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**Report of the individual review of the annual submission of
Australia submitted in 2013***

* In the symbol for this document, 2013 refers to the year in which the inventory was submitted, and not to the year of publication.

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I. Introduction and summary

1. This report covers the review of the 2013 annual submission of Australia, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 23 to 28 September 2013 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Ms. Karin Kindbom (Sweden) and Mr. Newton Paciornik (Brazil); energy – Ms. Olia Glade (New Zealand), Mr. Ralph Harthan (Germany), Ms. Yuriko Hayabuchi (Japan) and Ms. Carmen Meneses Lopez (Bolivarian Republic of Venezuela); industrial processes and solvent and other product use – Mr. Predrag Novosel (Montenegro) and Mr. Jos Olivier (the Netherlands); agriculture – Mr. Bernard Hyde (Ireland), Mr. Jacques Kouazoude (Benin) and Mr. Asaye Ketema (Ethiopia); land use, land-use change and forestry (LULUCF) – Mr. Sandro Federici (San Marino) and Ms. Valentyna Slivinska (Ukraine); and waste – Ms. Maryna Berezhnytska (Ukraine) and Ms. Violeta Hristova (Bulgaria). Mr. Federici and Ms. Kindbom were the lead reviewers. The review was coordinated by Mr. Roman Payo (UNFCCC secretariat).

2. In accordance with the “Guidelines for review under Article 8 of the Kyoto Protocol” (decision 22/CMP.1) (hereinafter referred to as the Article 8 review guidelines), 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. All encouragements and recommendations in this report are for the next annual submission, unless otherwise specified. The expert review team (ERT) notes that the 2012 annual review report of Australia was published after the due date for the submission of the 2013 annual submission.

3. In 2011, the main greenhouse gas (GHG) in Australia was carbon dioxide (CO₂), accounting for 73.6 per cent of total GHG emissions¹ expressed in CO₂ equivalent (CO₂ eq), followed by methane (CH₄) (20.4 per cent) and nitrous oxide (N₂O) (4.5 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) collectively accounted for 1.5 per cent of the overall GHG emissions in the country. The energy sector accounted for 76.4 per cent of total GHG emissions, followed by the agricultural sector (15.2 per cent), the industrial processes sector (6.0 per cent) and the waste sector (2.3 per cent). Total GHG emissions amounted to 552,298.91 Gg CO₂ eq and increased by 32.2 per cent between the base year² and 2011. The ERT concludes that the description in the national inventory report (NIR) of the trends for the different gases and sectors is reasonable.

4. Tables 1 and 2 show GHG emissions from sources included in Annex A to the Kyoto Protocol (hereinafter referred to as 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, elected activities under Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO₂, CH₄ and N₂O 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.

¹ In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO₂ 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 sources included in Annex A to the Kyoto Protocol only.

5. Additional background data on recalculations by Australia in the 2013 annual submission, as well as information to be included in the compilation and accounting database, can be found in annex I to this report.

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^a to 2011

	Greenhouse gas	Gg CO ₂ eq								Change (%)	
		Base year ^a	1990	1995	2000	2008	2009	2010	2011		Base year–2011
Annex A sources	CO ₂	277 905.08	277 905.08	303 867.06	349 423.18	403 098.63	405 059.26	405 893.01	406 614.75	46.3	
	CH ₄	116 126.74	116 126.74	112 186.91	115 635.14	115 356.99	112 360.54	110 880.77	112 569.20	-3.1	
	N ₂ O	18 415.97	18 415.97	20 635.67	25 557.12	25 661.28	24 983.61	24 574.53	25 064.96	36.1	
	HFCs	1 126.27	1 126.27	812.55	1 357.04	5 693.22	6 278.46	7 020.73	7 641.45	578.5	
	PFCs	3 950.13	3 950.13	1 312.56	1 103.55	381.14	307.89	243.76	259.25	-93.4	
	SF ₆	221.20	221.20	316.89	199.85	158.40	143.23	145.19	149.29	-32.5	
KP-LULUCF	Article 3.3 ^b	CO ₂					39 314.43	33 047.43	27 327.78	18 251.08	
		CH ₄					1 336.13	1 133.72	1 008.20	826.07	
		N ₂ O					676.44	584.47	657.82	554.57	
	Article 3.4 ^c	CO ₂	NA				NA	NA	NA	NA	NA
		CH ₄	NA				NA	NA	NA	NA	NA
		N ₂ O	NA				NA	NA	NA	NA	NA

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, 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 cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is 1990. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

^b Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

^c Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

Table 2
Greenhouse gas emissions by sector and activity, base year^a to 2011

Sector	Gg CO ₂ eq								Change (%)	
	Base year ^a	1990	1995	2000	2008	2009	2010	2011	Base year–2011	
Annex A	Energy	289 154.77	289 154.77	313 572.60	361 191.27	419 010.84	422 276.07	421 555.98	422 039.53	46.0
	Industrial processes	24 672.89	24 672.89	24 365.82	25 819.74	31 334.66	29 719.09	32 080.60	33 325.30	35.1
	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	86 506.66	86 506.66	84 643.47	92 218.99	86 676.43	83 860.13	81 632.54	84 142.95	-2.7
	Waste	17 411.06	17 411.06	16 549.75	14 045.88	13 327.74	13 277.67	13 488.88	12 791.14	-26.5
LULUCF	NA	106 303.45	23 719.75	63 079.30	-29 757.09	40 279.56	39 053.26	-40 347.90	NA	
Total (with LULUCF)	NA	524 048.83	462 851.39	556 355.19	520 592.57	589 412.54	587 811.24	511 951.01	NA	
Total (without LULUCF)	417 745.38	417 745.38	439 131.64	493 275.88	550 349.66	549 132.98	548 757.99	552 298.91	32.2	
Other ^b	NA	NA	NA	NA	NA	NA	NA	NA	NA	
KP-LULUCF	Article 3.3 ^c	Afforestation and reforestation				-15 307.95	-13 940.71	-16 290.89	-17 989.53	
		Deforestation				56 634.95	48 706.34	45 284.69	37 621.25	
		Total (3.3)				41 327.00	34 765.63	28 993.81	19 631.73	
	Article 3.4 ^d	Forest management				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
Total (3.4)	NA				NA	NA	NA	NA	NA	

Abbreviations: IE = included elsewhere, KP-LULUCF = LULUCF 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 sources included in Annex A to the Kyoto Protocol refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The “base year” for cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is 1990. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

^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 national totals.

^c Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

^d Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, namely forest management, cropland management, grazing land management and revegetation.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2013 annual inventory submission was submitted on 15 April; it contains a complete set of common reporting format (CRF) tables for the period 1990–2011 and an NIR. Australia also submitted the 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 26 February 2013. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Australia officially submitted revised emission estimates on 9 November 2013 in response to the list of potential problems and further questions raised by the ERT. The values used in this report are those submitted by the Party on 9 November 2013.

8. The full list of materials used during the review is provided in annex II to this report.

2. Overall assessment of the inventory

9. Table 3 contains the ERT's overall assessment of the annual submission of Australia. For recommendations for improvements related to cross-cutting issues for specific categories, please see the paragraphs cross-referenced in the table.

Table 3

The expert review team's overall assessment of the annual submission

<i>General findings and recommendations</i>		
The expert review team's (ERT's) findings on completeness of the 2013 annual submission		
Annex A sources ^a	Complete	Mandatory: None Non-mandatory: "NE" has been reported for: CO ₂ emissions from mining activities (surface mines) and post-mining activities (underground and surface mines); CO ₂ , CH ₄ and N ₂ O emissions from multilateral operations; potential emissions of SF ₆ from electrical equipment; potential emissions of PFCs and SF ₆ from imports (in bulk and in products); and CH ₄ emissions from enteric fermentation (poultry). The ERT encourages Australia to estimate these emissions

<i>General findings and recommendations</i>		
Land use, land-use change and forestry ^a	Complete	<p>Mandatory: None</p> <p>Non-mandatory: “NE” has been reported for: CO₂ emissions/removals from wetlands remaining wetlands (all pools); CO₂ emissions/removals from settlements remaining settlements (all pools); CH₄ and N₂O emissions from drainage of forest soils; and CO₂, CH₄ and N₂O emissions from biomass burning on wetlands remaining wetlands. The ERT encourages Australia to estimate these emissions</p>
KP-LULUCF	Generally complete	<p>Australia does not report under deforestation those lands that converted naturally to forest land after 1990 from which the forest vegetation has been cleared (see paras. 99 and 101 below), nor does Australia report under afforestation and reforestation those lands that converted naturally to forest land after 1990 as Australia has restricted this category to lands subject to planting events (see para. 100 below)</p>
The ERT’s findings on recalculations and time-series consistency in the 2013 annual submission	Generally consistent	<p>Improved and revised AD in the National Greenhouse and Energy Reporting system (NGER) have resulted in step changes for some individual fuel types within certain categories between 2002 and 2003 (see para. 25 below). In aggregate, the data are time-series consistent, as step changes for individual fuels and sectors reflect changes in the allocation of fuels to sectors over time rather than changes in the aggregate consumption of fuels</p>
The ERT’s findings on verification and quality assurance/quality control procedures in the 2013 annual submission	Sufficient	<p>Category specific recommendations can be found in, for example, paragraphs 61, 85 and 90 below</p>
The ERT’s findings on the transparency of the 2013 annual submission	Generally sufficient	<p>The 2013 annual submission is generally transparent and Australia has made efforts to improve transparency. However, Australia has not transparently described the recalculations performed in the industrial processes sector (see para. 56 below)</p> <p>Confidential data in some categories in the industrial processes sector and the solvent and other product use sector (see para. 57) continues to limit the transparency of the information, although improvements in transparency have been achieved</p> <p>For category-specific recommendations see paragraphs 65, 72, 78 and 79 below</p>

Abbreviations: AD = activity data, Annex A sources = sources included in Annex A to the Kyoto Protocol, 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, NE = not estimated, QA/QC = quality assurance/quality control.

^a The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in 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, or the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry).

10. The information provided in CRF summary table 3 for 2011 is generally consistent with the information in the NIR. However, the ERT identified several inconsistencies. For example: for the waste sector, for N₂O emissions, the NIR (table 8.2) indicates that a country-specific methodology was used and a default emission factor (EF), while CRF summary table 3 indicates country-specific and tier 1 methodologies and country-specific and default EFs; and for CH₄ emissions from solid waste disposal on land, the NIR (table 8.2) indicates that a tier 2/3 methodology was used while the CRF table indicates tier 2. The ERT recommends that Australia report consistent information on methods in the CRF summary table 3 and in the NIR.

11. The ERT also noted that CRF table 8(b) on recalculations was not completely filled in, as explanatory information for some categories is missing. The ERT recommends that Australia complete CRF table 8(b) with explanatory information for all categories.

3. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Inventory planning

12. The NIR and additional information provided by the Party during the review described the national system for the preparation of the inventory. The Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE) has overall responsibility for the national inventory. Other agencies and organizations are also involved in the preparation of the inventory as described in figure 1.1 in the NIR.

13. DIICCSRTE is responsible for all aspects of inventory planning and preparation, including the collection of activity data (AD) and coordination of AD collections by external consultants, the estimation of emissions, quality control (QC), improvement planning, preparation of the reports and the submission of the reports to the UNFCCC on behalf of the Australian Government. DIICCSRTE estimates emissions using the Australian Greenhouse Emissions Information System (AGEIS), which is an integral part of the inventory preparation and publishing process. AGEIS is used to generate emission estimates for all inventory years, for automated population of the CRF tables and for data storage activities.

14. Australia has elaborated a quality assurance/quality control (QA/QC) plan in accordance with decision 19/CMP.1 and the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). DIICCSRTE integrates QC procedures into the compilation process, such as a range of tools to identify anomalous entries in the database. AGEIS is used for QC and provides diagnostic statistics on collected AD and on estimated emissions to facilitate the identification and correction of anomalous entries.

15. Australia's QA system operates at a number of levels: the review of the estimates calculated by DIICCSRTE is conducted internally by staff who are not responsible for the data handling and by external consultants for specific categories and sectors. The review of inventory improvements is conducted by the National Inventory Users Group, and the public review of the emission estimates and methods is performed through the information on the DIICCSRTE and AGEIS websites. The official consideration of the inventory is overseen by the National Inventory Systems Executive Committee of DIICCSRTE. 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 DIICSRTE.

