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**Report of the individual review of the greenhouse gas inventories of  
New Zealand submitted in 2007 and 2008\***

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\* In the symbol for this document, 2008 refers to the year in which the inventory was submitted, and not to the year of publication.

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## I. Overview

### A. Introduction

1. This report covers the centralized review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of New Zealand, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. In accordance with the conclusions of the twenty-seventh session of the Subsidiary Body for Implementation, the focus of the review is on the most recent 2008 submission. The review took place from 15 to 20 September 2008 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. William Kojo Agyemang Bonsu (Ghana) and Mr. Vlad Trusca (Romania); energy – Ms. Branca Americano (Brazil), Mr. Frank Neitzert (Canada) and Mr. Matej Gasperic (Slovenia); industrial processes – Mr. Jos Olivier (Netherlands) and Mr. Teemu Oinonen (Finland); agriculture – Ms. Penny Reyenga (Australia) and Mr. Washington Zhakata (Zimbabwe); land use, land-use change and forestry (LULUCF) – Mr. Zhang Xiaoquan (China) and Mr. Aleksi Lehtonen (Finland); and waste – Ms. Kyoko Miwa (Japan) and Mr. Eduardo Calvo (Peru). Ms. Americano and Ms. Reyenga were the lead reviewers. The review was coordinated by Mr. Tomoyuki Aizawa and Mr. Matthew Dudley (UNFCCC secretariat).

2. In accordance with the “Guidelines for review under Article 8 of the Kyoto Protocol” (decision 22/CMP.1), a draft version of this report was communicated to the Government of New Zealand, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

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

3. The 2008 inventory was submitted on 14 April 2008; it contains a complete set of common reporting format (CRF) tables for the period 1990–2006 and a national inventory report (NIR). This is in line with decision 15/CMP.1. The Party indicated that the 2008 submission is also its voluntary submission under the Kyoto Protocol<sup>1</sup>. In its 2007 submission, New Zealand included a complete set of CRF tables for the period 1990–2005 and an NIR. Both the CRF table and the NIR were submitted on 4 May 2007. The expert review team (ERT) encourages New Zealand to continue to submit its next inventory by 15 April 2009 as required by decision 15/CMP.1. Where needed the ERT also used the 2006 submission, additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

### C. Emission profiles and trends

4. In 2006 (as reported in the 2008 annual inventory submission), the main GHG in New Zealand was carbon dioxide (CO<sub>2</sub>), accounting for 46.7 per cent of total GHG emissions<sup>2</sup> expressed in CO<sub>2</sub> eq, followed by methane (CH<sub>4</sub>) (35.3 per cent), and nitrous oxide (N<sub>2</sub>O) (17.1 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) collectively accounted for 0.9 per cent of the overall GHG emissions in the country. The agriculture sector accounted for 48.4 per cent of the total GHG emissions, followed by energy (43.8 per cent), industrial processes (5.4 per cent), waste (2.4 per cent), and solvent and other product use (0.1 per cent). Total GHG emissions amounted to 77,868.09 Gg CO<sub>2</sub> eq and increased by 25.7 per cent between the base year<sup>3</sup> and 2006. In 2005 (as reported in the annual 2007 inventory submission), total GHG emissions amounted to 77,159.08 Gg CO<sub>2</sub> eq. The shares of gases and sectors in 2006 (2008 annual inventory submission) were similar to those of

<sup>1</sup> Parties may start reporting information under Article 7, paragraph 1, of the Kyoto Protocol from the year following the submission of the initial report, on a voluntary basis (decision 15/CMP.1).

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

<sup>3</sup> Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

2005 (2007 inventory submission). The predominant GHGs emitted by New Zealand have changed since 1990. Whereas CH<sub>4</sub> and CO<sub>2</sub> contributed equally to New Zealand's emissions in 1990, CO<sub>2</sub> is now the major GHG in New Zealand's emissions profile. Growing emissions of CO<sub>2</sub> reflected the increased growth in emissions from the energy sector compared with CH<sub>4</sub> emissions from the agriculture sector.

5. Tables 1 and 2 show GHG emissions by gas and by sector, respectively.

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

6. New Zealand has reported a tier 1 key category analysis, both level and trend assessment, as part of its 2008 submission. The key category analysis performed by the Party and that performed by the secretariat<sup>4</sup> produced similar results. New Zealand has included the LULUCF sector in its key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). Land converted to forest land was identified as a key category in the 2007 submission but not in the 2008 submission. As New Zealand has reported uncertainty estimates for all sources, the ERT recommends that the Party explore the development of a tier 2 key category analysis.

#### **E. Main findings**

7. The inventory has been prepared generally in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT identified possible instances of both underestimations and overestimations of emissions (see paras. 36, 71, 72 and 88). The 2008 inventory submission is of a high quality and shows significant improvement in the major issues such as quality control and quality assurance (QA/QC) (in particular, the development of a risk register for the GHG inventory) and institutional arrangements compared with the 2007 submission. The 2008 submission covers all sectors and most categories and gases, and addresses many of the recommendations of previous reviews.

#### **F. Cross-cutting issues**

##### **1. Completeness**

8. New Zealand's inventory is generally complete in terms of years, sectors, source/sink categories, gases and geographic coverage. However, some minor categories such as grassland remaining grassland were reported as not estimated ("NE"). The ERT encourages New Zealand to estimate these emissions in its future submissions.

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<sup>4</sup> The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

**Table 1. Greenhouse gas emissions by gas, 1990–2006**

GHG emissions	Gg CO <sub>2</sub> eq								Change base year–2006 (%)
	Base year <sup>a</sup>	1990	1995	2000	2003	2004	2005	2006	
CO <sub>2</sub>	25 382.22	25 382.22	27 166.81	31 048.48	34 861.36	34 079.38	35 969.78	36 387.95	43.4
CH <sub>4</sub>	25 485.61	25 485.61	25 743.08	27 158.01	27 222.07	27 112.36	27 296.55	27 499.32	7.9
N <sub>2</sub> O	10 426.01	10 426.01	11 237.38	12 141.32	13 151.47	13 214.23	13 348.93	13 283.73	27.4
HFCs	NA, NO	NA, NO	148.33	297.47	631.75	431.02	662.19	592.95	NA
PFCs	641.68	641.68	150.51	58.02	101.90	84.83	59.15	90.89	–85.8
SF <sub>6</sub>	12.33	12.33	15.01	8.39	15.27	19.72	17.06	13.24	7.4

*Abbreviations:* NA = not applicable; NO = not occurring.

<sup>a</sup> Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account for the purpose of calculating the assigned amount.

