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Report on the individual review of the annual submission of Australia submitted in 2022*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual inventory of emissions and removals of greenhouse gases for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). Parties included in Annex I to the Convention that are Parties to the Kyoto Protocol are also required to report supplementary information under Article 7, paragraph 1, of the Kyoto Protocol with the inventory submission due under the Convention. This report presents the results of the individual review of the 2022 annual submission of Australia, conducted by an expert review team in accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol". The review took place from 12 to 17 September 2022 in Canberra, Australia.

* In the symbol for this document, 2022 refers to the year in which the inventory was submitted, not to the year of publication.

Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
2019 Refinement to the 2006 IPCC Guidelines	*2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
Annex I Party	Party included in Annex I to the Convention
AR	afforestation and reforestation
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
CER	certified emission reduction
CH_4	methane
CM	cropland management
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
COD	chemical oxygen demand
Convention reporting adherence	adherence to the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
CPR	commitment period reserve
CRF	common reporting format
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DC	degradable organic component
DOM	dead organic matter
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
FM	forest management
FMRL	forest management reference level
$Frac_{LEACH-MS}$	fraction of managed manure nitrogen losses due to leaching and run-off
FullCAM	Full Carbon Accounting Model
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
Kyoto Protocol Supplement	*2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MMS	manure management system(s)
N	nitrogen
N_2O	nitrous oxide
NA	not applicable

NE	not estimated
Nex	nitrogen excretion
NF_3	nitrogen trifluoride
NGER	National Greenhouse and Energy Reporting
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SIAR	standard independent assessment report
SEF	standard electronic format
SF_6	sulfur hexafluoride
SOC	soil organic carbon
SOM	soil organic matter
SWDS	solid waste disposal site(s)
TOW	total organic load in wastewater
UNFCCC Annex I inventory 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 greenhouse gas inventories"
UNFCCC review guidelines	"Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention"
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*
WWTP	wastewater treatment plant

I. Introduction

1. This report covers the review of the 2022 annual submission of Australia, organized by the secretariat in accordance with the Article 8 review guidelines (adopted by decision 22/CMP.1 and revised by decision 4/CMP.11). In accordance with the Article 8 review guidelines, this review process also encompasses the review under the Convention as described in the UNFCCC review guidelines, particularly in part III thereof, namely the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (annex to decision 13/CP.20). The review was conducted together with the review of one other Party and took place from 12 to 17 September 2022 in Canberra, Australia, and was coordinated by Pedro Torres and Xuehong Wang (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Australia.

Table 1
Composition of the expert review team that conducted the review for Australia

Area of expertise	*Name*	*Party*
Generalist	Marcelo Theoto Rocha	Brazil
Energy	Regine Röthlisberger	Switzerland
IPPU	Stanford Mwakasonda	United Republic of Tanzania
Agriculture	Olga Gavrilova	Estonia
LULUCF and KP-LULUCF	Sandro Federici	San Marino
Waste	Hans Oonk	Netherlands
Lead reviewers	Olga Gavrilova	
	Marcelo Theoto Rocha	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2022 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines.

3. The ERT has made recommendations that Australia resolve identified findings, including issues[1] designated as problems.[2] Other findings, and, if applicable, the encouragements of the ERT to Australia to resolve related issues, are also included in this report.

4. 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.

5. Annex I presents the annual GHG emissions of Australia, including totals excluding and including LULUCF, indirect CO_2 emissions, and emissions by gas and by sector, and contains background data on emissions and removals from KP-LULUCF, if elected by the Party, by gas, sector and activity.

6. Information to be included in the compilation and accounting database can be found in annex II.

[1] Issues are defined in decision 13/CP.20, annex, para. 81.
[2] Problems are defined in decision 22/CMP.1, annex, paras. 68–69, as revised by decision 4/CMP.11.

II. Summary and general assessment of the Party's 2022 annual submission

7. Table 2 provides the assessment by the ERT of the Party's 2022 annual submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

Table 2
Summary of review results and general assessment of the 2022 annual submission of Australia

Assessment			*Issue/problem ID#(s) in table 3 or 5*[a]
Dates of submission	Original submission: NIR, 27 May 2022; CRF tables (version 1), 27 May 2022; SEF tables, 27 May 2022 Revised submission: CRF tables (version 3), 16 September 2022 Unless otherwise specified, values from the most recent submission are included in this report		
Review format	Centralized		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	L.7
	(c) Development and selection of EFs?	No	
	(d) Collection and selection of AD?	Yes	E.3, E.4, L.1
	(e) Reporting of recalculations?	No	
	(f) Reporting of a consistent time series?	No	
	(g) Reporting of uncertainties, including methodologies?	Yes	G.2
	(h) QA/QC?	QA/QC procedures were assessed in the context of the national system (see supplementary information under the Kyoto Protocol below)	
	(i) Missing categories, or completeness?[b]	No	
	(j) Application of corrections to the inventory?	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	Yes	
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	Yes	
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:		
	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements?	No	
	(b) Performance of the national system functions?	No	
	Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry?	No	
	(b) Performance of the functions of the national registry and the adherence to technical standards for data exchange?	No	

Assessment			*Issue/problem ID#(s) in table 3 or 5*[a]
	Have any issues been identified related to the reporting of information on AAUs, CERs, ERUs and RMUs and on discrepancies in accordance with decision 15/CMP.1, annex, chapter I.E, in conjunction with decision 3/CMP.11, taking into consideration any findings or recommendations contained in the SIAR?	No	
	Have any issues been identified in matters related to Article 3, paragraph 14, of the Kyoto Protocol, specifically problems related to the transparency, completeness or timeliness of the reporting on the Party's activities related to the priority actions listed in decision 15/CMP.1, annex, paragraph 24, in conjunction with decision 3/CMP.11, including any changes since the previous annual submission?	No	
	Have any issues been identified related to the following reporting requirements for KP-LULUCF:		
	(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	No	
	(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	No	
	(c) Reporting requirements of decision 6/CMP.9?	No	
	(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	No	
CPR	Was the CPR reported in accordance with decision 18/CP.7, annex; decision 11/CMP.1, annex; and decision 1/CMP.8, paragraph 18?	Yes	
Adjustments	Has the ERT applied any adjustments under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Has the Party submitted a revised estimate to replace a previously applied adjustment?	No	Australia does not have a previously applied adjustment
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for assessing conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	No	
Questions of implementation	Did the ERT list any questions of implementation?	No	

[a] Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.
[b] Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex III.

III. Status of implementation of recommendations included in the previous review report

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 3 March 2022,[3] and had not been resolved by the time of publication of the report on the review of the Party's 2021 annual submission. The ERT has specified whether it believes the Party had resolved, was addressing or had not resolved each issue or problem by the time of publication of this review report and has provided the rationale for its determination, which takes into consideration the publication date of the most recent previous review report and national circumstances.

Table 3
Status of implementation of recommendations included in the previous review report for Australia

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
General			
G.1	Uncertainty analysis (G.4, 2021) Convention reporting adherence	Rectify the errors in the uncertainty analysis reporting in the NIR (vol. 1, pp.34 and 116, and vol. 3, p.108) by providing the correct uncertainty values.	Resolved. The sections in volume 1 of the NIR relating to uncertainty now correctly refer to annex 2 rather than annex 7 to the NIR. The uncertainty values in section 1.6 were corrected and are now consistent with the values reported in table A2.4.
G.2	Uncertainty analysis (G.5, 2021) Transparency	Include the information required by the 2006 IPCC Guidelines (vol. 1, chap. 3, section 3.2.2.3, and vol. 1, chap. 2, section 2.2 and annex 2A.1 on expert elicitation) when using expert judgment in the uncertainty analysis.	Addressing. The ERT identified the following, which was confirmed by the Party during the review: (a) The text in annex A2.2 to the NIR was updated to replace references to the use of expert judgment with the specific sources used in calculating uncertainty for the IPPU sector; (b) The uncertainty distributions used as inputs to the Monte Carlo uncertainty analysis for transport are based on published research and were derived in accordance with the 2006 IPCC Guidelines; (c) The uncertainty estimates for the agriculture sector were calculated in line with the 2006 IPCC Guidelines. Notes to NIR table A2.4, which mention the names of two individuals from CSIRO, refer to reports commissioned by Australia from those two experts. These two reports (one for livestock and one for other subsectors of the agriculture sector) document the uncertainty estimates and probability distribution functions for all the agriculture sector AD; (d) The uncertainty estimates for the waste sector (NIR annex A2.5) were updated with NGER reported uncertainties determined in line with sections 8.3–8.4 of the National Greenhouse and Energy Reporting (Measurement) Determination 2008;

[3] FCCC/ARR/2021/AUS.

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			(e) Prescribed methods for estimating uncertainty under the NGER scheme, which covers data for the energy, IPPU and waste sectors, are provided in chapter 8 of the National Greenhouse and Energy Reporting (Measurement) Determination 2008. Nevertheless, Australia reported that it is still reviewing uncertainty values and will provide further details on values determined using expert judgment in future annual submissions.
Energy			
E.1	International bunkers and multilateral operations – liquid fuels – all gases (E.1, 2021) (E.1, 2020) (E.2, 2019) Convention reporting adherence	Correct the AD on international bunkers to avoid discrepancies between CRF tables 1.D and 1.A(b).	Resolved. The Party reported that the AD on international bunkers were reviewed and discrepancies between CRF table 1.D and 1.A(b) removed (NIR vol. 3, p.188). However, the ERT found remaining differences between the data in these tables for some years, for example for jet kerosene (3 per cent for 2011), gas/diesel oil (19 per cent for 2014) and residual fuel oil (4–34 per cent for 2014–2018). During the review, the Party clarified that the remaining differences arose from the use of independent energy data sources for the two tables. For CRF table 1.A(b), data from the Australian Petroleum Statistics are used as a top-down verification of the bottom-up data from the Australian Energy Statistics used for CRF table 1.D. The Party explained that the Australian Energy Statistics are periodically updated to recalculate errors identified, whereas the Australian Petroleum Statistics are not. This may lead to apparent discrepancies. The ERT considers that the use of independent data sources is desirable, even though this may lead to differences. The ERT considers that the explanation provided by the Party is adequate and therefore the issue is resolved.
E.2	1.A Fuel combustion – sectoral approach – biomass – CH_4 and N_2O (E.2, 2021) (E.5, 2020) Transparency	Report the correct notation key ("NE") for biomass for categories 1.A.3.d (domestic navigation), 1.A.3.e.ii (other (other transportation)) and 1.A.4.b.ii (off-road and other machinery (residential)) and justify why the emissions for these categories were not estimated if they are below the significance threshold in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines and in line with the information provided to the ERT during the 2020 review, or estimate and report CH_4 and N_2O emissions for these categories.	Resolved. The Party reported CH_4 and N_2O emissions from biomass used for domestic navigation (category 1.A.3.d), other (other transportation) (category 1.A.3.e.ii) and off-road and other machinery (residential) (category 1.A.4.b.ii) in CRF tables 1.A(a)s3 and 1.A(a)s4.
E.3	1.A Fuel combustion – sectoral approach – solid fuels – CO_2, CH_4 and N_2O (E.7, 2021) Comparability	Allocate the emissions from the combustion of waste (non-biomass fraction) to other fossil fuels under the appropriate subcategory of category 1.A, in line with the 2006 IPCC Guidelines (vol. 2, table 1.1), and for categories where combustion of waste for energy occurs, include in the NIR information	Addressing. The Party reported other fossil fuels as "NO" in CRF table 1.A for public electricity and heat production (category 1.A.1.a) and manufacturing industries and construction (category 1.A.2). For reporting emissions from the combustion of waste (non-biomass fraction), the Party used "NA" in CRF table 1.A(b). According to the NIR (vol. 1, p.84), an investigation to determine the non-biomass fraction of waste fuels is under way.

