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

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

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I. Introduction and summary

1. This report covers the centralized review of the 2012 annual submission of Japan, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 10 to 15 September 2012 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Paul Filliger (Switzerland) and Ms. Batima Punsalmaa (Mongolia); energy – Ms. Duduzile Nhlengethwa-Masina (Swaziland) and Ms. Songli Zhu (China); industrial processes – Ms. Valentina Idrissova (Kazakhstan), Mr. Predrag Novosel (Montenegro) and Mr. Jacek Skoskiewicz (Poland); agriculture – Mr. Jorge Alvarez (Peru) and Mr. Daniel Bretscher (Switzerland); land use, land-use change and forestry (LULUCF) – Ms. Oksana Butryim (Ukraine), Mr. Agustin Inthamoussu (Uruguay) and Ms. Thelma Krug (Brazil); and waste – Ms. Maryna Bereznytska (Ukraine) and Mr. Sabin Guendehou (Benin). Ms. Bereznytska and Ms. Krug were the lead reviewers. The review was coordinated by Mr. Roman Payo (UNFCCC secretariat).

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

3. In 2010, the main greenhouse gas (GHG) in Japan was carbon dioxide (CO₂), accounting for 94.8 per cent of total GHG emissions¹ expressed in carbon dioxide equivalent (CO₂ eq), followed by nitrous oxide (N₂O) (1.8 per cent) and methane (CH₄) (1.6 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) collectively accounted for 1.9 per cent of the overall GHG emissions in the country. The energy sector accounted for 91.1 per cent of total GHG emissions, followed by industrial processes (5.2 per cent), agriculture (2.0 per cent), waste (1.7 per cent) and solvent and other product use (0.01 per cent). Total GHG emissions amounted to 1,257,981.87 Gg CO₂ eq and increased by 0.1 per cent between the base year² and 2010.

4. Tables 1 and 2 show GHG emissions from Annex A sources, emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO₂, CH₄ and N₂O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector.

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

¹ In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO₂ eq excluding LULUCF, unless otherwise specified.

² “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO₂, CH₄ and N₂O, and 1995 for HFCs, PFCs and SF₆. The base year emissions include emissions from Annex A sources only.

Table 1
Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year^a to 2010

		<i>Gg CO₂ eq</i>									<i>Change (%)</i>
		<i>Greenhouse gas</i>	<i>Base year^a</i>	<i>1990</i>	<i>1995</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>	<i>Base year–2010</i>
Annex A sources		CO ₂	1 141 196.05	1 141 196.05	1 223 692.68	1 251 556.70	1 282 256.52	1 213 206.46	1 142 253.99	1 191 947.38	4.4
		CH ₄	32 030.18	32 030.18	29 727.60	25 892.09	22 854.68	21 520.77	20 880.59	20 443.10	–36.2
		N ₂ O	31 649.36	31 649.36	32 656.39	28 964.59	24 064.86	22 818.90	22 571.97	22 067.21	–30.3
		HFCs	20 260.17	17 930.00	20 260.17	18 800.43	10 518.22	15 298.30	16 554.17	18 256.50	–9.9
		PFCs	14 240.36	5 670.00	14 240.36	9 519.49	7 002.07	4 617.89	3 267.84	3 405.25	–76.1
		SF ₆	16 961.45	38 240.00	16 961.45	7 188.49	4 807.94	3 795.22	1 851.27	1 862.42	–89.0
KP-LULUCF	Article 3.3 ^b	CO ₂						2 064.78	2 696.93	4 393.82	
		CH ₄						0.03	0.01	0.00	
		N ₂ O						2.37	3.12	2.96	
	Article 3.4 ^c	CO ₂	–77.78					–46 484.57	–50 123.72	–54 383.44	NA
		CH ₄	NO					12.75	5.29	1.38	NA
		N ₂ O	NO					1.29	0.54	0.14	NA

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

^a “Base year” for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO₂, CH₄ and N₂O, and 1995 for HFCs, PFCs and SF₆. The “base year” for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