**Table 2. Greenhouse gas emissions by sector, 1990–2006**

Sectors	Gg CO <sub>2</sub> eq								Change base year–2006 (%)
	Base year <sup>a</sup>	1990	1995	2000	2003	2004	2005	2006	
Energy	23 499.13	23 499.13	24 998.51	28 934.77	32 491.78	31 704.88	33 581.97	34 069.29	45.0
Industrial processes	3 402.67	3 402.67	3 386.65	3 643.31	4 280.08	4 042.43	4 245.70	4 233.07	24.4
Solvent and other product use	41.54	41.54	44.95	47.12	52.39	48.36	44.33	40.30	–3.0
Agriculture	32 498.86	32 498.86	33 745.35	35 959.14	37 136.18	37 186.07	37 579.15	37 667.62	15.9
LULUCF	NA	–20 507.69	–15 924.87	–19 974.27	–20 619.55	–24 230.34	–23 681.95	–22 749.26	NA
Waste	2 505.65	2 505.65	2 285.67	2 127.34	2 023.40	1 959.78	1 902.52	1 857.81	–25.9
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF)</b>	NA	41 440.17	48 536.26	50 737.41	55 364.27	50 711.19	53 671.72	55 118.83	NA
<b>Total (without LULUCF)</b>	61 947.86	61 947.86	64 461.13	70 711.69	75 983.82	74 941.52	77 353.67	77 868.09	25.7

*Abbreviations:* LULUCF = land use, land-use change and forestry; NA = not applicable.

<sup>a</sup> Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account for the purpose of calculating the assigned amount.

## 2. Transparency

9. The NIR provides much of the information on methods and data used necessary for assessing the inventory, but a number of areas were identified where transparency could be improved. However, New Zealand was able to provide supplementary information requested by the ERT during the review that largely addressed the concerns of the ERT as the transparency of the inventory. The ERT found that the NIR for the 2008 submission contained more detailed information on the choice of methodology, activity data (AD) and emissions factors (EFs) compared with the 2007 submission. However, the ERT recommends that New Zealand include additional information in the NIR, such as that provided for the ERT, in order to facilitate the reviews.

## 3. Recalculations and time-series consistency

10. The ERT noted that recalculations have been undertaken for the entire time series (1990 to 2005) to take into account improvements in methodologies, AD (including the use of annual data instead of three-year average data), and EFs. The change from three-year average data to single year data in the 2008 submission led to the recalculation of the whole time series for the agriculture and LULUCF sectors. The other major recalculation was due to the use of year-specific calorific values to convert tonnes (t) of fuel to petajoules (PJ) of fuel instead of constant calorific values. The Party provides the rationale for these recalculations in both the NIR and CRF table. The recalculations led to an overall increase in the base-year (1990) emissions of 0.1 per cent (47.7 Gg CO<sub>2</sub> eq) and an increase of 0.3 per cent (194.6 Gg CO<sub>2</sub> eq) for 2005 emissions. The ERT recommends that the Party provide more information in its NIR of the future annual submission on how recalculations affect the time series for categories and a justification of how recalculations have improved the accuracy of emission estimates, time-series consistency and completeness of the inventory.

## 4. Uncertainties

11. New Zealand reported a tier 1 uncertainty analysis that was prepared in accordance with the IPCC good practice guidance and reported these estimates in accordance with the UNFCCC reporting guidelines. New Zealand provided information on uncertainties in the NIR in accordance with the UNFCCC reporting guidelines. There were not many changes in the uncertainty estimates compared with those in the previous year's submission except that the 2008 submission included uncertainty estimates for waste incineration. However, the overall impact of this on the national uncertainty level for the 2008 submission compared with 2007 is negligible. New Zealand uses uncertainty estimates in establishing priority improvement plans for subsequent years' submissions. The ERT recommends that New Zealand use the tier 2 key category analysis to prioritize areas for improvement.

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

12. New Zealand's QA/QC is of a high standard, with the national inventory compiler serving as the QA/QC coordinator. The QA/QC plan is updated annually in conjunction with the annual improvement plan. The Party's QA/AC plan is in accordance with the IPCC good practice guidance. The Ministry for the Environment conducts tier 1 QC checks based on the procedures suggested in the IPCC good practice guidance for all key categories.

13. During the initial review, the ERT recommended that New Zealand intensify the time and resources directed at implementing the QA/QC plan, with the aim of reducing the number of minor errors and inconsistencies in its inventory. New Zealand responded to the recommendation by changing the inventory compilation schedule to allow more time for quality checking. For the 2008 submission, New Zealand set an earlier deadline of January 2008 for entering all sector-level data into the CRF Reporter. The earlier deadline allowed two months for further quality checking at the sector level

(between data spreadsheets and the CRF tables) and for checking consistency between the CRF tables and the NIR. As a result of this action, corrections were made to any errors that were found.

14. New Zealand contracted the accounting firm KPMG for three months to complete quality checks on key categories for the 2006 inventory year and to develop data quality objectives to further advance the implementation of New Zealand's QA/QC plan. KPMG checked that the calculations and assumptions used in the key spreadsheets and models were consistently applied, that data from the spreadsheets and models were accurately transferred to the CRF Reporter and that data from the CRF tables were accurately represented in the NIR. Based on this work, KPMG has developed a risk register for the New Zealand inventory.

15. During the review the ERT questioned whether and how the risk register developed by KPMG compliments the setting of national priorities for the inventory improvement plan using traditional tools such as the key category analysis, uncertainty management and recommendations from previous ERTs. Having assessed the risk register, which was provided by the Party, the ERT found it to be very useful as it classifies categories and subcategories in terms of risk in their transparency, consistency, comparability, completeness and accuracy. In addition, it provides a description of the risk, undertakes an assessment of the implication, likelihood and severity of the risk, provides the total risk score that indicates the level of urgency in addressing the issue and, above all, provides a mitigation and/or recommendation for action. The ERT recommends that New Zealand use the risk register, in addition to the key category uncertainty estimates and other recommendations from previous reviews, in developing its inventory improvement plan for 2009. The ERT further recommends that the KPMG risk register be integrated into the QA/QC plan. The ERT encourages the inventory staff and/or institutions to continue to use and update the KPMG risk register in order to identify future potential risks on a continual basis.

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

16. New Zealand has addressed most of the recommendations of the previous review. One of the major improvements that has taken place since the 2006 submission is the development of a comprehensive QA/QC plan. Following the availability of improved AD and methodologies, and revisions of EFs in the energy sector, New Zealand has also undertaken recalculations for the time series for the agriculture and LULUCF sectors and some parts of sectors other than energy, agriculture and LULUCF.

17. The ERT concluded that New Zealand has not implemented all of the recommendations from the previous review, such as:

- (a) Collecting data on the carbon content and heating value of imported coals and, if necessary, updating the CO<sub>2</sub> EF to reflect this;
- (b) Revising the allocation of emissions from fuels that are typically used in mobile combustion.

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

#### 1. Identified by the Party

18. The 2008 NIR identified several areas for improvement, some of which are in response to previous reviews, in particular the initial review. New Zealand indicated that it is working to reduce the uncertainty of CH<sub>4</sub> emissions, provide estimates of N<sub>2</sub>O emissions from pastoral soils, improve analysis of land converted to forest land and forest land remaining forest land, and provide estimates of carbon stock change in dead organic matter resulting from post-harvest residues. Furthermore, New Zealand plans to investigate the use of historic AD for crop land, land converted to grassland and grassland remaining grassland, and of EFs for N<sub>2</sub>O from soils.