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
		on the fuel mix and background methodological data, such as EFs and calorific values.	During the review, the Party stated that data on waste combusted for energy purposes, both biomass and non-biomass fractions, were reported under the NGER scheme and that the emissions were included in the GHG inventory. Under the NGER scheme, 1.7 PJ was reported as "industrial materials that are derived from fossil fuels, if recycled and combusted to produce heat or electricity", with a calorific value of 26.3 GJ/t and a CO_2 EF of 81.56 kg CO_2/GJ, and 1.3 PJ was reported as "biomass municipal and industrial materials, if recycled and combusted to produce heat or electricity" (National Greenhouse and Energy Reporting (Measurement) Determination 2008, schedule 1, part 1). The Party still reports these emissions in aggregate with those from solid fuels in the inventory. The ERT noted that in order to report emissions from non-biomass waste fuels under other fossil fuels, Australia would need to extract the data from the aggregation algorithm embedded in the software used to compile the emission estimates. The Party clarified that the apparent discrepancy between the data reported to IEA and the AD reported in the inventory for non-biomass waste identified during the review of the 2021 annual submission is due to the fact that the IEA data cover both biomass and non-biomass fractions of waste. The ERT considers that the recommendation has not yet been fully addressed because the Party did not report the non-biomass fraction of waste fuels under other fossil fuels in the CRF tables and because information on waste amounts and waste types (including calorific values, carbon contents and fossil/biogenic fractions of waste) is missing in the NIR. However, the ERT acknowledges the explanation provided by the Party for the apparent discrepancy between the IEA data and the AD on non-biomass waste reported in the inventory.
E.4	1.A.1.b Petroleum refining – gaseous fuels – CO_2 (E.3, 2021) (E.6, 2020) Comparability	Allocate any known refinery gas used in petroleum refining to liquid fuels or, if the volumes and types of "other" gaseous fossil fuels are not known with sufficient certainty, allocate them to other fossil fuels under category 1.A.1.b and only report natural gas under gaseous fuels. If unable to reallocate these other gaseous fossil fuels, explain in the NIR why the CO_2 IEF for gaseous fuels consumed in petroleum refining is comparatively low by including the (non-confidential) information provided to the ERT during the 2020 review (e.g. that a large share of the volume reported under gaseous fuels corresponds to the "other" gaseous fossil fuels reported by a single refinery).	Addressing. The Party stated in its NIR (vol. 3, p.181) that refinery gas is reported separately under "other fossil fuels" in CRF table 1.A(a)s1. The Party also stated that the IEF may still fluctuate over time depending on plant closures and the fuel categories reported by the refineries under the NGER scheme (vol. 1, p.68). During the review, the Party clarified that the use of other gaseous fuels by one refinery was not yet incorporated into the inventory for 2013–2016, but that these emissions will be included in the next annual submission.
E.5	1.A.3.b Road transportation – liquid fuels – CO_2	Include an estimation of the likely level of emissions in the NIR to demonstrate that it is below the significance threshold established in paragraph	Resolved. The Party reported in its NIR (vol. 3, p.161) that the emissions from urea-based catalytic converters are estimated to be 137.6 kt CO_2, or 0.027 per cent of the national total. Therefore, this category is considered insignificant according to

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
	(E.8, 2021) Transparency	37(b) of the UNFCCC Annex I inventory reporting guidelines, if the emissions from urea-based catalytic converters are considered to be insignificant. Otherwise, report emissions from urea-based catalytic converters in the CRF tables and describe in the NIR the estimation methodology and assumptions used.	paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. In addition, the Party described in detail (vol. 1, p.95) how the emissions from urea-based catalytic converters in heavy vehicles were estimated and reported that these emissions for heavy goods vehicles are below 23 kt CO_2.
E.6	1.A.3.b Road transportation – liquid fuels – CH_4 and N_2O (E.9, 2021) Transparency	Estimate CH_4 and N_2O emissions from lubricant use in two-stroke engines and report them under category 1.A.3.b.	Addressing. The Party reported in its NIR (vol. 1, p.102) that it will investigate methods to disaggregate and reallocate emissions from lubricant use in two-stroke engines in order to estimate and report CH_4 and N_2O emissions from lubricant use in two-stroke engines under road transportation (category 1.A.3.b). The ERT considers that emissions from lubricant use in two-stroke engines potentially fall under various categories (1.A.2.g, 1.A.3.b, 1.A.3.d, 1.A.4.a, 1.A.4.b and 1.A.4.c) but contribute only marginally to each category. During the review, the Party provided information that demonstrates the level of CH_4 and N_2O emissions from lubricant use in two-stroke engines is likely to be below 0.05 kt CO_2 eq and therefore insignificant (see also ID# I.5 below). The ERT agrees with this assessment but notes that this issue will not be fully resolved until the above-mentioned information is provided in the NIR.
IPPU			
I.1	2.B.8 Petrochemical and carbon black production – CO_2 (I.3, 2021) (I.9, 2020) Comparability	Report CO_2 emissions from ethylene oxide separately in category 2.B.8, or, if this is not possible, report them as "IE" and indicate in CRF table 9 where the emissions are reported, and provide a description, in the relevant section of the NIR, of the method used for estimating CO_2 emissions for this category.	Resolved. The Party reported CO_2 emissions from ethylene oxide production as "IE" under petrochemical and carbon black production (category 2.B.8) and indicated in CRF table 9 that the emissions are reported under the food and beverages industry (category 2.H.2), where ethylene oxide is used and emitted, as explained in the NIR (vol. 1, p.224).
I.2	2.B.8 Petrochemical and carbon black production – CO_2 (I.11, 2021) Transparency	Indicate in CRF table 9 under which category CO_2 emissions from methanol production (category 2.B.8.a), reported as "IE" in the CRF tables, are included.	Addressing. The Party reported CO_2 emissions from methanol production (category 2.B.8.a) as "IE" in CRF table 2.B.8.a and indicated in CRF table 9 that these emissions are included under petrochemical and carbon black production (category 2.B.8). The Party also reported in CRF table 9 that emissions and AD associated with methanol production are confidential. The ERT considers that the Party should indicate in CRF table 9 the actual category under which the emissions are included, which in this case would be other (category 2.B.8.g).
I.3	2.C.1 Iron and steel production – CO_2 (I.12, 2021) Convention reporting adherence	Correct the notation key in CRF table 2(I)A-Hs2 from "NO" to "IE" and provide in the NIR a comprehensive explanation of how emissions from sinter production are estimated.	Resolved. The Party reported emissions from sinter production as "IE" for the entire time series under category 1.A.2.a and provided a breakdown of sinter production emissions in its NIR (chaps. 3.4.2 and 3.4.3). It also provided an energy flow chart for coke oven and iron and steel (NIR figure 3.11).

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
I.4	2.C.4 Magnesium production – SF_6 (I.13, 2021) Transparency	Correct the description of the AD in CRF table 2(II)B-Hs1 and replace the notation key "NE" used for AD with the estimates for 1996–2000.	Addressing. The Party explained in its NIR (vol. 1, p.236) that experimental quantities of SF_6 were used between 1996 and 2000 as a cover gas in magnesium foundries. The ERT noted that AD in CRF table 2(II)B-Hs1 are still reported as amount of magnesium cast instead of amount of SF_6 consumed.
I.5	2.D.1 Lubricant use – CO_2 (I.6, 2021) (I.5, 2020) (I.21, 2019) Comparability	Report emissions from lubricant use in two-stroke engines separately under category 1.A.3.b (road transportation) of the energy sector.	Resolved. The ERT considers that CO_2 emissions from lubricant use in two-stroke engines potentially fall under various categories (1.A.2.g, 1.A.3.b, 1.A.3.d, 1.A.4.a, 1.A.4.b and 1.A.4.c) but contribute only marginally to each category. During the review, the Party provided information that demonstrates the level of CO_2 emissions from lubricant use in two-stroke engines is likely to be below the threshold of significance. Given this likely level of CO_2 emissions from lubricant use in two-stroke engines, the ERT considers it is justifiable that the Party reported these emissions in an aggregated manner under lubricant use (category 2.D.1), using an oxidation factor of 100 per cent for the amount of lubricant used in two-stroke engines (see also ID# E.6 above).
I.6	2.F.1 Refrigeration and air conditioning – HFCs (I.14, 2021) Transparency	Clearly document the methodology used for estimating emissions for this category, including summary information and references to all background data used, including to Dunse et al. (2020), in the NIR. Include in the NIR a detailed description of the methodology applied to calculate the uncertainties of the emissions estimated with the inverse model, and the uncertainty estimates for the entire time series.	Resolved. A detailed description of the methodology used by CSIRO to calculate the uncertainties of emissions estimated using the Inversion Technique for Emission Modelling (the 'InTEM inverse model') is included in appendix 4.A to the NIR (vol. 1, p.292), and a reference to the most recent report in which those data were published (CSIRO 2021) is provided in annex 9 to the NIR (section 4). The ERT considers the level of detail in the NIR, including for the tier 1 uncertainty analysis presented in annex 2, which provides information on uncertainty estimates by IPCC source category, to be sufficiently transparent for the purpose.
I.7	2.F.1 Refrigeration and air conditioning – HFCs (I.15, 2021) Transparency	Improve the description of the model provided in the NIR, including by specifying the formulae used to adjust the annual leakage rates, the values of the national HFC bank considered, the estimated values of the implied leakage rates and the final fractional changes obtained. Include in the NIR a justification for the methodology adopted for the corrections between the CSIRO and inventory estimates.	Resolved. The Party reported a comparison of HFC emission estimates calculated for the GHG inventory with estimates derived from measurements obtained at the Cape Grim Baseline Air Pollution Station, as documented in the NIR (vol. 1, pp.269–270). During the review, the Party explained that the practice of adjusting annual leakage rates has been discontinued and was not carried out during preparation of the NIR. The ERT considers the level of detail in the NIR to be sufficiently transparent for the purpose.
I.8	2.G.3 N_2O from product uses– N_2O (I.10, 2021) (I.6, 2020) (I.15, 2019) Transparency	Explain the methodology used for estimating N_2O imports using the per capita usage factor, verify that no underestimation or overestimation of emissions occurs and report the results in the NIR.	Resolved. The Party reported in its NIR (vol. 1, p.285) that limited information is available on the production and import of N_2O for use in the country, and that the per capita factor was derived from historical data on production and imports. This factor is estimated as 0.013 kt CO_2 eq per 1,000 persons, which is comparable with other Annex I Parties, for which per capita factors range from 0.00 to 0.02 kt CO_2 eq per 1,000 persons. The ERT agrees with the Party's assessment and has not identified any bias in the emission estimates.

