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Report of the individual review of the annual submission of Australia submitted in 2012*

* In the symbol for this document, 2012 refers to the year in which the inventory was submitted, and not to the year of publication.

Contents

I. Introduction and summary

1. This report covers the centralized review of the 2012 annual submission of Australia, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 24 to 29 September 2012 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Ms. Yuriko Hayabuchi (Japan) and Mr. Leif Hockstad (United States of America); energy – Mr. Liu Qiang (China), Mr. Anand Sookun (Mauritius) and Ms. Kennie Tsui (New Zealand); industrial processes – Ms. Sohyang Lee (Republic of Korea), Mr. Kakhaberi Mdivani (Georgia) and Ms. Kristina Saarinen (Finland); agriculture – Ms. Britta Maria Hoem (Norway) and Mr. Pa Ousman Jarju (Gambia); land use, land-use change and forestry (LULUCF) – Ms. Cristina García Díaz (Spain), Ms. Rosa Maria Rivas Palma (New Zealand) and Mr. Harry Vreuls (Netherlands); and waste – Mr. Takefumi Oda (Japan) and Ms. Mayra Rocha (Brazil). Ms. Lee and Ms. Saarinen were the lead reviewers. The review was coordinated by Ms. Lisa Hanle and Ms. Astrid Olsson (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 Australia, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

3. In 2010, the main greenhouse gas (GHG) in Australia was carbon dioxide (CO_2), accounting for 74.0 per cent of total GHG emissions [1] expressed in carbon dioxide equivalent (CO_2 eq), followed by methane (CH_4) (20.4 per cent) and nitrous oxide (N_2O) (4.4 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.3 per cent of the overall GHG emissions in the country. The energy sector accounted for 76.8 per cent of total GHG emissions, followed by the agriculture sector (14.7 per cent), the industrial processes sector (5.8 per cent) and the waste sector (2.6 per cent). Total GHG emissions amounted to 543,262.75 Gg CO_2 eq and increased by 30.0 per cent between the base year[2] and 2010.

4. Tables 1 and 2 show GHG emissions from Annex A sources, emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO_2, CH_4 and N_2O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector, and also do not include the emissions from deforestation that were included in Australia's initial report under the Kyoto Protocol for the base year and subsequently used for the calculation of the assigned amount.

5. Tables 3–5 provide information on the most important emissions and removals and accounting parameters that will be included in the compilation and accounting database.

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

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

Table 1

Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year to 2010[a]

			Gg CO_2 eq								*Change (%)*
		Greenhouse gas	*Base year*[a]	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*Base year –2010*
Annex A sources		CO_2	278 222.97	278 222.97	304 229.18	349 737.00	382 394.35	401 886.29	402 874.45	401 787.44	44.4
		CH_4	116 089.22	116 089.22	112 190.85	115 928.41	113 170.30	115 659.75	112 880.11	110 599.90	–4.7
		N_2O	18 383.12	18 383.12	20 599.26	25 522.49	25 899.57	25 679.42	25 008.39	23 828.08	29.6
		HFCs	1 126.27	1 126.27	826.39	1 778.12	4 567.55	5 722.33	6 264.30	6 658.38	491.2
		PFCs	3 950.13	3 950.13	1 312.56	1 103.55	1 536.23	381.14	307.89	243.76	–93.8
		SF_6	221.20	221.20	316.89	199.85	190.85	158.40	143.23	145.19	–34.4
KP-LULUCF	Article 3.3[b]	CO_2						38 875.69	32 247.28	25 870.18	
		CH_4						1 384.35	1 168.53	1 032.51	
		N_2O						685.03	590.64	661.03	
	Article 3.4[c]	CO_2	NA					NA	NA	NA	NA
		CH_4	NA					NA	NA	NA	NA
		N_2O	NA					NA	NA	NA	NA

Abbreviations: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

Table 2
Greenhouse gas emissions by sector and activity, base year[a] to 2010

			Gg CO_2 eq							*Change (%)*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*Base year –2010*
Annex A		Energy	289 457.38	289 457.38	313 918.31	361 490.07	395 974.80	417 745.21	420 321.32	417 430.68	44.2
		Industrial processes	24 669.72	24 669.72	24 375.94	26 236.75	29 508.96	31 322.95	29 393.76	31 698.06	28.5
		Solvent and other product use	IE, NA, NO	IE, NA, NO	IE, NA, NO	IE, NA, NO	IE, NA, NO	IE, NA, NO	IE, NA, NO	IE, NA, NO	NA
		Agriculture	86 462.84	86 462.84	84 596.39	92 179.10	89 023.77	86 635.15	83 989.50	80 058.25	–7.4
		Waste	17 402.96	17 402.96	16 584.49	14 363.50	13 251.32	13 784.01	13 773.78	14 075.76	–19.1
		LULUCF	NA	93 041.22	16 258.41	60 721.72	6 572.55	–37 097.86	46 155.90	38 284.80	NA
		Total (with LULUCF)	**NA**	**511 034.13**	**455 733.55**	**554 991.14**	**534 331.40**	**512 389.46**	**593 634.27**	**581 547.55**	**NA**
		Total (without LULUCF)	**417 992.91**	**417 992.91**	**439 475.14**	**494 269.42**	**527 758.85**	**549 487.32**	**547 478.36**	**543 262.75**	**30.0**
		Other[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation						–15 866.24	–14 356.10	–16 965.98	
		Deforestation						56 811.31	48 362.55	44 529.70	
		Total (3.3)						**40 945.07**	**34 006.45**	**27 563.72**	
	Article 3.4[d]	Forest management						NA	NA	NA	
		Cropland management	NA					NA	NA	NA	NA
		Grazing land management	NA					NA	NA	NA	NA
		Revegetation	NA					NA	NA	NA	NA
		Total (3.4)	**NA**					**NA**	**NA**	**NA**	**NA**

Abbreviations: IE = included elsewhere, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NA = not applicable, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Emissions/removals reported in the sector other (sector 7) are not included in Annex A to the Kyoto Protocol and are therefore not included in the national totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

Table 3
Information to be included in the compilation and accounting database in t CO_2 eq for the year 2010, including the commitment period reserve

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Commitment period reserve	2 661 821 229			2 661 821 229
Annex A emissions for current inventory year				
CO_2	401 787 443			401 787 443
CH_4	110 599 896			110 599 896
N_2O	23 256 087	23 828 079		23 828 079
HFCs	6 658 379			6 658 379
PFCs	243 764			243 764
SF_6	145 186			145 186
Total Annex A sources	**542 690 756**	**543 262 747**		**543 262 747**
Activities under Article 3, paragraph 3, for current inventory year				
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	–25 766 520	–25 490 148		–25 490 148
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	8 524 165			8 524 165
3.3 Deforestation for current year of commitment period as reported	44 477 420	44 529 702		44 529 702
Activities under Article 3, paragraph 4, for current inventory year[c]				
3.4 Forest management for current year of commitment period				
3.4 Cropland management for current year of commitment period				
3.4 Cropland management for base year				
3.4 Grazing land management for current year of commitment period				
3.4 Grazing land management for base year				
3.4 Revegetation for current year of commitment period				
3.4 Revegetation in base year				

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 4
Information to be included in the compilation and accounting database in t CO_2 eq for the year 2009

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2009				
CO_2	402 874 447			402 874 447
CH_4	112 880 114			112 880 114
N_2O	25 008 389			25 008 389
HFCs	6 264 296			6 264 296
PFCs	307 887			307 887
SF_6	143 231			143 231
Total Annex A sources	**547 478 364**			**547 478 364**
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009 as reported	–22 100 089	–21 823 716		–21 823 716
3.3 Afforestation and reforestation on harvested land for 2009 as reported	7 467 618			7 467 618
3.3 Deforestation for 2009 as reported	48 302 739	48 362 551		48 362 551
Activities under Article 3, paragraph 4, for 2009[c]				
3.4 Forest management for 2009				
3.4 Cropland management for 2009				
3.4 Cropland management for base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for base year				
3.4 Revegetation for 2009				
3.4 Revegetation in base year				

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 5
Information to be included in the compilation and accounting database in t CO_2 eq for the year 2008

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2008				
CO_2	401 886 291			401 886 291
CH_4	115 659 746			115 659 746
N_2O	25 679 418			25 679 418
HFCs	5 722 330			5 722 330
PFCs	381 136			381 136
SF_6	158 400			158 400
Total Annex A sources	**549 487 321**			**549 487 321**
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008 as reported	–23 081 077	–22 804 705		–22 804 705
3.3 Afforestation and reforestation on harvested land for 2008 as reported	6 938 466			6 938 466
3.3 Deforestation for 2008 as reported	56 741 787	56 811 310		56 811 310
Activities under Article 3, paragraph 4, for 2008[c]				
3.4 Forest management for 2008				
3.4 Cropland management for 2008				
3.4 Cropland management for base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for base year				
3.4 Revegetation for 2008				
3.4 Revegetation in base year				

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2012 annual inventory submission was submitted on 14 April 2012; it contains a complete set of common reporting format (CRF) tables for the period 1990–2010 and a national inventory report (NIR). Australia also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 13 April 2012. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Australia officially submitted revised emission estimates on 6 September 2012 in response to questions raised by the expert review team (ERT) in the course of the review. Australia also submitted revised data for KP-LULUCF on 15 November 2012 in response to questions raised by the ERT during the review.

8. The ERT also used previous years' submissions during the review. In addition, the ERT used the standard independent assessment report (SIAR), parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.[3]

9. During the review, Australia provided the ERT with additional information. The documents concerned are not part of the annual submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in annex I to this report.

Completeness of inventory

10. The inventory covers all mandatory[4] source and sink categories for the period 1990–2010 and is complete in terms of years and geographical coverage. However, CRF table 7 (summary overview of key categories) has not been completed for 1990. The ERT reiterates the recommendation in the previous review report that Australia provide CRF table 7 for 1990 in its next annual submission (see para. 16 below). The ERT noted that there are some categories which are reported as not estimated ("NE"); however, Australia indicated that this is due to a lack of data (e.g. potential emissions of SF_6 from electrical

[3] The SIAR, parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5(a), and 6(c) and (k)), under the auspices of the international transaction log (ITL) administrator using procedures agreed in the Registry System Administrators Forum. Part I is a completeness check of the submitted information relating to the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and to national registries. Part II contains a substantive assessment of the submitted information and identifies any potential problem regarding information on the accounting of Kyoto Protocol units and the national registry.

[4] Mandatory source and sink categories under the Kyoto Protocol are all source and sink categories for which the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* provide methodologies and/or emission factors to estimate GHG emissions.

equipment) or because the Intergovernmental Panel on Climate Change (IPCC) does not provide a corresponding estimation methodology in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) or the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) (e.g. CH_4 emissions from poultry for the category enteric fermentation). The ERT also noted that Australia has not estimated CH_4 emissions from post-mining activities at surface coal mines (see para. 43 below).

11. The ERT noted that Australia has not estimated potential emissions of SF_6 for the subcategory electrical equipment under consumption of halocarbons and SF_6. The ERT encourages Australia to provide such estimates in a future annual submission, when data become available and where further methodological guidance is provided in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines).

2. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Overview

12. The ERT concluded that the national system continued to perform its required functions.

13. Australia described the changes in the national system since the previous annual submission and these changes are discussed in chapter II.G.3 of this report. In summary, Australia reported in its NIR on a change to the designated representative with overall responsibility for the national inventory (see para. 125 below) as well as the incorporation into the annual submission of additional facility-specific data obtained under the National Greenhouse and Energy Reporting System (NGERS) (see paras. 21, 30, 31, 37, 41 and 125 below).

Inventory planning

14. The NIR described the national system for the preparation of the inventory. The Secretary of the Department of Climate Change and Energy Efficiency (DCCEE) has overall responsibility for the preparation of the inventory. Other agencies, government departments and organizations are also involved in the preparation of the inventory, as described in figure 1.1 of the NIR.

15. DCCEE is responsible for all aspects of the inventory preparation, including gathering activity data (AD), estimating emissions, quality control, planning inventory improvements and preparing reports and data for submission to the UNFCCC on behalf of the Australian Government. The official consideration of the inventory is overseen by the National Inventory Systems Executive Committee of DCCEE. The draft NIR is considered by the National Greenhouse Gas Inventory Committee, which includes representatives of the Australian state and territory governments and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The final release of each annual inventory submission to the UNFCCC is approved by DCCEE.