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

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

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

Sector	Gg CO ₂ eq								Change (%)
	Base year ^a	1990	1995	2000	2005	2008	2009	2010	Base year– 2010
Annex A									
Energy	1 078 975.22	1 078 975.22	1 156 752.61	1 190 873.94	1 226 930.36	1 161 084.24	1 097 415.91	1 145 611.50	6.2
Industrial processes	120 020.52	130 398.54	121 335.34	94 377.30	73 793.48	70 834.01	63 656.24	65 898.05	–45.1
Solvent and other product use	287.07	287.07	437.58	340.99	266.41	129.10	120.50	98.95	–65.5
Agriculture	31 261.03	31 261.03	30 039.22	27 629.29	26 521.36	25 910.10	25 584.66	25 499.61	–18.4
Waste	25 793.73	25 793.73	28 973.92	28 700.27	23 992.68	23 300.08	20 602.52	20 873.76	–19.1
LULUCF	NA	–70 075.44	–81 985.92	–87 739.14	–90 716.96	–78 674.40	–71 856.36	–73 179.09	NA
Total (with LULUCF)	NA	1 196 640.14	1 255 552.74	1 254 182.66	1 260 787.33	1 202 583.13	1 135 523.47	1 184 802.79	NA
Total (without LULUCF)	1 256 337.57	1 266 715.59	1 337 538.66	1 341 921.79	1 351 504.29	1 281 257.54	1 207 379.83	1 257 981.87	0.1
Other ^b	NA	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA
KP-LULUCF									
Article 3.3 ^c									
Afforestation and reforestation							–389.54	–415.03	–426.11
Deforestation							2 456.72	3 115.09	4 822.89
Total (3.3)							2 067.18	2 700.06	4 396.78
Article 3.4 ^d									
Forest management							–45 388.77	–49 005.55	–53 251.78
Cropland management	NA						NA	NA	NA
Grazing land management	NA						NA	NA	NA
Revegetation	–77.78						–1 081.76	–1 112.34	1 352.98
Total (3.4)	–77.78						–46 470.52	–50 117.89	–54 381.92

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

^a “Base year” for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO₂, CH₄ and N₂O, and 1995 for HFCs, PFCs and SF₆. The “base year” for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

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

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

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

Table 3
**Information to be included in the compilation and accounting database in t CO₂ eq
for the year 2010, including the commitment period reserve**

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment^a</i>	<i>Final^b</i>
Commitment period reserve	5 335 431 899			5 335 431 899
Annex A emissions for current inventory year				
CO ₂	1 191 947 378			1 191 947 378
CH ₄	20 443 104			20 443 104
N ₂ O	22 067 209			22 067 209
HFCs	18 256 504			18 256 504
PFCs	3 405 255			3 405 255
SF ₆	1 862 425			1 862 425
Total Annex A sources	1 257 981 874			1 257 981 874
Activities under Article 3, paragraph 3, for current inventory year				
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	-426 106			-426 106
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	NA			NA
3.3 Deforestation for current year of commitment period as reported	4 822 888			4 822 888
Activities under Article 3, paragraph 4, for current inventory year^c				
3.4 Forest management for current year of commitment period	-53 251 779			-53 251 779
3.4 Cropland management for current year of commitment period				
3.4 Cropland management for base year				
3.4 Grazing land management for current year of commitment period				
3.4 Grazing land management for base year				
3.4 Revegetation for current year of commitment period	-1 130 142			-1 130 142
3.4 Revegetation in base year	-77 781			-77 781

Abbreviations: NA = not applicable.

^a "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

^b "Final" includes revised estimates, if any, and/or adjustments, if any.

^c Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 4
**Information to be included in the compilation and accounting database in t CO₂ eq
for the year 2009**

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment^a</i>	<i>Final^b</i>
Annex A emissions for 2009				
CO ₂	1 142 253 986			1 142 253 986
CH ₄	20 880 586			20 880 586
N ₂ O	22 571 974			22 571 974
HFCs	16 554 169			16 554 169
PFCs	3 267 838			3 267 838
SF ₆	1 851 273			1 851 273
Total Annex A sources	1 207 379 827			1 207 379 827
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009 as reported	-415 033			-415 033
3.3 Afforestation and reforestation on harvested land for 2009 as reported	NA			NA
3.3 Deforestation for 2009 as reported	3 115 088			3 115 088
Activities under Article 3, paragraph 4, for 2009^c				
3.4 Forest management for 2009	-49 005 550			-49 005 550
3.4 Cropland management for 2009				
3.4 Cropland management for base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for base year				
3.4 Revegetation for 2009	-1 112 341			-1 112 341
3.4 Revegetation in base year	-77 781			-77 781

Abbreviations: NA = not applicable.