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
Agriculture			
A.1	3. General (agriculture) – N_2O (A.3, 2021) (A.8, 2020) Accuracy	Revise the estimation of N losses from manure management by updating $Frac_{LEACH-MS}$ to an appropriately justified value within the range provided in the 2006 IPCC Guidelines (vol. 4, chap. 10, equation 10.28) (i.e. 0.01–0.20), or provide a justification for the country-specific value currently used in the calculation model, including any value adopted from the 2019 Refinement to the 2006 IPCC Guidelines.	Resolved. The Party used a $Frac_{LEACH-MS}$ value of 0.02 for solid manure storage for all livestock types, which is provided in table 10.22 of the 2019 Refinement to the 2006 IPCC Guidelines (vol. 4, chap. 10), and recalculated N_2O emissions from N leaching and run-off from MMS for solid manure for the entire time series. In its NIR (vol. 1, p.320), Australia clarified that the $Frac_{LEACH-MS}$ value in the 2019 IPCC Refinement to the 2006 IPCC Guidelines better reflects Australia's situation and facilitates the accuracy and completeness of its inventory.
A.2	3. General (agriculture) – CO_2, CH_4 and N_2O (A.20, 2021) Transparency	Add an appropriate unit for all AD, parameters and EFs included in the NIR, including for the following in volume 1: the number of dairy cattle in each class for each state and season (N_{ij}) in equation 3A.1a_4 (p.310), additional intake for milk production (MA_{ijk}=4) in equation 3A.2_3 (p.313), the inorganic fertilizer EF for non-irrigated cropping (EF_{ij}) in equation 3B.5d_2 (p.335), the mass of limestone and dolomite applied to soils (M_{ij}) in equation 3G_1 (p.361), the default EFs for limestone ($EF_{j=1}$) and dolomite ($EF_{j=2}$) in equation 3G_1 (p.361), the mass of urea applied to soils (M_i) in equation 3H_1 (p.362) and the default EF for urea in equation 3H_1 (p.362).	Addressing. In its NIR, the Party provided appropriate units for all AD, parameters and EFs listed in the recommendation, except for units to express the number of dairy cattle in each class for each state/territory and season (N_{ij}) in equation 3A.1a_4 (NIR vol. 1, p.304) and additional intake for milk production (MA_{ijk}=4) in equation 3A.2_3 (NIR vol. 1, p.307).
A.3	3. General (agriculture) – CH_4 and N_2O (A.21, 2021) Convention reporting adherence	Report the correct uncertainty values for CH_4 from enteric fermentation, CH_4 from rice cultivation and both CH_4 and N_2O from agricultural residue burning, ensuring consistency between the agriculture chapter of the NIR and the tables in annex 2 to the NIR, including for enteric fermentation (vol. 1, section 5.3.6, p.316), rice cultivation (vol. 1, section 5.5.2, p.343) and burning of agricultural residues (vol. 1, section 5.8.2, p.360).	Resolved. The Party reported the correct uncertainty values for CH_4 emissions from enteric fermentation, CH_4 emissions from rice cultivation and both CH_4 and N_2O emissions from agricultural residue burning in the relevant sections of the NIR (e.g. for enteric fermentation, section 5.3.6; for rice cultivation, section 5.5.2). This reporting by Australia ensured consistency between the agriculture chapter of the NIR and the tables in annex 2 to the NIR. During the review, the Party clarified that additional QC checks were undertaken to ensure that uncertainty values presented in the text of the agriculture chapter (chap. 5) are consistent with the information in annex 2 to the NIR.
A.4	3.B.1 Cattle – N_2O (A.22, 2021) Convention reporting adherence	Include the information needed to ensure consistency between the NIR and CRF tables 3.B(a)s2 (allocation by MMS) and 3.B(b) (total N excreted per animal waste management system for beef cattle – feedlot); in particular, amend the text in the NIR (vol. 1, section 5.4.1.1, p.321) with regard	Resolved. In its NIR (vol. 1, p.315), the Party explained how it ensured consistency between the NIR and CRF tables 3.B(a)s2 (allocation by MMS) and 3.B(b) (total N excreted per animal waste management system for beef cattle – feedlot) and clarified that emissions from the manure of feedlot beef cattle, swine and poultry add up to more than 100 per cent under MMS allocation because manure from intensive livestock industries may pass through multiple treatment stages.

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
		to feedlot beef cattle, swine and poultry to indicate that emissions from the manure of animals under these three categories add up to more than 100 per cent under MMS allocation because manure from intensive livestock industries may pass through multiple treatment stages.	
A.5	3.B.4 Other livestock – CH_4 (A.7, 2021) (A.14, 2020) Convention reporting adherence	Report correct and consistent data for allocation of manure by climate region for buffalo and deer in CRF tables 3.B(a)s1 and 3.B(a)s2.	Resolved. In CRF tables 3.B(a)s1 and 3.B(a)s2, the Party corrected the data on allocation of manure by climate region for buffalo and deer. During the review, the Party confirmed that 100 per cent of deer and buffalo population numbers for each climate region are allocated to the pasture range and paddock MMS.
A.6	3.C Rice cultivation – CH_4 (A.23, 2021) Transparency	Include in the NIR the area under rice cultivation by State for the entire time series.	Resolved. The Party provided information on the area under rice cultivation by state/territory for the entire time series in the NIR (appendix 5.L).
A.7	3.D.a.1 Inorganic N fertilizers – N_2O (A.9, 2021) (A.16, 2020) Transparency	Provide detailed evidence in the NIR to support the country-specific N_2O EF for the application of inorganic N fertilizers, including a justification for the application of the EFs in the study by Shcherbak and Grace (2014) to non-urea fertilizers.	Not resolved. The Party continued to apply a country-specific EF for the category, with the IEF varying from 0.007 to 0.004 kg N_2O-N/kg N, but did not provide the required detailed evidence to support its use.
A.8	3.D.a.1 Inorganic N fertilizers – N_2O (A.10, 2021) (A.17, 2020) Transparency	Provide in the NIR a more detailed justification for the use of country-specific EFs for categories 3.D.a.5 (mineralization/immobilization associated with loss/gain of SOM) and 3.D.b.1 (atmospheric deposition), for example by referring to measurements, published scientific findings, causal biochemical explanations and country-specific soil and/or climate conditions.	Not resolved. The Party did not provide in its NIR a detailed justification for the use of country-specific EFs for mineralization/immobilization associated with loss/gain of SOM (category 3.D.a.5) or atmospheric deposition (category 3.D.b.1). During the review, the Party clarified that new research, which will likely provide scientific findings that justify the country-specific EFs for these categories, is expected to be published in time to be included in the next annual submission.
A.9	3.D.a.1 Inorganic N fertilizers – N_2O (A.24, 2021) Transparency	Include the production areas reported by the Australian Bureau of Statistics by State for the entire time series, especially where that information is key to understanding how the fraction of fertilizer applied to each production system has been calculated.	Resolved. In its NIR (vol.1, appendix 5.H), the Party reported data from the Australian Bureau of Statistics, by state/territory, on the production area for non-irrigated and irrigated crops, non-irrigated and irrigated pasture, cotton, horticultural vegetable crops and sugar cane for the entire time series.
A.10	3.D.a.2.a Animal manure applied to soils – N_2O (A.11, 2021) (A.18,	Explain in the NIR the estimation of the N_2O EF for animal manure applied to soils.	Addressing. The Party did not provide an explanation of how the N_2O EF used to calculate N_2O emissions from animal manure applied to soils for piggeries for the entire reporting period was determined.

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
	2020) Transparency		During the review, the Party noted that a link to the PigBal modelling tool and a reference for a manual on how to run it is included in the NIR (appendix 5.E). However, the ERT considers that the outputs of the PigBal model do not comprise a comprehensive explanation of this matter. In addition, the Party provided a brief description of key elements of the PigBal model (see also ID# A.17 in table 5). The ERT agrees with the information provided but notes that this issue will not be fully resolved until the required explanation of the use of the N_2O EF is provided in the NIR.
A.11	3.D.a.2.b Sewage sludge applied to soils – N_2O (A.25, 2021) Convention reporting adherence	Report the correct amount of sewage sludge applied to agricultural soils in 2019 (11,491,474.98 kg N) in CRF table 3.D so that the value is consistent with the information reported in the NIR (vol. 2, table 7.19).	Resolved. In CRF table 3.D, the Party reported the amount of sewage sludge applied to agricultural soils in 2019 as 11,491,474.98 kg N; this value is consistent with that reported in the 2021 NIR (vol. 2, table 7.19).
A.12	3.D.a.3 Urine and dung deposited by grazing animals – N_2O (A.26, 2021) Convention reporting adherence	Report the correct Nex value for poultry on pasture, range and paddock for 2019 in CRF table 3.B(b) so that total Nex on pasture, range and paddock for all animal categories is consistent with the value reported in CRF table 3.D (1,545,338,132.0 kg N).	Resolved. The Party reported the value for the total amount of Nex on pasture, range and paddock for all animal categories for 2019 consistently between CRF table 3.B(b) and CRF table 3.D (1,545,419,375.05 kg N).
A.13	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O (A.14, 2021) (A.21, 2020) Transparency	Clearly describe the data source for the area of cultivated organic soils reported in the agriculture chapter of the NIR, and explain in the NIR any differences between this reported area and the areas reported in CRF tables 4.B and 4.C.	Resolved. The Party revised, for the entire reporting period (1990–2020), the data on the area of cultivated organic soils presented in CRF tables 4.B and 4.C (LULUCF sector), thus ensuring consistency in these values with those reported in the agriculture chapter of the NIR (chap. 5). In addition, in its NIR (vol. 2, section 6.7.1.2, pp.103–104), Australia provided a detailed explanation of its approach to obtaining the data.
A.14	3.D.b.1 Atmospheric deposition – N_2O (A.27, 2021) Convention reporting adherence	Report the correct value for volatilized N from agricultural inputs of N for 2019 (494,966,010.6 kg N) in CRF table 3.D.	Resolved. In CRF table 3.D, the Party reported the amount of volatilized N from agricultural inputs of N for 2019 as 495,455,864.12 kg N, which is consistent with the total amount of N volatilized calculated as the sum of each subcategory, that is, (1,337,593,241.06 × 0.11) + (101,758,709.98 × 0.21) + (11,491,474.98 × 0.21) + (1,545,419,375.05 × 0.21) = 495,455,864.12 kg N.
A.15	3.G Liming – CO_2 (A.28, 2021) Transparency	Report all fraction of lime as limestone values used to estimate CO_2 emissions from liming, including all the assumptions made to extrapolate data for the latest year, and ensure that differences between the EFs reported in the NIR and the IEFs reported in the CRF tables are explained in the NIR.	Resolved. In its NIR (vol. 1, section 5.9, p.354, and appendix 5.K), the Party provided detailed information on its approach to estimating CO_2 emissions from liming, including all the assumptions and parameters used in the calculations. Australia also described the units relevant to the parameters and provided the sources of data as references. The ERT concludes that this explanation is consistent with the CO_2 IEFs reported in CRF table 3.G-I for limestone and dolomite.