16. Australia has a well-organized national system providing sufficient capacity for timely and reliable reporting of its annual inventory.

Inventory preparation

17. Table 4 contains the ERT’s assessment of Australia’s inventory preparation process. For improvements related to specific categories, please see the paragraphs cross-referenced in the table.

Table 4
Assessment of inventory preparation by Australia

	<i>General findings and recommendations</i>
<i>Key category analysis</i>	
Was the key category analysis performed in accordance with the IPCC <i>Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories</i> (hereinafter referred to as the IPCC good practice guidance) and the IPCC <i>Good Practice Guidance for Land Use, Land-Use Change and Forestry</i> (hereinafter referred to as the IPCC good practice guidance for LULUCF)?	Yes See paragraph 20 below
Approach followed?	Tier 1
Were additional key categories identified using a qualitative approach?	No
Has the Party identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories in the UNFCCC inventory?	Yes
Does the Party use the key category analysis to prioritize inventory improvements?	Yes
Are there any changes to the key category analysis in the latest submission?	No
<i>Assessment of uncertainty analysis</i>	
Approach followed?	Tier 1
Was the uncertainty analysis carried out in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF?	Yes
Quantitative uncertainty (including LULUCF)	Level = 5.6% Trend = 2.9%
Quantitative uncertainty (excluding LULUCF)	Level = 2.2% Trend = 1.5%

Abbreviations: IPCC = Intergovernmental Panel on Climate Change, LULUCF = land use, land-use change and forestry.

Inventory management

18. Australia has a centralized archiving system, AGEIS, which includes the archiving of disaggregated EFs and AD, documentation on how these EFs and AD have been generated and aggregated for the preparation of the inventory, as well as emission estimates from previous annual submissions, and integrated access to documentation of data sources, methodology descriptions and source reference material. 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. AGEIS is maintained and housed within DIICCSRTE.

4. Follow-up to previous reviews

19. Australia provided comments and, in most cases, addressed the recommendations made in previous review reports. Australia provided information on its responses to recommendations made in the previous review in annex 6.3 to the NIR. The ERT noted that this annex does not include the recommendations made in the previous review report because that review report was not published by the due date for the annual submission.

20. In response to a recommendation made in the previous review report, Australia has provided a key category analysis for 1990 and also completed CRF table 7. The ERT commends Australia for these improvements.

21. Australia has followed-up on most of the previously raised issues, but the following pending issues were noted by the ERT:

(a) The derivation of country-specific equipment leakage rates from commercial and industrial refrigeration and air-conditioning applications (see para. 58 below);

(b) The reallocation of emissions from pulverized coal used as reducing agents from the energy to the industrial processes sector, where Australia has stated that it will undertake this reallocation should suitable data become available (see paras. 45 and 60 below);

(c) The disaggregation of SF₆ emissions from electrical equipment into emissions from operation and from disposal (see para. 65 below);

(d) The correction of the many cells under additional information in CRF tables 4.A and 4.E that are reported as "0.0" instead of being filled out with appropriate values or notation keys (see para. 68 below);

(e) The inclusion of protein intake of dairy calves in the estimation of CH₄ and N₂O emissions (see para. 74 below);

(f) Inclusion in the NIR of the results of the QA/QC process undertaken with respect to the revised country-specific methodology for prescribed burning of savannahs (see para. 80 below);

(g) The consistent application of criteria and transparent documentation for land representation (see para. 83 below);

(h) The provision of a transparent and improved description in the NIR of QA/QC procedures in the waste sector (see para. 90 below);

(i) The inclusion of the conversion ratio between chemical oxygen demand (COD) and biochemical oxygen demand (BOD) used in the estimation of emissions from domestic and commercial wastewater handling in the documentation box of the CRF table

and an explanation of the use of the COD conversion ratio in CRF table 6.B. (see para. 93 below).

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

22. During the review, the ERT identified a number of areas for improvement, including some related to specific categories. These are listed in the relevant chapters of this report and in table 9.

B. Energy

1. Sector overview

23. The energy sector is the main sector in the GHG inventory of Australia. In 2011, emissions from the energy sector amounted to 422,039.53 CO₂ eq, or 76.4 per cent of total GHG emissions. Since 1990, emissions have increased by 46.0 per cent. The key drivers for the rise in emissions are the increase in emissions from: energy industries (by 87,177.94 Gg CO₂ eq, or 61.0 per cent, especially due to increases in emissions from electricity generation, which has grown by 53.4 per cent in 1990–2011 reflecting rising electricity demands by the growing Australian economy); transport (by 25,573.78 Gg CO₂ eq, or 41.2 per cent, especially due to the 36.5 per cent increase in emissions from road transportation, which reflects the growing importance of motor vehicles as modes of passenger and freight transportation in Australia); other sectors (by 5,394.98 Gg CO₂ eq, or 35.8 per cent, especially due to increased diesel oil consumption in the agriculture, forestry and fishing subcategory); and manufacturing industries and construction (by 5,312.33 Gg CO₂ eq, or 14.9 per cent, especially due to increased non-energy mining operations leading to the more than doubling of emissions in this category). Within the energy sector, 54.5 per cent of the emissions were from energy industries, followed by 20.8 per cent from transport, 9.7 per cent from manufacturing industries and construction and 6.9 per cent from fugitive emissions from solid fuels. Other sectors accounted for 4.8 per cent of the sectoral emissions and fugitive emissions from oil and natural gas accounted for 2.8 per cent. The remaining 0.4 per cent was from the category other (fuel combustion).

24. The main source of AD for the energy sector is the National Greenhouse and Energy Reporting system (NGER), supplemented by the use of other published sources only where necessary. Additional data are published by the Australian Bureau of Statistics (ABS) and the Bureau of Resources and Energy Economics (BREE), considered in the estimations of emissions from fuel combustion (ABS for transport and BREE for all other fuel-combustion categories). BREE and its predecessor organizations have collected energy statistics for over 35 years and use this data to meet Australia's reporting commitments to the International Energy Agency (IEA). ABS is the national statistical agency with legislative backing for its collection powers.

25. In Australia's 2012 energy statistics, BREE has further incorporated the improved AD available under the NGER into the time series. This has resulted in extensive revisions to fuel consumption and the reallocation of fuel use between categories from 2003. As a result, a step change now exists in the reporting of some individual fuel types within certain categories (e.g. liquid fuels consumption for manufacture of solid fuels and other energy industries is reported as 24,374.10 TJ for 2002 and 57,446.31 TJ for 2003). In response to a question raised by the ERT during the review, Australia explained that it is exploring the possibility of extending the revision through to the earlier part of the time series and that these revisions will be incorporated into future recalculations of the national inventory when available. The ERT commends the Party for its effort in improving AD and recommends that Australia resolve the inconsistencies in the time series.

26. Uncertainty data reported by corporations under NGER have been incorporated into the national inventory for the category public electricity and heat production. In the NIR, the Party reports that a review of NGER uncertainty data in other fuel combustion categories will be undertaken with the intention of incorporating these data in the uncertainty analysis. The ERT commends Australia for its efforts to improve uncertainty data and encourages the Party in its intention to undertake a review of NGER uncertainty data in other fuel combustion categories and incorporate these estimates in the uncertainty analysis.

27. The ERT noted that, in section 3.2.2 of the NIR (volume 1, page 47), Australia stated that some non-CO₂ emissions (e.g. N₂O emissions from boilers) from fuel combustion in electricity generation and other energy transformation and industrial activities may be overestimated due to the absence of reliable information on the equipment in use and the use of the default EF. In response to a question raised by the ERT during the review, Australia explained that this issue is inherent to varying degrees in all inventories using the tier 2 approach to estimate non-CO₂ emissions for stationary combustion. It arises due to the difficulty in collecting up-to-date emission control data for newly installed equipment types. Heaters in the residential category burning wood are a large source of non-CO₂ emissions where there is very good data (annual changes in appliance mix and user behaviour based on expert opinion and survey data, as well as the emissions data from CSIRO to generate formulae for gas emissions as a function of particle emission). In response to a question raised by the ERT during the review, the Party indicated that, while it has no plans to improve non-CO₂ EFs in other stationary combustion activities at this stage, the Party is always willing to consider further improvements where data availability and resources allow. The ERT acknowledges the Party's response and encourages the Party to consider further improvements to the non-CO₂ EFs.

28. Australia reported energy data on a gross calorific value basis. This means that reported implied emission factors (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 given on a net calorific value (NCV) basis. The ERT has taken this into account in the preparation of this report. Specifically, the ERT has converted Australia's reported values into NCV-based IEFs and used the NCV-based values to identify potential problems in the energy sector. Thus, any issue relating to an energy-sector IEF included in this report refers to the NCV-based value, not the reported IEF in the Party's CRF tables.

2. Reference and sectoral approaches

29. Table 5 provides a review of the information reported under the reference approach and the sectoral approach, as well as comparisons with other sources of international data. Issues identified in table 5 are more fully elaborated in paragraphs 30–37 below.

Table 5

Review of reference and sectoral approaches

		<i>Paragraph cross-references</i>
Difference between the reference approach and the sectoral approach	Energy consumption:	
		–85.98 PJ (–1.66%)
	CO ₂ emissions:	
		–1,612.99 Gg CO ₂ eq (–0.43%)

		<i>Paragraph cross-references</i>
Are differences between the reference approach and the sector approach adequately explained in the NIR and the CRF tables?	Yes	30
Are differences with international statistics adequately explained?	Yes	31–35
Is reporting of bunker fuels in accordance with the UNFCCC reporting guidelines?	Yes	
Is reporting of feedstocks and non-energy use of fuels in accordance with the UNFCCC reporting guidelines?	Yes	

Abbreviations: CRF = common reporting format, NIR = national inventory report, UNFCCC reporting guidelines = “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories”.

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

30. The ERT noted that, for some years in the period 1990–2011, there are differences between the sectoral and reference approach ranging between 2.0 per cent and 8.0 per cent for CO₂ emissions from gas and liquid fuels. Limited explanations are provided in the documentation box of CRF table 1.A(c). The NIR (annex 4) reports the difference in CO₂ emissions between the sectoral and reference approach for 2011 only, and does not provide explanations for the differences. In the 2013 annual submission, the Party made a significant effort to document the differences and did provide the explanation for the noted deviations. However, the relevant information is scattered across several sections and tables and not in annex 4 to the NIR. The ERT encourages the Party to include a table of differences in the estimations of the energy consumption and the CO₂ emissions by aggregate fuel type (solid, liquid, gas, other) between the sectoral approach and the reference approach for the entire time series, and to explain the differences. In response to a question raised by the ERT during the review, Australia explained that the sectoral tables for the years prior to 2011 have been revised in response to AD and methodology changes, as described in the relevant sections on uncertainty and time-series consistency in the 2013 annual submission. However, the ERT noted that the reference approach tables for the years prior to 2011 have not been revised to reflect those corresponding revisions to the sectoral approach. The ERT recommends that the Party revise the reference approach tables for the years prior to 2011.

31. The ERT noted several issues regarding discrepancies between the data reported in the CRF tables and the IEA data. Specific differences include:

(a) Data on imports and exports of crude oil are higher in the CRF tables for most years, while data on refinery feedstocks have been reported to the IEA but are missing in the CRF tables. Some of the crude oil in the CRF tables may also be classified as refinery feedstocks in the IEA data;

(b) For the whole time series, the ERT considers that coking coal and sub-bituminous coal may be reported with other bituminous coal in the CRF tables. The natural gas time series are similar until 2003, when several discrepancies start to occur. Production figures reported in the CRF tables are 5–12 per cent higher between 2003 and 2009; imports are 8 per cent lower from 2007 to 2009; and exports are 4–8 per cent higher from

2006 to 2008. In addition, CRF table 1.A(b) reports a natural gas stock increase in 2009 and a stock decrease in 2010 and 2011, although no natural gas stock changes are reported to the IEA for any year. These stock changes contribute greatly to the difference between the respective apparent consumption figures in 2010 and 2011;

(c) For exports, liquefied petroleum gas (LPG) figures are reported in the CRF tables but not submitted to the IEA from 1992 to 2001 and natural gas liquids (NGL) are reported to the IEA but missing in the CRF tables for the same period. The ERT considers that the LPG figures reported in the CRF tables may have been classified as NGL in the IEA data;

(d) Data for stock changes of liquid and solid fuels differ between the CRF tables and the IEA data, with large discrepancies observed for other bituminous coal in several years, in particular in 1997, 2000–2001 and 2009–2011. Stock changes for lignite are reported in the CRF tables from 2003 onwards, but do not appear in the IEA data.