## 2. Identified by the expert review team

19. The ERT identifies the following cross-cutting issues for improvement:
- (a) Reporting improvements made to the national system as part of the supplementary information under Article 7, paragraph 1, of the Kyoto Protocol, as required by 15/CMP.1;
  - (b) Improving the QA/QC plan by integrating the risk register that has been developed into New Zealand's planned improvement processes;
  - (c) Developing a tier 2 key category analysis;
  - (d) Improving the transparency of the inventory by providing in the NIR improved documentation on methods used and rationale for the selection of country-specific EFs;
  - (e) Providing information on how and where CO<sub>2</sub> associated with feedstock and other non-energy use of fuels was accounted for.
20. Recommended improvements relating to specific source/sink categories are presented in the relevant sector chapters of this report.

## II. Energy

### A. Sector overview

21. The energy sector is the second largest contributor to GHG emissions in New Zealand. In 2006, emissions from the energy sector (34,069.29 Gg CO<sub>2</sub> eq) constituted 43.8 per cent of the total GHG emissions. It is the fastest growing sector and emissions in 2006 were 45.0 per cent above the 1990 level. The key driver for this rise is the increase in CO<sub>2</sub> emissions from road transportation and public electricity and heat production.

22. The ERT concluded that methodological approaches, AD and EFs used to estimate emissions for the energy sector are presented in the NIR in a transparent manner (though there are some exceptions, which are described in paras. 24, 25, 31, 32, 34, 35, 36 and 38). Tier 1 methods are used for all categories. AD are compiled by the Ministry of Economic Development (MED), which is responsible for estimating emissions from the energy sector, based on its own database and on data compiled by Statistics New Zealand. The AD used for emission estimates, together with other energy statistics, are regularly published in the New Zealand Energy Data File, which is available on the MED website.<sup>5</sup> Country-specific EFs are used for CO<sub>2</sub> emissions, while mostly IPCC tier 1 or tier 2 EFs are used for non-CO<sub>2</sub> emissions. The NIR includes the complete set of EFs and the energy balance.

23. In its 2007 submission the time series was recalculated following the introduction of revised fuel combustion EFs as well as corrections to AD. In the 2008 submission the time series was recalculated as year-specific calorific values were introduced. The impact of the 2008 recalculation was a 78.38 Gg decrease in the 1990 emissions and an increase of 100.32 Gg for 2005 emissions.

24. Three external reviews of the energy sector have been undertaken, focusing on emission estimates (Clarkson, 2002), EFs (Hale and Twomey, 2003) and the overall sectoral inventory (Goldthorpe, 2006). The ERT commends New Zealand for its initiatives to improve estimates. However, the ERT found that there is a lack of transparency in the procedures for the use of plant-specific data (EFs, AD and emission estimates), particularly for fugitive emissions from oil and natural gas. The ERT recommends that data produced externally be subject to procedures, including

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<sup>5</sup> <[http://www.med.govt.nz/templates/MultipageDocumentTOC\\_28205.aspx](http://www.med.govt.nz/templates/MultipageDocumentTOC_28205.aspx)>.

QA/QC procedures, in accordance with the IPCC good practice guidance. The ERT notes that additional documentation and explanatory background material could be incorporated into the CRF tables and NIR.

25. In the 2008 submission, New Zealand only allocates AD and emissions to iron and steel. The emissions in the subcategories pulp, paper and print, and food processing, beverages and tobacco are reported as not occurring (“NO”) despite the fact that the energy balance attached to the NIR (Annex II) clearly indicates that there is consumption of fuels in these categories. The ERT strongly encourages New Zealand to improve transparency in the reporting of manufacturing industries and construction, and disaggregate energy consumption in this category into corresponding subcategories. In order to improve transparency, the ERT recommends that New Zealand consult with Statistics New Zealand in order to ensure the proper aggregation of detailed data from the statistical office into the subcategories required in the CRF tables.

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

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

26. In 2006, the CO<sub>2</sub> emissions estimated using the sectoral approach were 1.1 per cent higher than those estimated using the reference approach. By type of fuel, the differences are –4.0 per cent for liquid fuels, 2.5 per cent for solid fuels and 2.3 per cent for gaseous fuels. However, the differences in energy consumption are larger and all positive: 6.0 per cent for liquid fuels, 27.4 per cent for solid fuels and 5.0 per cent for gaseous fuels.

27. Differences in gaseous fuels are due to the natural gas EF that is based on a weighted average of the EF for all gas streams where the weightings are the amount of gas produced at each field. The EF for Maui and Kapuni treated gas are based on gas composition data provided yearly by the Natural Gas Corporation. According to the explanation provided in the documentation box of CRF table 1.A(c), most of the other gas EFs are from NZEIH; however, the NIR and CRF tables contain neither an explanation of this abbreviation nor the associated reference. The ERT recommends that New Zealand update the references and provide an appropriate explanation for the abbreviation used in the NIR in its future submissions.

28. The ERT found that no explanation is provided for discrepancies in CO<sub>2</sub> emissions for solid fuels or for why the difference for liquid fuel is negative. The ERT recommends that New Zealand provide a general explanation of the differences for solid, liquid and gaseous fuels and in particular address the issue of negative differences in future submissions. In addition, there is no explanation of the differences in energy consumption between the sectoral and reference approaches, which are not similar to those of CO<sub>2</sub> emissions. Furthermore, the ERT recommends that the Party make an effort to reconcile the methods used in estimating AD.

### **2. International bunker fuels**

29. The NIR reports that the allocation of fuel consumption between domestic and international air transport is based on refuelling at the domestic and international terminals of New Zealand airports. Currently there is no basis for splitting the domestic and international components of fuels used for international flights with a domestic segment; however, the number of international flights with a domestic segment is considered to be negligible. During the in-country review, New Zealand began consultations with the airlines to clarify this situation and assess the order of magnitude of the AD. New Zealand recognizes the weaknesses in the sectoral splits and distinction between domestic and international fuels and informed the ERT that a cross-governmental group has been established to focus on international bunker issues, including the improvement of both marine and aviation fuel data. New Zealand provided the ERT with information on its efforts to overcome this issue and the ERT encourages the Party to continue with these efforts and to report them in future submissions.

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

30. The non-energy use of bitumen, the use of natural gas as feedstock for methanol production and the amount of carbon contained in the coal used in iron and steel production are taken into account in the reference approach. The IPCC default value is used for the fraction of carbon stored in bitumen, and for confidentiality reasons only the total amount of carbon stored for the production of methanol is reported.

31. The previous review noted that the carbon mass balance approach, which takes into account the amount of carbon contained in the fuel that is input to each manufacturing plant and the amount of carbon stored in the final products, is used for sub-category “chemicals” under manufacturing industries and construction. Emissions from both the energy and the industrial processes sectors are aggregated in the resulting estimates. CO<sub>2</sub> emissions from methanol production are reported under the energy sector while CO<sub>2</sub> emissions associated with other chemical products (ammonia, urea, etc.) are reported under the industrial processes sector. The ERT recommends that New Zealand improve the transparency by providing in the NIR a carbon flow cycle (e.g. carbon mass balance for natural gas (from the well to the end consumer) and associated products) and by clearly indicating where and how CO<sub>2</sub> is accounted for in the CRF tables in order to avoid double counting or the possible underestimation of emissions from fuel combustion.