Inventory preparation

Key categories

16. Australia has reported a tier 1 key category analysis, both level and trend assessment, as part of its 2012 annual submission. The tier 1 key category analysis performed by Australia and that performed by the secretariat[5] produced similar results. Minor differences can be attributed to the finer disaggregation used by the Party. Australia has included the LULUCF sector in its key category analysis, which was performed in accordance with 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). The ERT noted that Australia did not report a key category analysis for 1990 and reiterates the recommendation made in previous review reports that the Party provide such an analysis in its next annual submission.

17. In its NIR and in response to questions raised by the ERT during the review, Australia explained that it uses the results of the key category analysis to prioritize the development and improvement of the inventory.

18. Australia has identified key categories for activities under Article 3, paragraph 3, of the Kyoto Protocol for 2010, namely CO_2 emissions and removals from afforestation and reforestation, and deforestation. In addition, Australia has provided a correlation between the activities which are key categories under the Kyoto Protocol and the associated categories under the Convention in NIR table A.1.7.

Uncertainties

19. Australia has reported a tier 1 uncertainty analysis in accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines) and the IPCC good practice guidance. The uncertainty assessment was conducted by sectoral expert consultants and independently reviewed by CSIRO. A tier 2 approach has been used for calculating the uncertainty for a number of categories (e.g. petroleum and natural gas consumption for petroleum refining and coal; and petroleum and natural gas consumption for manufacture of solid fuels and other energy industries) and Australia has reported that this approach is still under consideration for use for the whole inventory for future annual submissions. The ERT welcomes Australia's efforts to conduct a tier 2 uncertainty analysis and encourages Australia to do so for the whole inventory for a future annual submission.

20. The reported uncertainty of the total estimated GHG emissions for 2010 is ±2.8 per cent excluding LULUCF and ±3.6 per cent including LULUCF. The uncertainty of the trend in the total estimated GHG emissions is ±1.9 per cent excluding LULUCF and ±3.0 per cent including LULUCF. The ERT noted that, as reported in the Party's previous annual submission, the uncertainty of the emissions trend is continuing to improve: in Australia's 2011 annual submission the trend uncertainty was reported as ±2.0 per cent excluding LULUCF and ±8.2 per cent including LULUCF.

[5] 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.

Recalculations and time-series consistency

21. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that recalculations reported by Australia of the time series 1990–2009 have been undertaken to take into account changes made in all sectors, including revisions to AD, the inclusion of additional sources of data (e.g. the use of NGERS data in the energy sector (see paras. 30, 31 and 37 below)) and the refinement of the estimation methodology for some categories (e.g. CH_4 and N_2O emissions from prescribed burning of savannas (see para. 67 below)). The major changes, and the magnitude of the impact, include the following: a decrease in the estimated total GHG emissions for 1990 (0.1 per cent) and an increase for 2009 (0.3 per cent). The rationale for these recalculations is well documented in chapter 10 of the NIR and in CRF table 8(b). The ERT commends Australia for transparently documenting the rationale for the recalculations in the NIR.

Verification and quality assurance/quality control approaches

22. Australia has elaborated a quality assurance/quality control (QA/QC) plan in accordance with decision 19/CMP.1 and the IPCC good practice guidance. Australia's QA system operates at a number of levels: the preparation of the inventory is overseen by the National Inventory Systems Executive Committee, the review of the NIR is conducted by the National Greenhouse Gas Inventory Committee and CSIRO, the review of inventory improvements is conducted by the National Inventory Users Group, the public review of the emission estimates and methods is performed through the easily accessible information on the DCCEE and Australian Greenhouse Gas Emissions Information System web pages, and the review of the estimates calculated by DCCEE is conducted by external consultants for specific categories and sectors (e.g. subcategories under mineral products, chemical industry and metal production in the industrial processes sector, and agricultural soils in the agriculture sector for 2012).

Transparency

23. The NIR and the CRF tables are generally transparent. However, the ERT reiterates the recommendation made in the previous review report that Australia improve the transparency of the information on: the industrial processes sector (see paras. 50, 51 and 54 below), in particular by reporting data for the categories currently reported using the notation key confidential ("C") (e.g. adipic acid production and nitric acid production); the agriculture sector, for example by indicating in the NIR where feedlot cattle are reported (see para. 62 below); the KP-LULUCF activities, in particular with regard to the reporting of areas of deforestation (see paras. 112–114 below); and in the waste sector, by providing additional information on the country-specific parameters and circumstances (see paras. 93 and 102 below). The ERT noted that Australia has described the treatment of confidential information in chapter 1 of the NIR. The ERT commends Australia for transparently documenting the treatment of confidentiality. However, the ERT encourages Australia to provide a more detailed explanation of how confidential information in the industrial processes sector is used and verified in the NIR of its next annual submission.

Inventory management

24. Australia has a centralized archiving system, the Australian Greenhouse Emissions Information System, which includes the archiving of disaggregated emission factors (EFs) and AD, documentation on how these EFs and AD have been generated and aggregated for the preparation of the inventory, and emission estimates from previous annual submissions. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, documentation on annual key categories, key category

identification methods and planned inventory improvements. The archive is maintained and housed within DCCEE. During the review, the ERT was provided with the requested additional archived information.

3. Follow-up to previous reviews

25. The ERT noted that Australia has implemented several recommendations made in previous review reports, as outlined in table A.6.3.a of annex 6 to the NIR. The ERT commends Australia for these improvements. Major improvements made in the 2012 annual submission include:

(a) The incorporation of NGERS data on energy and carbon content for refinery fuel consumption;

(b) The improvement of the model parameters (e.g. average trip length and urban vehicle kilometres travelled) for road transportation;

(c) Continued improvements in the LULUCF sector regarding the documentation for the tier 3 approach and the QA/QC procedures through the comparison of the tier 3 model with a tier 2 approach for the land-conversion categories (see paras. 70 and 87 below).

26. The ERT noted that the 2011 annual review report was published on 18 July 2012, which is after the due date for the submission of the 2012 annual submission (15 April 2012). Hence, the ERT exercises a degree of latitude in its reiteration of recommendations made in the 2011 annual review report, including:

(a) Conducting additional surveying of small electricity generators (see para. 37 below);

(b) Improving transparency in the chemical industry for categories that are currently reported as confidential (see para. 51 below);

(c) Improving transparency by explaining in the NIR that feedlot cattle are reported under other (enteric fermentation) in the CRF tables (see para. 62 below);

(d) Implementing a new method for calculating emissions from dairy calves that reflects pre-weaning feeding regimes (see para. 64 below);

(e) Applying consistent criteria to determine how to report if the gain or loss of forest cover due to climate variation permanently exceeds or is permanently below the forest threshold (see para. 74 below);

(f) Improving the consistency of the reporting and providing estimates for the full chosen period for land conversion (50 years) (see paras. 71, 73 and 82 below);

(g) Improving the QC activities in the waste sector (see para. 91 below).

4. Areas for further improvement identified by the expert review team

27. During the review, the ERT identified several cross-cutting issues for improvement. These are listed in table 7 below.

28. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report and in table 7 below.

B. Energy

1. Sector overview

29. The energy sector is the main sector in the GHG inventory of Australia. In 2010, emissions from the energy sector amounted to 417,430.68 Gg CO_2 eq, or 76.8 per cent of total GHG emissions. Since 1990, emissions have increased by 44.2 per cent. The key drivers for the rise in emissions are the increases in emissions from energy industries (by 87,787.61 Gg CO_2 eq, or 61.3 per cent), transport (by 21,173.59 Gg CO_2 eq, or 34.1 per cent), other sectors (by 5,421.48 Gg CO_2 eq, or 36.0 per cent) and manufacturing industries and construction (by 5,037.28 Gg CO_2 eq, or 14.1 per cent). Within the energy sector, 55.4 per cent of the emissions were from energy industries, followed by 19.9 per cent from transport, 9.7 per cent from manufacturing industries and construction and 6.8 per cent from fugitive emissions from solid fuels. Other sectors accounted for 4.9 per cent of the sectoral emissions and fugitive emissions from oil and natural gas accounted for 2.9 per cent. The remaining 0.7 per cent were from the category other (fuel combustion).

30. The Party has made recalculations for the energy sector between the 2011 and 2012 annual submissions for 2009 following changes in AD and EFs. The impact of these recalculations on the energy sector is an increase in emissions of 2,966.34 Gg CO_2 eq, or 0.7 per cent, for 2009. A key reason for the recalculations being undertaken for the energy sector was the change in the availability of data from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), which compiles the Australian Energy Statistics (AES). This was due to the introduction of data from NGERS, allowing for improved AD, particularly for 2009. The main recalculations took place in the following categories:

(a) Energy industries (an increase in emissions of 7,187.56 Gg CO_2 eq, or 3.2 per cent): mainly due to the reallocation of emissions from natural gas and diesel from manufacturing industries and construction to manufacturing of solid fuels and other energy industries, owing to the introduction of AD available from NGERS;

(b) Transport (a decrease in emissions of 752.11 Gg CO_2 eq, or 0.9 per cent): partly due to the update of the non-CO_2 EFs and the deterioration rates for a range of vehicle types in the light of two new studies on road transportation (see para. 40 below);

(c) Other (fugitive emissions from solid fuels) (an increase in emissions of 119.10 Gg CO_2 eq, or 0.4 per cent): due to the inclusion of emissions from flaring, beginning in 2009, owing to the introduction of AD available from NGERS (see para. 41 below).

31. For its 2012 annual submission, Australia, for the first time, used AD from NGERS for the main energy subcategories (e.g. public electricity and heat production). This resulted in extensive revisions to the estimates of fuel consumption and the reallocation of fuel use between categories in the energy sector, particularly for 2009. Because AD from NGERS were available for 2009 only, this has resulted in a step change in the time series for some individual fuel types within certain categories. Australia has described in the "planned improvements" sections of its NIR its plan to revise the entire time series for those categories affected by the step change for future annual submissions. The ERT strongly recommends that Australia review and ensure time-series consistency for the categories affected for its next annual submission.

2. Reference and sectoral approaches

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

32. For the year 2010, there is a difference of 0.9 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. According to CRF table 1.A(c), the main reason for the difference between the sectoral and reference approaches is a discrepancy in liquid fuel emissions due to the uncertainty in the reference approach with converting consumption from volumetric units into energy units. Australia has not provided a rationale in the NIR to describe the difference between the reference approach and the sectoral approach. The ERT recommends that Australia describe the difference between the reference and sectoral approaches in the NIR of its next annual submission.

33. The apparent consumption in Australia's reference approach for 2010 corresponds closely to the International Energy Agency (IEA) data. For 2010, there is a difference of 3.4 per cent in the apparent consumption between the reference approach and the IEA data. The apparent consumption reported to the UNFCCC for Australia corresponds to that reported to IEA within 6 per cent for all years of the time series. Although the total apparent consumption in the CRF tables is comparable to the IEA data, both liquid fuels and gaseous fuels are 8 per cent higher in the CRF tables compared to the IEA data. The difference relating to liquid fuels may be caused by the conversion factor from tonnes of fuel to TJ. In response to questions raised by the ERT during the review, Australia noted that although the national energy balance reports a stock change of –112.7 PJ for 2009-2010 for natural gas, no stock change for natural gas is reported by IEA. Australia indicated in response to a question raised by the ERT during the review that it intends to provide further explanations of the differences observed between the data in the CRF tables and the IEA data in the next annual submission. The ERT welcomes this effort and recommends that the Party include any rationale for the differences observed between the CRF tables and the data reported to IEA for both liquid and gaseous fuels in the NIR of its next annual submission.

International bunker fuels

34. The AD on international bunker fuels are based on data from ABARES as part of AES. According to the NIR, an independent assessment was carried out to assess the AD for domestic and international aviation for both 2009 and 2010 collected by ABARES compared with the data from the Department of Infrastructure and Transport (DIT). DIT developed a software tool to compute and track the carbon footprint associated with aircraft fuel uplifted in Australia. The results showed a difference between the AD reported in the CRF tables and those generated from the software tool of 1.7 per cent for 2009 and 5.6 per cent for 2010. As described in the NIR, Australia concluded that these results are a good verification of the inventory estimates generated from the ABARES data. The ERT commends the Party for this effort and encourages Australia to continue carrying out similar assessments for future annual submissions.

35. Previous review reports identified that the data reported in the CRF tables were higher by a relatively constant percentage (between 4 per cent and 7 per cent) for all years of the time series compared with the IEA data for both domestic and international fuel use for aviation and navigation. In response to questions raised by the ERT during the review, Australia confirmed that the data reported to IEA are consistent with the data published in the national inventory and that the discrepancy was caused by the energy conversion used by IEA. The ERT encourages Australia to confirm the energy conversion with IEA and also to provide a summary of the energy conversion applied in the NIR of its next annual submission.