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
LULUCF			
L.1	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.1, 2021) (L.2, 2020) (L.3, 2019) (L.4, 2017) (L.29, 2016) Comparability	Provide separate AD and estimates for the following categories and pools currently reported as "IE": cropland, wetlands and settlements converted to forest land (all pools except organic soils); cropland converted to grassland (all pools); and cropland and grassland converted to settlements (all pools). Until this is done, provide in the NIR an update of the status of efforts to provide estimates for these pools.	Addressing. The Party provided estimates for emissions from cropland, wetlands and settlements converted to forest land (CRF table 4.A), while it reported as "IE" both emissions from cropland converted to grassland (all pools) (CRF table 4.B) and emissions from cropland and grassland converted to settlements (all pools) (CRF table 4.E). Further, the Party reported in its NIR (vol. 2, p.153) that a project to develop new spatial data for identifying the conversion of cropland and grassland to settlements is under way.
L.2	4.A.2.3 Wetlands converted to forest land – CO_2 (L.3, 2021) (L.8, 2020) Transparency	Include in the NIR the reason for using organic soils for reporting carbon stock changes for the establishment or reforestation of mangrove forests on degraded coastal (tidal) wetlands, and the scientific basis for the relatively significant carbon gain in organic soils.	Resolved. The Party reported in its NIR (vol. 3, p.185) that carbon stock changes for wetlands converted to forest land (mangroves, CO_2 emissions) are now estimated using FullCAM. This model is calibrated to observed regional Australian SOC values for mangrove wetlands obtained from published scientific papers; the method for doing so is described in the NIR (appendix 6.J).
L.3	4.B.2.3 Wetlands converted to cropland – CO_2 (L.4, 2021) (L.9, 2020) Accuracy	Calculate CO_2 emissions for organic soils on wetlands converted to cropland using a cultivated area consistent with that reported under category 3.D.a.6 and reconsider the assumption that all wetlands converted to cropland contain organic soils.	Resolved. The Party reported values for the area of organic soils under CM and GM in CRF table 4.B (3,000 ha) and CRF table 4.C (1,000 ha) respectively. Consistently with the sum of these values (4,000 ha), the Party reported in CRF table 3.D a total area of 4,000 ha cultivated histosols.
L.4	4(II) Emissions/removals from drainage and rewetting and other management of organic/mineral soils – CO_2 (L.6, 2021) (L.11, 2020) Convention reporting adherence	Complete the cells for CO_2 emissions from drained organic soils in forest land, cropland and grassland in CRF table 4(II) consistently with the reporting of carbon stock changes in organic soils in background CRF tables 4.A–4.C to enhance comparability.	Resolved. The Party reported CO_2 emissions from drained organic soils in cropland and grassland in CRF tables 4.B and 4.C respectively. The CO_2 emissions for these categories were reported as "IE" in CRF table 4(II), and note 4 to this table indicates where the emissions are reported. For other land-use categories, emissions are reported as "NO" in CRF table 4(II).
L.5	4(II) Emissions/removals from drainage and rewetting and other management of organic/mineral soils – N_2O	Report N_2O emissions from drained forest organic soils, using the same AD that were used to estimate CO_2 emissions from drained forest organic soils, to enhance completeness.	Resolved. The Party reported in CRF table 4(II) N_2O emissions from drained organic soils in forest land as "NO" reflecting the fact that conversion of tidal marshes to mangroves does not include drainage of organic soils.

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
	(L.7, 2021) (L.11, 2020) Transparency		
L.6	4.H Other (LULUCF) – N_2O (L.8, 2021) (L.12, 2020) Transparency	Accurately report N_2O emissions from aquaculture production by expressing the emissions in CRF table 4 as N_2O instead of N_2O-N and include the AD for aquaculture production in the same table as that showing the estimated emissions in the NIR (vol. 2, table 6.56).	Resolved. The Party reported annual production from coastal aquaculture (fish and crustaceans, in kt) in NIR table 6.10.3 (vol. 2, p.140). Further, the associated N_2O emissions for category 4.H were reported in CRF table 4 (in Gg N_2O).
Waste			
W.1	5.A Solid waste disposal on land – CH_4 (W.1, 2021) (W.1, 2020) (W.10, 2019) Transparency	Explain how data from background studies conducted in 2008 were used to estimate the waste composition for the most recent years of the time series.	Resolved. The Party explained in the NIR (vol. 2, section 7.3.3.2, p.329) that waste composition data not covered under the NGER scheme were derived as a simple average of waste mixes from studies conducted in 2008. These mixes were verified in 2014 as part of a desktop audit of waste composition data. Owing to the absence of new data, the estimates based on the 2008 studies were also applied to more recent years of the time series. The ERT considers this practice to be in line with the 2006 IPCC Guidelines (vol. 1, chap. 5, p.5.7), which indicate that "as a general assumption emission factors or other estimation parameters do not change over time unless otherwise indicated [and] countries should clearly document the reason for using different factors or parameters in the time series".
W.2	5.C.1 Waste incineration – CO_2, CH_4 and N_2O (W.5, 2021) Completeness	Check for the occurrence of unreported incinerated waste, especially waste lubricant and hazardous waste, for which there are default CO_2 EFs, and biosolids, for which there are default N_2O EFs in tables 5.2 and 5.5 respectively of the 2006 IPCC Guidelines (vol. 5); and, if occurring, estimate and report the relevant emissions and explain the recalculation in the NIR. If these emissions occur but the Party considers them to be insignificant, demonstrate that the likely level of emissions is below the significance threshold, as defined in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party reported in its NIR (vol. 2, section 7.5, p.343) an analysis of the likely level of emissions from unreported incinerated waste. The analysis demonstrates that the likely level of emissions from this source is below the significance threshold established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (264.07 kt CO_2 eq for Australia in 2020). Additional information on this matter is included in section 7.5 and table A5.2 of the NIR.
W.3	5.C.1 Waste incineration – CO_2 (W.6, 2021) Accuracy	Estimate and report emissions from the incineration of clinical waste using the default oxidation factor of 1.0 provided in the 2006 IPCC Guidelines (vol. 5, chap. 5, table 5.2) and explain any recalculations in the NIR. If the Party considers these emissions to be insignificant, demonstrate that the likely level of emissions is below the significance threshold	Resolved. The Party reported emissions from the incineration of clinical waste in NIR table 7.17 (vol. 2, p.343), noting that they were estimated using the default oxidation factor of 1.0 provided in the 2006 IPCC Guidelines.

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
		established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	
W.4	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.7, 2021) Completeness	Estimate and report CO_2, CH_4 and N_2O emissions from accidental fires on SWDS using the existing literature and explain any recalculations in the NIR. If the Party considers these emissions to be insignificant, demonstrate that the likely level of emissions is below the significance threshold established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party reported in its NIR (vol. 2, section 7.5, p.343) and annex 5 to the NIR (vol. 3, table A5.2, p.162) that it estimated emissions of CO_2, CH_4 and N_2O from accidental fires on SWDS to be 0.02 Mt CO_2 eq, or 0.004 per cent of total national emissions. Accordingly, emissions from this source were not reported in the inventory on the grounds that they fall below the significance threshold established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.
W.5	5.D.1 Domestic wastewater – CH_4 (W.8, 2021) Accuracy	Justify the use of the country-specific method of subtracting the COD in wastewater after treatment; or, alternatively, use equation 6.1 of the 2006 IPCC Guidelines (vol. 5), without any subtraction, to estimate CH_4 emissions and explain any recalculation in the NIR.	Resolved. The Party reported in its NIR (vol. 2, p.350) information on its country-specific method of estimating CH_4 emissions from the treatment of domestic wastewater, which ensures an improved estimate of organic carbon balance over the wastewater treatment and discharge process and an estimate of COD removed upon wastewater treatment. The discharge of treated effluent is regulated by the state and territory governments; indirect emissions of CH_4 from the well-managed and monitored environments are unlikely to occur. The ERT agrees that the Party's reporting is consistent with the 2006 IPCC Guidelines.
W.6	5.D.2 Industrial wastewater – CH_4 (W.9, 2021) Transparency	Clearly report in the NIR the reasons for the significant increase in CH_4 recovery from industrial wastewater in the beer, and pulp and paper industries since 2017.	Resolved. The Party reported in its NIR (vol. 2, section 7.6, p.359) an analysis of the trends in CH_4 recovery from industrial wastewater in the beer, and pulp and paper industries since 2017.
KP-LULUCF			
KL.1	CM – CO_2 (KL.2, 2021) (KL.7, 2020) Accuracy	Report the correct area used for estimation of CO_2 emissions from the drainage of organic soils under CM, ensuring consistency with the area reported for the LULUCF sector, as appropriate.	Resolved. The Party reported values for the area of organic soils under CM and GM in CRF table 4(KP-I)B.2 (3,000 ha) and CRF table 4(KP-I)B.3 (1,000 ha) respectively. Consistently with the sum of these values (4,000 ha), the Party reported in CRF table 3.D a total area of 4,000 ha of cultivated histosols.
KL.2	RV – CO_2 (KL.4, 2021) (KL.4, 2020) (KL.7, 2019) Comparability	Report the carbon stock changes for different carbon pools separately and eliminate the error in the reporting of the notation key in CRF table 4(KP-I)B.4.	Not resolved. The Party reported in its NIR (vol. 2, p.78) on carbon stock changes for all five carbon pools (above-ground biomass, below-ground biomass, deadwood, litter and soil). Disaggregation of the tier 2 estimates was undertaken using the results from scoping of the tier 3 FullCAM approach. However, carbon stock changes for the litter carbon pool were not reported in CRF table 4(KP-I)B.4 as requested by the previous ERT; rather, the Party reported such carbon stock changes as "IE" since they were included in the deadwood estimates. Nevertheless, the notation key "IE" is the appropriate one to use when, as in this case, carbon stock change is reported somewhere other than in the table being considered. The ERT considers that the recommendation has not yet been fully addressed because the Party did not disaggregate carbon stock changes for the deadwood and

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			litter components of DOM. The ERT concludes that this potential problem with respect to mandatory reporting requirements does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised..
KL.3	HWP – CO_2 (KL.6, 2021) (KL.5, 2020) (KL.4, 2019) (KL.7, 2017) (KL.8, 2016) Transparency	Document the process for deriving the country-specific half-lives for HWP and provide information to justify that the methodologies used are at least as detailed or accurate as those prescribed in decision 2/CMP.7, annex, paragraph 29.	Resolved. The Party reported in its NIR (vol. 3, p.190) that a tier 2 methodology was developed for a comparison with Australia's tier 3 methodology. This default tier 2 methodology was based on the first-order decay function contained in equation 12.1 of the 2006 IPCC Guidelines (vol. 4, p.12.11) and used default half-lives for HWP. The results from the application of the tier 2 methodology and of the comparison of the tier 2 with the tier 3 methodology were largely consistent with those from the tier 3 methodology, as shown in NIR figure 11.14a.