### 4. Country-specific issues

32. New Zealand reports fugitive emissions of CO<sub>2</sub> and CH<sub>4</sub> from geothermal plant operations. No methodology is provided in the 2008 submission, but in New Zealand’s initial review report (IRR), it was concluded that the geothermal emission estimates submitted in 2006 could be considered as conservative. In the 2008 submission, New Zealand reports that CO<sub>2</sub> fugitive emissions from geothermal energy amounted to 305.68 Gg in 2006, on the basis of 79,302.87 TJ of available energy. It also reports that in 2005, 262.19 Gg of CO<sub>2</sub> were emitted on the basis of virtually the same amount (79,485.88 TJ) of geothermal energy. Estimated CH<sub>4</sub> emissions for 2006 and 2005 show similar ratios based on the same AD. There is therefore a large, unexpected difference in emission estimates for the two years. New Zealand acknowledged this issue and indicated that it will revise both fugitive emissions and heat from geothermal energy and will also include additional information in future submissions in order to improve both the accuracy and completeness of its inventory. The ERT looks forward to receiving this information and recommends that New Zealand improve transparency by providing a description of the geothermal emission estimation methodology in the NIR.

## C. Key categories

### 1. Stationary combustion: liquid fuels – CO<sub>2</sub>

33. As identified during the previous review, New Zealand’s worksheets used for estimation of stationary combustion includes emissions from fuels that are typically used in mobile combustion, such as gasoline, jet kerosene and aviation gasoline. Although the amounts of these fuels used under stationary combustion categories are relatively small, the ERT reiterates the recommendation from the previous review and requests that New Zealand review this allocation, reallocate these data into appropriate mobile combustion categories, if necessary, and perform the corresponding recalculations.

### 2. Stationary combustion: solid fuels – CO<sub>2</sub>

34. The NIR states that emissions from coal combustion are calculated using the EF for sub-bituminous coal of 91.2 kt CO<sub>2</sub>/PJ (Baines, 1993). However, according to the accompanying Excel spreadsheet, the carbon content of coal is changing. The lowest carbon content used is in agriculture/forestry/fishery (24.75 t C/TJ) and the highest is in residential (25.55 t C/TJ). The weighted average coal carbon content is 24.92 t C/TJ, corresponding to a CO<sub>2</sub> EF of 91.38 t CO<sub>2</sub>/TJ, which is higher than the EF referenced in the NIR. During the previous review, the ERT recommended that

New Zealand collect data on the carbon content and heating value of imported coals and, if necessary, update the CO<sub>2</sub> EF to reflect this situation. The ERT reiterates the recommendation from the previous review and requests that New Zealand address the discrepancy between the emission estimates and the methods described in the NIR and, in order to improve transparency, provide appropriate background information on carbon content of coal used in different sectors.

### 3. Stationary combustion: gaseous fuels – CO<sub>2</sub>

35. In response to the recommendation made during the previous review, New Zealand estimates average annual CO<sub>2</sub> EFs based on production data for the Maui and Kapuni gas fields. The NIR indicates that excess CO<sub>2</sub> is removed from Kapuni gas and separate EFs are used for treated (53.1 t CO<sub>2</sub>/TJ) and untreated (84.1 t CO<sub>2</sub>/TJ) Kapuni gas. However, the NIR provides no information on where the CO<sub>2</sub> released during treatment is allocated and accounted for (e.g. there are no CO<sub>2</sub> emissions reported under 1.B.2.a.ii oil production). In order to improve transparency and to avoid possible missing estimates or double counting, the ERT recommends that the Party provide full carbon flow from Maui and Kapuni gas fields through mixing stations and crude methanol production to treated natural gas available to the end consumers and carbon stored as feedstock in future NIRs, along with the appropriate corresponding AD.

36. In the NIR, when comparing the reference and sectoral approaches, New Zealand notes that non-energy use is not included in the sectoral approach. The ERT encourages New Zealand to investigate whether emissions from gaseous fuels in other (manufacturing industries and construction) are overestimated. The ERT found that AD in this subsector include all non-energy use because the energy balance in 2006 allocates only 28.43 PJ of gaseous fuels (CRF 44.29 TJ) to industrial processes. During the review, the Party was not able to provide an appropriate explanation for the above-mentioned discrepancy or to explain whether other (manufacturing industries and construction) includes only the AD for non-energy use of non-treated Kapuni gas (EF 84.1t CO<sub>2</sub>/TJ) and not the corresponding GHG emissions. In order to avoid the possible underestimation or overestimation of GHG emissions, the ERT would recommend New Zealand to improve transparency of emission estimates and address this issue in future submissions by providing a carbon flow of natural gas produced, stored as feedstock and used for combustion.

### 4. Road transportation – CO<sub>2</sub>

37. CO<sub>2</sub> from road transportation is an important key category not only in terms of level assessment, but also in terms of trend assessment. However, the ERT noted that a tier 1 approach is needed to estimate emissions and that the Party has used this approach. A tier 1 approach is used. AD on fuel consumed are extracted from the Delivery of Petroleum Fuels by Industry Survey, conducted by Statistics New Zealand, and from the Energy Data File of the MED. Country-specific and IPCC default EFs (IPCC, 2000) are used.

### 5. Fugitive emissions: oil and natural gas – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

38. Fugitive emissions from oil exploration and production are reported as “NE” in the CRF. However, New Zealand statistics show production of crude oil in 2006 (38.9 PJ from energy balance, given in Annex 2, p. 157 of the NIR). The Party indicated that the information provided in flaring (gas) (e.g. 262.48 Gg CO<sub>2</sub> in 1990) includes both fugitive emissions (venting and flaring) for both oil and gas production, and stated its intention to place at least the venting and flaring estimate under a “combined” category. To improve transparency, New Zealand is strongly encouraged to provide further disaggregation of oil and gas estimates and a description in its methodology of how each source is estimated in future submissions. As indicated in New Zealand’s IRR, when emissions are estimated elsewhere, the notation key included elsewhere (“IE”) should be used, not the notation key “NE”.

39. Fugitive emissions from natural gas are only reported for distribution and flaring. Fugitive transmission estimates are confidential and are included in the distribution estimate. It appears to the ERT that a considerable amount of data exists for New Zealand's natural gas system, which involves production, processing, transmission and distribution. It is good practice to estimate emissions separately for each of these elements of a natural gas system. In the IRR, New Zealand was encouraged to disaggregate transmission and distribution, to assess QA/QC procedures used by the data providers and to include a brief explanation of transmission emissions; it appears that this has not been completed for the 2008 submission. New Zealand is strongly encouraged again to provide further disaggregation of natural gas estimates, estimates for categories reported as "NE" and a description in its methodology of how each source is estimated.

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

##### **1. Railways and navigation: liquid fuels – CO<sub>2</sub>**

40. These two categories exhibit large inter-annual changes in CO<sub>2</sub> emissions during the period 1990–2004. During the in-country visit, New Zealand informed the ERT that these estimates will be reviewed, and, if appropriate, recalculated. The ERT welcomes this intention and encourages New Zealand to revise these estimates or explain the trends.