^a "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

^b "Final" includes revised estimates, if any, and/or adjustments, if any.

^c Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 5
**Information to be included in the compilation and accounting database in t CO₂ eq
for the year 2008**

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment^a</i>	<i>Final^b</i>
Annex A emissions for 2008				
CO ₂	1 213 206 460			1 213 206 460
CH ₄	21 520 771			21 520 771
N ₂ O	22 818 899			22 818 899
HFCs	15 298 297			15 298 297
PFCs	4 617 893			4 617 893
SF ₆	3 795 216			3 795 216
Total Annex A sources	1 281 257 536			1 281 257 536
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008 as reported	-389 538			-389 538
3.3 Afforestation and reforestation on harvested land for 2008 as reported	NA			NA
3.3 Deforestation for 2008 as reported	2 456 719			2 456 719
Activities under Article 3, paragraph 4, for 2008^c				
3.4 Forest management for 2008	-45 388 766			-45 388 766
3.4 Cropland management for 2008				
3.4 Cropland management for base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for base year				
3.4 Revegetation for 2008	-1 081 756			-1 081 756
3.4 Revegetation in base year	-77 781			-77 781

Abbreviations: NA = not applicable.

^a "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

^b "Final" includes revised estimates, if any, and/or adjustments, if any.

^c Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2012 annual inventory submission was submitted on 12 April 2012; it contains a complete set of common reporting format (CRF) tables for the period 1990–2010 and a national inventory report (NIR). Japan also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were also submitted on 12 April 2012. The annual submission was submitted in accordance with decision 15/CMP.1.

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

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

Completeness of inventory

9. The inventory covers all mandatory⁴ source and sink categories for the period 1990–2010 except for some carbon stock changes in pools in the LULUCF sector (see para. 83 below) and is complete in terms of years and geographical coverage.

10. The ERT noted that Japan has provided estimates for a number of pools in the LULUCF sector that were previously reported as not estimated (“NE”) (including soil carbon stock change for settlements remaining settlements and land converted to settlements). The ERT commends Japan for improving the completeness of its inventory. However, several categories and pools in the LULUCF sector are still reported as “NE” (e.g. soil carbon stock change for several cropland, grassland and wetlands categories (NIR table 5-4). The ERT reiterates the recommendation made in the previous review report that Japan improve the completeness of the reporting in its next annual submission, especially the reporting of carbon stock changes for mandatory categories.

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

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

11. The ERT noted that Japan continues to report some actual emissions of fluorinated gases (F-gases) as “NE” for the years 1990–1994, owing to a lack of activity data (AD) (see paras. 53, 57 and 64 below). The ERT reiterates the recommendation made in the previous review report⁵ that Japan report estimates of such actual emissions of F-gases in its next annual submission.

12. The ERT noted that Japan has reported actual and potential emissions of some F-gas species for the time series 1995–2010 as “NE” in CRF table 2(II). For example, for HFC-23 Japan has reported actual emissions from solvents and from semiconductor manufacture as “NE” for the whole time series 1990–2010, and has reported potential emissions from imported and exported products, and destroyed amount, also as “NE” for the whole time series 1990–2010. In response to a question raised by the ERT during the review, Japan indicated that it considers that the estimates of actual emissions of F-gases for the period 1995–2010 are complete. In order to improve completeness, the ERT recommends that Japan report actual emission estimates for all relevant species of F-gases in CRF table 2(II), or, if notation keys are used, revise its use of “NE” and explain the reporting in the documentation box of CRF table 2(II) and in the NIR in its next annual submission. The ERT encourages Japan to report potential emissions for all relevant species of F-gases in CRF table 2(II) in the next annual submission.