Feedstocks and non-energy use of fuels

36. During the review, the ERT raised the question of why the ethane EF adopted under chemicals differed from the EF reported in CRF table 1.A(d). Australia responded that the quantity of ethane related to the chemicals industry was sourced from NGERS and that it was difficult to determine the exact quantity of ethane feedstock associated with those chemical products from the NGERS data. Taking into account the observation of the ERT, Australia indicated that it will carry out further analysis of the NGERS data and other supplementary data sources in order to ascertain the non-energy ethane consumption. The ERT encourages Australia to report the findings from this analysis in its next annual submission.

3. Key categories

Stationary combustion: liquid fuels – CO_2

37. Public electricity and heat production was the largest contributor of CO_2 emissions to Australia's GHG inventory for 2010. The ERT noted that the AD for public electricity and heat production over certain thresholds are collected through NGERS and that the energy use of small power stations is estimated as the difference between the total of the values reported under NGERS and the ABARES energy statistics. This was highlighted in the recommendations made in the previous review reports that Australia collect AD from the smaller power stations on a regular basis. In response to questions raised by the ERT during the review regarding the status of implementation of this recommendation, Australia indicated that it intends to incorporate additional surveying of small electricity generators into the inventory improvement plan; however, owing to budgetary constraints, no timeline has as yet been set. The ERT reiterates the recommendation made in the previous review report that Australia collect AD from the smaller power stations on a regular basis and incorporate the data into its next annual submission.

38. The ERT noted that the CO_2 implied emission factors (IEFs) for liquid fuels in petroleum refining for 2009 and 2010 were 66.87 t CO_2/TJ and 68.32 t CO_2/TJ, respectively.[6] These values are lower than the reported values for the period 1990–2008, which were constant at 72.63 t CO_2/TJ from 1990 to 2000 and fluctuated only slightly below that (no lower than 72.38 t CO_2/TJ) until 2008. In response to questions raised by the ERT during the review of the 2011 annual submission, Australia indicated that the difference observed, beginning in 2009, is mainly due to the use of facility-level data in the inventory since the introduction of NGERS data. In the previous review report, the ERT recommended that Australia review and ensure the time-series consistency of this EF. In response to the question raised by the ERT during review of the 2012 annual submission as to whether any progress has been made on the implementation of this recommendation, Australia stated that it would be appropriate to analyse several years of NGERS data in order to understand the variability of the data before proceeding to recalculate the time series in a manner consistent with the IPCC good practice guidance. Australia also stated that NGERS data covering several years of the time series are now available. The ERT strongly recommends that Australia carry out the review and ensure time-series consistency, consistent with the IPCC good practice guidance, in its next annual submission.

[6] Australia has reported energy data on the basis of gross calorific values. Hence, the reported IEFs are about 5 per cent lower for liquid and solid fuels and biomass, and about 10 per cent lower for gaseous fuels than would have been the case if the data were reported on the basis of net calorific values (NCVs). The IEFs mentioned here have been converted into NCV-based values and therefore do not reflect the IEFs reported by the Party.

Civil aviation: liquid fuels – CO_2

39. The country-specific EF for liquid fuels was constant for the entire time series 1990–2010 (69.79 t CO_2/TJ). In response to a question raised by the ERT during the review, Australia indicated that an independent study conducted in 2011 to review the fuel characteristics of aviation gasoline resulted in a CO_2 IEF value that was ± 2 per cent of the value reported in the CRF tables. The ERT commends Australia for its efforts to verify the CO_2 IEF for aviation gasoline and agrees with the use of the constant EF, assuming continuing similar circumstances.

Road transportation: liquid fuels – CH_4 and N_2O

40. Australia uses a tier 3 model to estimate non-CO_2 emissions from road transportation on the basis of an independent consultant's report.[7, 8] In its 2012 annual submission, Australia identified plans to further investigate the EFs for large sports utility vehicles, passenger vehicles and light commercial vehicles to support the further disaggregation of the EFs. The ERT encourages Australia to report its findings in the next annual submission.

Coal mining and handling – CO_2 and CH_4

41. According to the NIR, AD for 2009 and 2010 on the recovery and flaring of CH_4 and CO_2 from coal mines are now available from NGERS. During the review, the ERT asked Australia how it will ensure time-series consistency for the AD, as the CRF tables for 1990–2008 currently include the notation key not occurring ("NO") for this category. In response to the question raised by the ERT during the review, Australia indicated that there may have been changes in the national circumstances due to the introduction of a domestic emissions trading system, whereby the flaring of rich drained CH_4 from mines rather than venting could have first become a cost-effective form of abatement available to coal mines in 2009. Australia also indicated that it intends to research all available historical data to determine whether CH_4 flaring took place prior to 2009. The ERT recommends that Australia undertake such research and provide updated information in its next annual submission.

42. The NIR (figure A6.2) provides a summary of CH_4 flows for underground mines. In response to a question raised by the ERT during the review regarding whether Australia intends to update this figure to include the above-mentioned CH_4 flaring, Australia confirmed that the figure does not include the CH_4 flaring activity but that it should. The ERT recommends that Australia update the figure to incorporate the CH_4 flaring for its next annual submission.

43. Some of the recommendations made in the previous review reports included that Australia implement a more comprehensive method for estimating CH_4 emissions from surface mining, including any emissions from post-mining activities. The current ERT observed that in CRF table 1.B.1 of the 2012 annual submission fugitive CH_4 emissions from post-mining activities at surface mines are still reported as "NE", citing "no data or IPCC methodology available". In response to a question raised by the ERT during the review regarding the status of implementation of the new method for estimating emissions from surface mining, and why Australia reported the notation key "NE", the Party explained that the post-mining component of the emissions is accounted for in the EFs for surface mining. The ERT recommends that Australia use the notation key included

[7] Orbital Australia. 2010. *Emissions Factor Derivation from NISE2 Measurements of Vehicles from the Australian Fleet*. (internal report to the Department of Climate Change and Energy Efficiency).

[8] Orbital Australia. 2011. *Preparation of Weighted GHG Results from Additional Data Sources*. (internal report to the Department of Climate Change and Energy Efficiency).

elsewhere ("IE") in its next annual submission and describe where the corresponding emissions are reported in the NIR and in CRF table 9(a).

44. Australia has reported CO_2 emissions from surface mining as "NE". In response to questions raised by the ERT during the review, Australia indicated that this is due to the lack of relevant estimation methodologies available in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Further, Australia stated that a higher-tier method for estimating emissions from individual surface mines could be implemented using data collected from NGERS. The ERT encourages Australia to further investigate the suitability of using NGERS data for this category and, if appropriate, to implement this methodology for the estimation of fugitive emissions relating to surface coal mining for future annual submissions.

4. Non-key categories

Stationary combustion – solid and liquid fuels: CO_2, CH_4 and N_2O

45. Previous stages of the review identified that Australia is currently reporting AD for and emissions of CO_2, CH_4 and N_2O from petroleum refining for solid fuels as not applicable ("NA"). In response to questions raised by the ERT during the review, Australia stated that the AD for solid fuels and the related emissions should have been reported as "NO" rather than "NA". The ERT recommends that Australia revise the reported notation key for the entire time series in its next annual submission.

46. Previous stages of the review identified that the IEFs for CO_2 and CH_4 for all years of the time series (254.96 t/TJ and 394.61 kg/TJ, respectively, for 2010) and the N_2O IEF for most years of the time series (2.77 kg/TJ for 2010) for the consumption of liquid fuels under residential is the highest such IEF among all of the reporting Parties and higher than the IPCC default range (from 63.07 t/TJ to 100.83 t/TJ for CO_2, from 0.7 kg/TJ to 10 kg/TJ for CH_4 and from 0.2 kg/TJ to 0.6 kg/TJ for N_2O). In response to questions raised by the ERT during the review, Australia confirmed that the corresponding emission estimates were correct; however, an error arose in the transfer of the AD to the CRF Reporter software and not all of the AD for liquid fuels were reported in CRF table 1.A(a). The ERT strongly recommends that Australia review the internal data collection system and revise the entire time series of AD for its next annual submission.

C. Industrial processes and solvent and other product use

1. Sector overview

47. In 2010, emissions from the industrial processes sector amounted to 31,698.06 Gg CO_2 eq, or 5.8 per cent of total GHG emissions. Emissions from the solvent and other product use sector were included under other (chemical industry) from 1990 to 2010 for confidentiality reasons. Since 1990, emissions have increased by 28.5 per cent in the industrial processes sector. The key drivers for the rise in emissions in the industrial processes sector are the increases in emissions from consumption of halocarbons and SF_6 (by 2,975.8 per cent since 1990) and chemical industry (by 232.9 per cent since 1990). Within the industrial processes sector, 35.9 per cent of the emissions were from metal production, followed by 21.6 per cent from chemical industry, 21.5 per cent from consumption of halocarbons and SF_6 and 20.3 per cent from mineral products. The remaining 0.7 per cent were from other production. The total estimated emissions from the industrial processes sector increased by 7.8 per cent from 2009 to 2010. According to the NIR, this increase in emissions reflects a return to normal operations following the global economic downturn, which led to a reduction in industrial activity in 2009.

48. The Party has made recalculations for the industrial processes sector between its 2011 and 2012 annual submissions in response to recommendations made in previous review reports and following changes in AD. The impact of these recalculations on the industrial processes sector is a decrease in emissions of 1.0 per cent for 2009. The main recalculations took place in the following categories:

(a) Other (chemical industry) (a decrease in N_2O emissions by 247.48 Gg CO_2 eq, or 7.4 per cent);

(b) Limestone and dolomite use (an increase in CO_2 emissions by 29.05 Gg CO_2 eq, or 0.5 per cent);

(c) Iron and steel production (a decrease in CO_2 emissions by 93.72 Gg CO_2 eq, or 1.0 per cent);

(d) Other production (a decrease in emissions by 8.95 Gg CO_2 eq, or 5.3 per cent);

(e) Consumption of halocarbons and SF_6 (an increase in emissions by 14.67 Gg CO_2 eq for HFCs (0.2 per cent) and by 17.90 Gg CO_2 eq for SF_6 (14.3 per cent).

49. During the review, the ERT asked the Party to provide information on the progress made in the implementation of the following recommendations made in the previous review report: the use of a country-specific EF for lime production; the reallocation from the energy sector to the industrial processes sector of the GHG emissions from the use of coke as a reducing agent in iron and steel production; the provision of additional information regarding the calculation of HFC emissions from consumption of halocarbons and SF_6 (e.g. annual leakage rates from commercial and industrial refrigeration and air-conditioning applications); and the adoption of a revised method for estimating SF_6 emissions from electrical equipment. In response to the questions raised by the ERT during the review, Australia provided preliminary information and data related to these improvements and noted that these data and information were not available in time to be included in the 2012 annual submission. The Party indicated that the data and information on improvements would be included in its next annual submission. The ERT welcomes these efforts and recommends that Australia follow through and provide the data and information in its next annual submission.

50. Australia uses multiple data sets, including plant-specific data, to compile the time series for cement production, lime production, limestone and dolomite use and soda ash production. Australia uses NGERS data for 2009 onwards, data from the emissions-intensive trade-exposed industries assistance programme for the period 2007–2008 and data from industry surveys for the period 1990–2006. As a result of the multiple data sets, the ERT raised questions about how Australia ensures that the emission estimates accurately represent the national emissions. In response to the questions raised by the ERT during the review, Australia indicated that it has determined that using these data sets is the best way to estimate its GHG emissions for these categories, and the Party referred to table 4.8 of the NIR, which provides a comparison between sources of carbonate supply and use in the Australian economy, in order to ensure completeness. The ERT concluded that this is the best way for Australia to collect AD for these categories. The ERT recommends that Australia transparently describe in its next annual submission how the multiple data sets reflect the national GHG emissions for each category, how the Party ensures that all emission categories are covered by these data sets and how verification of the data is carried out, as well as how the data result in a consistent time series.

2. Key categories

Other (chemical industry) – CO_2 and N_2O

51. The AD for this category are reported as confidential. Recommendations made in previous review reports were for Australia to improve the transparency of this subcategory. During the review, the Party was asked to provide the disaggregated AD and EFs for other (chemical industry), in order to allow a review of the time-series consistency and the accuracy of the emission estimates. The Party did not provide such data, owing to concerns about confidentiality, but responded that it is exploring options for reporting the required information. The ERT welcomes this planned improvement and reiterates the recommendation made in the previous review report that the Party provide the disaggregated data, or information on the improvement plan, in its next annual submission.

