peer review. When implemented it will combine traditional forest inventory and soil survey methods, process model assessments, and advanced remote sensing methods and GIS systems. The CMS output is expected to provide data on present soil carbon reserves enabling their calculation back to 1990.

171. The ERT noted international peer-review of CMS activities as a good example of a verification approach consistent with Good Practice Guidance as elaborated for other sectors.

4.2. Identified by the ERT

172. The ERT encourages NZ to provide an explanation of the model used for accounting CO_2 emissions in the NIR, to increase the transparency of reporting.

173. Transparency would be improved by including more explanation in relation to country-specific emission/conversion factors used to account for CO_2 emissions due to changes in woody biomass and forest and grassland conversion. This would allow for more accurate estimation of GHG emissions and sinks in the LUCF sector. The ERT encourages NZ to improve the quality of national emission/conversion factors.

174. The ERT recommends New Zealand to include in its national GHG inventory estimates accounting for abandonment of managed lands and CO_2 emissions and removals from soils source categories, including emissions from liming.

175. The ERT encourages NZ to continue and accelerate the work on CMS so that CO_2 emissions and removals for abandonment of managed lands and CO_2 emissions and removals from soils source categories could be accounted for and reported.

E. WASTE

1. General overview

176. Emissions from the waste sector represented around 4 per cent of total greenhouse gas emissions in 1998. Methane emissions, the major greenhouse gas from this sector, have reduced by 23 per cent from 1990 to 1998. The waste sector has one key source: methane emissions from solid waste disposal sites (SWDS), which represents 3 per cent of the NZ inventory total.

1.1. Verification and QA/QC approaches

177. Consultants (SCS Wetherill Environmental and Bruce Wallace Partners, 1998) provided estimates of emissions from SWDS and wastewater treatment. The report was peer reviewed by independent NZ experts. There are no other verification procedures in place for this sector.

1.2. Completeness

178. All CRF tables were completed. Estimates were reported for methane emissions from SWDS (Category 6A) and wastewater handling (6B). Emissions from waste incineration were reported as NE because this is considered to be a negligible activity in NZ.

179. Incineration of waste is negligible in NZ and emissions have not been estimated. They are entered correctly as NE. It is assumed that no waste is disposed of in unmanaged sites and this should be entered as NO, not NE.

1.3. Transparency

180. The methodologies and assumptions for estimating emissions were summarized in the NIR and the detailed report was referenced in the NIR. Background tables were completed in the CRF.

1.4. Uncertainties

181. Uncertainties are estimated for methane emissions from landfill and wastewater treatment using expert judgement and are consistent with IPCC Guidelines.

1.5. Recalculations

182. Methane emissions from SWDS were recalculated for the years 1990 to 1997 and entered in table 8 of the CRF. The NIR references the report that provided the recalculated estimates.

2. Consistency with the IPCC and UNFCCC guidelines

183. The estimation of the key source in this category, methane emissions from SWDS, was consistent with the default methodology in the IPCC Guidelines and largely consistent with the tier 1 methodology in Good Practice Guidance. The reporting of emissions from this source in the CRF and in the NIR was consistent with UNFCCC guidelines. Some minor issues and suggested improvements are noted below.

3. Key sources

3.1. Methane emissions from solid waste disposal (SWDS)

184. Emissions decreased by 14 per cent between 1990 and 1998 due to increased landfill gas collection.

Methodology

185. NZ used the IPCC default tier1 methodology with country-specific assumptions to estimate methane emissions from SWDS. The NIR provided a summary of the methodology, described in detail in a consultants' report provided to the ERT during the review.

186. The methodology diverged from the IPCC Guidelines in two areas: (i) the fraction of degradable organic carbon dissimilated (DOC_f) is reduced from 0.77 to 0.5 and (ii) the methane oxidation factor is increased from 0 to 0.1. Both these modifications are consistent with Good Practice Guidance.

Activity data

187. Data on MSW generation, waste composition and the percentage of MSW disposed to SWDS were obtained from the NZ Government's National Waste Data report and national waste surveys for the period 1993 to 1995. Consequently the methane emissions estimates are based on actual data to 1995 and projected waste disposal data from 1996 onwards. The waste data was updated in 2000 and will be reflected in subsequent inventory estimates.