32. The NIR (section 3.2.6) analyses the differences between the IEA data and the data in the CRF tables. Additional information on this matter is also included in sections 3.5.4 and 3.5.6 of the NIR. During the review, Australia explained that it has undertaken a project to reconcile the data provided by BREE to the IEA with the published BREE data used in the inventory. The ERT highly commends the Party for acknowledging the differences and undertaking an in-depth investigation of their source as well as the inclusion of the section on the international comparisons. The ERT encourages the Party to maintain the section in the next annual submission so that the differences between the IEA data and the data in the CRF tables are accounted for and explained transparently, and to include an update on the progress of the investigative project.

33. The ERT noted that the data reported by the Party in the CRF tables for domestic aviation are systematically lower than in the IEA data by around 10 per cent for most years, with larger differences (up to 16 per cent) for the years from 1999 to 2003. The two exceptions are 2004 and 2005 when the CRF figures are 15–20 per cent higher than those reported to the IEA. In response to a question raised by the ERT during the review, the Party explained that aviation turbine domestic fuel consumption is expected to be lower in the CRF tables compared with the IEA data because Australia allocates a proportion of this fuel consumption to military use under other (energy). The allocation is 8 per cent in 2011. The ERT acknowledges the Party's effort in clarifying the issue, although the ERT notes that the explanation provided does not explain the observed trend in 2004 and 2005, and therefore recommends that Australia include the explanation in its NIR to improve transparency.

34. The ERT noted that domestic navigation figures reported by the Party in the CRF tables are systematically higher than the relevant IEA data (by 25–100 per cent). These differences are due to the large amount reported in the category other (gasoline plus coal) in CRF table 1.A(a). In response to a question raised by the ERT during the review, Australia explained that the national inventory allocates a proportion of petrol to domestic navigation to represent fuel consumed by small marine craft. This distribution of AD is summarized in table 3.A.13a of the NIR. This reallocation is done within the inventory compilation process and would not be reported as navigation in the submission to the IEA. The ERT acknowledges the Party's explanation and recommends that the explanation be included in its NIR to improve transparency.

35. The ERT noted that the data on coal production in CRF table 1.B.1 are higher than those reported to the IEA by 13–23 per cent for 1990–2011. For example, for 2011, CRF table 1.B.1 reports 107.98 Mt coal mined at underground mines and 415.20 Mt at surface mines, but IEA data are 76 Mt and 326 Mt, respectively. In response to a question raised by the ERT during the review, Australia explained that the amount of coal mined reported to

the IEA only comprises black coal production and does not include brown coal production. When including brown coal production to the IEA data, the amount matches that in Australia's CRF table 1.B.1 for surface mines. The ERT acknowledges the Party's explanation and recommends that the explanation be included in the section on international comparisons in the NIR to improve transparency.

International bunker fuels

36. The ERT noted that for jet kerosene in international aviation, the data reported by the Party in CRF table 1.A(b) are consistent with IEA data within 2 per cent for all years, except 2001 (CRF data 5 per cent lower), and 2002 (CRF data 4 per cent higher). The NIR (section 3.6.2) includes information on a specific project implemented by the Party in order to resolve the issues related to the international comparisons, which includes the international bunker fuels category. In response to a question raised by the ERT during the review on the project referred to in section 3.6.2 of the NIR, the Party explained that the project found that the principal reasons for differences between the IEA data and the inventory are differences in data year alignment (for some fuels, published data relates to Australian financial years (July to June) while IEA data relates to calendar years) and in the IEA reporting structure compared with that of the Australian energy statistics (which has led to differences in average energy conversion factors used for major fuels). The project also concluded that the data reported to the IEA are generally consistent with the data published in the Australian energy statistics. However, in some instances data are provided to the IEA in different units to those presented in the Australian energy statistics (for example the IEA requires liquid fuel data to be reported in tonnes). Australia explained that the conversion factors applied by the IEA may result in differences with its inventory data. The ERT commends the Party for its effort and recommends that the Party include this clarification in its NIR to further improve the transparency of the inventory.

37. For the years in the period 1990–1999, the Party reported the residual fuel oil figures for international marine bunkers in the CRF tables to be 5–22 per cent lower than in the IEA data; for 2002 an opposite (–11 per cent) discrepancy is observed. This difference with IEA data has been noted in previous review reports. In response to a question raised by the ERT during the review, the Party responded that the data used in the inventory are consistent with those reported in the Australian energy statistics and provided to the IEA. The Party further stated that the difference may result from the conversion of tonnage data reported to the IEA into energy units as used in the Party's inventory. The ERT acknowledges the Party's response and recommends that the Party investigate the underlying issue and determine why the data processing in the CRF tables by the Party and by the IEA arrive at different conclusions, and include a more detailed explanation in the NIR.

Feedstocks and non-energy use of fuels

38. No problems were identified.

3. Key categories

Stationary combustion: liquid and solid fuels – CO₂, CH₄ and N₂O³

39. The ERT noted that, following a recommendation made in the previous review report, Australia has commissioned a study to investigate the appropriateness of the fuel

³ Not all emissions related to all gases under this category are key categories, particularly N₂O emissions. However, since the issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

characteristics, including the CO₂ EFs, for liquid fuels types used in the national GHG inventory. For example, for ethanol, the CO₂ EF used in the inventory (67.3 Gg CO₂/PJ, NIR table 3.2, NIR vol. 1, p. 45) is 7.0 per cent higher than that in the preliminary results of that study. In response to a question raised by the ERT during the review, Australia explained that the results of the study are preliminary and that further analysis of ethanol characteristics will be undertaken before any changes are made in the inventory. The ERT commends the Party for its efforts to improve the accuracy of its emission estimates and encourages the Party to perform a further analysis of Australian fuel characteristics and incorporate the improved CO₂ EFs in its inventory.

40. The ERT noted that Australia's IEFs for CH₄ from liquid fuels (fuel combustion, sectoral approach, CRF table 1A(a)) for 1990–2004 are extremely high (19.4–25.8 kg/TJ), surpassing the average of Annex I Parties other than Australia for that period (7.7–11.4 kg/TJ) by 118–170 per cent. In response to a question raised by the ERT during the review, Australia explained that it is aware of this issue and that it will continue to review the IEFs for non-CO₂ gases from liquid fuels. For example, Australia will review the IEFs for new heavy-duty diesel vehicles to take account of the latest exhaust emission standards adopted in Australia. Australia's IEF for CH₄ from liquid fuels is most influenced by the contribution of CH₄ emissions from road transportation. The CH₄ IEF for road transportation has been on a downward trend since the mid-1990s because the inventory reflects improved vehicle emissions control technology performance in the Australian fleet. As discussed in section 3.5.2 of the NIR, the Australian fleet has a relatively high non-CO₂ emissions profile. Australia also explained that Australian emissions standards have tended to lag behind those applied in Western Europe and the United States (e.g. the Australian standards for petrol passenger vehicles established in the Australian Design Rule 79/01, equivalent to European Union standard Euro 3 introduced in Europe in 2000,⁴ were introduced in Australia in 2006). Consequently, the types of emissions control technology employed in Australia in the period 1990–2004 also tended to lag as these were introduced in order to comply with the emissions standards, and this results in the comparatively higher CH₄ IEF. In addition, Australia has a relatively slow fleet turnover and consequently a slow transition to vehicles with improved emission control technologies. Recent improvements in Australia's liquid fuel CH₄ emission estimates reflected studies that were undertaken in 2011 to refine the IEFs and Australian design rules applied to the emission standards for older vehicles, incorporating the results of direct measurements for older vehicles undertaken to better characterize the Australian vehicle fleet. These revisions were incorporated into the entire time series in the 2012 and 2013 annual submissions, and (as outlined in section 3.5.5 of the 2012 NIR) generally had a downward effect on non-CO₂ emissions due to the lower calculated deterioration factors. A number of other parameters, including average trip length and percentage of urban vehicle kilometres travelled, were updated after the collection of new AD. The ERT encourages the Party to continue to improve its non-CO₂ EFs.

41. For public electricity and heat production, the ERT considers that the inter-annual changes in the CO₂ IEF for liquid fuels between 1997 (74.94 t/TJ) and 1998 (72.87 t/TJ) as well as between 2008 (72.93 t/TJ) and 2009 (72.00 t/TJ) are significant. The 1998 value is 2.8 per cent lower than the 1997 value. The 2009 value is 1.3 per cent lower than the 2008 value. In response to a question raised by the ERT during the review, Australia explained that the CO₂ IEF decreased between 1997 and 1998 and between 2008 and 2009 due a change in the liquid fuel mix for those years. From 1997 to 1998 there was a decrease in the

⁴ Directive 98/69/EC of the European Parliament and of the Council of 13 October 1998 relating to measures to be taken against air pollution by emissions from motor vehicles and amending Council Directive 70/220/EEC.

liquid fuel proportion of fuel oil, which has a higher CO₂ EF than diesel oil, which is the other major liquid fuel. The ERT recommends that Australia include this information in its NIR to improve transparency.

42. For petroleum refining, the ERT noted that the inter-annual changes in the CO₂ IEF for liquid fuels between 2008 (68.29 t/TJ) and 2009 (66.87 t/TJ) as well as between 2009 (66.9 t/TJ) and 2010 (68.3 t/TJ) are significant (the 2009 value is 2.1 per cent lower than the 2008 value and the 2010 value is 2.2 per cent higher than the 2009 value). In response to a question raised by the ERT during the review, Australia explained that CO₂ from liquid fuels utilizes facility-specific EFs obtained from NGER and that the IEFs will vary depending on the liquid fuel mix used and the refinery processes undertaken in the year. Australia had seven refineries in 2009. Therefore, changes in fuel mix and qualities in those refineries will tend to result in minor variations in the overall IEF, such as the 2.1 per cent fluctuation noted. The ERT recommends that Australia include this information in its NIR to improve transparency.

43. The ERT noted that Australia has reported estimates for AD and GHG emissions for petroleum refining (solid fuels) in CRF table 1A(a) for the years 2007 and 2008. However, for all other years within the time series 1990–2011, emissions in this category are reported as “NA” (not applicable) and the AD as “NO” (not occurring). The NIR text does not explain this issue. In response to a question raised by the ERT during the review, Australia explained that the Australian energy statistics reported a small amount of coal tar for the years 2007 and 2008 under petroleum refining, which was subsequently included in the inventory as a solid fuel type. For the years 2009 onwards, the NGER system was introduced requiring mandatory reporting of facility-level fuel consumption, by fuel type, for all of Australia’s petroleum refineries. Subsequently, this higher quality NGER data has been used to compile the national inventory for the petroleum refining sector since 2009. These data have shown that solid fuels are not consumed within petroleum refineries and therefore solid fuels have not been included in the inventory after 2008. Australia also explained that the consumption of a solid fuel is generally not expected within petroleum refining, as indicated by NGER data. Australia indicated that the Party will review the validity of these data for the next annual submission in consultation with BREE (the compilers of the Australian energy statistics). The ERT acknowledges the explanation provided by the Party and recommends that the Party include the explanation in the NIR to improve transparency.

44. For iron and steel, the ERT considers the inter-annual change in the CO₂ IEF for liquid fuels between 2000 (64.29 t/TJ) and 2001 (70.96 t/TJ) as significant. The 2001 value is 10.4 per cent higher than the 2000 value. In response to a question raised by the ERT during the review, Australia explained that 2001 saw an increase in the use of diesel and fuel oil relative to the consumption of LPG. As LPG has a significantly lower CO₂ EF, the change in fuel mix resulted in an increase in the overall CO₂ IEF for liquid fuels. The ERT recommends that Australia include this information in its NIR to improve transparency.