Iron and steel production – CO_2

52. The NIR states that a tier 1b method is used to estimate CO_2 emissions from iron and steel production. The use of coke and natural gas as reducing agents is reported under the industrial processes sector, while the use of pulverized coal as a reducing agent is allocated to the energy sector. In response to questions raised by the ERT during the review about Australia's progress in reallocating process-related emissions from the energy sector to the industrial processes sector, Australia informed the ERT that the AD for this category are confidential, but that it is examining the reallocation of the data and whether the data can be reported. Australia mentioned that an update on this issue will be included in its next annual submission. The ERT recommends that Australia reallocate the use of pulverized coal used as a reducing agent, along with the corresponding emissions, to the industrial processes sector in its next annual submission.

Consumption of halocarbons and SF_6 – HFCs

53. The Party has provided detailed information on HFC emissions from stocks and banks in the NIR. However, it is not clear which gases are included under each subcategory in the NIR or in the CRF tables. In previous review reports it was observed, for example, that the stocks of split systems and packaged air-conditioning equipment in NIR tables 4.26 and 4.27 are shown to be quite large in the mid-1990s. Recommendations made in previous review reports included that the Party should exclude the non-HFC emissions from refrigerants from its estimate of HFC emissions, or at least clarify what is included in the emission estimates in the title of, or footnote to, the related tables. In response to questions raised by the ERT during the review regarding progress made in the implementation of this recommendation, Australia provided the ERT with preliminary information on HFC emissions, which the Party intends to report in its 2013 annual submission. The ERT welcomes these efforts and recommends that the Party provide the recalculated HFC emission estimates in its next annual submission.

3. Non-key categories

Lime production – CO_2

54. The CO_2 IEF for this category fluctuates between 1990 and 2010 (from 0.749 t/t to 0.755 t/t). Australia estimated CO_2 emissions from this category by applying different EFs (facility-specific and country-specific) to commercial lime and in-house lime. In response to questions raised by the ERT during the review, Australia provided information and data on the derivation of these EFs. Under NGERS, for commercial lime production since 2007, facilities with facility-specific lime product composition data use that information to develop EFs, while facilities without such data use a country-specific default EF

(0.75 t CO_2/t lime). For the years prior to 2007 a weighted average EF has been developed and applied. The country-specific EFs are based on assumed fractional purities for both commercial and in-house lime. For the in-house lime, 0.73 t CO_2/t lime was applied as the country-specific EF. The ERT welcomes Australia's explanation, including that it intends to include this additional information in its next annual submission. The ERT recommends that the Party do so and also include references to the EF data sources, in order to improve transparency, in its next annual submission.

Electrical equipment – SF_6

55. Australia has implemented several improvements in the 2012 annual submission in response to recommendations in the previous review report. For example, the Party has estimated SF_6 emissions using a new method provided to the previous ERT and corrected the error identified by the previous ERT in the estimation of the nameplate capacity of new equipment. The ERT welcomes the continued efforts by Australia to check and improve its estimates for this category. However, SF_6 emissions resulting from the disposal of electrical equipment were reported with operational emissions. Consistent with the IPCC good practice guidance they should be reported separately, in order to assess whether the appropriate AD and EFs are applied. Therefore, the ERT recommends that Australia disaggregate the emissions and report the estimates separately under each function (operation and disposal) in its next annual submission.

D. Agriculture

1. Sector overview

56. In 2010, emissions from the agriculture sector amounted to 80,058.25 Gg CO_2 eq, or 14.7 per cent of total GHG emissions. Since 1990, emissions have decreased by 7.4 per cent. The key driver for the fall in emissions is the 15.7 per cent decrease in CH_4 emissions from enteric fermentation (10,023.42 Gg CO_2 eq). Within the sector, 67.3 per cent of the emissions were from enteric fermentation, followed by 17.2 per cent from agricultural soils, 10.8 per cent from prescribed burning of savannas and 4.1 per cent from manure management. Field burning of agricultural residues accounted for 0.4 per cent. The remaining 0.2 per cent were from rice cultivation.

57. The Party has made recalculations for the agriculture sector between its 2011 and 2012 annual submissions in response to the 2011 annual review report and following changes in AD and EFs. The impact of these recalculations on the agriculture sector is a decrease in emissions of 0.9 per cent (756.12 Gg CO_2 eq) for 2009. The main recalculations took place in the following categories:

(a) Prescribed burning of savannas (a decrease in emissions by 804.54 Gg CO_2 eq, or 6.6 per cent);

(b) Agricultural soils (an increase in emissions by 49.49 Gg CO_2 eq, or 0.4 per cent);

(c) Enteric fermentation (a decrease in emissions by 5.04 Gg CO_2 eq, or 0.01 per cent);

(d) Field burning of agricultural residues (an increase in emissions by 4.87 Gg CO_2 eq, or 1.6 per cent).

58. Recommendations made in the previous review report included that Australia provide a more transparent description of the uncertainty analysis for the agriculture sector. The ERT noted that additional information was not provided in the 2012 annual submission. In response to questions raised by the ERT during the review, Australia indicated that the

tier 2 uncertainty analysis for the agriculture sector had been updated. For the 2012 annual submission the uncertainty estimates for prescribed burning of savannas were updated to reflect the use of a revised methodology (see para. 67 below). The uncertainty estimates, however, were not updated in NIR table A.7.9. The ERT reiterates the recommendation made in the previous review report that Australia provide a transparent description of its tier 2 uncertainty analysis in annex 7 to the NIR, including information on the sources of the applied values and distributions used, in its next annual submission.

59. The value 0.00 is reported in many cells under additional information in CRF table 4.A (e.g. for "feeding situation" and "pregnant" for all animal types and "digestibility of feed" for selected animal types), as well as in the cells of CRF table 4.B(a) and in the additional information to CRF table 4.E. In order to make the reporting more accurate and transparent, the ERT recommends that Australia report the appropriate notation keys instead of the value 0.00 in its next annual submission.

60. The references to the sources of some AD used in the calculations for the agriculture sector are lacking in the NIR (e.g. for the amount of synthetic fertilizer used, the allocation of animal waste management systems, and the area of cultivated histosols). In response to questions raised by the ERT during the review, the Party provided the ERT with the relevant references for the data sources. The ERT welcomes this information and recommends that the Party present the references in a more transparent manner in its next annual submission.

2. Key categories

Enteric fermentation – CH_4

61. Australia uses a tier 2 methodology with country-specific EFs to estimate emissions from enteric fermentation for cattle, sheep and swine. For most other livestock categories a tier 1 methodology with IPCC default EFs is used. For deer, alpacas, emus and ostriches country-specific EFs were used because IPCC default EFs are not available. The ERT considered the methods used to be in line with the IPCC good practice guidance.

62. Although there is no information in chapter 6.3 of the NIR on where emissions from feedlot cattle are reported in the CRF tables, it is clearly described in the documentation box of CRF table 4.A and it is also mentioned in the NIR as an explanation of the difference between the data from the Food and Agriculture Organization of the United Nations and the data reported in the CRF tables for beef cattle. The ERT reiterates the recommendation made in the previous review report that, in order to improve transparency, in its next annual submission Australia include information in the NIR to explain that emissions from feedlot cattle are reported under other (enteric fermentation) in the CRF tables.

Manure management – CH_4 and N_2O

63. To estimate CH_4 emissions from manure management, Australia uses a tier 2 method with country-specific EFs. To estimate N_2O emissions the methodology used is a tier 2 method based on the Revised 1996 IPCC Guidelines, with country-specific values for nitrogen excretion factors and the use of different animal waste management systems and IPCC default EFs. The ERT considered the methodologies to be in line with the IPCC good practice guidance.

64. As mentioned in the previous review reports, Australia calculates N_2O emissions from dairy cattle without including the protein intake of dairy calves. The current method assumes that calves are on pasture from birth. In response to questions raised by the ERT during the review, Australia indicated that it intends to implement a new method for

calculating emissions from dairy calves that reflects pre-weaning feeding regimes as soon as possible. According to Australia's preliminary assessment, when the new method is applied the estimated N_2O emissions from dairy cattle will increase and the estimated CH_4 emissions will decrease. According to Australia, the analysis indicates that the total effect of the methodological change will be a very small decrease in GHG emissions from manure management. The ERT reiterates the recommendation made in the previous review report that Australia apply this new method for its next annual submission.

65. In the reporting on manure management in CRF table 4.B(b), nitrogen excretion for ostriches has not been reported for 2010. In response to a question raised by the ERT during the review, Australia indicated that the nitrogen excretion factor for ostriches was 7 kg/head/year; however, the value did not appropriately appear in the CRF tables. The ERT recommends that Australia correct this in its next annual submission.

Agricultural soils – N_2O

66. For the fraction of nitrogen that volatilises as ammonia and nitrogen oxides from animal manure ($Frac_{GASM}$), values from the 2006 IPCC Guidelines are used in the calculation of emissions from agricultural soils. In response to questions raised by the ERT during the review regarding the representativeness of these fractions, Australia provided the ERT with information that demonstrated that these parameters better represent the Australian circumstances than the default fractions from the IPCC good practice guidance. The ERT recommends that Australia include this information in the NIR of its next annual submission.

Prescribed burning of savannas – CH_4 and N_2O

67. A new, revised country-specific methodology was used to estimate emissions from prescribed burning of savannas for the 2012 annual submission, which resulted in lower GHG emission estimates than previously reported for all years, except for 2005. In response to questions raised by the ERT during the review regarding whether the new methodology had been subject to any peer review process, the ERT was informed that the method was developed in conjunction with a savanna burning method for Australia's Carbon Farming Initiative (CFI). Through the CFI process, the method was first reviewed by invited external experts and through public submissions, and then by the Domestic Offset Integrity Committee as part of the CFI approval process. In addition, Australia is planning to implement an independent QA process for the method used in the inventory and has engaged an external expert to develop such a process for the estimation of emissions from prescribed burning of savannas. This is scheduled for implementation for the next annual submission. The ERT commends Australia for the improvements made for this category and recommends that the Party include the results of the planned QA/QC processes in its next annual submission.

E. Land use, land-use change and forestry

1. Sector overview

68. In 2010, net emissions from the LULUCF sector amounted to 38,284.80 Gg CO_2 eq. Since 1990, net emissions have decreased by 58.9 per cent. The key driver for the fall in emissions is the decrease in emissions from forest land converted to grassland. In addition, net emissions by sources and removals by sinks show large inter-annual changes and the LULUCF sector shifts between being a net sink and a net source of emissions throughout the time series. For example, the LULUCF sector was a net source of emissions in 2003 (247,798.95 Gg CO_2 eq) and a net sink in 2004 (37,218.92 Gg CO_2 eq). This trend is principally affected by natural disturbances such as fire, although it is also influenced by,

among other things, the inter-annual climate variability and drought. Within the sector, net emissions of 70,581.32 Gg CO_2 eq were from grassland and 19,851.52 Gg CO_2 eq from cropland. These emissions were offset by net removals of 49,641.08 Gg CO_2 eq from forest land. The category other (LULUCF) was a net sink of 2,506.97 Gg CO_2 eq and includes harvested wood products, agricultural lime application and N_2O emissions from disturbance associated with land converted to grassland.

69. The Party has made recalculations for the LULUCF sector between its 2011 and 2012 annual submissions, following changes in AD, in order to rectify identified errors and due to a revision for the category cropland remaining cropland. The impact of these recalculations on the LULUCF sector is a decrease in emissions of 14.5 per cent for 2009. The main recalculations took place in the following categories:

(a) Cropland (an increase in emissions by 39,325.23 Gg CO_2 eq, or 155.7 per cent);

(b) Grassland (a decrease in emissions by 53,833.22 Gg CO_2 eq, or 39.2 per cent);

(c) Forest land (a decrease in removals by 6,679.20 Gg CO_2 eq, or 12.1 per cent).

70. The emissions and removals for all land-conversion categories were estimated using a tier 3 approach, in which an ecosystem mass-balance model including all carbon pools (the Full Carbon Accounting Model (FullCAM)) is fully integrated with a spatially explicit land representation. A combination of tier 2 and tier 3 methodological approaches was used for land remaining in the same category. Australia has continued to improve the documentation relating to the tier 3 approach and the comparison of the results of the tier 3 model with those of the tier 2 approach for the land-conversion categories. The ERT welcomes these continued improvements.