188. Projected activity data assumes that the per capita generation of MSW remains at the 1995 level due to the uncertainty with projected recycling rates and waste to energy issues. Consequently total waste generation from 1995 to 1998 increases in line with projected population increase.

189. The proportion of waste entering each type of SWDS was obtained from the 1995 National Landfill Census. It was assumed, based on expert judgement, that 90 per cent of MSW is disposed of in managed SWDS and 10 per cent goes to uncategorized sites.

190. NZ officials confirmed that sewage sludge disposed to SWDS is included in the estimate of methane emissions.

Emission factors

191. The DOC of the NZ waste entering SWDS was calculated based on waste composition estimates from the NZ surveys – including the proportion of wood in the construction and demolition stream - and by applying IPCC default values for each fraction of the waste stream.

192. An average methane recovery rate of 60 per cent was assumed for NZ landfills with gas collection systems. The ERT was informed that this is at the lower end of the range assumed by USEPA. No default values are provided by IPCC Guidelines for methane recovery efficiency.

193. Methane emissions were calculated as total methane generated, less methane oxidized and methane recovered. The IEF is 0.04 t methane per tonne MSW disposed in SWDS, which is at the extreme low end of the range of other Parties' IEFs.

Results from previous reviews

194. The draft S and A report identified the CH4 IEF (0.04 t/t) as low. NZ authorities responded that the IEF was not different to comparable countries such as Australia (0.05 t/t) and Norway (0.12 t/t). The ERT reviewed the IEF and found that the methodology used by NZ is consistent with IPCC Guidelines and the assumptions in the calculations are consistent with IPCC default values. The per capita methane emissions (31.4 kg) are within the range of other Annex I Parties. The ERT concluded that the NZ IEF is consistent with the IPCC default methodology.

4. Non-key sources

195. Wastewater treatment and waste incineration were reviewed at a summary level.

196. Estimated methane and nitrous oxide emissions from industrial and domestic and commercial wastewater treatment were provided in the CRF. A summary of the methodology and assumptions used to estimate emissions and the calculation tables for 1998 emissions were provided in the NIR. Details of the methodology and assumptions were provided in the same report that estimates methane emissions from landfill. The methodology to estimate methane emissions is consistent with IPCC default methodology. Country-specific emissions assumptions and emission factors were used.

197. A key assumption is that there is no leakage of methane from anaerobic treatment plants. This assumption is based on expert judgement but is not supported by independent data such as measurement.

198. Nitrous oxide emissions from industrial and domestic wastewater treatment have been estimated using country-specific data and emission factors. Emissions from domestic waste are derived from measurement of the nitrogen content in raw sewage.

Waste incineration

199. Waste incineration is assumed to be negligible in NZ and emissions are entered as NE in the CRF. There are no MSW incinerators in NZ although there is likely to be some waste incineration at, for example at hospitals. This is likely to a very small emissions source.

5. Areas for further improvement

5.1. Identified by the Party

200. The ERT did not receive specific information on ongoing activities in the energy sector.

5.2. Identified by the ERT

201. NZ is encouraged to explore the application of Good Practice Guidance tier 2 (first order decay) methodology for methane emissions from SWDS;

202. If NZ chooses to apply IPCC tier 2 methodology, it should compare the resulting emissions estimates and IEF with those obtained by the default methodology. This will help to determine whether the apparently low – but appropriate – IEF for methane from SWDS is realistic or a consequence of the default methodology;

203. NZ is encouraged to obtain actual methane recovery data where available, such as from energy recovery schemes, to help verify landfill gas collection efficiency assumptions;

204. Use of notation keys should be checked for consistency with the UNFCCC Guidelines;

205. The NIR should clarify that sewage sludge emissions are included in the estimate for SWDS;

206. Although not required under IPCC and UNFCCC Guidelines applicable at the time of submission, NZ is encouraged to consider implementing QA/QC procedures consistent with Good Practice Guidance for future submissions.

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