##### **2. Road transportation: liquid fuels – CH<sub>4</sub>**

41. Following the initial review, New Zealand revised the CH<sub>4</sub> emissions from gasoline and diesel oil in line with the recommendations of the previous ERT and submitted the revised estimates. The revised EFs used to estimate the annual emissions in the period 1990–2002 are those suggested by Hale and Twomey (2003): 19.5 kg/TJ for gasoline and 4 kg/TJ for diesel oil. These values, which have already been used to estimate emissions in 2003 and 2004, correspond to the midpoint of the tier 2 EFs reported for United States vehicles (uncontrolled) in the Revised 1996 IPCC Guidelines. For gasoline, the selected CH<sub>4</sub> EF is 2.5 per cent lower than the tier 1 IPCC default value and for diesel oil the selected CH<sub>4</sub> EF is 20 per cent lower than the tier 1 IPCC default value.

42. CH<sub>4</sub> emissions from road transportation have been identified as a key category by trend. After the initial review, New Zealand informed the ERT that in the future it will attempt to use country-specific EFs for liquid fuels. The ERT encourages New Zealand to implement a higher tier approach to estimate these emissions, in accordance with the IPCC good practice guidance.

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

#### **A. Sector overview**

43. In 2006, the industrial processes sector accounted for 4,233.07 Gg CO<sub>2</sub> eq, or 5.4 per cent, of total GHG emissions, and the solvent and other product use sector accounted for 40.30 Gg CO<sub>2</sub> eq, or 0.1 per cent of total GHG emissions. CO<sub>2</sub> emissions accounted for 83.1 per cent of GHG emissions from the industrial processes sector. Emissions from the industrial processes sector increased by 24.4 per cent between 1990 and 2006 while emissions from the solvent and other product use sector decreased by 3.0 per cent. The key drivers for the rise in emissions are HFC consumption and increased CO<sub>2</sub> emissions from steel production (23.6 per cent since 1990), which are partly compensated by an 87.1 per cent decrease in PFCs from aluminium production. Within the industrial processes sector, 38.3 per cent of GHG emissions were from iron and steel production, followed by 13.1 per cent CO<sub>2</sub> from emissions from cement production, 12.9 per cent CO<sub>2</sub> emissions from aluminium production, and 12.4 per cent from refrigeration and air conditioning equipment. All solvent and other product use emissions come from N<sub>2</sub>O.

44. The description in the NIR of the methods and country-specific EFs used is sufficient to determine consistency with the IPCC good practice guidance. However, the ERT recommends that New Zealand further improve the transparency of the NIR, particularly for key categories. For the 2008 submission, no category-specific QA/QC procedures were in place for verifying plant-specific information. The ERT recommends that the Party implement source-specific QA/QC activities for the largest key categories.

45. For several industrial processes categories, the NIR also provides information on the EFs for precursor gases, which decreases the transparency for GHGs. The ERT encourages New Zealand to move the information on emissions of indirect GHGs (e.g. CO, NO<sub>x</sub>, non-methane volatile organic compounds (NMVOC)) and SO<sub>2</sub> to an annex of its NIR.

46. In the 2007 submission, some recalculations were made, the most significant of which was for CO<sub>2</sub> emissions from mineral products, which decreased in 2004 by 4.95 Gg CO<sub>2</sub> eq (0.8 per cent). In the 2008 submission, several recalculations were made, the most significant of which were in 2005: HFCs from consumption of halocarbons and SF<sub>6</sub> (-79.37 Gg CO<sub>2</sub> eq, 10.7 per cent); CO<sub>2</sub> from cement production (+44.03 Gg, 6.3 per cent); CO<sub>2</sub> from metal production (-29.29 Gg, 1.3 per cent); and PFCs from aluminium production (-21.55 Gg, 26.7 per cent). The ERT recommends that in the future New Zealand provide more information on how recalculations affect the time series of categories and a justification of how they improve the accuracy of the emissions, time-series consistency or completeness.

47. The ERT observed apparent discrepancies between the figures and trends reported in CRF table 1.A(d) for CO<sub>2</sub> emissions in chemicals and cement production that could not be explained. The ERT also observed that detailed information on CO<sub>2</sub> associated with feedstocks and other non-energy use of fuels, including CO<sub>2</sub> capture from flue gases and subsequent CO<sub>2</sub> storage (e.g. in urea), is lacking in the NIR. To enable assessment of possible unreported or double-counted emissions, the ERT recommends that New Zealand provide this information by listing the feedstocks and non-energy use of fuels and indicate how and where associated CO<sub>2</sub> emissions have been accounted for in the inventory. Moreover, the ERT also recommends that the Party provide consistent supplementary information on the corresponding sectoral part of the NIR in the CRF feedstock table 1A(d) and its documentation box.

48. An uncertainty analysis has been performed using tier 1 methods. However, the uncertainties in the AD often seem improbably small (e.g. 0 per cent in many cases) and the description of uncertainty estimates for CO<sub>2</sub> is missing (only the result of uncertainty in CO<sub>2</sub> is provided). The ERT recommends that New Zealand reassess the uncertainty estimates for the AD and provide a more detailed and comprehensive description of the uncertainty estimates used for each category.

## **B. Key categories**

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

49. New Zealand is commended for the detailed description of this category that has been provided within the limitations posed by the confidentiality of the AD. The information provided during the review showed that there were no anomalies in the implied emission factor (IEF) or the cement kiln dust (CKD) correction factors used. The ERT recommends that the Party further improve transparency by including in the NIR the tier of the method used to calculate emissions for each year, information on the selected CKD correction factor values and its trends, a description of the QC performed by the plants/inventory agency on reported data as well as the conclusion of the QC performed during the Party's review of the EF.

### **2. Ammonia production – CO<sub>2</sub>**

50. New Zealand provides a clear description of the methodology used and the inter-annual variation of the IEF. However, the ERT was not able to clarify the relation between the ammonia emissions

reported here and the emissions from the methanol production reported in the energy sector with the amount of natural gas reported as stored in the CRF feedstock table 1.A.(d). The ERT recommends that New Zealand improve in particular the section in the NIR on emissions and storage of the feedstocks and other non-energy use of fuels as discussed in the energy sector of this report and explain or resolve the apparent discrepancies observed during the review.

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

51. The NIR provides a description of the tier 2 method used but provides little information about the years in which the mass balance method is used, which fluxes are included and the years in which another method was used. The ERT recommends that the Party further improve the description of the category in the NIR, including the rationale for the selection of the EFs and carbon contents, and provide information on which flux elements are included in the mass balance calculation and where and how the resulting emissions are reported in the CRF.

### 4. Aluminium production – CO<sub>2</sub>

52. Recalculations have been made for the CO<sub>2</sub> emissions time series using a more detailed methodology that improves the accuracy of the emissions and uses a mix of estimated and plant-specific data. However, it is unclear from the NIR to what extent, and for which years, EFs and carbon contents are based on measured plant-specific data or on estimated values. The ERT notes that the International Aluminium Institute and the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) defaults applied are not developed specifically for New Zealand and their use as country-specific factors needs to be justified. The ERT recommends that the Party improve transparency by providing in the NIR a more detailed description of methods, including the formulas used to calculate the emissions, and the rationale for the selection of the EFs and carbon contents.