71. Australia chose 50 years as the transition period for land-use conversion, but this was not fully applied in its disaggregation of land uses into the land-use remaining and land-use conversion subcategories, which is inconsistent with the IPCC good practice guidance for LULUCF. Australia's 2012 annual submission includes information on an improved disaggregation of land uses in its improvement plan resulting from a recommendation made in the previous review report. In response to a question raised by the ERT during the review regarding Australia's intended timeline for the full implementation of this transition period, Australia informed the ERT that its intention is to progressively implement the conversion period for all land-use categories over the next three submission years. This means that it will be consistently applied across all land-use categories for the 2015 annual submission. The ERT looks forward to seeing the results of this improvement in the Party's future annual submissions and encourages Australia to give priority to the land-use categories that are key categories.

72. In response to questions raised by the ERT during the review regarding the treatment of land areas that have been naturally regrown to forest since 1990 and have been subject to a human-induced clearing event, Australia identified errors due to an inconsistency in the treatment of soils on forest land converted to cropland and forest land converted to grassland. Australia submitted revised emission estimates to correct this error, resulting in a reduction in the estimate of emissions for forest land converted to other land of 3,712 Gg CO_2 eq for 2010. The ERT recommends that Australia report these revised emission estimates in the next annual submission.

2. Key categories

Forest land remaining forest land – CO_2

73. The subcategory forest land remaining forest land is subdivided into "harvested native forest", "pre-1990 plantations", "other native forests" and "fuelwood" (which includes emissions from across the other three subdivisions). Australia has elected to move lands from the conversion subcategory to the remaining category after 50 years, but is also planning to further use subcategories to separate recent land conversions (0 to 20 years) from older land conversions (21 to 50 years). As Australia's current reporting is not consistent with the IPCC good practice guidance for LULUCF, which requires any change in the area of forest land to correspond to a change in land use, the ERT reiterates the recommendation made in the previous review report that Australia report land-use categories consistently in its next annual submission.

74. As indicated in the previous review reports, Australia has explained that changes in the forest area under the subdivision "other native forests" do not always correspond to real changes in land use. Changes in forest cover due to climate variation in areas where tree crown cover is close to the threshold selected (20 per cent) are reported as changes in forest area. In the NIR, Australia has referred to an ongoing research project to improve the reporting on these changes in land use. In response to questions raised by the ERT during the review for Australia to elaborate on its latest efforts, Australia described work under way on a sparse woody vegetation national mapping programme to supplement the forest cover mapping programme. The implementation of the mapping programme as an annual update process, including ensuring time-series consistency, is expected to begin in 2013 and result in improved reporting on the "other native forests" category in the 2014 annual submission. The ERT welcomes this progress and recommends that the Party report the results in its 2014 annual submission. The ERT also reiterates the recommendation made in the previous review report that, in its next annual submission, Australia consistently apply the following criteria in the CRF tables and provide transparent documentation in the NIR:

(a) Areas of managed rangelands and pasture land where, due to climate variation, the tree crown cover permanently exceeds the forest threshold can no longer be considered grassland; they should be reported as a separate subdivision (e.g. natural forest expansion on grassland) under the subcategory land conversion to forest land;

(b) Areas of managed forests where, due to climate variation, the tree crown cover is permanently below (i.e. it is not expected to exceed) the forest threshold can no longer be considered forest land; they should be reported as a separate subdivision under the subcategory forest land converted to a new land use (e.g. grassland).

75. Australia assumes that there is no change in the soil carbon stock for the category forest land remaining forest land, which is estimated following the tier 1 approach from the IPCC good practice guidance for LULUCF. Australia has reported in the NIR that research is ongoing with a view to implementing higher-tier modelling of soil carbon for all forest land remaining forest land subcategories. The ERT welcomes these efforts and encourages Australia to implement higher-tier modelling and report on the results in its next annual submission.

Land converted to forest land – CO_2

76. Australia has reported land converted to forest land as a land-use change from grassland to plantations and the reporting is restricted to conversions since 1990. The area converted to forest land in 2010 was 1,129.78 kha and the associated removals were estimated at 16,982.53 Gg CO_2 eq. The method used to estimate emissions and removals is

a combination of tier 3 emission estimation and approach 3 land representation. The model covers all carbon pools, namely living biomass, dead organic matter and soils.

77. Australia has noted in the NIR that there are differences in the areas reported for forest land converted to grassland and cropland and the area of deforestation reported under Article 3, paragraph 3, of the Kyoto Protocol. In response to questions raised by the ERT during the review regarding the provision of further explanations for the reason for the differences (see paras. 112–114 below), the ERT learned that for the reporting under the Convention and for afforestation/reforestation land under the Kyoto Protocol, Australia only includes human-induced conversions on land converted to forest land since 1990 and excludes any natural forest regeneration.[9] Further, in response to these issues, Australia provided additional information on the direct human-induced conversion of non-forest land to forest land, including an estimate of the additional cumulative area of land that has been subject to direct human-induced conversion from grassland to forest land since 1990, considering implemented legal and regulatory frameworks (see para. 111 below). Based on the information provided to the ERT during the review, the ERT recommends that Australia review the estimates of land converted to forest land in order to ensure accuracy and completeness, and submit recalculated estimates in its next annual submission.

78. In addition, Australia provided information on clear-cut deforestation on areas subject to direct human-induced conversion of grassland to forest land. The ERT recommends that Australia review these figures in combination with the review recommended in paragraph 77 above, at the latest for its 2014 annual submission.

Cropland remaining cropland – CO_2

79. Australia has reported under cropland remaining cropland only land that was used for cropping prior to 1972 and has remained as cropland. The CO_2 emissions and removals were estimated using the tier 3 approach (FullCAM), which includes estimates of emissions and removals from living biomass, dead organic matter and mineral soils associated with land management practices and annual climate variability. Australia reported the CO_2 emissions for this land category as 7,433.51 Gg CO_2 for an area of 21,691.76 kha (equal area to that reported in the previous annual submission). Australia has reported in its 2012 annual submission for the first time the change in carbon stocks in living biomass for perennial woody crops, estimated using tier 1 methods as an interim method while it moves to a tier 2 method. The ERT commends Australia for this improved reporting and looks forward to seeing the results of the planned improvements to estimate emissions using a tier 2 method in the Party's future annual submissions.

80. Australia has reported that it conducted an internal review of the data inputs used in the estimation of emissions from the grassland and cropland categories. In this process Australia addressed, among other issues, recommendations made in the previous review report that the Party provide a greater disaggregation of crops. The analysis led to a more extensive QA/QC of the yield data for crop and pasture rotations, the re-evaluation of several crop and pasture regimes and the finding that some of the annual, herbaceous crops have growth cycles longer than the annual cycle. These crop and pasture rotations have now been rectified to ensure that they are aligned with an annual cycle of crop growth. Australia has also reported that the implementation of QC processes has led to improved crop management and yield data for the years prior to 2009. The ERT welcomes these improvements.

81. In response to questions raised by the ERT during the review regarding the provision of additional information on the data used that resulted from the re-evaluation of

[9] In the case that afforestation/reforestation land (under the Kyoto Protocol) is subsequently cleared, it should be reported as forest land converted to grassland and cropland.

the crop and pasture regimes, Australia informed the ERT that it plans to use a new plant growth model for the 2013 annual submission. The new model will provide more accurate estimates of pasture yields over the entire time series from 1970 onwards for all regions. The ERT looks forward to seeing the results of this improvement and recommends that Australia use the model for the next annual submission.

82. The land that is managed under a crop–pasture rotation has been reported under cropland remaining cropland. The conversion categories include only forest land converted to cropland or to grassland after 1972, leading to a variable land-conversion period (from 18 years for 1990 to 37 years for 2009), which is inconsistent with the IPCC good practice guidance for LULUCF. As precise information on the conversion of land prior to 1972 is not available, it is not possible to have the information for the 50-year period that Australia uses. The ERT reiterates the recommendation made in the previous review report that Australia improve the consistency of its reporting and provide estimates for the full chosen transition period (50 years) in its next annual submission.

Grassland remaining grassland – CO_2

83. In 2010, grassland remaining grassland amounted to a net source of 27,040.66 Gg CO_2. Emissions and removals are estimated for shrub and grass systems, including the effects of grazing, grass and shrub transitions and fire. The tier 3 approach (FullCAM) is used to estimate emissions and removals from all pools for the grass system. Australia has changed the calculation of the carbon stock changes in the above- and below-ground living masses for annual, herbaceous crops, in line with the IPCC good practice guidance for LULUCF. These changes are now calculated at the end of the crop cycle, as opposed to during the course of the crop cycle as was done for previous annual submissions. In line with the IPCC good practice guidance for LULUCF, Australia no longer reports the changes in carbon stock in dead organic matter. The ERT commends Australia for these improvements.

84. In response to questions raised by the ERT during the review about the change in estimation methods for crop and pasture regimes, Australia noted that for the arid and semi-arid regions of the country there are no pasture production yield data available. Australia explained that this is because of the poor grazing quality of these regions and the very low stocking rates (<0.03 cattle/ha). Australia informed the ERT that for these regions the CSIRO plant growth model will be used to estimate the amount of above-ground biomass that is likely to be grown in these arid and semi-arid regions and the results will be reported in the next annual submission. The ERT looks forward to seeing the results of this improvement and recommends that Australia include them in the next annual submission.

85. Australia is also developing a new grass-growth model and completing a full national time series of change in sparse woody (shrub) vegetation cover from 1988 onwards using the National Carbon Accounting System Landsat data. It is anticipated that the ongoing development of the methodology will provide for disaggregated reporting of the shrub component in the 2014 annual submission. In the meantime, a tier 2 method is used to estimate emissions and removals from the shrub areas for living biomass and dead organic matter. At the moment, Australia reports the CO_2 emissions and removals for this category as an aggregate number. The ERT reiterates the recommendation made in the previous review report that Australia also present the information in CRF table 5.C, disaggregated by grassland type, including grass and shrub transitions.

Forest land converted to cropland and forest land converted to grassland – CO_2

86. Australia has reported continuously cyclic forest regrowth and re-clearing of woody regrowth on grassland under forest land converted to grassland. Forest growth in the category forest land converted to grassland is modelled using a tier 3 method. Following a

recommendation made in the previous review report that Australia review the increase in carbon stocks in mineral soils for forest land converted to cropland, Australia reviewed the data and parameters in the model. These data have been improved and no such increase appears in the 2012 annual submission. The ERT commends Australia for this quality check and for the resulting improvement.

87. In the NIR, Australia has reported on the results of a tier 2 method to verify the emission estimates reported for the forest land converted to cropland and forest land converted to grassland categories. In response to questions raised by the ERT during the review regarding the implementation of the tier 2 method (e.g. the inclusion of living biomass in the method, the assumptions regarding the initial biomass assumed for each forest type, and the comparison of the tier 2 and tier 3 methods), Australia informed the ERT that it is undertaking further work on this tier 2 model during 2012 and hopes to present an uncertainty range for the estimate derived from the tier 2 model in its next annual submission. The ERT welcomes this QA/QC activity and recommends that Australia include the uncertainty range in the next annual submission.

3. Non-key categories

Biomass burning – CO_2, CH_4 and N_2O

88. In CRF table 5(V) Australia has not reported all emissions from biomass burning, but only a part of the annual emission estimates of the non-CO_2 gases. The CO_2 emissions and removals are included in other CRF tables as follows: CO_2 emissions and removals associated with the burning and subsequent regrowth of forest land are reported under forest land remaining forest land "other native forests"; those associated with slash burning in harvested native forests are reported under forest land remaining forest land "harvested native forests"; and those associated with the burning and subsequent regrowth of savannas and temperate grassland are reported under grassland remaining grassland. Non-CO_2 emissions from prescribed burning of savannas are reported under the agriculture sector. For the 2012 annual submission, Australia changed the methodology used to estimate emissions from biomass burning for grassland remaining grassland and no longer reports emissions from dead wood, rather only those from living perennial biomass. Australia's review of the EFs for CH_4 from biomass burning is ongoing and it is envisaged that the results of the project will be used for the 2014 annual submission. The ERT commends Australia for these ongoing improvement projects and recommends that Australia report on the results of the review of the EFs in its next annual submission.