[a] References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) in which the issue or problem was raised. Issues are identified in accordance with paras. 80–83 of the UNFCCC review guidelines and classified as per para. 81 of the same guidelines. Problems are identified and classified as problems of transparency, accuracy, consistency, completeness or comparability in accordance with para. 69 of the Article 8 review guidelines in conjunction with decision 4/CMP.11.

[b] The report on the review of the 2018 annual submission of Australia was not available at the time of this review. Therefore, 2018 is excluded from the list of review years in which issues could have been identified.

IV. Issues and problems identified in three or more successive reviews and not addressed by the Party

9. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues and/or problems included in table 4 have been identified in three or more successive reviews, including the review of the 2022 annual submission of Australia, and had not been addressed by the Party by the time of publication of this review report.

Table 4
Issues and/or problems identified in three or more successive reviews and not addressed by Australia

ID#	Previous recommendation for issue	Number of successive reviews issue not addressed[a]
General	No issues identified.	
Energy		
E.4	Allocate any known refinery gas used in petroleum refining to liquid fuels or, if the volumes and types of "other" gaseous fossil fuels are not known with sufficient certainty, allocate them to other fossil fuels under category 1.A.1.b and only report natural gas under gaseous fuels. If unable to reallocate these other gaseous fossil fuels, explain in the NIR why the CO_2 IEF for gaseous fuels consumed in petroleum refining is comparatively low by including the (non-confidential) information provided to the ERT during the 2020 review (e.g. that a large share of the volume reported under gaseous fuels corresponds to the "other" gaseous fossil fuels reported by a single refinery).	3 (2020–2022)
IPPU	No issues identified.	

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
Agriculture		
A.7	Provide detailed evidence in the NIR to support the country-specific N_2O EF for the application of inorganic N fertilizers, including a justification for the application of the EFs in the study by Shcherbak and Grace (2014) to non-urea fertilizers.	3 (2020–2022)
A.8	Provide in the NIR a more detailed justification for the use of country-specific EFs for categories 3.D.a.5 (mineralization/immobilization associated with loss/gain of SOM) and 3.D.b.1 (atmospheric deposition), for example by referring to measurements, published scientific findings, causal biochemical explanations and country-specific soil and/or climate conditions.	3 (2020–2022)
A.10	Explain in the NIR the estimation of the N_2O EF for animal manure applied to soils.	3 (2020–2022)
LULUCF		
L.1	Provide separate AD and estimates for the following categories and pools currently reported as "IE": cropland, wetlands and settlements converted to forest land (all pools except organic soils); cropland converted to grassland (all pools); and cropland and grassland converted to settlements (all pools). Until this is done, provide in the NIR an update of the status of efforts to provide estimates for these pools.	6 (2016–2022)
Waste	No issues identified.	
KP-LULUCF		
KL.2	Report the carbon stock changes for different carbon pools separately and eliminate the error in the reporting of the notation key in CRF table 4(KP-I)B.4.	4 (2019–2022)

[a] The report on the review of the 2018 annual submission of Australia has not yet been published. Therefore, 2018 was not included when counting the number of successive years for this table.

V. Additional findings made during the individual review of the Party's 2022 annual submission

10. Table 5 presents findings made by the ERT during the individual review of the 2022 annual submission of Australia that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2022 annual submission of Australia