### 5. Aluminium production – PFCs

53. The large inter-annual variations in the IEFs are not explained in the NIR. However, during the review the ERT received detailed information from the smelter explaining in detail the causes of these variations. The ERT recommends that New Zealand provide this information in the NIR, in particular how the EFs for the early 1990s were determined and which tiers were used for which years, in future submissions. Recalculations have been made for the PFC emissions time series using EFs and methods that, according to the NIR, are based on WBCSD/WRI documents, but which are in fact the updated slope values from the recognized international scientific literature. Apparent inconsistencies between the change in the slope values and the changes in resulting emissions could not be resolved during the review and the ERT recommends that New Zealand further check that calculations were performed correctly.

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

54. For most subcategories, product life factors and other IEFs are not reported in the CRF, and the NIR only provides a reference to another report. The ERT recommends that New Zealand provide more information in the NIR on the EFs and leakage rates used, particularly for the largest sources (e.g. commercial refrigeration and mobile air conditioning) in future submissions.

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

### Solvent and other product use – CO<sub>2</sub>

55. CO<sub>2</sub> emissions from NMVOCs are reported as not applicable (“NA”). The ERT recommends that New Zealand change the notation keys for CO<sub>2</sub> to “NE” and review the notation keys for N<sub>2</sub>O from solvent and other product use.

## IV. Agriculture

### A. Sector overview

56. In 2006, the agriculture sector accounted for 37,667.62 Gg CO<sub>2</sub> eq, or 48.4 per cent, of total GHG emissions. Emissions from the sector increased by 15.9 per cent between 1990 and 2006. The key drivers for the rise in emissions were a 10.5 per cent increase in CH<sub>4</sub> emissions from enteric fermentation and a 26.8 per cent increase in N<sub>2</sub>O emissions from the agricultural soils category. Within the sector, 64.0 per cent of emissions were from enteric fermentation, followed by 33.8 per cent from agricultural soils (N<sub>2</sub>O), 2.1 per cent from manure management and 0.04 per cent from other minor sources.

57. The submission for the agriculture sector is largely complete and covers all major sources. Minor livestock categories, such as buffalo, camels and llamas are not estimated. New Zealand estimates that these animals accounted for only 0.04 per cent of all livestock in the country. Rice cultivation does not occur in New Zealand.

58. New Zealand has mainly used IPCC tier 2 approaches and country-specific EFs. The NIR and the CRF tables are transparent and complete. The Party has implemented tier 2 QC checks and QA activities for some categories in addition to the tier 1 QC checks. The Party has also stated that it is undertaking research to develop country-specific EFs for manure management and N<sub>2</sub>O from soils. As New Zealand uses many country-specific values, the ERT encourages the Party to include comparisons with the IPCC defaults and IEFs of other Parties in the category-specific QA/QC sections of the NIR along with an explanation of any significant differences.

59. In the 2007 submission, minor recalculations were made to correct transcription and precision errors in the AD. In the 2008 submission, the time series was recalculated as New Zealand has moved from reporting emissions as a three-year average to reporting annual estimates. Comparing the 2008 submission with the 2007 submission, the impact of these recalculations was a 1.77 Gg CO<sub>2</sub> eq increase in the 1990 emissions and an increase of 133.86 Gg CO<sub>2</sub> eq for 2005 emissions.

60. New Zealand has conducted a single livestock population characterization of feed intakes for dairy cattle, beef cattle, sheep and deer, which were used for estimating CH<sub>4</sub> emissions from enteric fermentation, CH<sub>4</sub> and N<sub>2</sub>O emissions from manure management and N<sub>2</sub>O emissions from pasture, range and paddock manure. This is in line with the IPCC good practice guidance.

### B. Key categories

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

61. New Zealand uses a tier 2 method and country-specific EFs for the estimation of CH<sub>4</sub> emissions from manure management from cattle, sheep and deer. The Party has indicated that it has recently completed measurement of CH<sub>4</sub> emissions from anaerobic lagoons. New Zealand is encouraged to use these data to develop country-specific EFs in order to further improve its inventory. The ERT believes that estimated emissions from this category are of a good quality.

#### 2. Pasture, range and paddock manure – N<sub>2</sub>O

62. New Zealand estimates N<sub>2</sub>O emissions from animal excreta deposited on pastures using a country-specific EF (EF<sub>PRP</sub>) of 0.01 kg N<sub>2</sub>O-N/kg N based on measurements, while the IPCC default value is 0.02 kg N<sub>2</sub>O-N/kg N. The NIR clarifies that an EF of 0.01 kg N<sub>2</sub>O-N/kg N is a proper value and that measurements continued until they dropped down to background emission levels. The chosen value is adequately addressed in the NIR and therefore the approach for emissions estimation is justified.



### 3. Indirect emissions – N<sub>2</sub>O

63. In the estimation of N<sub>2</sub>O from leaching and runoff, New Zealand has used a country-specific parameter for  $\text{Frac}_{\text{LEACH}}$  of 0.07, which is much lower than the IPCC default value. The Party calculated this figure using the OVERSEER model and a recalculation has been performed for the whole time series. The rationale for this change is adequately documented in a peer-reviewed article by Thomas et al. (2005) and therefore the use of this parameter is justified.

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

##### Field burning of agricultural residues – CH<sub>4</sub> and N<sub>2</sub>O

64. The emissions from the burning of agricultural residues vary between years depending on climatic conditions. Overall emissions from this category have declined as it is assumed that 50 per cent of stubble was burnt in the years 1990–2003, decreasing to 30 per cent for 2004–2006. These values were based on the expert judgment of officials from the Ministry of Agriculture and Forestry who were working with the arable production sector. New Zealand has indicated that the 2007 agricultural census (results are due mid-2008) will provide updated data. The ERT encourages the Party to review the current allocations as part of its QA processes once the new data are available.

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

### **A. Sector overview**

65. In 2006, the LULUCF sector in New Zealand represented a net sink of 22,749.26 Gg CO<sub>2</sub> eq, offsetting 29.2 per cent of total GHG emissions. GHG net removals by sinks in the LULUCF sector increased by 10.9 per cent from 1990 to 2006. The key driver for this rise in removals is the increase in net removals from forest land remaining forest land due to expanded plantations.

66. Within the LULUCF sector, 25,843.52 CO<sub>2</sub> eq of net removals were from forest land remaining forest land and 2,132.74 Gg CO<sub>2</sub> eq of net emissions were from land converted to forest land. Other land-use categories accounted for a small portion of the total removals/emissions in the LULUCF sector.

67. The CRF for 2006 includes estimates of CO<sub>2</sub> emissions/removals for all categories except for grassland remaining grassland, wetland remaining wetland and settlements remaining settlements. The ERT encourages New Zealand to improve the completeness of the inventory by reporting on these land-use categories in future submissions.

68. In the 2007 submission, 2003–2004 estimates were recalculated owing to a revision of the AD. In the 2008 submission the time series was recalculated owing to changes in the AD (annual data replaced the three-year average data and updated data was provided by the National Exotic Forest Description (NEFD)). Comparing the 2008 submission with the 2007 submission, the impact of the recalculations was a 1,527.09 Gg increase in net removals in 1990 and a decrease of 818.86 Gg for net removals in 2005.

69. Carbon stock changes were estimated for living biomass under all reported categories, and for dead organic matter and mineral soils under part of some reported categories. A tier 2 modelling approach using country-specific data has been used to estimate removals and emissions in planted forests (excluding soils). A tier 1 method was used for other categories.