F. Waste

1. Sector overview

89. In 2010, emissions from the waste sector amounted to 14,075.76 Gg CO_2 eq, or 2.6 per cent of total GHG emissions. Since 1990, emissions have decreased by 19.1 per cent. The key driver for the fall in emissions is the steady increase in the recovery rate of CH_4 emissions from landfills. Within the sector, 79.1 per cent of the emissions were from solid waste disposal on land, followed by 20.1 per cent from wastewater handling, 0.6 per cent from other (waste) and 0.2 per cent from waste incineration. Over the period 1990 to 2010, emissions from solid waste disposal on land and wastewater handling decreased by 17.8 per cent and 24.9 per cent, respectively.

90. Australia has made recalculations for the waste sector between its 2011 and 2012 annual submissions, mainly following changes in AD. The impact of these recalculations on the waste sector is a decrease in emissions of 2.1 per cent for 2009. The main recalculations took place in the following categories:

(a) Solid waste disposal on land: a revision of the AD on wood and paper disposal in the harvested wood products model (a decrease in emissions of 164.45 Gg CO_2 eq, or 1.5 per cent);

(b) Wastewater handling: a revision of the facility-level CH_4 capture volume (see para. 96 below) (a decrease in emissions of 208.41 Gg CO_2 eq, or 6.9 per cent);

(c) The inclusion of emissions from composting of solid waste (see para. 102 below) (an increase in emissions of 71.25 Gg CO_2 eq).

91. Although the accuracy of the estimates has been enhanced by the recalculations, the ERT identified some errors in the additional information provided in the CRF tables and in the NIR (see paras. 94 and 98 below). In response to questions raised by the ERT during the review, Australia informed the ERT that it is currently improving the QC process for the data in the waste sector CRF tables in order to reduce the chances of misreporting. The ERT welcomes the planned improvement to the QC process and recommends that Australia fully implement the QC procedures to eliminate such errors in its next annual submission.

2. Key categories

Solid waste disposal on land – CH_4

92. To estimate emissions from this category, Australia applied the IPCC tier 2 methodology using country-specific degradable organic carbon fraction values and the IPCC default parameter values for degradable organic carbon and methane generation constant, in line with the UNFCCC reporting guidelines and the IPCC good practice guidance. In order to accurately estimate CH_4 emissions from landfills, Australia back-calculated the compositional landfilled amounts of solid waste to 1940 in a reasonable manner, assuming that the total landfilled waste correlates with the sum of the paper and wood waste disposed of at landfills, data which are available back to 1936.

93. The ERT noted that, although Australia has reported the incineration of municipal solid waste (MSW) occurring until 1996 in the CRF tables, the Party has reported a fraction of MSW disposed of at solid waste disposal sites (SWDS) of 1.0 for the period 1990–1996. In response to questions raised by the ERT during the review regarding the assumption that 100 per cent of MSW is disposed of at SWDS, Australia explained that the quantities of waste reported in the CRF tables refer to the waste disposed of at landfills as opposed to the waste generated. As such, Australia explained that all waste reported in CRF table 6.A is disposed of at landfills; hence the use of 1.0 for the fraction of MSW disposed of at SWDS. In order to improve transparency, the ERT recommends that Australia provide information in its next annual submission explaining why the Party does not take into account the fraction of MSW incinerated in the additional information to CRF table 6.A.

94. As noted in the previous review report, Australia incorrectly recorded a delay time of 50 years, as opposed to 0.5 years, in the additional information to CRF table 6.A. The ERT observed that this incorrect delay time remains in the Party's 2012 annual submission. The ERT therefore reiterates the recommendation made in the previous review report that Australia correct the delay time in the additional information to CRF table 6.A in its next annual submission.

Wastewater handling – CH_4 and N_2O[10]

95. Australia has developed country-specific biochemical degradable carbon loadings and methane conversion factor values to produce estimates of CH_4 generation from wastewater handling. Australia's estimates of CH_4 emissions from domestic and commercial wastewater and industrial wastewater handling are in line with the IPCC good practice guidance.

96. Australia has made recalculations for this category as a result of a revision of the facility-level CH_4 capture volume. In response to questions raised by the ERT during the review regarding the CH_4 capture capacity at individual wastewater treatment plants, Australia provided detailed information on the reason for this recalculation, including the error identified by DCCEE during QA checks for Sydney Water, which services the largest population centre in Australia. The ERT welcomes the Party's effort to improve the AD.

97. Recommendations made in the previous review report included that Australia state the conversion ratio between chemical oxygen demand (COD) and biochemical oxygen demand used in the estimation of emissions from domestic and commercial wastewater handling. In response to questions raised by the ERT during the review, Australia provided the ratio of 2.6:1. The ERT commends the Party for its cooperation and recommends that Australia include this ratio in its next annual submission.

98. The ERT noted that the values for COD generation for some industries reported in the NIR for industrial wastewater are not consistent with the corresponding data in CRF table 6.B. For example, according to the NIR the COD for vegetables is 1.2 kg COD/m^3 wastewater generated, while 0.22 kg COD/m^3 wastewater generated is reported in CRF table 6.B. The ERT therefore reiterates the recommendation made in the previous review reports that Australia improve its QC procedures to eliminate such mistakes in its next annual submission.

99. Australia has developed a country-specific methodology and parameter values (e.g. nitrogen (N) loadings and N amounts in effluent) to estimate N_2O emissions from human sewage, in order to enhance the accuracy of the N_2O emission estimates for this category. The approach is based on the IPCC good practice guidance and comprises estimates of emissions from sewage treatment at wastewater treatment plants and emissions from effluent discharged into the aquatic environment and from disposal of treated sludge on land. Facility-specific data on total N entering wastewater treatment plants and being discharged in effluent have been obtained, partly through NGERS, representing 108 facilities. Australia used the IPCC default EF to estimate emissions from wastewater treatment plants, effluent and treated sludge applied to agricultural land.

100. Recommendations made in previous review reports included that Australia reallocate emissions from sludge application on agricultural land to the agriculture sector. In response to questions raised by the ERT during the review regarding why the discussion of planned improvements on this issue that appeared in the 2011 annual submission was deleted in the 2012 annual submission, Australia indicated that it has initiated the necessary steps to undertake this reallocation for its 2013 annual submission. The ERT welcomes the Party's approach and recommends that Australia report according to this reallocation in its next annual submission.

[10] Not all emissions related to all gases under this category are key categories, particularly N_2O emissions. However, since the calculation procedures for issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

3. Non-key categories

Waste incineration – CO_2, CH_4 and N_2O

101. Australia has reported estimates of CO_2 emissions from the incineration of solvents and clinical waste, as well as of CO_2 and N_2O emissions from the incineration of MSW, for the period 1990–1996 (incineration ceased in 1996). As mentioned in previous review reports, however, CH_4 and N_2O emissions from the incineration of solvents and clinical waste are likely to still be occurring. In response to questions raised by the ERT during the review, Australia stated that, although the IPCC good practice guidance does not provide relevant N_2O EFs, it intends to conduct a review to determine N_2O EFs for clinical waste and solvent incineration. The ERT welcomes the Party's approach and encourages it to quantify the emissions of CH_4 and N_2O from waste incineration in its future annual submissions.

Other (waste) – CH_4 and N_2O

102. In its 2012 annual submission, Australia has reported CH_4 and N_2O emissions from biological treatment of solid waste, which were estimated applying the methodology from the 2006 IPCC Guidelines and country-specific EFs. The ERT welcomes the adoption of a country-specific approach to estimate emissions from biological treatment of solid waste that considers national circumstances in which aerobic windrow composting is the dominant form of treatment. However, the properties of the country-specific EFs and the related actual share of aerobic windrow composting in Australia are not clear from the NIR. In response to a question raised by the ERT during the review, Australia provided additional information.[11, 12] In order to improve transparency, the ERT recommends that Australia provide this detailed information on the properties of the country-specific EFs and the national circumstances, referencing the relevant literature, in its next annual submission.

103. Australia uses survey data taken from an annual industry survey on the total amount of material processed through composting and anaerobic digestion for the years 2004–2010 only. In order to obtain the full time series of AD for 1990–2003, Australia extrapolates the survey data for 2004–2010. To improve the estimation of the time series, the ERT encourages Australia to continue to investigate alternative data sources.

G. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

1. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Overview

104. Australia has included in its NIR the information required in accordance with decision 15/CMP.1, annex, paragraphs 5–9 for activities under Article 3, paragraph 3, of the Kyoto Protocol. Australia has chosen annual accounting for activities under Article 3, paragraph 3. Australia has not elected to account for any activity under Article 3, paragraph 4, of the Kyoto Protocol.

105. Australia's forest definition under the Kyoto Protocol matches its forest definition under the Convention. The NIR states that forest areas have been mapped consistently since

[11] De Groot M. 2010. *Update of Emission Factors for N_2O and CH_4 for Composting, Anaerobic Digestion and Waste Incineration.* (final report). Amersfoort: DHV B.V.

[12] Recycled Organics Unit. 2010. *Organics Recycling in Australia: Industry Statistics 2010*. Sydney, Australia: Recycled Organics Unit. Available at <www.recycledorganics.com/publications>.

1972 using remote sensing data, and that time-series consistent wall-to-wall monitoring ensures the clear reporting of activities under Article 3, paragraph 3, of the Kyoto Protocol (afforestation, reforestation and deforestation).

106. Australia's NIR describes that the land areas included in the accounting for deforestation are those that meet the minimum forest area and met the forest definition on 31 December 1989 but have subsequently ceased to do so. During the review, the ERT considered that there is a discrepancy in the land areas between deforestation activities under the Kyoto Protocol and forest land converted to cropland and grassland under the Convention, as well as a lack of transparency in the reporting of land-use changes to and from forest land. In response to the list of potential problems and further questions raised by the ERT during the review week, Australia informed the ERT about deforestation that is occurring on afforestation and reforestation lands. Australia submitted revised emission estimates indicating that this area of deforestation is equal to 11.85 kha. The ERT welcomes this improved reporting.

107. Australia has made recalculations for the KP-LULUCF activities between its 2011 and 2012 annual submissions in order to include the most recent satellite data. The impact of these recalculations on each KP-LULUCF activity for 2008 and 2009 is as follows:

(a) A decrease in the estimated removals from afforestation and reforestation by 1,665.46 Gg CO_2 eq (3.6 per cent);

(b) An increase in the estimated emissions from deforestation by 11,358.77 Gg CO_2 eq (12.1 per cent).

Activities under Article 3, paragraph 3, of the Kyoto Protocol

Afforestation and reforestation – CO_2

108. Australia has used a tier 3, approach 3, system to estimate net emissions from activities under Article 3, paragraph 3, of the Kyoto Protocol. These are the same methods used for the reporting under the Convention, with additional data and policy settings. Australia has explained in the NIR some of the steps taken to ensure that only direct human-induced change on land that was non-forest on 31 December 1989 is included in afforestation and reforestation. These include removing from the remote-sensing, data and programme land areas protected from human-induced change (e.g. national parks) and a process of expert assessment to assign a cause to the land-use change mapped.

109. In the 2012 annual submission, Australia does not consider forests that are "naturally regrown" to be human-induced from its reporting on land converted to forest land under the Convention and on afforestation and reforestation under the Kyoto Protocol. Australia has included in its 2012 annual submission only planted and direct seeded forests established since 1990 under the afforestation and reforestation activity. In response to questions raised by the ERT during the review regarding the provision of additional information to explain the rationale for the exclusion of naturally regrown forest, the Party explained that the land converted to forest land reported under the Convention also only includes direct human-induced conversions to forest land since 1990, and that thus the Convention reporting and the area of afforestation and reforestation under the Kyoto Protocol are the same.

110. For 2010, Australia has reported that 147.93 kha of the afforestation and reforestation land has been harvested since the beginning of the commitment period and 981.86 kha has not been harvested. Australia has reported the harvesting and non-harvesting activity by regional location and species group in CRF tables 5(KP-1)A.1.2 and (KP-1)A.1.1, respectively. The ERT noted that, for the non-harvested areas, there was an increase in removals for some subactivities (e.g. NSW_Hardwood, NSW_Other and

NSW_Softwood), which was not reflected as an increase in the respective areas. Similar variations were observed in relation to the harvested areas, where the net emissions for some of the categories did not follow the pattern of area change. The ERT reiterates the recommendation made in the previous review report that Australia provide more information on the estimation of the carbon stock changes for the units of land harvested and not harvested in chapter 11 of the NIR in its next annual submission.