45. For iron and steel, the ERT considers that the inter-annual change in the CO₂ IEF for solid fuels between 2002 (49.11 t/TJ) and 2003 (66.20 t/TJ) is significant. The 2003 value is 34.8 per cent higher than the 2002 value. In response to a question raised by the ERT during the review, Australia explained that, in general, the relatively low solid fuel IEF prior to 2003 is due to the use of coke oven gas, which is classed as a solid fuel and has a low CO₂ EF (37.0 t/TJ gross calorific value (GCV)). The increase in the IEF from 2003 is due to the introduction and increasing use of black coal, in the form of pulverized coal directly injected into the blast furnace. Black coal has a significantly higher CO₂ EF than that of coke oven gas, and therefore acts to increase the overall IEF for solid fuels. To date, this pulverized coal use has been reported under stationary combustion instead of under the industrial processes sector, as no data have been available to separate the use from overall

black coal use in iron and steel. The ERT welcomes the Party's explanation and recommends that Australia include this information in the NIR to improve transparency.

46. For non-ferrous metals, the ERT noted that CO₂ emissions peaked in 2008. Thereafter, the trend is decreasing. CO₂ emissions in 2011 (11,392.53 Gg CO₂) are similar to those in 1991–1992. In response to a question raised by the ERT during the review, Australia responded that this is a trend commonly seen in national inventories as a result of the downturn following the global financial crisis. Australia also explained that the incorporation of NGER data into the Australian energy statistics has resulted in a series of recalculations to the latter years of the time series for non-ferrous metals (as well as related categories such as manufacture of solid fuels and other energy industries and mining (country-specific category under other (manufacturing industries and construction))), because the nature of non-ferrous metals production is that companies often span over several industry categories (this is particularly the case where a mining operation occurs as part of a metal production or smelting plant). This leads to potential difficulties in the allocation of facilities across mining and non-ferrous metals categories reported under stationary combustion. The NGER data have provided improved understanding of these industry category splits and this has resulted in the reallocation of fuel consumption over the past two annual submissions. These reallocations have resulted in time series that exhibit strong growth in emissions since 2008 for manufacture of solid fuels and other energy industries and mining. Australia indicated that this should be viewed in conjunction with the decline in emissions for non-ferrous metals since 2008. Australia further explained that the country is undertaking consultation with the BREE to gain further understanding of the allocation of emissions from non-ferrous metal-related facilities across industries within the Australian energy statistics. The ERT commends the Party for its efforts in investigating the issue and recommends that the Party include these explanations in the NIR. The ERT also encourages the Party to include an update on its progress in consulting with BREE regarding this issue.

47. The ERT noted a notable step drop in the CO₂ IEFs for solid fuels in non-ferrous metals between 2002 and 2003 (from 89.94 t/TJ to 88.20 t/TJ). In response to a question raised by the ERT during the review, Australia demonstrated that the changing mix of black coal and coke from 2002 to 2003 is driving the change in the CO₂ IEF for solid fuels. In 2002 a small amount of coke relative to black coal was consumed. Coke has a higher CO₂ EF than black coal and therefore its presence increases the overall CO₂ IEF for solid fuels. However, in 2003 there is no consumption of coke – only black coal. Therefore the CO₂ IEF is reduced to that equivalent to black coal. The change in fuel mix in 2003 is a result of revisions by BREE to the Australian energy statistics as a result of the incorporation of NGER data. This has resulted in revisions to fuel consumption and the reallocation of fuel use between source categories for the period 2003 to 2008. The Party also pointed out that some discussion on this issue is provided in sections 3.2.4 and 3.4.5 of the NIR, along with recalculation tables. Australia stated that it is their understanding that BREE is considering extending the revision further back through the time series for future releases of the Australian energy statistics. Those revisions will subsequently be incorporated into future recalculations of the inventory. The Party also referred to a further discussion in section 3.4.6 of the NIR under planned improvements. The ERT commends the Party for its efforts in responding to the request and investigating the issue, and recommends that Australia incorporate the revised time series with a consolidated explanation in its NIR, when available, for a future annual submission.

48. For chemicals, the ERT considers the inter-annual change in the CO₂ IEF for solid fuels between 2002 (84.70 t/TJ) and 2003 (94.09 t/TJ) as significant. The 2003 value is 11.1 per cent higher than the 2002 value. In response to a question raised by the ERT during the review, Australia explained that 2003 saw a sharp reduction in the use of coal tar, which is classified as a solid fuel and has a significantly lower CO₂ EF (81.8 t/TJ GCV)

than that of black and brown coal. Therefore, the changed fuel mix resulted in an increase in the overall CO₂ IEF for solid fuels. The ERT acknowledges the Party's explanation and recommends that Australia include the explanation in its NIR to improve transparency.

Civil aviation: liquid fuels – CO₂, CH₄ and N₂O

49. For fuel consumption and emissions for civil aviation (jet kerosene), the ERT noted that CO₂ and N₂O emissions follow the same pattern as that of fuel consumption (the same growth value of 18.0 per cent between 2010 and 2011). However, CH₄ emissions do not follow this pattern and declined between 2010 and 2011 by approximately 2 per cent. In response to a question raised by the ERT during the review, Australia explained that it estimates CO₂ emissions using fuel consumption data and country-specific EFs, but CH₄ and N₂O are estimated using data for landing and take-off (LTO) cycles at airports in Australia, aircraft fleet characteristics and default EFs for LTO and cruise components of aircraft operations from table 1-52 of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines). The method estimates CH₄ and N₂O emissions for LTO and cruise components of flights separately. The Revised 1996 IPCC Guidelines provides a CH₄ EF of 0 for cruise and therefore CH₄ is only estimated during LTO cycles. Further, the Party stated that it was not possible to source 2011 LTO data in time for the preparation of the 2013 annual submission, and hence Australia held constant 2010 LTO data from airports. As all CH₄ emissions are attributed to the LTO component of flight, the ERT considers that holding constant airport LTO data skewed CH₄ to negative growth, as increases in overall fuel consumption in 2011 resulted in a disproportionate amount of fuel being allocated away from the LTO cycle to the cruise cycle. The Party stated that 2011 LTO data are now available and will be included in the 2014 annual submission. The ERT acknowledges the Party's explanation and recommends that the Party include the 2011 LTO data in the annual submission. For CH₄ emissions for 2012, if 2012 LTO data are not available, the ERT also recommends that Australia review the assumptions to estimate CH₄ emissions to ensure that they do not follow the trend of CO₂ and N₂O emissions.

Road transportation: liquid fuels – CO₂

50. The ERT considered the inter-annual change in the CO₂ IEF between 2009 (69.83 t/TJ), 2010 (68.00 t/TJ) and 2011 (64.6 t/TJ) to be significant. The 2010 value is 2.6 per cent below the 2009 value and the 2011 IEF value is 5.0 per cent below the 2010 value. In response to a question raised by the ERT during the review, Australia explained that the AD for fuel consumption was entered incorrectly for 2009–2011 into the CRF Reporter resulting in the incorrect IEF figure. Emission values are correct and remain as reported in the CRF tables. The corrected AD for 2009 and 2010 are 609,864.47 TJ and 602,538.34 TJ, respectively. The corrected IEF for both 2009 and 2010 is 66.70 t/TJ. For 2011, the correct gasoline consumption is 600,510.69 TJ, CO₂ emissions are 40,054.06 Gg and the IEF is 66.70 t/TJ. The ERT recommends that Australia correct the AD and IEF values.

51. The ERT noted that, for LPG in road transportation, the constant CO₂ IEF (59.60 t/TJ, CRF table 1.A(a)) is one of the lowest between reporting Parties (ranging from 60.55 t/TJ to 69.96 t/TJ with the exclusion of Kazakhstan at 55.15 t/TJ). In response to a question raised by the ERT during the review, Australia explained that the IEF is affected by the country-specific EF for LPG and that a study was commissioned in 2011 to investigate the appropriateness of the fuel characteristics, including the CO₂ EF, for liquid fuel types used in the inventory. The study compared the energy contents, density, carbon content and EF of the fuel types used to produce the inventory with publicly available Australian data and other public sources from Europe and the United States of America. The study also compared inventory fuel characteristics to an unpublished Australian

database accumulated from fuel testing. The study concluded that the values used in the inventory for the CO₂ EFs for petrol, jet kerosene, diesel, fuel oil and LPG are correct as far as can be judged. The ERT welcomes the Party's explanation and recommends that the Party include this information in the section on the international comparisons in its NIR to improve transparency.

Railways: liquid fuels – all gases⁵

52. The ERT considered the inter-annual change for fuel consumption between 2007 and 2008 (19.3 per cent) to be significant. In response to a question raised by the ERT during the review, Australia explained that automotive diesel oil consumption reported in the Australian energy statistics reflects changes in domestic energy consumption patterns. Australia has seen rapid expansion of rail networks to support resources boom: numerous privately operated rail networks for the transport of coal and iron ore have been commissioned throughout Australia. Private rail networks service several significant iron ore operations in mining regions and are an example of significant increases in fuel consumption associated with increased rail activity. Australia also explained that the Australian energy statistics are subject to continuous improvements, particularly in regards to the allocation of fuel consumption to different subcategories. Although this can lead to changes in the energy consumption allocated to a particular category within transport, long-term fuel consumption trends remain consistent with key transport activity indicators such as freight and passenger movements. For example, rail freight data publicly available for the period 2000–2008⁶ show a 48 per cent growth in activity over this period, consistent with a 47 per cent growth in fuel consumption reported in the same period in the CRF tables. The ERT welcomes the Party's explanation and recommends that the Party include this explanation in its NIR.

Navigation: liquid fuels – all gases⁷

53. The ERT considered the inter-annual change for liquid fuel consumption between 2006 and 2007 (35.4 per cent) to be significant. In response to a question raised by the ERT during the review, Australia explained that the AD were sourced from the Australian energy statistics, which reported a large increase in diesel fuel consumption in 2007, and that fuel consumption remains consistent with key transport activity indicators such as freight and passenger movements (2007 saw a large increase in iron ore and coal shipments from Australia). This is similar to the situation with the railways AD described in paragraph 52 above. The Party also explained that the Australian energy statistics are subject to continuous improvement, particularly with regards to sector allocation. The ERT recommends that the Party review the AD for 2006–2007 for the category and explain the significant inter-annual changes.

⁵ Not all emissions related to all gases under this category are key categories, particularly CH₄ and N₂O emissions. However, since the issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

⁶ See the table, T 2.2b, "Total domestic freight by state/territory, by transport mode – rail", available in the zip file Part T "Transport" at <http://www.bitre.gov.au/publications/2011/stats_004.aspx>.

⁷ Not all emissions related to all gases under this category are key categories, particularly CH₄ and N₂O emissions. However, since the issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

4. Non-key categories

Oil and natural gas – CO₂ and CH₄

54. The ERT noted that CH₄ emissions from natural gas exploration decreased by 95.6 per cent between 2009 and 2010, and increased by 1,755.1 per cent between 2010 and 2011. Meanwhile, CO₂ emissions in the same subcategory increased by 1,023.6 per cent between 2009 and 2010, and decreased by 75.8 per cent between 2010 and 2011. The ERT also noted that in the 2012 annual submission the values for the CO₂ and CH₄ emissions for this subcategory for the year 2010 were different from those included in the 2013 annual submission. In response to a question raised by the ERT during the review, Australia explained that an error was made when populating the CRF Reporter. For natural gas exploration in 2010 only, a component of CH₄ emissions was misallocated to CO₂ emissions. This misallocation affected the gas breakdown, but the overall GHG emissions for natural gas exploration remained unchanged and correct. The ERT considered that the CH₄ emissions for 2010 were underestimated because only a fraction of the CH₄ emissions was reported and included this issue in the list of potential problems and further questions raised by the ERT. Australia corrected this problem in the revised estimates submitted on 9 November 2013. The ERT considers that the potential underestimation has been resolved. The ERT recommends that the Party include detailed information about this change in its NIR.