70. The IPCC approach 1 was applied to represent land areas based on Land Cover Database (LCDB) in 1997 and 2002 and extrapolated to the remaining years of the inventory period, except for forest land, which was based on the NEFD for forest conversion and planted forest. However, attributing a conversion period of 1–5 years for converted lands is inconsistent with the IPCC good practice guidance for LULUCF, which defines the land-use conversion period as 20 years (default) or longer.

New Zealand's current attribution of this conversion period tends to overestimate removals/sources for the land remaining categories and underestimate those for land conversion categories. The ERT acknowledges that the Party is developing the Land Use and Carbon Analysis System (LUCAS), which will replace LCDB data in the inventory from the 2010 submission onwards. The ERT recommends that the Party use a minimum of 20 years as the conversion period in order to distinguish the subcategories in its LUCAS.

71. According to the NEFD, more than 10,000 ha of forest area (plantation) have been lost annually for other land uses since 2005, which is much larger than the area reported for forest conversion in CRF tables 5B–5F. The ERT recommends that New Zealand review its land area data and emission estimates, particularly for forest conversion as emissions may be being underestimated. In response to the draft report New Zealand has indicated that these changes in forest areas will be accounted for in the 2009 submission.

72. When calculating carbon stock changes in mineral soils from land-use conversion to forest land, cropland, grassland and other land, New Zealand includes lagged emissions/removals of soil carbon from conversion post-1990 using a constant rate of soil emissions/removals for the 20 years following conversion, but excludes lagged emissions/removals from conversion pre-1990, which leads to an underestimation of the soil carbon stock changes. This also results in significant IEF variation from year to year. The ERT recommends that the Party review the method for estimating carbon stock changes in soils in its future submissions.

73. Uncertainty has been assessed for all of the land-use categories that have been reported. Tier 1 QA/QC procedures for forest land, cropland and grassland have been implemented. The ERT recommends that New Zealand prepare and implement QA/QC procedures for all reported land-use categories in its future submissions.

## **B. Key categories**

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

74. A tier 1 method has been applied for natural forests by assuming zero carbon stock change and accounting for the loss of carbon in living biomass due to harvesting of natural forest. For plantations, a tier 2 method (the forestry-oriented linear programming interpreter (FOLPI) model) was used to estimate carbon stock change in living biomass and dead organic matter, but carbon stock changes in mineral soils were not estimated and the IEF of dead organic matter was rather high compared with other Annex I Parties. The ERT recommends that New Zealand collect data, estimate the changes in carbon stock in mineral soils of plantations and reconsider the parameter of dead organic matter in its future submissions, in particular in its LUCAS.

### **2. Land converted to forest land – CO<sub>2</sub>**

75. A tier 2 method was used to estimate carbon loss in living biomass and mineral soil for low-producing grassland converted to forest land. Carbon stock changes for other land uses converted to forest land, input as "IE" in table 5.A of the CRF, were incorrectly reported in forest land remaining forest land according to the Party's clarification during the review. The ERT recommends that New Zealand report carbon stock changes in correct categories in future submissions.

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

76. The carbon stock changes in living biomass of perennial vegetation were estimated using the tier 1 method and default parameters from the IPCC good practice guidance for LULUCF. However, only carbon gain was accounted for, which leads to an overestimation of CO<sub>2</sub> removals. Carbon stock changes in dead organic matter and soils were not estimated. The ERT recommends that New Zealand

use country-specific parameters, include carbon loss from perennial crops, and estimate carbon stock changes in soils, particularly in cultivated organic soils, in future submissions.

### C. Non-key categories

#### 1. Land converted to cropland, land converted to wetland, land converted to settlements and land converted to other land – CO<sub>2</sub>

77. The tier 1 method and country-specific parameters from the IPCC good practice guidance for LULUCF were largely used for estimating carbon stock changes in living biomass and mineral soils. Carbon stock changes in dead organic matter were not estimated. The ERT encourages New Zealand to collect data and estimate the carbon stock changes in dead organic matter (especially for forest conversions) in its future submissions.

#### 2. N<sub>2</sub>O emissions associated with land-use conversion to cropland – N<sub>2</sub>O

78. Emissions are estimated using the tier 1 method and default EFs from the IPCC good practice guidance for LULUCF. As New Zealand uses a country-specific EF for agricultural soils, the ERT recommends that the Party use this EF to estimate N<sub>2</sub>O associated with land-use conversion to cropland.

## VI. Waste

### A. Sector overview

79. In 2006, the waste sector accounted for 1,857.81 Gg CO<sub>2</sub> eq, and 2.4 per cent of total GHG emissions. Emissions from the sector decreased by 25.9 per cent between 1990 and 2006. The key driver for the fall in emissions is the reduction in emissions from solid waste disposal on land, due to flaring and recovery for energy purposes. In 2006, emissions from solid waste disposal on land were 30.5 per cent lower than in 1990.

80. Within the sector, 79.4 per cent of emissions were from solid waste disposal on land, followed by 20.3 per cent from wastewater handling and 0.3 per cent from waste incineration. Most of the emissions came from CH<sub>4</sub>, which accounted for 90.7 per cent of the sectoral emissions, while N<sub>2</sub>O accounted for 9.1 per cent and CO<sub>2</sub> for 0.2 per cent.

81. In the 2007 submission, CH<sub>4</sub> emissions from solid waste disposal on land for 1990–2004 were recalculated with revised degradable organic carbon (DOC) values (from 0.17 Gg C/Gg to 0.15 Gg C/Gg) as recommended by the ERT. Some other small updates to AD were made. In the 2008 submission, recalculations were made to the time series for all categories owing to updated AD since the 2007 submission. In addition, for the 2008 submission, New Zealand estimated emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from the incineration of clinical, quarantine and hazardous waste for the first time. This improved the completeness of the inventory, and the ERT welcomes these efforts made by New Zealand.

82. New Zealand does not provide AD in CRF table 6B. However, New Zealand submits the calculation spreadsheet showing the latest year AD and estimation procedures for all categories. The ERT welcomes the increased transparency, especially for the categories where the method used is not fully consistent with the default method and no relevant information is provided in CRF tables. New Zealand is encouraged to continue its efforts to improve the reporting of information in the NIR as well as the calculation spreadsheets.

83. There are some typographical errors and other errors due to wrong units and misunderstanding of terminology in some CRF tables. The ERT encourages New Zealand to correct those errors in future submissions.

## B. Key categories

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

84. New Zealand estimates emissions using the IPCC tier 2 first order decay method, with waste composition data. Default carbon content values by waste type are used to estimate DOC for New Zealand (0.152 Gg C/Gg). The k value (0.06) is obtained by adjusting the default value and taking into consideration the climatic condition of New Zealand.

85. New Zealand revised its waste data since 2005 based on latest available information, which led to a decrease in the waste generation rate (from 2.14 kg/capita/day in 2005 to 2.11 kg/capita/day). The methane correction factor (MCF) was also updated to reflect the latest waste management practice. The latest available data, with a linear extrapolation where data are not available, were applied to reflect annual changes, which led to an decrease of DOC in municipal solid waste (MSW) from 0.153 in 1990 to 0.141 (Gg C/Gg waste), and an increase from 0.139 in 2005 to 0.152 (Gg C/Gg waste). As a result of these recalculations, emissions were reduced by 1.39 Gg CO<sub>2</sub> eq for the base year and increased by 60.08 Gg CO<sub>2</sub> eq for 2005.