111. In response to the list of potential problems and further questions raised by the ERT during the review week (see paras. 112–114 below), Australia provided information on the areas of non-forest land in 1990 that naturally regrew into forest after 1990 and on the direct human-induced conversion of grassland to forest land. Australia provided the ERT with information on the legal and regulatory frameworks covering the non-forest land and on which regeneration into forest could be considered a direct human-induced activity that would allow afforestation and reforestation to occur. Australia also provided in the NIR, as an alternative to the present approach (i.e. excluding these lands from the accounting for afforestation and reforestation), an estimate of the additional cumulative amount of land that could be considered to have been subject to direct-human induced conversion from grassland to forest land since 1990. Using this information and approach, Australia has estimated that the area of land converted to forest land and the associated (additional) removals would increase. The ERT welcomes this information and recommends that Australia include forest land that "naturally" regrew after 1990, and that is subject to the implemented legal and regulatory frameworks that, in practice, result in human-induced afforestation and reforestation activities, in its reporting under Article 3, paragraph 3, of the Kyoto Protocol in its next annual submission, including the relevant background references and justification.

Deforestation – CO_2

112. Australia's mapping of deforestation follows the same mapping framework as for the identification of afforestation and deforestation. In the NIR, Australia has stated that the reporting on deforestation is consistent with the methods provided in section 4.2.6.2 of the IPCC good practice guidance for LULUCF. Australia has stated that its accounting for deforestation includes only areas that: (a) meet or exceed the size of the country's minimum forest area (i.e. 0.05 to 1 ha); (b) met the definition of forest on 31 December 1989; and (c) ceased to meet the definition of forest at some point after 1 January 1990 as a result of direct human-induced deforestation. Given this interpretation, only existing forest on 31 December 1989 that has subsequently been cleared would be included in the reporting on deforestation. During the course of the review, Australia noted that it had omitted to report in the NIR that deforestation on afforestation/reforestation lands must also be accounted and that this omission should be corrected. The ERT recommends that Australia correct this omission in its next annual submission.

113. Australia has explained in the NIR that the area reported as forest land converted to grassland and cropland under the Convention is different from the area reported as deforestation land in the reporting under the Kyoto Protocol. The reason for the difference is the exclusion from the accounting for deforestation of land that was not forest in 1990 but, after 1990, subsequently naturally regrew and was then re-cleared. Owing to the lack of transparency, the ERT developed a list of potential problems and further questions raised by the ERT during the review week, including a recommendation that Australia demonstrate that land that is classified as afforestation/reforestation land and is then converted to another land use is accounted for as deforestation.

114. In response to the list of potential problems and further questions raised by the ERT during the review week, Australia analysed the available data for monitoring the harvest of afforestation and reforestation lands to distinguish harvest events and transitions from forest

to non-forest land. Australia explained that there is a high degree of uncertainty in relation to the management of post-harvest areas. Nevertheless, Australia stated that a period of eight years following the year of harvest would be a reasonable time frame in which to detect whether the forest land was deforested. This resulted in an estimated cumulative area of 11.85 kha of afforestation and reforestation land that was deforested. Using the tier 2 model and this area results in a reduction in the estimate of removals equivalent to 276,372 t CO_2 eq/year in the accounting for afforestation and reforestation. Australia used this information to submit revised emission estimates. The ERT recommends that Australia document this approach in the NIR of its next annual submission.

115. The ERT conducted a careful review of all relevant decisions (including decision 16/CMP.1), as well as all the relevant references in the IPCC good practice guidance for LULUCF. Based on this review, the ERT concluded that decision 16/CMP.1, for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, does not restrict deforestation to areas that were forest on 31 December 1989, nor does the decision exclude naturally regrown forest, regardless of whether such forest was established through human-induced means or not.[13] Deforestation is defined in the annex to decision 16/CMP.1 as the direct human-induced conversion of forested land to non-forested land. The ERT notes that its conclusion is consistent with the conclusions of the eighth meeting of inventory lead reviewers, that in the case where the guidance provided in the IPCC good practice guidance for LULUCF is inconsistent with the provisions of the relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP), the decisions take precedence. Therefore, the ERT strongly recommends that, in its next annual submission, but at the latest in its 2014 annual submission, Australia include in the accounting for deforestation estimates of the emissions from naturally regenerated forest land established since 31 December 1989 which has been subsequently deforested. Australia has noted that, in its view, it has implemented the IPCC good practice guidance for LULUCF, as specified, and has implemented a "balanced accounting" approach in which neither the sequestration nor the emissions on these lands with natural forest regeneration since 1990 are counted and that the overall net emissions have not been underestimated.

116. In response to the list of potential problems and further questions raised by the ERT during the review week, Australia provided information and data on the impact of direct human-induced afforestation and reforestation of regenerated forest within legal and regulatory frameworks (see para. 111 above). On the basis of the information provided, the ERT concluded that the potential additional removals resulting from the inclusion of afforestation and reforestation on these naturally regrown lands are greater than the additional emissions from deforestation, and therefore that the overall net emissions reported by Australia were not underestimated and an adjustment was not warranted.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

117. Australia has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings included in the SIAR on the SEF tables and the SEF comparison report.[14]

[13] Australia noted an omission in its 2012 NIR regarding the accounting of deforestation on afforestation/reforestation lands, which must also be accounted (see para. 112 of this report).

[14] The SEF comparison report is prepared by the ITL administrator and provides information on the outcome of the comparison of data contained in the Party's SEF tables with corresponding records contained in the ITL.

The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings contained in the SIAR.

118. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements referred to in decision 22/CMP.1, annex, paragraph 88(a–j). The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

Accounting of activities under Article 3, paragraph 3, of the Kyoto Protocol

119. Australia has reported information on its accounting of KP-LULUCF in the accounting table, as included in the annex to decision 6/CMP.3.

120. Table 6 shows the accounting quantities for KP-LULUCF as reported by the Party and the final values after the review.

Table 6
Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol, in t CO_2 eq

	2012 submission[a]			*2010 and 2011 submissions*[b]	*"Net" accounting quantity*[c]
	As reported	*Revised estimates*	*Final*	*Final*	
Afforestation and reforestation	–70 958 902	–70 129 785	–70 129 785	–46 294 933	–23 834 852
Deforestation	149 521 946	149 703 563	149 703 563	93 815 088	55 888 475
Forest management	NA	NA	NA	NA	NA
Article 3.3 offset[d]	NA	NA	NA	NA	NA
Forest management cap[e]	NA	NA	NA	NA	NA
Cropland management	NA	NA	NA	NA	NA
Grazing land management	NA	NA	NA	NA	NA
Revegetation	NA	NA	NA	NA	NA

Abbreviations: CRF = common reporting format, GHG = greenhouse gas, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

[a] The values included under the 2012 submission are the cumulative accounting values for 2008, 2009 and 2010 as reported in the accounting table of the KP-LULUCF CRF tables for the inventory year 2010.

[b] The values included under the 2010 and 2011 submissions are the final accounting values as a result of the 2010 and 2011 reviews and are included in table 4 of the 2011 annual review report (FCCC/ARR/2011/AUS, page 33) in the column "2011 annual submission", "Final".

[c] The "net accounting quantity" is the quantity of Kyoto Protocol units that the Party shall issue or cancel under each activity under Article 3, paragraph 3, and paragraph 4, if relevant, based on the final accounting quantity in the 2011 submission and where the quantities issued or cancelled based on the 2010 review have been subtracted ("net accounting quantity" = final 2012 – final 2010 and 2011).

[d] "Article 3.3 offset": for the first commitment period, a Party included in Annex I to the Convention that incurs a net source of emissions under the provisions of Article 3, paragraph 3, of the Kyoto Protocol may account for anthropogenic GHG emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net

source of emissions under the provisions of Article 3, paragraph 3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic GHG emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

[e] In accordance with decision 16/CMP.1, annex, paragraph 11, for the first commitment period only, additions to and subtractions from the assigned amount of a Party resulting from forest management under Article 3, paragraph 4, of the Kyoto Protocol after the application of decision 16/CMP.1, annex, paragraph 10, and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

121. Based on the information provided in table 6 for the activity afforestation/reforestation, Australia shall issue 23,834,852 removal units (RMUs) in its national registry.

122. Based on the information provided in table 6 for the activity deforestation, Australia shall cancel 55,888,475 assigned amount units, emission reduction units, certified emission reduction units, and/or RMUs in its national registry.

National registry

123. The ERT took note of the SIAR and its finding that the reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1. The ERT further noted from the SIAR and its finding that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with decisions 16/CP.10 and 12/CMP.1. The national registry also has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate.

Calculation of the commitment period reserve

124. Australia has reported its commitment period reserve in its 2012 annual submission. Australia reported that its commitment period reserve has not changed since the initial report review (2,661,821,229 t CO_2 eq), as it is based on the assigned amount and not on the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

125. Australia reported that there have been changes in its national system since the previous annual submission. Australia reported in its NIR that the designated representative with overall responsibility for the national inventory has been changed from the Director of the National Inventory Team to the Assistant Secretary of National Inventory Systems and International Reporting Branch of DCCEE. Australia also reported that it is continuing the efforts initiated in the 2011 annual submission to incorporate more facility-specific data obtained through NGERS into the national inventory. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

126. Australia reported that there have been changes in its national registry since the previous annual submission. Australia reported in its NIR that changes to the Australian National Registry of Emission Units included enhancements to security to ensure that two authorization steps are required in the approval of high-risk transfer transactions, a change in the publicly available information available under the Public Reports, and improvements to data integrity measures. The ERT concluded that, taking into account the confirmed changes in the national registry, Australia's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1,

and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the CMP.

5. Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

127. Australia reported that there have been changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, since the previous annual submission. The ERT concluded that the information provided continues to be complete and transparent.

128. Australia has reported updated and additional information relating to the actions and activities in which Australia is engaged to implement its commitments under Article 3, paragraph 14 of the Kyoto Protocol in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties. In its NIR, Australia reported that it hosted the Expert Group on Clean Fossil Energy Business meeting and annual session in 2012, which facilitated knowledge-sharing and cooperation among government and industry. Australia also reported updated information relating to the Carbon Capture Use and Storage Action Group's activities.

129. More broadly, Australia provides information on a range of additional initiatives currently under way. For example, Australia is contributing to global efforts in the development, diffusion and transfer of advanced technologies that capture and store GHGs and encourage their wider use. In that effort, Australia facilitates the participation of least developed countries and other Parties not included in Annex I to the Convention to strengthen their capacity. Specific project and partnerships include the Australia–China Joint Coordination Group on Clean Coal Technology, the Global Carbon Capture and Storage Institute, the Carbon Sequestration Leadership Forum, the Asia Pacific Partnership on Clean Development and Climate, the Global Methane Initiative, and the Asia Pacific Economic Cooperation Expert Group on Clean Fossil Energy.

III. Conclusions and recommendations

A. Conclusions

130. Australia made its annual submission on 14 April 2012. The annual submission contains the GHG inventory (comprising the CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on: activities under Article 3, paragraph 3, of the Kyoto Protocol, Kyoto Protocol units, changes to the national system and the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1.

131. The ERT concludes that the inventory submission of Australia has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1990–2010 and an NIR; these are complete in terms of geographical coverage, years, sectors, categories and gases. The ERT notes that CRF table 7 (summary overview of key categories) has not been completed for 1990. The ERT noted that although Australia reports "NE" for CH_4 emissions from post-mining activities at surface coal mines (see para. 43 above), in response to questions raised by the ERT during the review, the notation key "IE" should be used.

132. The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1.

133. The Party's inventory is in line with the Revised 1996 Guidelines and the IPCC good practice guidance and is generally in line with the IPCC good practice guidance for LULUCF.

134. The Party has made recalculations for the inventory between its 2011 and 2012 annual submissions following changes in AD and EFs and in order to rectify identified errors. The impact of these recalculations on the national totals is an increase in emissions of 0.3 per cent for 2009. The main recalculations took place in the following sectors/categories:

(a) CO_2, CH_4 and N_2O[15] emissions from forest land, cropland, grassland and other in the LULUCF sector (an increase in removals by 7,815.01 Gg CO_2 eq, or 14.5 per cent);

(b) CO_2, CH_4 and N_2O emissions across all categories in the energy sector (an increase in emissions by 2,966.34 Gg CO_2 eq, or 0.7 per cent);

(c) All categories in the agriculture sector, except CH_4 emissions from rice cultivation (a decrease in emissions by 756.12 Gg CO_2 eq, or 0.9 per cent).