C. Industrial processes and solvent and other product use

1. Sector overview

55. In 2011, emissions from the industrial processes sector amounted to 33,325.30 Gg CO₂ eq, or 6.0 per cent of total GHG emissions. Emissions from the solvent and other product use sector were included under other (chemical industry) from 1990 to 2011 for confidentiality reasons (NIR page 211). Since the base year, emissions from the industrial processes sector have increased by 35.1 per cent. The key drivers for the trend in emissions are refrigeration and air-conditioning equipment and the country-specific category “confidential chemical industry emissions” (reported under other (chemical industry)), where emissions increased by 7,019.35 Gg CO₂ and 3,975.71 Gg CO₂ eq, respectively, and aluminium production, where emissions decreased by 2,502.65 Gg CO₂ eq. Emissions from refrigeration and air-conditioning equipment increased due to the growing stock of gas and low levels of destruction and recycling. Emissions from aluminium production decreased due to the control techniques that reduced PFC emissions from anode effects. Within the industrial processes sector, 38.1 per cent of the emissions were from metal production, followed by 23.4 per cent from consumption of halocarbons and SF₆, 19.7 per cent from mineral products and 18.1 per cent from chemical industry. The remaining 0.8 per cent were from other production.

56. Australia has made recalculations for the industrial processes sector between the 2012 and 2013 annual submissions (see table 10 below). The reasons for the recalculations are described only briefly in the NIR and CRF table 8(b) in terms of the types of changes (in AD, EFs or methodologies). However, justifications as described by the IPCC good practice guidance are not provided in the NIR. In response to a question raised by the ERT during the review, Australia provided transparent and detailed explanations for these recalculations. The ERT recommends that Australia provide this and similar information for future recalculations in the recalculation sections, as recommended by the IPCC good practice guidance.

57. Confidentiality continues to limit the transparency of the information in this sector where the AD for many categories are reported as confidential, especially in chemical

industry. For example, production of soda ash, ammonia, nitric acid, ethylene and methanol are reported as “C” (confidential) in CRF table 2(I).A-G. In response to a recommendation made in the 2011 review report, Australia has explained that the confidentiality provisions of the National Greenhouse and Energy Reporting Act 2007⁸ under which chemical industry data are obtained are explicit and restrict the publication of such confidential data. In recent years, Australia has invested efforts in providing as much information as it can within the restrictions of the Act, including the provision of IEF information and discussions of comparisons with other Annex 1 Parties. Australia also explained that it remains committed to enhancing the transparency of the chemicals industry estimates and it will continue to explore additional options within the confidentiality restrictions of the Act. The ERT reiterates the recommendation made in previous reports that the Party continue to increase the transparency of this sector and the solvent and other product use sector by disaggregating data further within the confidentiality restrictions imposed by the legislation.

58. Australia has implemented several improvements to the reporting of this sector in the 2013 annual submission in response to recommendations made in previous review reports. Issues related to the time series, due to using multiple sources of data within the minerals industry, have been more transparently explained in the appropriate sections of the NIR. The Party clarified in the NIR that equipment stocks reported in tables 4.25–4.29 of the NIR are inclusive of equipment charged with non-HFC refrigerants. However, some recommendations have not yet been implemented (e.g. the derivation of country-specific equipment leakage rates from commercial and industrial refrigeration and air-conditioning applications). The ERT commends the Party for the continuous improvement in many sections of its annual submission and recommends that the Party complete the process of addressing all the recommendations made in previous review reports.

2. Key categories

Ammonia production – CO₂

59. The ERT noted that Australia is using the tier 1b methodology from the Revised 1996 IPCC Guidelines to estimate CO₂ emissions from ammonia production. However, the ERT noted that Australia, in addition, applied an oxidation factor of 99.5 per cent. The ERT considers that the use of this oxidation factor is not in line with the IPCC good practice guidance, and therefore concluded that CO₂ emissions from ammonia production were potentially underestimated. The ERT included this issue in the list of potential problems and further questions raised by the ERT. In its response to this list, Australia submitted revised estimates that do not include the oxidation factor. The ERT considers that the potential underestimation has been resolved. The ERT recommends that the Party include detailed information about this change to the methodology for estimating emissions from ammonia production in its NIR.

Iron and steel production – CO₂

60. The NIR states that a tier 1b method is used to estimate CO₂ emissions from iron and steel production. CO₂ emissions from the use of coke and natural gas as reducing agents are reported under the industrial processes sector, but the use of pulverized coal as a reducing agent is allocated to the energy sector (see para. 45 above). The ERT considers that allocating the CO₂ emissions from pulverized coal to the energy sector is not in accordance with the IPCC good practice guidance, and that these emissions should be allocated to the industrial processes sector. In response to questions raised by the ERT

⁸ Available at <<http://www.comlaw.gov.au/Series/C2007A00175>>.

during the review, Australia explained that, to date, no publicly released data (e.g. voluntary company reporting) have been available to enable the reallocation of emissions from pulverized coal use as a reducing agent from the energy to the industrial processes sector and that it will undertake this reallocation should suitable data become available. The ERT reiterates the recommendation made in previous review reports that Australia reallocate process-related emissions from the energy sector to the industrial processes sector and explain any recalculation in its NIR.

Consumption of halocarbons and SF₆ – HFCs

61. Australia has reported in NIR table 4.22 (page 176) the annual losses of HFCs by equipment type. The ERT noted that, for domestic refrigeration, that table reports the annual loss as 0.3 per cent. However, Australia has reported a product life factor (equivalent to the annual loss) of 4.3 per cent in CRF table 2(II).F. The ERT also noted that similar inconsistencies occur for other equipment types. In response to a question raised by the ERT during the review, Australia explained that the values reported in the CRF tables are wrong, because they have been calculated based on the total stock of gas in operating equipment in the corresponding year rather than based on the quantity of gas filled in new equipment. The ERT recommends that Australia correct these inconsistencies.

62. Australia has reported AD and IEF per substance for all subcategories of air-conditioning equipment in CRF table 2(II).F. However, all emissions from every substance are reported as “IE” (included elsewhere) in the same table. In response to a question raised by the ERT during the review, Australia explained that the reporting of AD and IEFs per substance is a recent improvement and that emissions per substance have not been updated in that CRF table (aggregated emissions are reported in CRF table 2(II)). The ERT recommends that Australia report disaggregated emissions by substance in CRF table 2(II).F.

63. The ERT noted that Australia bases its estimation of SF₆ emissions from the subcategory other (consumption of halocarbons and SF₆) on the assumption that the Australian per capita emissions are the same as the per capita emissions reported by New Zealand. The ERT also noted that, according to the IPCC good practice guidance (page 3.63), applications in this category include: gas-air tracer in research and leak detectors; medical purposes; equipment used in accelerators, lasers and night vision goggles; sound-proof windows; applications utilizing its adiabatic properties (e.g. tennis balls or shoe soles); and military applications. The IPCC good practice guidance provides a decision tree for identifying sources (fig. 3.8) and calculation methods for SF₆ emissions in this subcategory (equations 3.22 to 3.26). The ERT further notes that Australia started to use Airborne Warning And Control System (AWACS) planes from 2010⁹ and that these planes are potentially a source of SF₆ emissions, as indicated in section 8.3.1 of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines). In response to a question raised by the ERT during the review, Australia confirmed the existence of these planes and that the associated potential SF₆ emissions are not reported in the 2013 annual submission. The ERT considers that, in the absence of AWACS planes, Australia’s per capita SF₆ emissions from this subcategory could be expected to be similar to the per capita use in New Zealand (New Zealand does not operate any AWACS planes), but the similarity disappears if the emissions from AWACS planes need to be considered. Therefore the ERT concludes that not reporting emissions from the use of SF₆ by AWACS aircraft is a potential underestimation of SF₆ emissions from this

⁹ See <<http://www.airforce.gov.au/Technology/Aircraft/B737-Wedgetail/?RAAF-yFLAkgbpvuhRf7dG5J3kHi1Q4caywtso>>.

subcategory. This issue was included in the list of potential problems and further questions raised by the ERT.

64. In its response to the list of potential problems and further questions raised by the ERT, Australia indicated that the AWACS used in Australia (Boeing E-7A Wedgetail) operate at a lower voltage than the bigger AWACS. Operating at lower voltage does not require the use of SF₆ as an electrical insulator, so the operation of planes using AWACS in Australia does not entail any SF₆ emissions. The ERT is satisfied with the information provided and considers that the potential underestimation has been resolved. The ERT recommends that Australia include this information in its NIR.

3. Non-key categories

Electrical equipment – SF₆

65. Australia continues to report SF₆ emissions resulting from the disposal of electrical equipment together with the operational emissions. This is not in line with the IPCC good practice guidance, as these SF₆ emissions should be reported separately, in order to assess whether the appropriate AD and EFs are applied. In response to a question raised by ERT during the review, Australia explained that currently it has no access to data that would make this disaggregation possible. As set out in the NIR, the EFs obtained under NGER have been derived from gas mass balances and integrate operational and disposal phases of the equipment life cycle. Any effort to disaggregate emission estimates would be based on an assumption and would likely result in inaccurate allocation between operation and disposal. A change to the legislation would be required in order to require reporters to provide data disaggregated into lifetime and disposal losses. Australia also explained that it will consider progressing this legislative change in the context of the full set of inventory improvement priorities as set out in the inventory improvement plan. The ERT reiterates the recommendation made in the previous review report that the Party disaggregate the emissions and report the estimates separately under each function (operation and disposal).

D. Agriculture

1. Sector overview

66. In 2011, emissions from the agriculture sector amounted to 84,142.95 Gg CO₂ eq, or 15.2 per cent of total GHG emissions. Since 1990, emissions have decreased by 2.7 per cent. The key driver for the fall in emissions is a 14.2 per cent (9,101.2 Gg CO₂ eq) decrease in emissions from enteric fermentation as a result of a fall in sheep numbers. Within the sector, 65.1 per cent of the emissions were from enteric fermentation, followed by 17.8 per cent from agricultural soils, 12.3 per cent from prescribed burning of savannas and 3.9 per cent from manure management. Field burning of agricultural residues accounted for 0.5 per cent and rice cultivation accounted for 0.4 per cent.

67. The ERT noted that emissions for the agriculture sector are compiled on a state-by-state basis to better reflect climatic and management differences. The ERT noted that the majority of EFs and parameters used in the agriculture sector are country specific, largely based on studies within Australia. The ERT also noted that these studies are relatively old (over 10 years old). The ERT commends Australia for providing some category-specific planned improvements in the NIR (e.g. section 6.3.6). However, the ERT strongly recommends that Australia continue to implement planned improvements which either update or verify the use of country-specific parameters and EFs that are based on relatively old studies.

68. The ERT noted that Australia continues to report “0.00” for many cells under additional information in CRF table 4.A (e.g. for feeding situation and percentage pregnant for all animal types, and digestibility of feed for selected animal types) and for the additional information in CRF table 4.E (e.g. fraction of above-ground biomass, fraction oxidized and carbon fraction for both living biomass and dead biomass). The ERT reiterates the recommendation made in the previous review report that Australia use the appropriate values or notation keys.

69. Australia has included the references to the sources of some AD (e.g. amount of fertilizer used, the allocation of animal waste management systems and the area of cultivated histosols) in section 6.2.1 of the NIR. The ERT commends Australia for including the references to the sources of some AD in response to a recommendation made in the previous review report.

70. Australia states in its NIR that a comprehensive review of the methodologies, AD and livestock characterization data was conducted in 2000–2001 involving agricultural experts from industry, government and academia. In response to a question raised by the ERT during the review on whether such an in-depth review will be repeated, the Party explained that it has prioritized the livestock types which will undergo review, with immediate priority assigned to dairy cattle, pigs and feedlot cattle. The ERT recommends that the Party fully document in the NIR, as they occur, the planned improvements as a result of these priority reviews.

2. Key categories

Enteric fermentation – CH₄

71. Australia uses tier 2 methodologies with country-specific EFs to calculate emissions from enteric fermentation for cattle, feedlot cattle, sheep and swine. For goats, buffalo, camels, horses, donkeys and mules a tier 1 methodology and IPCC default EFs are used. Country-specific EFs are used for deer, alpacas, emus and ostriches, as default EFs are not available. The ERT considered this to be in line with the IPCC good practice guidance.