86. In 2006, two thirds of MSW were treated in facilities with CH<sub>4</sub> recovery systems. The CH<sub>4</sub> generated from landfill is estimated from total waste and L<sub>0</sub> and k values, which were developed based on profiles of total waste generated and climatic condition. The Waste Management NZ Ltd (2005) report that was provided to the ERT appears to indicate that CH<sub>4</sub> recovered from landfill is estimated using higher L<sub>0</sub> and k values (recovered gas = waste in facilities with recovery × higher L<sub>0</sub> and k values × average collection system efficiency). The use of the higher L<sub>0</sub> and k values is based on the assumption that waste treated by facilities with recovery systems contains more organic matter. However, the ERT believes that this approach may lead to an underestimation of the net emissions as higher L<sub>0</sub> and k values are used to estimate the recovered gas rather than estimate the methane generated from landfill sites. When reporting the recovered amount of landfill gases, it is good practice to meter gas recovered for energy and flaring. The ERT recommends that New Zealand either revise the methods used to estimate the net emissions of methane, or provide more detailed justification for the current method and the reported volume of recovered methane demonstrating that it is not overestimated.

## C. Non-key categories

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

87. New Zealand estimated CH<sub>4</sub> and N<sub>2</sub>O emissions from this category using the tier 1 method from the recognized international scientific literature. When the AD were not readily applicable to tier 1, modified methods were used to develop parameters using the available data. In the 2008 submission, the meat industry is subdivided into two categories: rendering (estimation is based on wastewater volume following tier 1 of the recognized international scientific literature) and kills (for which wastewater volume data is not available so estimation is based on carcass numbers). The ERT welcomes the continuous efforts for improvements made by New Zealand.

88. In previous submissions, emissions from the wine industry (CH<sub>4</sub> and N<sub>2</sub>O) and wool scouring (N<sub>2</sub>O) were estimated, but these sources were omitted from the 2008 submission. Even though these emissions were very minor (1.36 Gg CO<sub>2</sub> eq in 2005), their exclusion represents an underestimation of emissions. The ERT strongly recommends that New Zealand estimate and report emissions from these sources, or provide sufficient information to indicate that the emissions from these sources have become negligible by 2006.

## VII. Other issues

### 1. Changes to the national system

89. The Party has not reported on any changes to its national system in the 2008 submission. In response to questions raised by the ERT during the review the Party provided information on the changes to the national system, which include improvements made to QA/QC as well as institutional arrangements put in place for effective management of the national inventory. The ERT considers these changes to be in accordance with the requirements of national systems as defined in decision 19/CMP.1. The ERT strongly recommends that New Zealand provide updated information on the national system in the section on supplementary information under Article 7, paragraph 1, of the Kyoto Protocol in its next annual submission.

### 2. Changes to the national registry

90. The Party reported on changes in its national registry in the 2008 submission. The changes include contact details for the registry administrator.

### 3. Commitment period reserve

91. New Zealand has not reported its commitment period reserve in the 2008 submission. In response to questions raised by the ERT during the review, New Zealand reported that its commitment period reserve has not changed since the initial report review (309,564,733 t CO<sub>2</sub> eq). The ERT agrees with this figure. The ERT recommends that New Zealand include information on its commitment period reserve in its next annual submission.

## VIII. Conclusions and recommendations

92. New Zealand submitted, in accordance with the deadline established by the UNFCCC reporting guidelines, a complete set of CRF tables for the years 1990–2006 and an NIR. The ERT concluded that New Zealand's inventory submission is generally of a high quality and shows significant improvement in major issues such as QA/QC and institutional arrangements. The submission is largely complete in terms of sectors and most categories, GHGs, and geographic coverage. The ERT found that the NIR provides much of the information necessary to assess the inventory, but a number of areas were identified where transparency could be improved.

93. The inventory is generally in line with the Revised 1996 IPCC guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. However, the ERT identified possible instances of underestimations and overestimations of emissions (see paras. 36, 71, 72 and 88).

94. The key recommendations are that New Zealand:

- (a) Further improve its QA/QC plan by integrating the risk register that it has developed in its planned improvement processes;
- (b) Undertake a tier 2 key category analysis;
- (c) Provide a detailed description in the NIR of how feedstocks and non-energy use of fuels are treated and reported;
- (d) Enhance the methodology descriptions, explanations and justifications for the adoption of EFs in order to ensure transparency;
- (e) Review the possible underestimations of emissions identified for forest conversion, solid waste disposal on land and wastewater handling and revise estimates as appropriate;

- (f) Ensure that the LUCAS model for LULUCF reporting that is currently under development is capable of estimating dead organic carbon and soil carbon stock change for all land conversions.

### **IX. Questions of implementation**

- 95. No questions of implementation were identified by the ERT during the review.

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

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gp/english/>>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gp/landuse/gp/landuse.htm>>.

“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories”. FCCC/SBSTA/2006/9. Available at <<http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>>.

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

“Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol”. Decision 19/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>>.

“Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol”. Decision 15/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>>.

“Guidelines for review under Article 8 of the Kyoto Protocol”. Decision 22/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>>.

Status report for New Zealand 2007. Available at <<http://unfccc.int/resource/docs/2007/asr/nzl.pdf>>.

Status report for New Zealand 2008. Available at <<http://unfccc.int/resource/docs/2008/asr/nzl.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2007. Available at <<http://unfccc.int/resource/webdocs/sai/2007.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2008. Available at <<http://unfccc.int/resource/webdocs/sai/2008.pdf>>.

FCCC/ARR/2006/NZL. Report of the individual review of the greenhouse gas inventory of New Zealand submitted in 2006. Available at <<http://unfccc.int/resource/docs/2007/arr/nzl.pdf>>.

FCCC/IRR/2007/NZL: Report of the review of the initial report of New Zealand. Available at <<http://unfccc.int/resource/docs/2007/irr/nzl.pdf>>.

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

Responses to questions during the review were received from Ms. Sonia Petrie (Ministry for the Environment), including additional material on the methodology and assumptions used. The following documents were also provided by New Zealand:

NZL, 2008: Note on methanol and urea CO<sub>2</sub> emissions/storage calculations.

Ure, C.R. (New Zealand Steel), 2000. *Alternative Ironmaking at New Zealand Steel*. Paper presented at the 2000 ISS Electric Furnace Conference (Proceedings Vol. 58).

Waste Management NZ Ltd. 2005. *Landfill Methane Recovery Estimate for Updating the National Greenhouse Gas Inventory from the Waste Sector – Solid Waste Disposal Sites*. Report to the Ministry for the Environment. 2 June 2005.

Sinclair Knight Merz. 2007. *GHG from the Waste Incineration Sector. Final version 2.0* Report prepared for Ministry for the Environment. 31 July 2007.

Beca Infrastructure Ltd. 2007. *National Greenhouse Gas Inventory from Wastewater Treatment and Discharge*, Prepared for Ministry for the Environment, August 2007.

Waste incineration worksheets dec 2007.XLS, 2008.

Worksheets for GHG calcs.xls, 2007.

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