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
General		No general findings additional to those included in table 3 were made by the ERT during the review.	
Energy			
E.7	1.A.2.b Non-ferrous metals – solid fuels – CO_2, CH_4 and N_2O	According to data in CRF table 1.A(a)2, solid fuel consumption under chemicals (category 1.A.2.c) for 2019 decreased by 52.5 per cent between the 2021 and 2022 annual submissions (from 8,583.82 TJ to 4,081.11 TJ). During the review, the Party explained that this reduction in fuel consumption was the result of a reallocation of black coal consumption from chemicals (category 1.A.2.c) to non-ferrous metals in the state of Western Australia. The reallocation was carried out to reflect NGER data on black coal consumption, given the Party's higher degree of confidence in these data (which are based on plant-level reporting) than in Australian Energy Statistics data on black coal consumption. However, the ERT could not identify a change in solid fuel consumption in non-ferrous metals as a result of the reallocation. The Party investigated the issue and determined that an underestimation was reported in the 2019 and 2020 annual submissions because the deduction of black coal consumption from chemicals had not been added to non-ferrous metals. The Party submitted revised CRF tables (version 3) on 16 September 2022; the revised tables include AD and emissions from black coal consumption under non-ferrous metals. The ERT considers the issue resolved.	Not an issue/problem
E.8	1.B.2.b Natural gas – CH_4	In CRF table 8, the Party reported a recalculation of fugitive CH_4 emissions from natural gas (category 1.B.2.b), which resulted in a reduction in these emissions of 10.7 per cent (878.49 kt CO_2 eq). According to sectoral background data CRF table 1.B.2, the recalculation was made for the subcategory natural gas distribution (1.B.2.b.v), and according to information in the NIR (vol. 1, pp.161–164, and vol. 2, p.372), the recalculation was made to reflect revised natural gas distribution figures, a revised apportionment of the leakage share of unaccounted gas, and incorporation of plant-specific data collected under the NGER scheme. The information provided in the NIR was not sufficient to allow the ERT to assess the recalculation. However, the ERT suspected that the reduction in fugitive emissions attributable to improvements in gas distribution infrastructure in recent years was double counted, both in the reduction of unaccounted for gas over time and in the reduction of the leakage share of unaccounted for gas over time (as shown in NIR table 3.A.24, vol. 1, p.190). During the review, the Party clarified that the reduction in emissions was not double counted and provided the ERT with additional information on the calculation of CH_4 emissions from gas distribution. The majority of distribution losses were estimated on the basis of the reporting of individual natural gas distributors under the NGER scheme. These distributors have the option to use a simplified method for calculating emissions that is based on gas sales, state/territory average values for unaccounted for gas and a national value for the share of unaccounted for gas that is considered to be fugitive emissions. Alternatively, the distributors can choose a more tailored method that is based on the equipment components of their distribution system (equipment-specific EFs are from the American Petroleum Institute's *Compendium of Greenhouse Gas*	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		Emissions Estimation Methodologies for the Oil and Natural Gas Industry (API, 2009)) and the measured gas throughput at their plant. The methodology used in the tailored approach is described by the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (chap. 3.3.8). Approximately 60 per cent of the data collected from natural gas distributors under the NGER scheme is plant-specific data. The CH_4 IEF for gas distribution in Australia is higher than the tier 1 default CH_4 EF provided in the 2006 IPCC Guidelines (vol. 2, table 4.2.2). The ERT recommends that the Party include in the NIR a description of the two methods for estimating fugitive CH_4 emissions available to natural gas distributors under the NGER scheme, including, for both methods, the assumptions made, the required AD and EFs, and relevant references.	
IPPU		No findings for the IPPU sector additional to those included in table 3 were made by the ERT during the review.	
Agriculture			
A.16	3.B Manure management – CH_4	In its NIR (vol. 1, p.326), Australia reported the equation it used for estimating CH_4 emissions from swine and dairy cattle MMS (equation 3B.3_1). One of the determinants in the equation is an integrated MCF (iMCF), which is based on the proportion of different MMS in use across the country. During the review, in response to a question raised by the ERT on how integrated MCF values were determined, the Party explained that the calculation of these values is set out in section 4B.8 of the *Australian methodology for the estimation of greenhouse gas emissions and sinks 2006: Agriculture* (NGGIC, 2007). The proportion of different MMS in each state/territory for dairy cattle manure management is reported in appendix 5.A to the NIR (vol. 1, p.357) and for swine manure management in appendix 5.E (vol. 1, p.381). However, the ERT noted in the NIR that the Party did not provide any information to support selecting MCFs for two MMS: anaerobic lagoons and drains to paddocks (the MCF for drains to paddocks is assumed to be similar to a liquid/slurry system according to a footnote to NIR table 5.A.7 (vol. 1, p.358)). During the review, Australia explained that a review conducted by Wiedemann et al. (2014) collated climatic conditions at piggeries by state/territory. All available temperature observations from nearby weather stations (time series ranging from 11 to 129 years) informed the average annual temperature used to select an appropriate MCF from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.17) to calculate CH_4 emissions from piggeries for the entire reporting period. In addition, the Party clarified that the rationale for the choice of MCF values for anaerobic lagoons and drains to paddocks, which are used to store and treat manure from dairy cattle, was evaluated on the basis of the results described in section 6.1 of the *Review of the methods and data used to estimate dairy cattle emissions in the national inventory* (Dairy Technical Working Group, 2015), where 23 sites distributed evenly among all states/territories were chosen for an accurate representation of the average temperature of dairy regions across Australia and to calculate average annual temperatures for 1990–2012. The ERT noted that relying on data of annual average temperature consolidated for only one year or period may result in the selection of inappropriate MCFs to be used for estimating CH_4 emissions from MMS of dairy cattle and swine in other years. Therefore, the ERT asked the Party to provide data on annual average temperature by state/territory for the entire reporting period. In response, Australia stated that data for the entire time series and the trend in average annual temperature for the dairy regions in each state/territory cannot be obtained quickly, while noting that the overall trend in temperature is an increase of about 0.25 °C per decade, or 0.75 °C over the inventory period. Year-to-year variation would not change the climatic zone but might require a small change in MCF values.	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		The ERT recommends that the Party either (1) report data on average annual temperature by state/territory for the entire reporting period in the NIR (e.g. in tabular format in an appendix) in order to justify the appropriateness of the current MCFs for anaerobic lagoons and drains to paddocks, which have been selected to estimate CH_4 emissions from swine and dairy cattle MMS or (2) adjust the MCF values of the two MMS anaerobic lagoons and drains to paddocks (the latter of which is assumed to be similar to a liquid/slurry system) in accordance with the data collected on average annual temperature by state/territory for the entire reporting period and recalculate CH_4 emissions from MMS of swine and dairy cattle, as necessary.	
A.17	3.B.3 Swine – CH_4 and N_2O	In its NIR (vol. 1, p.381), the Party reported that the PigBal model was used to determine nutrient balance for intensive piggeries in Australia and to estimate CH_4 and N_2O emissions from manure management for swine. The Party indicated in NIR table 5.2 (vol. 1, p.298) that the PigBal model corresponds to the tier 3 approach of the 2006 IPCC Guidelines (vol. 4, chap. 10). However, the ERT noted that Australia did not provide the full extent of information on the tier 3 approach it used (i.e. the PigBal model) as required by paragraph 50(a) of the UNFCCC Annex I inventory reporting guidelines. During the review, the Party provided the ERT with a summary table containing a list of sources referenced in the NIR and copies of other scientific publications that support elements of the PigBal model (e.g. basis and type of model, main equations and key assumptions). The ERT considers that the additional information provided is in line with that required by paragraph 50(a) of the UNFCCC Annex I inventory reporting guidelines. The ERT recommends that the Party report information on the PigBal model in accordance with paragraph 50(a) of the UNFCCC Annex I inventory reporting guidelines, such as the additional information on the model provided to the ERT during the review.	Yes. Convention reporting adherence
LULUCF			
L.7	4. General (LULUCF) – CO_2 and N_2O	The Party reported in appendix 6.B to its NIR (vol. 2, p.188) information on FullCAM, a tier 3 approach it uses to estimate carbon stock changes for all carbon pools of forest land; biomass, DOM and SOM pools of annual cropland; biomass, DOM and SOM pools of pasture in grassland; all carbon pools of forest land converted to cropland, grassland or wetlands; and biomass pools in land converted to wetlands. FullCAM is continuously updated in terms of components and data for variables, as well as in calibration and validation of the model's outcomes. Through the collection of new data across the country for the variables of interest, confidence in the model is enhanced and reliability and quality of the inventory estimates are increased over time. Information was provided in the NIR on the updating process for biomass and DOM carbon stock changes in forest land (vol. 2, p.79) and biomass carbon stocks in forest land (vol. 2, pp.127 and 152). Information on verification of the estimates of SOC changes in cropland by comparison with estimates prepared using alternative methods (a tier 2 methodology from the 2019 Refinement to the 2006 IPCC Guidelines) was also reported in the NIR (vol. 2, p.213). The ERT noted that while the UNFCCC Annex I inventory reporting guidelines encourage the use of tier 3 methods (para. 13), they also require that verification information consistent with the 2006 IPCC Guidelines be provided in the NIR for estimates of emissions and/or removals prepared by using tier 3 methods (para. 41). The ERT recommends that the Party provide in its NIR information on new data updates and associated calibration and validation of its model, FullCAM, or a comparison of estimates derived using the model with estimates derived from an alternative method for SOC changes in forest land and grassland.	Yes. Transparency
L.8	4.A Forest land – CO_2	The Party reported in its NIR (vol. 2, p.57) a country-specific method, which it developed consistently with guidance in the 2019 Refinement to the 2006 IPCC Guidelines, for refining the managed land proxy by excluding a fraction of the natural	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		background of emissions and removals caused by natural disturbances. In accordance with IPCC good practice, the country-specific method to refine the managed land proxy is based on the expectation that CO_2 emissions will be balanced by subsequent removals across the landscape at some future point in time, as illustrated in NIR figure 6.4.5 (vol. 2, p.53). The ERT noted that in NIR table 6.4.19 (vol. 2, p.56), the Party disaggregated the natural disturbance component from the total emissions and removals from forest land estimated according to the managed land proxy, although emissions from natural disturbances and subsequent removals were reported in aggregate. The ERT notes that the 2019 Refinement to the 2006 IPCC Guidelines (section 2.6.4) and the Kyoto Protocol Supplement (tables 4D and 6F) provide guidance for disaggregating emissions and subsequent removals that are associated with natural disturbances on managed lands. The ERT recommends that the Party report in the NIR annual emissions associated with natural disturbances disaggregated from subsequent annual removals (e.g. NIR table 6.4.19).	
Waste			
W.7	5.A Solid waste disposal on land – CH_4	The Party reported in CRF table 5.A that a substantial amount of CH_4 generated from solid waste disposal on land is recovered and used for energy generation or is flared. The method used for quantifying the CH_4 recovered is specified in the NIR (vol. 1, p.317). CH_4 recovery is measured by landfill operators and reported under the NGER scheme. However, the section of the NIR on QA/QC for the waste sector (vol. 2, p.361) does not contain specific information on how QA/QC of the NGER data is organized. During the review, the Party explained the QA/QC procedures for data on CH_4 recovery. Landfill CH_4 is often collected by the landfill operator and subsequently sold to an energy producer. Under the NGER scheme, CH_4 recovery, utilization and flaring is reported by the landfill operators. The amount of CH_4 from landfills used by energy companies is reported by the energy companies. The reporting of landfill operators and energy producers are separate processes but data from both are compared by the inventory team to verify the amount of CH_4 recovered. The ERT recommends that the Party provide in the NIR a more detailed explanation of QA/QC procedures for data on CH_4 recovery, utilization and flaring, including how the amount of CH_4 used for energy generation or flaring is verified, preferably including a table with the results, at an aggregated level, of a comparison of data from landfill operators with those from energy companies.	Yes. Transparency
W.8	5.D Wastewater treatment and discharge – CH_4	The Party reported in CRF table 5.D a ratio of TOW and TOW removed as sludge of 0.73 for 2020 (in CRF table 5.D, "TOW" is total organic product and "S" is sludge, with both being expressed in kt of "COD" per year, where for Australia "COD" is the indicator for DC). The ERT considers this ratio to be higher than expected when comparing it with that of other Annex I Parties with similar modern WWTPs (at which about 50 per cent of TOW is removed as sludge). Both TOW in wastewater and the amount removed as sludge are based on the reporting of individual WWTP operators under the NGER scheme. During the review, the Party provided examples of NGER reporting of both domestic and industrial WWTPs. Some of these plants have an aerated wastewater system and an anaerobic digester of sludge; these plants reported that almost all TOW in the influent is removed as sludge (which means that upon aerobic treatment, almost all TOW is converted to biological biomass, while no TOW is consumed by bacteria for their energy production). The ERT considers it likely that	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		WWTPs reported the amount of sludge (dry mass) instead of the amount of TOW removed as sludge. The consequence of this would be an overestimation of the CH_4 correction factor (MCF) and an overestimation of CH_4 emissions. The ERT considers that an alternative approach to calculating CH_4 emissions could be implemented based on data available from WWTP on parameters to which the operators are accustomed, for example sludge dry mass and sludge organic matter content. This would allow Australia to determine the amount of TOW removed as sludge, for example as the product of (1) the total dry mass of sludge, (2) the average organic matter content of sludge and (3) a conversion of organic matter to COD. When one assumes that organic matter can be described as cellulose ($C(H_2O)_n$), oxidation proceeds via $C(H_2O)_n + n\ O_2 \rightarrow n\ CO_2 + n\ H_2O$ and the conversion of 1 kg organic matter thus corresponds to 32/30 kg COD. CH_4 emissions can subsequently be calculated at the national level by the inventory team. The ERT recommends that the Party (1) better explain the definition of TOW removed as sludge to WWTP operators and improve the QA/QC procedures for data collected on wastewater treatment and discharge under the NGER scheme to ensure that accurate values of sludge are reported or, alternatively, (2) recalculate CH_4 emissions from wastewater treatment using data on more common WWTP parameters that are available from the WWTP operators and include a description of the methodology in the NIR.	
KP-LULUCF			
KL.4	FM – CO_2, CH_4 and N_2O	The Party reported in CRF table "accounting" (row 21) for the activity FM the excluded subsequent removals from land subject to natural disturbances as "NA". The ERT noted that this is not in line with reporting under the Kyoto Protocol because any subsequent removals on lands from which emissions from natural disturbances have been excluded shall be subtracted from the accounting quantity of the respective activity. The ERT also noted that the Party reported in its NIR (vol. 3, pp.53–58) that it provided methodological information and estimates of the quantification and disaggregation of emissions and subsequent removals that are associated with natural disturbances on managed lands. During the review, the Party clarified that it has excluded subsequent natural disturbances removals from the net emissions reported in CRF table "accounting" (row 19) for the activity FM, so moving those subsequent removals to row 21 in the same table would result in double counting. The ERT acknowledges the clarification provided by the Party and notes that reporting excluded subsequent removals from land subject to natural disturbances as "NA" has no impact on the accounting of KP-LULUCF activities and that there is no double counting of natural disturbances removals in the Party's reporting. The ERT concludes that this potential problem with respect to mandatory reporting requirements does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised.	KP reporting adherence

[a] Recommendations made by the ERT during the review are related to issues as defined in para. 81 of the UNFCCC review guidelines or problems as defined in para. 69 of the Article 8 review guidelines.

VI. Application of adjustments

11. The ERT did not identify the need to apply any adjustments for the 2022 annual submission of Australia.

VII. Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol

12. Table I.5 presents the accounting quantities for KP-LULUCF reported by Australia and the final values agreed by the ERT. The final quantities of units to be issued and cancelled are presented in table I.6.

VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2022 annual submission.