72. The ERT noted that substantial weight loss occurs in cattle between the summer and autumn seasons in some territories (NIR table 6.B.1 in appendix 6.B). In response to a question raised by the ERT during the review, Australia provided a rationale for the seasonal weight loss identified, stating that periods of weight loss reflect declines in pasture availability and/or quality in the different regions of Australia in response to weather conditions. The ERT recommends that Australia include this rationale in its NIR to enhance transparency.

Manure management – CH₄ and N₂O

73. Australia uses a combination of default IPCC and country-specific parameters in the estimation of CH₄ emissions from manure management. The ERT notes that the high temperatures, high solar radiation and low humidity environments of Australia dries manure rapidly, which results in lower emissions. For the estimation of N₂O emissions from manure management Australia utilizes country-specific nitrogen excretion values and animal waste management system data and a tier 2 method based on the Revised 1996 IPCC Guidelines. The ERT considers the approaches used to be in line with IPCC good practice guidance.

74. The ERT noted that Australia continues to calculate N₂O emissions from dairy cattle without including the protein intake of dairy calves. The ERT strongly reiterates the recommendation made in previous review reports that Australia include the protein intake of dairy calves in the estimation of N₂O emissions.

75. Australia has included a nitrogen excretion value for ostriches in CRF table 4.B(b) in response to a recommendation made in the previous review report. The ERT commends Australia for this improvement.

76. The ERT notes that under the Carbon Farming Initiative¹⁰ a number of biodigesters are being built in Australia. The ERT recommends that Australia use formula 1 (footnote to table 4.10 of the IPCC good practice guidance) to account for CH₄ emissions from the quantities of manure that will be used as feedstock for these biodigesters, report emissions accordingly in the CRF tables, and describe the method and parameters used in the NIR. Furthermore, where the biodigesters are used to generate electricity, the ERT recommends that the emissions be allocated to the public electricity and heat production category.

77. The improvement plan for emissions from manure management (NIR section 6.4.6) indicates that Australia is undertaking an upgrade of the country-specific PigBal model and is working with the agriculture experts to update feed intake, herd characteristics and animal waste management system allocation. The ERT recommends that Australia make every effort to include the results of this analysis in the estimation of emissions for its next annual submission and include a description of the methodological approaches, parameters and EFs used in the NIR.

Agricultural soils – N₂O

78. The ERT considers that Australia has not transparently described the application of synthetic fertilizers to forests by disaggregating the quantity of fertilizer nitrogen applied to forests from total fertilizer sales. In response to a question raised by the ERT during the review, the Party explained that it does not have sufficient data to specifically allocate fertilizer use to forest land and that it is assumed that the fertilizer applied to forest lands is included under the fertilizer applied to non-irrigated grassland systems. The ERT recommends that Australia include this information in its NIR and encourages the Party to continue to explore opportunities to collect these data.

79. For the estimation of N₂O emissions from crop residues returned to soil, Australia uses the tier 1 methodology from the IPCC good practice guidance with country-specific data on residue-to-crop ratios, dry matter content and carbon to nitrogen (C:N) ratios. In response to a question raised by the ERT during the review, Australia provided the references to the sources of these country-specific data and additional information. The ERT recommends that Australia include the information provided to the ERT during the review in the NIR.

Prescribed burning of savannas – CH₄ and N₂O

80. In its 2012 annual submission Australia included a revised country-specific methodology for prescribed burning of savannas. As noted in the previous review report, Australia planned to implement an independent QA process for the 2013 annual submission. The ERT reiterates the recommendation made in the previous review report that Australia include the results of the QA process undertaken with respect to this revised methodology in the NIR.

¹⁰ See <<http://www.climatechange.gov.au/reducing-carbon/carbon-farming-initiative>>.

E. Land use, land-use change and forestry

1. Sector overview

81. In 2011, net removals from the LULUCF sector amounted to 40,347.90 Gg CO₂ eq. Since 1990, net emissions have decreased by 138.0 per cent (from 106,303.45 Gg net emissions to 40,347.90 net removals). The key driver for the fall in emissions is the reduction of the area annually deforested and in the harvesting of natural forests; further, removals increased because of the increase of area converted to forest land. Within the sector, net removals occurred in forest land (102,143.08 Gg CO₂ eq) and other (LULUCF) (2,938.47 Gg CO₂ eq), while net emissions occurred in grassland (48,614.15 Gg CO₂ eq) and cropland (16,119.50 Gg CO₂ eq).

82. The land representation of the Party is complex because of the following elements:

(a) The transition period applied to conversions between land uses is not the same for all categories (i.e. for land converted to forest land a transition period is not applied because all areas converted since 1990 are continuously reported under this category);

(b) Areas with land-cover change not associated with a land-use change are not transferred to the land conversion categories but directly move from the land remaining category characterized by the previous land cover to the land use category characterized by the new land cover. For example, where there is a natural increase in forest cover on grassland the lands are reclassified from grassland remaining grassland to forest land remaining forest land (other native forest);

(c) Data reported in the annual land-use matrices in NIR table 7.6, which are deemed to ensure transparency of the land representation, are not consistent with those reported in the CRF tables, since the data in the matrices are based on land-cover changes (specifically forest cover change) instead of on land-use changes;

(d) Although a 50 year transition period is applied, historical data go back to 1972 only.

83. The ERT, noting that Australia has included the enhancement of its land representation in its work programme, reiterates the recommendation made in the previous review report that Australia consistently apply the following criteria 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);

(c) The transition period selected is applied consistently across the time series and to each conversion category, including land converted to forest land.

84. Further, considering the complexity of the Australian land representation, the ERT recommends that the Party add the following information to improve transparency:

(a) A summary table, in the general section of the LULUCF chapter that reports, for each land category and subdivision, additional relevant information related to land

representation (including: the methodology applied for preparing land data, including assumptions and inferences; the background data; and the transition period applied);

(b) A confusion matrix¹¹ for both land converted to grassland and land converted to cropland, where errors of commission¹² and omission¹³ in the classification of land-use changes are reported to ensure that no systematic errors affected the estimate.

2. Key categories

Forest land remaining forest land – CO₂

85. Australia reports carbon stock losses from living biomass in the harvested native forests subdivision as “NO” in CRF table 5.A, although in the NIR (section 7.5.1) the methodology reported for estimating carbon stock changes in the harvested native forests includes losses associated with harvesting. The ERT recommends that Australia address this inconsistency either by reporting separately carbon stock gains and losses of living biomass or by using the notation key “IE” for carbon stock losses.

Cropland and grassland – CO₂

86. Sections 7.8 and 7.9 of the NIR indicate that the model applied for estimating carbon stock changes in soil organic matter (SOM) does not consider changes in carbon stock associated with changes in management practices. This means that climatic variability and changes in crop productivity are the variables that determine the estimated annual carbon stock changes in SOM and their trend. The ERT notes that the IPCC tier 1 methodology for SOM in cropland and grassland from sections 3.3 and 3.4 of the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) is designed to estimate carbon stock changes associated with changes in management practices only, so that the model currently applied by Australia does not produce estimates fully comparable with those prepared by applying the IPCC tier 1 methodology. Noting that the development of the model is in the work programme of Australia, the ERT recommends that Australia enhance its model by including the impact of management practices, and their changes, on the carbon stock changes in SOM.

Grassland converted to forest land – CO₂

87. The ERT noted that the model used for forest plantations does not verify the simulated data on carbon stock growth, in any area of forest plantation, by comparing them with data on harvested stock compiled in the statistics of forest plantations. The ERT considers such verification a tool to ensure that the model does not overestimate or underestimate, systematically, the carbon accumulation associated with forest growth. In response to a question raised by the ERT during the review, Australia compared the approximate log volumes estimated for pre- and post-1990 plantations based on the inventory models with the Australian Forest and Wood Products Statistics (AFWPS) estimate of domestic production of softwood and hardwood plantation log volumes. The volumes show a divergence from 1999 onwards which, the Party assumes, is due to a divergence in the modelled and actual age of areas of pre-1990 plantations harvested. The

¹¹ A confusion matrix is a matrix where each column of the matrix represents the instances in a predicted class, while each row represents the instances in an actual class.

¹² An error of commission is when a pixel in a digital image reports the presence of a feature (such as trees) that, in reality, is absent (no trees are actually present).

¹³ An error of omission is when a pixel in a digital image that contains a certain feature (such as trees) is not classified according to such feature (such as forest land).

ERT recommends that Australia further investigate the issue, include this analysis as a verification check of its estimates for the pre- and post-1990 plantations, and report on this issue in its NIR.

3. Non-key categories

CO₂ emissions from agricultural lime application

88. Australia reports the CO₂ emissions from lime application under the category other (LULUCF) since there are no data to disaggregate the lime applied among land-use categories. Noting that Parties have flexibility to accommodate the reporting to their national circumstances, the ERT recommends that Australia report the CO₂ emissions from lime application in CRF table 5(IV). If data are not available for discriminating different land-use categories to which lime is applied, the ERT recommends that Australia report the total amount of lime under the land-use category to which most lime is applied and to use the notation key “IE” for other land-use categories.

F. Waste

1. Sector overview

89. For 2011, emissions from the waste sector amounted to 12,791.14 Gg CO₂ eq, or 2.3 per cent of total GHG emissions. Since 1990, emissions have decreased by 26.5 per cent. The key driver for the fall in emissions is the steady increase in the recovery rate of CH₄ emissions from landfills. Within the sector, 78.2 per cent of the emissions were from solid waste disposal on land; followed by 21.0 per cent from wastewater handling and 0.6 per cent from the category other (waste). The remaining 0.2 per cent were from waste incineration.

90. The ERT noted that the description of the sector-specific QA/QC procedures is not yet completely transparent. In response to a question raised by the ERT during the review, Australia described in detail the category-specific QA/QC procedures for CH₄ emissions from managed waste disposal on land for all subcategories. The ERT reiterates the recommendation made in the previous review report that Australia improve the description of QA/QC procedures, especially for key categories.

2. Key categories

Solid waste disposal on land – CH₄

91. Australia applied the IPCC tier 2 methodology using country-specific first-order decay parameters. The ERT noted that the emissions for this category have been revised as a result of the incorporation of NGER data into the estimates for the first time. These NGER data include quantities and composition of waste disposed in landfill, CH₄ capture and decay rate constants based on the geospatial coordinates of each landfill. The use of NGER waste composition data has resulted in a change in the overall composition of waste landfilled throughout the time series. The ERT welcomes this work by the Party to increase the accuracy of data.

92. The ERT noted that Australia has corrected the value reported for time lag considered in CRF table 6.A (from 50 years to 0.5 years), in response to a recommendation made in the previous review report. The ERT commends Australia for this correction.

Wastewater handling – CH₄

93. The ERT noted that Australia has not yet included the conversion ratio between COD and BOD used in the estimation of emissions from domestic and commercial wastewater handling. In response to a question raised by the ERT during the review, Australia provided the ratio of 2.6:1. The ERT reiterates the recommendation made in previous review reports that Australia include this ratio in the documentation box of CRF table 6.B and explain the use of the COD conversion ratio in this CRF table.

3. Non-key categoriesWaste incineration – CH₄ and N₂O

94. The ERT noted that Australia has estimated CO₂ emissions from the incineration of clinical waste and solvents, but the Party continues to report CH₄ and N₂O emissions as “NA” in CRF table 6.C. The ERT reiterates the encouragement made in the previous review report that Australia estimate the CH₄ and N₂O emissions from the incineration of solvents and clinical waste.

Other (waste) – CH₄ and N₂O

95. Australia has reported CH₄ and N₂O emissions from biological treatment of solid waste with aerobic windrow composting as the dominant form of treatment. Emissions were estimated by applying the methodology from the 2006 IPCC Guidelines and country-specific EFs. The ERT commends the Party for providing in the NIR the detailed information on the country-specific EFs, relevant literature and the national circumstances, addressing a recommendation made in the previous review report.