135. Australia has chosen annual accounting for activities under Article 3, paragraph 3, of the Kyoto Protocol. Australia has not elected to account for any activity under Article 3, paragraph 4, of the Kyoto Protocol. With respect to the conclusion in paragraph 115 above that Australia does not include deforestation on all land areas in its accounting, the ERT concludes that decision 16/CMP.1, supported by the conclusions of the eighth meeting of inventory lead reviewers, does not restrict deforestation to be applied to land that was forest by 31 December 1989, and emissions from "naturally" regenerated forest land established since 31 December 1989 which has been subsequently cleared must be included in the annual submission. The ERT also concludes, based on the information provided during the review, that the potential additional removals from the inclusion of afforestation/reforestation on these naturally regrown lands are greater than the additional deforestation emissions, and therefore that the overall net emissions reported by Australia were not underestimated and an adjustment was not warranted.

136. The Party has made recalculations for the KP-LULUCF activities between its 2011 and 2012 annual submissions in order to rectify errors identified at earlier stages of the review. The impact of these recalculations on each KP-LULUCF activity for 2008 and 2009 is as follows:

(a) A decrease in the estimate of removals from afforestation and reforestation by 1,665.46 Gg CO_2 eq (3.6 per cent);

(b) An increase in the estimate of emissions from deforestation by 11,358.77 Gg CO_2 eq (12.1 per cent).

137. Australia has reported information on its accounting of Kyoto Protocol units in accordance with decision 15/CMP.1, annex, chapter I.E, and used the required reporting format tables as specified by decision 14/CMP.1.

138. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1.

139. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the

[15] N_2O emissions for the category other were not recalculated for 2009.

technical standards for data exchange between registry systems in accordance with relevant decisions of the CMP.

140. Australia has reported information under decision 15/CMP.1, annex, chapter I.H, "Minimization of adverse impacts in accordance with Article 3, paragraph 14", as part of its 2012 annual submission. The information was provided on 14 April 2012 and is complete and transparent (see paras. 128 and 129 above).

B. Recommendations

141. The ERT identifies issues for improvement as listed in table 7 below. The recommendations are to be implemented for the next annual submission, unless otherwise specified.

Table 7
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph reference*
General	Completeness of inventory	Provide CRF table 7 for 1990	10 and 16
	Transparency	Improve the transparency of the information provided in relation to all sectors	23
Energy	Sector overview	Review opportunities to incorporate NGERS data into the annual submission and ensure time-series consistency where NGERS data are used	31
	Comparison of the reference approach with the sectoral approach	Describe the difference between the reference and sectoral approaches in the NIR	32
		Include the rationale for the differences observed between the CRF tables and the data reported to IEA for both liquid and gaseous fuels in the NIR	33
	Stationary combustion: liquid fuels – CO_2	Collect and incorporate activity data from a survey of small power stations	37
		Analyse NGERS data in order to understand the variability in the data and, on the basis of this analysis, recalculate the time series in a manner consistent with the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*	38
	Coal mining and handling – CO_2 and CH_4	Conduct research to determine whether CH_4 flaring took place prior to 2009 and provide updated information	41
		Update figure A6.2 in the NIR to incorporate CH_4 flaring activity	42
		Revise the notation key from "NE" to "IE" for the post-mining component of surface mining emissions and describe where the emissions are reported in the NIR and in CRF table 9(a)	43

Sector	*Category*	*Recommendation*	*Paragraph reference*
	Stationary combustion: solid fuels – CO_2, CH_4 and N_2O	For petroleum refining, revise the notation key used from "NA" to "NO" for the whole time series	45
	Stationary combustion (residential): liquid fuels – CO_2, CH_4 and N_2O	Review the internal data collection system and revise the entire time series of AD	46
Industrial processes and solvent and other product use	Sector overview	Implement the following planned improvements: the use of a country-specific EF for lime production; the reallocation from the energy sector to the industrial processes sector of the emissions from the use of coke as a reducing agent in iron and steel production; the provision of additional information regarding the calculation of HFC emissions from the category consumption of halocarbons and SF_6; and the adoption of a revised method for estimating SF_6 emissions from electrical equipment	49
		Where NGERS data are used, transparently describe how the multiple data sets reflect the national GHG emissions for each subcategory, how it is ensured that all emission categories are covered by these data sets and how verification of the data is carried out, as well as how the data result in a consistent time series	50
	Other (chemical industry) – CO_2 and N_2O	Provide the disaggregated data, or information on the improvement plan, to improve transparency in relation to the chemical industry	51
	Iron and steel production – CO_2	Reallocate the pulverized coal used as a reducing agent, along with the corresponding emissions, to the industrial processes sector	52
	Consumption of halocarbons and SF_6 – HFCs	Provide the recalculated data for HFC emission estimates	53
	Lime production – CO_2	Include additional information on the derivation of the EFs, including references to the data sources	54
	Electrical equipment – SF_6	Disaggregate the emissions and report them separately under each function (operation and disposal)	55
Agriculture	Sector overview	Provide a transparent description of the tier 2 uncertainty analysis in annex 7 to the NIR, including information on the sources of the applied values and distributions used	58
		Report the appropriate notation keys in CRF table 4.A instead of the value 0.00	59
		Include the references for sources of AD (e.g. amount of synthetic fertilizer used, the allocation of animal waste management systems, and the area of cultivated histosols)	60
	Enteric fermentation – CH_4	Include information in the NIR to explain that emissions from feedlot cattle are reported under other (enteric fermentation) in the CRF tables	62
	Manure management	Apply the new method for calculating emissions from dairy	64

Sector	*Category*	*Recommendation*	*Paragraph reference*
	– CH_4 and N_2O	calves that reflects pre-weaning feeding regimes	
		Include in CRF table 4.B(b) the nitrogen excretion rate for ostriches for 2010	65
	Agricultural soils – N_2O	Provide information to demonstrate the representativeness for the value of the fraction of nitrogen that volatilises as ammonia and nitrogen oxides from animal manure ($Frac_{GASM}$) from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*	66
	Prescribed burning of savannas – CH_4 and N_2O	Document the results of the planned QA/QC processes for the new emission estimation method	67
LULUCF	Sector overview	Report revised emission estimates for soils on forest land converted to cropland and forest land converted to grassland	72
	Forest land remaining forest land – CO_2	Report land-use categories consistently with respect to the timing for moving lands from the conversion category to the remaining category	73
		Report the results of the work under way on a national mapping programme to supplement the forest cover mapping programme	74
		Consistently apply the following criteria in the CRF tables and provide transparent documentation in the NIR: (a) areas of managed rangelands and pasture land where, due to climate variation, the tree crown cover permanently exceeds the forest threshold can no longer be considered grassland; they should be reported as a separate subdivision (e.g. natural forest expansion on grassland) under the subcategory land conversion to forest land; and (b) areas of managed forests where, due to climate variation, the tree crown cover is permanently below (i.e. it is not expected to exceed) the forest threshold can no longer be considered forest land; they should be reported as a separate subdivision under the sub-category forest land converted to a new land use (e.g. grassland)	74
	Land converted to forest land – CO_2	Review the estimates of land converted to forest land in order to ensure accuracy and completeness, and submit recalculated estimates	77
		Review these figures in combination with the review recommended in paragraph 77 of this report, at the latest in the 2014 annual submission	78
	Cropland remaining cropland – CO_2	Implement and report on the new plant growth model	81
		Improve the consistency of the reporting and provide estimates for the full chosen period (50 years)	82
	Grassland remaining grassland – CO_2	Implement and report on the use of the CSIRO plant growth model used to estimate the amount of above-ground mass that is likely to be grown in arid and semi-arid regions	84
		Improve transparency by presenting information in CRF table 5.C disaggregated by grassland type, including grass and shrub transitions	85

Sector	*Category*	*Recommendation*	*Paragraph reference*
	Forest land converted to cropland and forest land converted to grassland – CO_2	Provide the results of the review of the tier 2 method used to verify the emission estimates reported	87
	Biomass burning – CO_2, CH_4 and N_2O	Report the results of the review of the EFs	88
Waste	Sector overview	Fully implement the QC procedures so as to eliminate mistakes when filling in data in the CRF tables	91
	Solid waste disposal on land – CH_4	Provide information to explain why the Party does not take into account the fraction of municipal solid waste incinerated in the additional information to CRF table 6.A	93
		Correct the delay time in the additional information to CRF table 6.A	94
	Wastewater handling – CH_4 and N_2O	Include the conversion ratio between chemical oxygen demand and biochemical oxygen demand used in the estimation of domestic and commercial wastewater handling	97
		Improve the QC procedures	98
		Reallocate emissions from sludge application on agricultural land to the agriculture sector of the inventory	100
	Other (waste) – CH_4 and N_2O	Provide detailed information on the properties of the country-specific EFs and the national circumstances in relation to aerobic windrow composting, referencing the appropriate literature	102
Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol	Activities under Article 3, paragraph 3, of the Kyoto Protocol	Provide more information on the estimation of the carbon stock changes for the units of land harvested and not harvested in chapter 11 of the NIR	110
		Include forest land that "naturally" regrew after 1990, and that is subject to the implemented legal and regulatory framework that, in practice, results in human-induced afforestation and reforestation activities, in the reporting under Article 3, paragraph 3, of the Kyoto Protocol	111
	Deforestation – CO_2	Reflect in the NIR that deforestation on afforestation/reforestation lands must also be accounted	112
		Document in the NIR the approach of using a period of eight years following the year of harvest to detect whether forest land has been deforested	114
		Include in the accounting for deforestation the emissions from naturally regenerated forest land established since 31 December 1989 which has been subsequently deforested in the next annual submission, but at the latest in the 2014 annual submission	115

Abbreviations: CRF = common reporting format, EF = emission factor, GHG = greenhouse gas, IE = included elsewhere, IEA = International Energy Agency, IPCC = Intergovernmental Panel on Climate Change, NA = not applicable, NE = not estimated,

NGERS = National Greenhouse and Energy Reporting System, NIR = national inventory report, NO = not occurring, QA/QC = quality assurance/quality control.

IV. Questions of implementation

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

Annex I

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

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/gpglulucf/gpglulucf.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 Australia 2012. Available at <http://unfccc.int/resource/docs/2012/asr/aus.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2012. Available at <http://unfccc.int/resource/webdocs/sai/2012.pdf>.

FCCC/ARR/2011/AUS. Report of the individual review of the annual submission of Australia submitted in 2011. Available at <http://unfccc.int/resource/docs/2012/arr/aus.pdf>.

UNFCCC. *Standard independent assessment report*, parts I and II. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Rob Sturgiss (Department of Climate Change and Energy Efficiency), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Australia:

Baldock, Jeffrey A, *et al.* (June 2011). *Enhancing FullCAM-Draft.* Australian Government Department of Climate Change.

Meyers, C.P., *et al. (*2012). *Direct measurements of the seasonality of emission factors from savanna 1 fires in northern Australia.* Darwin, NT: Research Institute for the Environment and Livelihoods, Charles Darwin University.

Russell-Smith, Jeremy, *et al. (2009)* Improving estimates of savanna burning emissions for greenhouse accounting in northern Australia: limitations, challenges, applications. *International Journal of Wildland Fire 18*, 1–18. CSIRO PUBLISHING. http://www.publish.csiro.au/journals/ijwf.

Meyer, C.P. (2011) Review of the National Greenhouse Gas Emissions Methodology for Savanna Burning Report to the Commonwealth Department of Climate Change and Energy Efficiency. CSIRO. <http://www.cawcr.gov.au>.

Reay, David S. (2004). Nitrous Oxide in Agricultural Drainage Waters Following Field Fertilisation. Water, Air, and Soil Pollution: Focus 4: 437-451. Klewar Academic Publishers.

Sawamot, Takuji, et al. (2005) Evaluation of emission factors for indirect N_2O emissions due to nitrogen leaching in agro-ecosystems. Washington, DC. American Geophysical Union.

[1] Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
BOD	biochemical oxygen demand
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
COD	chemical oxygen demand
CRF	common reporting format
EF	emission factor
ERT	expert review team
$FRAC_{GASM}$	fraction of nitrogen that volatilises as ammonia and nitrogen oxides from animal manure
Gg	gigagram (1 Gg = 1,000 tonnes = 10^9 grams)
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1,000 grams)
KP-LULUCF	land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
m^3	cubic metre
MSW	municipal solid waste
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NGERS	National Greenhouse and Energy Reporting System
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10^{15} joule)
QA/QC	quality assurance/quality control
RMU	removal unit
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
SWDS	solid waste disposal site
TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change