Annex I

Overview of greenhouse gas emissions and removals and data and information on activities under Article 3, paragraphs 3–4, of the Kyoto Protocol, as submitted by Australia in its 2022 annual submission

1. Tables I.1–I.4 provide an overview of the total GHG emissions and removals as submitted by Australia.

Table I.1
Total greenhouse gas emissions and removals for Australia, base year–2020
(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions and removals including indirect CO_2 emissions*[a]		*Land-use change (Article 3.7 bis as contained in the Doha Amendment)*[b]	*KP-LULUCF (Article 3.3 of the Kyoto Protocol)*[c]	*KP-LULUCF (Article 3.4 of the Kyoto Protocol)*	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*			*CM, GM, RV, WDR*	*FM*
FMRL								4 700.00
Base year[d]	626 253.79	425 624.31	NA	NA	148 163.36		42 365.43	
1990	626 253.79	425 624.31	NA	NA				
1995	504 056.92	439 269.88	NA	NA				
2000	555 489.95	489 528.65	NA	NA				
2010	603 247.58	536 893.74	NA	NA				
2011	582 074.53	538 663.88	NA	NA				
2012	566 439.40	541 899.74	NA	NA				
2013	549 887.67	532 267.33	NA	NA		14 841.60	20 153.91	3 089.49
2014	548 935.92	526 711.78	NA	NA		18 074.73	27 271.51	–7 598.59
2015	537 823.58	534 936.02	NA	NA		9 352.47	16 873.60	–21 529.05
2016	513 732.80	543 976.81	NA	NA		6 058.47	–6 191.11	–4 061.87
2017	512 506.39	550 874.87	NA	NA		3 746.24	–9 853.01	–14 761.97
2018	518 521.95	552 484.02	NA	NA		14 734.35	–6 718.95	–22 666.55
2019	506 210.09	546 606.62	NA	NA		9 531.16	–13 702.94	–10 001.75
2020	488 003.60	528 149.46	NA	NA		9 084.12	–7 061.23	255 391.60

Note: Emissions and removals reported for the sector other (sector 6) are not included in the total GHG emissions.

[a] The Party did not report indirect CO_2 emissions in CRF table 6.

[b] The value reported in this column relates to GHG emissions from conversion of forests (deforestation) in 1990 as contained in the report on the review of the Party's report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol.

[c] Activities under Article 3, para. 3, of the Kyoto Protocol, namely AR and deforestation.

[d] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year for CM, GM and RV under Article 3, para. 4, of the Kyoto Protocol is 1990. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

Table I.2
Greenhouse gas emissions and removals by gas for Australia, excluding land use, land-use change and forestry, 1990–2020
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	278 154.16	125 133.25	16 084.65	1 424.68	4 607.01	NO	220.56	NO
1995	305 003.00	115 838.53	15 562.64	1 018.65	1 530.84	NO	316.21	NO
2000	349 635.49	118 052.18	19 088.84	1 252.66	1 287.06	NO	212.43	NO
2010	405 103.32	104 768.45	19 537.87	7 070.97	283.32	NO	129.81	NO
2011	403 828.77	106 310.04	20 287.68	7 817.92	301.30	NO	118.16	NO
2012	406 150.91	106 641.05	20 490.30	8 207.62	294.88	NO	114.98	NO
2013	397 887.46	106 249.16	19 263.64	8 566.91	192.00	NO	108.17	NO
2014	393 952.88	103 494.60	19 673.14	9 293.00	192.54	NO	105.63	NO
2015	401 793.06	103 955.98	19 054.83	9 844.64	171.32	NO	116.17	NO
2016	411 264.29	103 078.58	19 042.91	10 248.98	224.92	NO	117.13	NO
2017	414 358.31	105 002.79	20 719.44	10 476.34	202.63	NO	115.36	NO
2018	416 283.83	105 796.25	19 578.74	10 443.95	236.00	NO	145.27	NO
2019	416 761.93	99 367.73	18 751.65	11 285.31	303.14	NO	136.86	NO
2020	400 333.47	97 303.74	18 586.65	11 564.39	270.31	NO	90.90	NO
Percentage change 1990–2020	**43.9**	**–22.2**	**15.6**	**711.7**	**–94.1**	**NA**	**–58.8**	**NA**

Note: Emissions and removals reported for the sector other (sector 6) are not included in the total GHG emissions.
[a] Australia did not report indirect CO_2 emissions in CRF table 6.

Table I.3
Greenhouse gas emissions and removals by sector for Australia, 1990–2020
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	293 666.65	25 902.44	84 926.98	200 629.48	21 128.23	NO
1995	318 379.28	25 051.49	75 915.23	64 787.04	19 923.88	NO
2000	364 335.94	26 128.90	82 258.00	65 961.30	16 805.82	NO
2010	418 387.00	34 089.08	69 784.02	66 353.84	14 633.64	NO
2011	415 192.34	34 909.04	74 352.72	43 410.65	14 209.78	NO
2012	420 619.32	32 520.28	75 780.02	24 539.66	12 980.11	NO
2013	414 055.13	30 168.27	75 966.97	17 620.34	12 076.96	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2014	408 090.73	30 144.51	76 429.62	22 224.14	12 046.93	NO
2015	418 703.55	31 065.31	73 559.27	2 887.56	11 607.88	NO
2016	428 056.56	31 194.87	72 639.84	–30 244.01	12 085.54	NO
2017	430 153.54	31 842.68	76 552.45	–38 368.48	12 326.19	NO
2018	432 557.74	32 574.68	75 148.80	–33 962.08	12 202.81	NO
2019	431 584.98	33 409.37	69 752.77	–40 396.53	11 859.50	NO
2020	415 868.44	32 728.68	67 830.81	–40 145.86	11 721.53	NO
Percentage change 1990–2020	**41.6**	**26.4**	**–20.1**	**–120.0**	**–44.5**	**NA**

Note: Australia did not report indirect CO_2 emissions in CRF table 6.

Table I.4

Greenhouse gas emissions and removals from activities under Article 3, paragraphs 3–4, of the Kyoto Protocol by activity, base year–2020, for Australia

(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[a]	*Activities under Article 3.3 of the Kyoto Protocol*		*FM and elected activities under Article 3.4 of the Kyoto Protocol*				
	Land-use change	*AR*	*Deforestation*	*FM*	*CM*	*GM*	*RV*	*WDR*
FMRL				4 700.00				
Technical correction				–13 873.69				
Base year[b]	148 163.36				27 347.18	14 995.03	23.21	NA
2013		–23 778.45	38 620.04	3 089.49	3 205.35	16 898.44	50.13	NA
2014		–24 173.40	42 248.13	–7 598.59	3 780.38	23 426.59	64.54	NA
2015		–24 015.11	33 367.58	–21 529.05	32.97	16 753.48	87.14	NA
2016		–26 784.48	32 842.94	–4 061.87	–4 149.48	–2 123.45	81.81	NA
2017		–28 122.38	31 868.62	–14 761.97	–4 197.26	–5 786.71	130.96	NA
2018		–19 851.65	34 586.00	–22 666.55	–2 257.63	–4 623.07	161.75	NA
2019		–16 130.17	25 661.33	–10 001.75	–2 454.65	–11 422.35	174.06	NA
2020		–17 001.81	26 085.93	255 391.60	1 758.06	–9 012.88	193.60	NA
Percentage change base year–2020					**–93.6**	**–160.1**	**734.0**	**NA**

Note: Values in this table include emissions from land subject to natural disturbances, if applicable.

[a] The value reported in this column relates to 1990.

[b] The base year for CM, GM and RV under Article 3, para. 4, of the Kyoto Protocol is 1990. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

2. Table I.5 provides information on the Party's accounting quantities for reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5

Accounting quantities for activities under Article 3, paragraph 3, and forest management and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol for Australia

(kt CO_2 eq)

GHG source/sink activity	*Net emissions/removals*										*Accounting parameters*	*Accounting quantities*[a]
	Base year[b]	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*Total*[c]		
A.1. AR		–23 778.446	–24 173.398	–24 015.106	–26 784.477	–28 122.379	–19 851.654	–16 130.167	–17 001.812	–179 857.439		–179 857.439
Excluded emissions from natural disturbances[d]		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
Excluded subsequent removals from land subject to natural disturbances		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
A.2. Deforestation		38 620.044	42 248.129	33 367.576	32 842.943	31 868.623	34 585.999	25 661.327	26 085.933	265 280.573		265 280.574
B.1. FM										–222 426.135		–149 036.637
Net emissions/ removals		3 089.487	–7 598.593	–21 529.049	–4 061.866	–14 761.968	–22 666.554	–10 001.750	255 391.598	177 861.305		
Excluded emissions from natural disturbances[d]		19 001.867	17 711.079	6 470.297	25 161.284	17 017.904	11 387.328	18 918.914	284 618.767	400 287.441		400 287.441
Excluded subsequent removals from land subject to natural disturbances		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
Any debits from newly established forest		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
FMRL[e]											4 700.000	

GHG source/sink activity	*Net emissions/removals*										*Accounting parameters*	*Accounting quantities*[a]
	Base year[b]	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*Total*[c]		
Technical corrections to FMRL											–13 873.687	
FM cap											117 214.453	–117 214.453
B.2. CM (if elected)	27 347.182	3 205.349	3 780.378	32.970	–4 149.481	–4 197.258	–2 257.625	–2 454.647	1 758.057	–4 282.258		–223 059.712
B.3. GM (if elected)	14 995.034	16 898.437	23 426.588	16 753.484	–2 123.445	–5 786.710	–4 623.073	–11 422.353	–9 012.883	24 110.044		–95 850.226
B.4. RV (if elected)	23.214	50.128	64.542	87.144	81.814	130.959	161.751	174.063	193.597	943.998		758.287
B.5. WDR (if elected)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA

[a] Cumulative net emissions and removals for all years of the commitment period reported in the annual submission under review.
[b] Net emissions and removals from CM, GM, RV and/or WDR, if elected, in the Party's base year as established in decision 9/CP.2.
[c] The accounting quantity is the total quantity of units to be issued or cancelled for a particular activity.
[d] The Party indicated that it is excluding emissions from natural disturbances at the end of the commitment period.
[e] As inscribed in the appendix to the annex to decision 2/CMP.7 in kt CO_2 eq per year.

3. Table I.6 provides an overview of key data from Australia's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.6
Key data for Australia under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2022 annual submission

Parameter	*Data*
Periodicity of accounting	(a) AR: annual accounting
	(b) Deforestation: annual accounting
	(c) FM: commitment period accounting
	(d) CM: commitment period accounting
	(e) GM: commitment period accounting
	(f) RV: commitment period accounting
	(g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	CM, GM and RV
Election of application of provisions for natural disturbances	Yes, for FM
3.5% of total base-year GHG emissions, excluding LULUCF	14 651.806 kt CO_2 eq (117 214.453 kt CO_2 eq for the duration of the commitment period)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	Cancel 16 054 518 units
2. Deforestation	Cancel 54 752 192 units
3. FM	Issue 117 214 453 RMUs
4. CM	Issue 223 059 712 RMUs
5. GM	Issue 95 850 226 RMUs
6. RV	Cancel 758 287 units

Note: Values in this table reflect the difference in the accounting quantities for activities under Article 3, para. 3, and FM and any elected activities under Article 3, para. 4, of the Kyoto Protocol as reported in table I.5 between this report and the previously published review report for the Party (FCCC/ARR/2021/AUS).