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

96. Table 6 provides an overview of the information reported and parameters selected by the Party under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 6

Supplementary information reported under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

<i>Findings and recommendations</i>	
Has the Party reported information in accordance with the requirements in paragraphs 5–9 of the annex to decision 15/CMP.1?	Sufficient
Identify any elected activities under Article 3, paragraph 4, of the Kyoto Protocol	Activities elected: None
Identify the period of accounting	Annual accounting
Assessment of the Party’s ability to identify areas of land and areas of land-use change	Sufficient

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

97. In response to a question raised by the ERT during the review on the absence of a minimum width in the forest definition reported in the NIR, Australia explained that the thresholding and conditional probability network algorithms used to identify forest land from satellite images detect, at a sub-pixel level, the smallest possible forest width, such as windbreaks, consistently over the whole time series data. Given this, a minimum width for forests is not defined, because the method picks up fine-scale forest cover changes ensuring that even small-scale deforestation events are detected. The ERT recommends that Australia include this information in its NIR.

Afforestation and reforestation – CO₂

98. As for grassland converted to forest land (see para. 87 above), the ERT recommends that Australia verify its estimates of carbon stock changes from living biomass in afforested and reforested lands by using statistical data on harvesting.

Deforestation – CO₂

99. Australia does not report under deforestation those lands that converted naturally to forest land after 1990 from which the forest vegetation has been cleared. Australia applies such exclusion only to lands that have never been reported under any KP-LULUCF activity before being cleared. As indicated in previous review reports,¹⁴ the ERT noted that decision 16/CMP.1 does not restrict deforestation to areas that were forest on 31 December 1989.¹⁵ In response to a question raised by the ERT during the review, Australia indicated that, in its view, it has implemented the IPCC good practice guidance for LULUCF with the exclusion of lands that did not meet the forest definition before 1 January 1990.¹⁶ However, as also indicated in the previous review report, the ERT also noted that the eighth meeting of inventory lead reviewers concluded 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.¹⁷ Therefore, the ERT recommends that Australia enhance the consistency of its reporting and accounting with the provisions of decision 16/CMP.1 by reporting under deforestation each and any cleared forest land since 1990, regardless of its land use on 31 December 1989.

100. The ERT noted that, according to information provided by Australia during the review, lands naturally converted to forest after 31 December 1989, which are currently excluded from reporting under afforestation and reforestation, if reported they would result in net removals (under afforestation and reforestation) that are larger, in absolute terms, than the underestimation of emissions associated with the subsequent clearing of some of those lands (which should be reported under deforestation).

101. The ERT also noted that through decision 15/CMP.1, the CMP agreed that Parties shall report information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in accordance with good practice guidance.¹⁸ The ERT also noted that in

¹⁴ FCCC/ARR/2010/AUS, paragraph 139; FCCC/ARR/2012/AUS, paragraph 115.

¹⁵ Decision 16/CMP.1, annex, paragraph 1(d).

¹⁶ Section 4.2.6.2 – Choice of methods for identifying units of land subject to direct human-induced deforestation.

¹⁷ Paragraph 45(c) of the conclusions and recommendations of the eight meeting of inventory lead reviewers (21–22 March 2011). Available at <https://unfccc.int/files/national_reports/annex_i_ghg_inventories/review_process/application/pdf/co_n_rec.8.pdf>.

¹⁸ Decision 15/CMP.1, annex, paragraph 5.

accordance with the UNFCCC “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories”, an inventory is considered complete when it “covers all sources and sinks [...] included in the IPCC guidelines”.¹⁹ The ERT further noted that through decision 22/CMP.1, the CMP agreed that adjustments shall be applied only when inventory data are incomplete and/or are prepared in a way that is not consistent with the Revised 1996 IPCC Guidelines as elaborated by the IPCC good practice guidance.²⁰ The ERT further noted that Australia is reporting in accordance with section 4.2.6.2 of the IPCC good practice guidance for LULUCF. Therefore, in the opinion of the ERT, an adjustment does not apply.

102. The ERT noted that the same methodology used for establishing its base year emissions from deforestation is used for estimating emissions and removals during the commitment period. For this reason, the ERT recommends that Australia not modify the methodology used. Nevertheless, the ERT, noting that the assumptions, inferences and parameters of the model can be further improved, and recognising that the IPCC good practice guidance for LULUCF has been updated and superseded by the 2006 IPCC Guidelines and the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol* for the second commitment period of the Kyoto Protocol, encourages Australia to work on the model development to achieve an updated version for reporting in the second commitment period.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

103. 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 standard independent assessment report (SIAR) on the SEF tables and the SEF comparison report.²¹ 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.

104. 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

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

¹⁹ Paragraph 4. Included in document FCCC/SBSTA/2006/9. Available at <<http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>>.

²⁰ Decision 22/CMP.1, annex, paragraph 79.

²¹ The SEF comparison report is prepared by the international transaction log (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.

accounting of KP-LULUCF has been prepared and reported in accordance with decisions 16/CMP.1 and 6/CMP.3.

106. Table 7 shows the accounting quantities for KP-LULUCF as reported by the Party and the final values after the review.

Table 7

Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol, in t CO₂ eq

	2013 submission ^a			2010, 2011 and 2012 submissions ^b	Net accounting quantity ^c
	As reported	Revised estimates	Final	Final	
Afforestation and reforestation	-96 037 042		-96 037 042	-70 129 785	-25 907 257
Non-harvested land	-95 999 190		-95 999 190	-70 118 569	-25 880 621
Harvested land	-37 852		-37 852	-11 216	-26 636
Deforestation	188 184 717	188 247 236	188 247 236	149 703 563	38 543 673
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, 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 The values included under the 2013 submission are the cumulative accounting values for 2008, 2009, 2010 and 2011, as reported in the accounting table of the KP-LULUCF CRF tables for the inventory year 2011.

^b The values included under the 2010, 2011 and 2012 submissions are the final accounting values as a result of the 2012 review and are included in table 6 of the 2012 annual review report (FCCC/ARR/2012/AUS, page 35) in the column "2012 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 2013 submission and where the quantities issued or cancelled based on the 2012 annual review report have been subtracted ("net accounting quantity" = final 2013 – final 2012 annual review report).

^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 greenhouse gas 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 greenhouse gas 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.

107. Based on the information provided in table 7 for the activity afforestation/reforestation, Australia shall issue 25,907,257 removal units (RMUs) in its national registry.

108. Based on the information provided in table 7 for the activity deforestation, Australia shall cancel 38,543,673 assigned amounts units, emission reduction units, certified emission reductions units and/or RMUs in its national registry.

Calculation of the commitment period reserve

109. Australia has reported its commitment period reserve in its 2013 annual submission. Australia reported that its commitment period reserve has not changed since the initial report review (2,661,821,229 t CO₂ eq) as it is based on the assigned amount and not the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

110. Australia reported that there are changes in its national system since the previous annual submission. The Party described the changes to the arrangements for approving the inventory, the process for inventory compilation and the QA/QC activities undertaken in its NIR. 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

111. Australia reported that there are changes in its national registry since the previous annual submission. The Party described the changes, including release of a new version and enhancement to the registry web application, changes to the publicly available information as well as a new internet address in its NIR. The ERT concluded that 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 CMP decisions.

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

112. Australia reported that there are changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission. The ERT concluded that, taking into account the updated and additional information reported, the information provided under Article 3, paragraph 14, continues to be complete and transparent.

113. 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, under the Australia–China Joint Coordination Group on Clean Coal Technology (established in 2007), the Australian Government Department of Resources, Energy and Tourism and China's National Energy Administration in December 2010 signed a memorandum of understanding to collaborate on a feasibility study for a full-scale post-combustion capture (PCC) project with carbon capture and storage (CCS) in China. The feasibility study will focus on a commercial-scale (600 MW), integrated CCS demonstration project using the PCC process. In December 2012 it was agreed to continue the project and commence stage two of the project. Furthermore, Australia also reports that in 2012 it hosted the "Coal mining methane abatement seminar" under the Global Methane Initiative as well as the hosting of the annual Carbon Sequestration Leadership Forum.

114. 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 to capture and store GHGs.

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 (see para. 113 above); 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

115. Table 8 summarizes the ERT’s conclusions on the 2013 annual submission of Australia, in accordance with the Article 8 review guidelines.

Table 8

Expert review team’s conclusions on the 2013 annual submission of Australia

		<i>Paragraph cross-references</i>
The ERT concludes that the inventory submission of Australia is complete (categories, gases, years and geographical boundaries and contains both an NIR and CRF tables for 1990–2011)		
Annex A sources ^a	Complete	
LULUCF ^a	Complete	
KP-LULUCF	Generally complete	99–101
The ERT concludes that the inventory submission of Australia has been prepared and reported in accordance with the UNFCCC reporting guidelines		
	Yes	
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		
	Yes	
The Party’s inventory is in accordance with the <i>Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories</i> , the <i>IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories</i> and the <i>IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry</i>		
	Yes	56, 59, 65, 86
Australia has reported information on Article 3, paragraphs 3 and 4, of the Kyoto Protocol		
	Yes	
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		
	Yes	
The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1		
	Yes	

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 relevant CMP decisions

Yes

Did Australia provide information in the NIR on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol?

Yes

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, CMP = Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, CRF = common reporting format, ERT = expert review team, IPCC = Intergovernmental Panel on Climate Change, 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, NIR = national inventory report, UNFCCC reporting guidelines = “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories”.

^a The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in 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*, or the *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

B. Recommendations

116. The ERT identified the issues for improvement listed in table 9. All recommendations are for the next annual submission, unless otherwise specified.

Table 9

Recommendations identified by the expert review team

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph cross-references</i>
Cross-cutting		Report consistent information on methods in the CRF summary table 3 and in the NIR	10
		Complete CRF table 8(b) with explanatory information on recalculations for all categories	11
Energy	General	Resolve the inconsistencies in the time series	25
	Reference approach	Revise the information in the CRF tables for the reference approach	30
	Comparison with international statistics	Include explanations in the NIR for the differences between the CRF tables and the IEA data for domestic aviation, domestic navigation, coal production and international bunker fuels	33, 34, 35, 36, 37
	Stationary combustion: liquid and solid	Include explanations in the NIR for the variations in the CO ₂ IEF for liquid fuels for public electricity and heat production	41

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph cross-references</i>
	fuels – CO ₂ , CH ₄ and N ₂ O	For petroleum refining, include explanations in the NIR for: the variations in the CO ₂ IEF for liquid fuels; why emissions from solid fuels are only reported for 2007 and 2008	42, 43
		For iron and steel, include explanations in the NIR for the variations in the CO ₂ IEF for liquid and solid fuels	44, 45
		For non-ferrous metals and related categories, include explanations in the NIR for the allocation of emissions	46
		For non-ferrous metals, incorporate the revised time series with a consolidated explanation in its NIR, when available,	47
		For chemicals, include explanations in the NIR for the variation in the CO ₂ IEF for solid fuels	48
	Civil aviation: liquid fuels – CO ₂ , CH ₄ , N ₂ O	For CO ₂ , CH ₄ and N ₂ O, include actual LTO data in the estimation of emissions for 2011; for CH ₄ , review the assumptions in the estimation of the emissions	49
	Road transportation: liquid fuels – CO ₂	Correct the AD and the IEF values for the years in the period 2009–2011; improve the transparency of the information on CO ₂ EF for different liquid fuels	50, 51
	Railways: liquid fuels – all gases	Include explanations in the NIR for the trend of fuel consumption	52
	Navigation: liquid fuels – all gases	Review the AD for 2006–2007 for the category and explain the significant inter-annual changes	53
	Oil and natural gas – CO ₂ and CH ₄	Include explanations in the NIR for the revisions made to resolve the incorrect allocation of CO ₂ and CH ₄ emissions	54
Industrial processes and solvent and other product use	Recalculations	Include justifications as indicated in the IPCC good practice guidance	56
	Transparency	Continue to increase the transparency of the industrial processes and solvent and other product use sectors by disaggregating data further within the confidentiality restrictions imposed by the legislation	57
	General	Address all recommendations made in previous review report	58

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph cross-references</i>
	Ammonia production – CO ₂	Include detailed information about the change regarding the oxidation factor	59
	Iron and steel production – CO ₂	Reallocate the emissions from the use of pulverized coal as a reducing agent from the energy sector to the industrial processes sector	60
	Consumption of halocarbons and SF ₆ – HFCs	Correct the values reported in the CRF tables for the annual losses of HFCs by equipment type	61
		Report disaggregated emissions by substance in CRF table 2(II).F	62
		Explain that the use of AWACS in Australia does not result in SF ₆ emissions	64
	Electrical equipment – SF ₆	Disaggregate the emissions and report the estimates separately under each function (operation and disposal)	65
Agriculture	General	Continue to implement planned improvements which either update or verify the use of country-specific parameters and EFs that are based on relatively old studies	67
		Report estimates or the appropriate notation key for the cells under additional information in CRF tables 4.A and 4.E currently reported as “0.00”	68
		Fully document in the NIR, as they occur, the planned improvements as a result of the reviews of methodologies, AD and livestock characterization data	70
	Enteric fermentation – CH ₄	Explain the rationale for seasonal weight loss in cattle in some territories	72
	Manure management – CH ₄ and N ₂ O	Include the protein intake of dairy calves in the estimation of N ₂ O emissions	74
		Use formula 1 (footnote to table 4.10 of the IPCC good practice guidance) to account for CH ₄ emissions from the quantities of manure that will be used as feedstock for these biodigesters, report emissions accordingly in the CRF tables, and describe the method and parameters used in the NIR. Furthermore, where the biodigesters are used to generate electricity, allocate these emissions to the public electricity and heat production category	76

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph cross-references</i>
		Make every effort to include the results of the upgrade of the country-specific PigBal model in the estimation of emissions and include a description of the methodological approaches, parameters and EFs used in the NIR	77
	Agricultural soils – N ₂ O	Improve the transparency of the information on the application of synthetic fertilizer to forests	78
		Improve the transparency of the information on the estimation of N ₂ O emission from crop residues to returned to soil	79
	Prescribed burning of savannas – CH ₄ and N ₂ O	Include the results of the planned QA process for the methodology	80
LULUCF	General	For the land representation, consistently apply the criteria and provide transparent documentation in the NIR	83, 84
	Forest land remaining forest land – CO ₂	Report separately carbon stock gains and losses of living biomass or use the notation key “IE” for carbon stock losses	85
	Cropland and grassland – CO ₂	Enhance the model to estimate carbon stock changes in soil organic matter by including the impact of management practices and their changes	86
	Grassland converted to forest land – CO ₂	For forest plantations, verify the simulated data on carbon stock growth, in any area of forest plantation, by comparing them with data on harvested stock compiled in the statistics of forest plantations, include this analysis as a verification check of its estimates for the pre- and post-1990 plantations, and report on this issue in its NIR	87
	CO ₂ emissions from agricultural lime application	Report the CO ₂ emissions from lime application in CRF table 5(IV), or if data are not available for discriminating different land-use categories to which lime is applied, report the total amount of lime under the land-use category to which most lime is applied and to use the notation key “IE” for other land-use categories	88
Waste	General	Improve the description of QA/QC procedures, especially for key categories	90

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph cross-references</i>
	Wastewater handling – CH ₄	Include the conversion ratio between COD and BOD used in the estimation of emissions from domestic and commercial wastewater handling in the documentation box of CRF table 6.B and explain the use of the COD conversion ratio in this CRF table	93
KP-LULUCF	General	Include in the NIR justification for the absence of a minimum width in the forest definition reported in the NIR	97
	Afforestation and reforestation – CO ₂	Verify the estimates of carbon stock changes from living biomass in afforested and reforested lands by using statistical data on harvesting	98
	Deforestation – CO ₂	Report under deforestation each and any cleared forest land since 1990, regardless of its land use on 31 December 1989	99
		When estimating emissions and removals during the commitment period, do not modify the methodology used for establishing the base year emissions from deforestation	102

Abbreviations: AD = activity data, AWACS = Airborne Warning And Control System, BOD = biochemical oxygen demand, COD = chemical oxygen demand, CRF = common reporting format, EF = emission factor, IE = included elsewhere, IEA = International Energy Agency, IEF = implied emission factor, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, 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, LTO = landing and take-off, LULUCF = land use, land-use change and forestry, NIR = national inventory report, QA = quality assurance, QC = quality control.

IV. Questions of implementation

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

Annex I

Background data on recalculations and information to be included in the compilation and accounting database

Table 10
Recalculations in the 2013 annual submission for the base year and the most recent year

<i>Greenhouse gas source and sink categories</i>	<i>1990</i>	<i>2010</i>	<i>1990</i>	<i>2010</i>	<i>Reason for the recalculation</i>
	<i>Value of recalculation (Gg CO₂ eq)</i>		<i>Per cent change</i>		
1. Energy	-302.62	4 125.30	-0.1	1.0	Changed EFs and AD
A. Fuel combustion (sectoral approach)	-305.03	4 153.21	-0.1	1.1	
1. Energy industries	-311.66	1 888.11	-0.2	0.8	
2. Manufacturing industries and construction	-0.02	268.83	-0.00006	0.7	
3. Transport	6.64	2 462.22	0.01	3.0	
4. Other sectors		-467.62		-2.3	
5. Other		1.68		0.1	
B. Fugitive emissions from fuels	2.41	-27.92	0.007	-0.07	
1. Solid fuels	0.31		0.002		
2. Oil and natural gas	2.10	-27.92	0.02	-0.2	
2. Industrial processes	3.16	382.54	0.01	1.2	Changed EFs and AD
A. Mineral products					
B. Chemical industry	3.16	13.56	0.2	0.2	
C. Metal production		6.63		0.1	
D. Other production					
E. Production of halocarbons and SF ₆					
F. Consumption of halocarbons and SF ₆		362.35		5.3	
G. Other					
3. Solvent and other product use					
4. Agriculture	43.82	1 574.29	0.05	2.0	Changed EFs and AD
A. Enteric fermentation		780.89		1.4	
B. Manure management		-6.86		-0.2	
C. Rice cultivation		2.23		1.3	
D. Agricultural soils	43.82	759.51	0.3	5.5	
E. Prescribed burning of savannas		6.18		0.1	
F. Field burning of agricultural residues		32.33		9.7	
G. Other					

<i>Greenhouse gas source and sink categories</i>	1990	2010	1990	2010	<i>Reason for the recalculation</i>
	<i>Value of recalculation (Gg CO₂ eq)</i>		<i>Per cent change</i>		
5. Land use, land-use change and forestry	13 262.23	768.45	14.3	2.0	Changed EFs and AD
A. Forest land	-119.16	-2 482.61	0.3	5.0	
B. Cropland	156.93	119.92	0.5	0.6	
C. Grassland	13 344.25	3 487.80	12.1	4.9	
D. Wetlands					
E. Settlements					
F. Other land					
G. Other	-119.79	-356.66	2.8	14.2	
6. Waste	8.10	-586.88	0.05	-4.2	Changed EFs and AD
A. Solid waste disposal on land	10.59	-586.20	0.1	-5.3	
B. Wastewater handling	-2.49	-0.69	-0.1	-0.02	
C. Waste incineration					
D. Other					
7. Other					
Total CO₂ equivalent without LULUCF	-247.53	5 495.24	-0.06	1.0	
Total CO₂ equivalent with LULUCF	13 014.71	6 263.70	2.5	1.1	

Abbreviations: AD = activity data, EF = emission factor, LULUCF = land use, land-use change and forestry.

Table 11
Information to be included in the compilation and accounting database in t CO₂ eq for 2011, including the commitment period reserve

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment^a</i>	<i>Final^b</i>
Commitment period reserve	2 661 821 229			2 661 821 229
Annex A emissions for 2011				
CO ₂	406 602 284	406 614 751		406 614 751
CH ₄	112 569 201			112 569 201
N ₂ O	25 064 964			25 064 964
HFCs	7 641 451			7 641 451
PFCs	259 251			259 251
SF ₆	149 293			149 293
Total Annex A sources	552 286 443	552 298 910		552 298 910
Activities under Article 3, paragraph 3, for 2011				
3.3 Afforestation and reforestation on non-harvested land for 2011	-26 719 667			-26 719 667
3.3 Afforestation and reforestation on harvested land for 2011	8 730 140			8 730 140
3.3 Deforestation for 2011	37 603 973	37 621 253		37 621 253
Activities under Article 3, paragraph 4, for 2011^c				
3.4 Forest management for 2011				
3.4 Cropland management for 2011				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2011				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2011				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.

^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 12
Information to be included in the compilation and accounting database in t CO₂ eq for 2010

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment^a</i>	<i>Final^b</i>
Annex A emissions for 2010				
CO ₂	406 208 537	405 893 015		405 893 015
CH ₄	110 551 685	110 880 771		110 880 771
N ₂ O	24 574 527			24 574 527
HFCs	7 020 726			7 020 726
PFCs	243 764			243 764
SF ₆	145 186			145 186
Total Annex A sources	548 744 425	548 757 988		548 757 988
Activities under Article 3, paragraph 3, for 2010				
3.3 Afforestation and reforestation on non-harvested land for 2010	-25 280 798			-25 280 798
3.3 Afforestation and reforestation on harvested land for 2010	8 989 912			8 989 912
3.3 Deforestation for 2010	45 267 627	45 284 692		45 284 692
Activities under Article 3, paragraph 4, for 2010^c				
3.4 Forest management for 2010				
3.4 Cropland management for 2010				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2010				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2010				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.

^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 13
Information to be included in the compilation and accounting database in t CO₂ eq for 2009

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment^a</i>	<i>Final^b</i>
Annex A emissions for 2009				
CO ₂	405 049 245	405 059 258		405 059 258
CH ₄	112 360 538			112 360 538
N ₂ O	24 983 606			24 983 606
HFCs	6 278 457			6 278 457
PFCs	307 887			307 887
SF ₆	143 231			143 231
Total Annex A sources	549 122 964	549 132 977		549 132 977
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009	-21 559 259			-21 559 259
3.3 Afforestation and reforestation on harvested land for 2009	7 618 550			7 618 550
3.3 Deforestation for 2009	48 692 034	48 706 338		48 706 338
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 the base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2009				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.

^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 14
Information to be included in the compilation and accounting database in t CO₂ eq for 2008

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment^a</i>	<i>Final^b</i>
Annex A emissions for 2008				
CO ₂	403 087 810	403 098 631		403 098 631
CH ₄	115 356 989			115 356 989
N ₂ O	25 661 281			25 661 281
HFCs	5 693 222			5 693 222
PFCs	381 136			381 136
SF ₆	158 400			158 400
Total Annex A sources	550 338 837	550 349 659		550 349 659
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008	-22 439 465			-22 439 465
3.3 Afforestation and reforestation on harvested land for 2008	7 131 511			7 131 511
3.3 Deforestation for 2008	56 621 083	56 634 952		56 634 952
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 the base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2008				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.

^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.

Annex II

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>.

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B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Robert Sturgiss (National Inventory Systems and International Reporting Branch, Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education), including additional material on the methodology and assumptions used.

Annex III

Acronyms and abbreviations

AD	activity data
AGEIS	Australian Greenhouse Emissions Information System
AWACS	Airborne Warning And Control System
BOD	biochemical oxygen demand
BREE	Bureau of Resources and Energy Economics
C	confidential
CCS	carbon capture and storage
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
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DIICSRTE	Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education
EF	emission factor
ERT	expert review team
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ without GHG emissions and removals from LULUCF
GCV	gross calorific value
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
LPG	liquefied petroleum gas
LTO	land and take-off
LULUCF	land use, land-use change and forestry
Mt	million tonnes
N ₂ O	nitrous oxide
NA	not applicable
NCV	net calorific value
NE	not estimated
NGER	National Greenhouse and Energy Reporting system
NGL	natural gas liquids
NIR	national inventory report
NO	not occurring
PCC	post-combustion capture
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
SOM	soil organic matter
Tg	teragram (1 Tg = 1 million tonnes)
TJ	terajoule (1 TJ = 10 ¹² joule)
UNFCCC	United Nations Framework Convention on Climate Change