Annex II

Information to be included in the compilation and accounting database

Tables II.1–II.8 include the information to be included in the compilation and accounting database for Australia. Data shown are from the Party's annual submission, including the latest revised estimates submitted, adjustments (if applicable) and the final data to be included in the compilation and accounting database.

Table II.1
Information to be included in the compilation and accounting database for 2020, including on the commitment period reserve, for Australia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
CPR	4 060 457 844		–	4 060 457 844
Annex A emissions				
CO_2	399 922 128	400 333 467	–	400 333 467
CH_4	97 303 626	97 303 735	–	97 303 735
N_2O	18 585 689	18 586 651	–	18 586 651
HFCs	11 564 388		–	11 564 388
PFCs	270 315		–	270 315
Unspecified mix of HFCs and PFCs	NO	NO	–	NO
SF_6	90 902		–	90 902
NF_3	NO	NO	–	NO
Total Annex A sources[a]	**527 737 048**	**528 149 457**	**–**	**528 149 457**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–17 001 812		–	–17 001 812
Deforestation	26 085 933		–	26 085 933
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	255 391 598		–	255 391 598
CM	1 758 057		–	1 758 057
CM for the base year	27 347 182		–	27 347 182
GM	–9 012 883		–	–9 012 883
GM for the base year	14 995 034		–	14 995 034
RV	193 597		–	193 597
RV for the base year	23 214		–	23 214

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.2
Information to be included in the compilation and accounting database for 2019 for Australia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	416 356 588	416 761 933	–	416 761 933
CH_4	99 367 624	99 367 731	–	99 367 731
N_2O	18 750 698	18 751 645	–	18 751 645
HFCs	11 285 310		–	11 285 310
PFCs	303 142		–	303 142
Unspecified mix of HFCs and PFCs	NO		–	NO
SF_6	136 862		–	136 862

	Original submission	*Revised submission*	*Adjustment*	*Final value*
NF_3	NO	NO	–	NO
Total Annex A sources[a]	**546 200 225**	**546 606 625**	**–**	**546 606 625**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–16 130 167		–	–16 130 167
Deforestation	25 661 327		–	25 661 327
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–10 001 750		–	–10 001 750
CM	–2 454 647		–	–2 454 647
CM for the base year	27 347 182		–	27 347 182
GM	–11 422 353		–	–11 422 353
GM for the base year	14 995 034		–	14 995 034
RV	174 063		–	174 063
RV for the base year	23 214		–	23 214

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.3
Information to be included in the compilation and accounting database for 2018 for Australia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	416 283 827		–	416 283 827
CH_4	105 796 248		–	105 796 248
N_2O	19 578 735		–	19 578 735
HFCs	10 443 946		–	10 443 946
PFCs	236 003		–	236 003
Unspecified mix of HFCs and PFCs	NO		–	NO
SF_6	145 265		–	145 265
NF_3	NO		–	NO
Total Annex A sources[a]	**552 484 025**		**–**	**552 484 025**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–19 851 654		–	–19 851 654
Deforestation	34 585 999		–	34 585 999
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–22 666 554		–	–22 666 554
CM	–2 257 625		–	–2 257 625
CM for the base year	27 347 182		–	27 347 182
GM	–4 623 073		–	–4 623 073
GM for the base year	14 995 034		–	14 995 034
RV	161 751		–	161 751
RV for the base year	23 214		–	23 214

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.4
Information to be included in the compilation and accounting database for 2017 for Australia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	414 358 312		–	414 358 312
CH_4	105 002 792		–	105 002 792
N_2O	20 719 440		–	20 719 440

	Original submission	*Revised submission*	*Adjustment*	*Final value*
HFCs	10 476 342		–	10 476 342
PFCs	202 626		–	202 626
Unspecified mix of HFCs and PFCs	NO		–	NO
SF_6	115 357		–	115 357
NF_3	NO		–	NO
Total Annex A sources[a]	**550 874 868**		**–**	**550 874 868**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–28 122 379		–	–28 122 379
Deforestation	31 868 623		–	31 868 623
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–14 761 968		–	–14 761 968
CM	–4 197 258		–	–4 197 258
CM for the base year	27 347 182		–	27 347 182
GM	–5 786 710		–	–5 786 710
GM for the base year	14 995 034		–	14 995 034
RV	130 959		–	130 959
RV for the base year	23 214		–	23 214

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.5
Information to be included in the compilation and accounting database for 2016 for Australia
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	411 264 288		–	411 264 288
CH_4	103 078 580		–	103 078 580
N_2O	19 042 913		–	19 042 913
HFCs	10 248 982		–	10 248 982
PFCs	224 924		–	224 924
Unspecified mix of HFCs and PFCs	NO		–	NO
SF_6	117 125		–	117 125
NF_3	NO		–	NO
Total Annex A sources[a]	**543 976 813**		**–**	**543 976 813**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–26 784 477		–	–26 784 477
Deforestation	32 842 943		–	32 842 943
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–4 061 866		–	–4 061 866
CM	–4 149 481		–	–4 149 481
CM for the base year	27 347 182		–	27 347 182
GM	–2 123 445		–	–2 123 445
GM for the base year	14 995 034		–	14 995 034
RV	81 814		–	81 814
RV for the base year	23 214		–	23 214

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.6
Information to be included in the compilation and accounting database for 2015 for Australia
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	401 793 062		–	401 793 062
CH_4	103 955 984		–	103 955 984
N_2O	19 054 832		–	19 054 832
HFCs	9 844 642		–	9 844 642
PFCs	171 324		–	171 324
Unspecified mix of HFCs and PFCs	NO		–	NO
SF_6	116 172		–	116 172
NF_3	NO		–	NO
Total Annex A sources[a]	**534 936 017**		**–**	**534 936 017**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–24 015 106		–	–24 015 106
Deforestation	33 367 576		–	33 367 576
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–21 529 049		–	–21 529 049
CM	32 970		–	32 970
CM for the base year	27 347 182		–	27 347 182
GM	16 753 484		–	16 753 484
GM for the base year	14 995 034		–	14 995 034
RV	87 144		–	87 144
RV for the base year	23 214		–	23 214

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.7
Information to be included in the compilation and accounting database for 2014 for Australia
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	393 952 876		–	393 952 876
CH_4	103 494 595		–	103 494 595
N_2O	19 673 139		–	19 673 139
HFCs	9 293 001		–	9 293 001
PFCs	192 536		–	192 536
Unspecified mix of HFCs and PFCs	NO		–	NO
SF_6	105 633		–	105 633
NF_3	NO		–	NO
Total Annex A sources[a]	**526 711 780**		**–**	**526 711 780**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–24 173 398		–	–24 173 398
Deforestation	42 248 129		–	42 248 129
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–7 598 593		–	–7 598 593
CM	3 780 378		–	3 780 378
CM for the base year	27 347 182		–	27 347 182
GM	23 426 588		–	23 426 588
GM for the base year	14 995 034		–	14 995 034

	Original submission	*Revised submission*	*Adjustment*	*Final value*
RV	64 542		–	64 542
RV for the base year	23 214		–	23 214

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.8
Information to be included in the compilation and accounting database for 2013 for Australia
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	397 887 458		–	397 887 458
CH_4	106 249 156		–	106 249 156
N_2O	19 263 636		–	19 263 636
HFCs	8 566 913		–	8 566 913
PFCs	192 001		–	192 001
Unspecified mix of HFCs and PFCs	NO		–	NO
SF_6	108 170		–	108 170
NF_3	NO		–	NO
Total Annex A sources[a]	**532 267 335**		**–**	**532 267 335**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–23 778 446		–	–23 778 446
Deforestation	38 620 044		–	38 620 044
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	3 089 487		–	3 089 487
CM	3 205 349		–	3 205 349
CM for the base year	27 347 182		–	27 347 182
GM	16 898 437		–	16 898 437
GM for the base year	14 995 034		–	14 995 034
RV	50 128		–	50 128
RV for the base year	23 214		–	23 214

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

No mandatory categories from the 2006 IPCC Guidelines were identified as missing.

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl.

IPCC. 2014. *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at https://www.ipcc.ch/publication/2013-revised-supplementary-methods-and-good-practice-guidance-arising-from-the-kyoto-protocol/.

IPCC. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Geneva: IPCC. Available at https://www.ipcc.ch/publication/2013-supplement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories-wetlands/.

IPCC. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. E Calvo Buendia, K Tanabe, A Kranjc, et al. (eds.). Geneva: IPCC. Available at https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2016, 2017, 2019, 2020 and 2021 annual submissions of Australia, contained in documents FCCC/ARR/2016/AUS, FCCC/ARR/2017/AUS, FCCC/ARR/2019/AUS, FCCC/ARR/2020/AUS and FCCC/ARR/2021/AUS respectively.

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at https://unfccc.int/documents/510888.

Annual status report for Australia for 2022. Available at https://unfccc.int/documents/546305.

C. Other documents used during the review

Responses to questions during the review were received from Tamara Curll, Brooke Perkins, Nicola McPherson and Mark Hunstone (Department of Climate Change, Energy, the Environment and Water), including additional material on the methodology and assumptions used. The following references may not conform to UNFCCC editorial style as some have been reproduced as received:

AMI (American Petroleum Institute). 2009. Available at https://www.api.org/~/media/files/ehs/climate-change/2009_ghg_compendium.ashx.

CSIRO (Commonwealth Scientific and Industrial Research Organisation). 2021. CSIRO report on Australian and Global Synthetic Greenhouse Gas Emissions 2021. CSIRO Mathematics, Informatics and Statistics, Canberra. Available at https://www.awe.gov.au/environment/protection/ozone/publications/csiro-report-australian-global-sgg-emissions-2021.

Dairy Technical Working Group, 2015. Review of the methods and data used to estimate dairy cattle emissions in the national inventory. A report to the Department of the Environment.

Dunse, BL, Derek, N, Fraser, PJ, Krummel, PB & Steele, LP 2020. Australian and global HFC, PFC, Sulfur Hexafluoride, Nitrogen Trifluoride and Sulfuryl Fluoride Emissions. Report prepared for the Australian Government Department of Agriculture, Water and the Environment, CSIRO Oceans and Atmosphere, Climate Science Centre, Aspendale, Australia, vi, 42 p.

National Greenhouse and Energy Reporting (Measurement) Determination 2008. Available at https://www.legislation.gov.au/Details/F2022C00737/Download.

NGGIC (National Greenhouse Gas Inventory Committee), 2007. Australian methodology for the estimation of greenhouse gas emissions and sinks 2006: Agriculture, Canberra.

Wiedemann, S., Sullivan, T. and McGahan, E.J., 2014. GHG Prediction methods for feedlots, poultry and pigs. Technical report for the Department of Environment Greenhouse Gas Inventory Team, FSA Consulting Report 8199/1.