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

Overview

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

14. Japan stated in the NIR that the national system has not changed since the previous annual submission.

Inventory planning

15. The NIR describes in detail the national system for the preparation of the inventory. The Ministry of the Environment (MOE) has overall responsibility for the national inventory. The Greenhouse Gas Inventory Office of Japan (GOI) (within the Center for Global Environmental Research of the National Institute for Environmental Studies) compiles the inventory. Other ministries and organizations are also involved in the preparation of the inventory, mainly providing data (i.e. the Ministry of Economy, Trade and Industry; the Ministry of Land, Infrastructure, Transport and Tourism; the Ministry of Agriculture, Forestry and Fisheries; the Ministry of Health, Labour and Welfare; the Federation of Electric Power Companies of Japan; Japan Coal Energy Center; Japan Cement Association; the Japan Iron and Steel Federation; and the Japan Paper Association). Private consulting companies are contracted by MOE to perform tasks related to inventory compilation and quality control. The Committee for the Greenhouse Gas Emissions Estimation Methods, run by MOE, discusses and defines the methods, AD and emission factors (EFs) used. It leads six working groups (called breakout groups in the NIR) on energy and industrial processes, transport, F-gases, agriculture, waste, and LULUCF. Japan has a well-developed quality assurance/quality control (QA/QC) plan, which has included, since 2009, a Quality Assurance Working Group (QAWG), which was established as a result of discussions within the aforementioned committee.

⁵ FCCE/ARR/2011/JPN.

Inventory preparation

Key categories

16. Japan has reported tier 1 and tier 2 key category analyses, both level and trend assessment, as part of its 2012 annual submission. The tier 1 key category analysis performed by the Party and that performed by the secretariat⁶ produced similar, but not identical, results, owing to the different levels of category aggregation used. In the trend analysis, as actual F-gas emissions are not estimated for 1990, Japan has used the value for the base year (1995) F-gas emissions. Five F-gas categories were identified as key categories due to their trend in Japan's analysis, whereas in the secretariat's analysis only one was identified as a key category. The chosen disaggregation of categories is considered appropriate to the country's conditions. Japan has included the LULUCF sector in its key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). In response to a recommendation made in the previous review report, the reporting of the key category analysis in the NIR and in CRF table 7 has been made consistent.

17. In its NIR Japan explained that it uses the results of the key category analysis to prioritize the development and improvement of its inventory.

18. Japan has identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol for 2010: CO₂ emissions and removals from afforestation and reforestation, deforestation and forest management. In addition, it included revegetation on the basis of qualitative considerations.

Uncertainties

19. Japan has calculated and provided information on uncertainties at the overall inventory level, at the sector and gas (or aggregated gases) levels and for the KP-LULUCF activities in NIR tables 1-4 and 1-5. In annex 7 to the NIR, disaggregated information is presented in the format provided in table 6-1 of the uncertainty chapter of the IPCC good practice guidance for all sectors and categories. The uncertainties are calculated in accordance with the IPCC good practice guidance, using a tier 1 approach with country-specific and default values from the IPCC good practice guidance. Japan uses its uncertainty assessment in the prioritization of inventory improvements. The uncertainty of the total net emissions for 2010, including LULUCF, is estimated at 2.0 per cent, with the trend uncertainty estimated at 1.0 per cent. Both values have not changed since the Party's previous annual submission. The values are relatively low compared with those of other reporting Parties included in Annex I to the Convention. The main reason for this is that the uncertainty of indirect N₂O emissions from agricultural soils, a major contributor to the uncertainty of other Parties' inventories, are not a major contributor to the uncertainty of the Japanese inventory, because, although the estimates are as uncertain as for other Parties, the emissions are substantially lower than in other Parties (e.g. indirect N₂O emissions from

⁶ The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

agricultural soils estimated for 2010 accounted for 0.2 per cent of total GHG emissions for Japan and, for example, 3.5 per cent, 2.7 per cent, 1.6 per cent and 1.6 per cent for New Zealand, Hungary, Canada and the United Kingdom of Great Britain and Northern Ireland, respectively). For Japan, the uncertainty of the inventory is dominated by the estimated emissions from fuel combustion, which are, as for other Parties, characterized by a lower uncertainty.

20. Considering the detailed information on uncertainties available at the category level, the ERT encourages Japan to perform a tier 2 uncertainty analysis for its next annual submission.

Recalculations and time-series consistency

21. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that main recalculations reported by Japan of the time series 1990–2009 have been undertaken to take into account:

(a) In the energy sector, revisions to the AD on fuel consumption in the energy statistics and updates of the EFs used for the estimation of CH₄ and N₂O emissions from road transportation (see para. 34 below);

(b) In the industrial processes sector, revisions to the AD for limestone and dolomite use, soda ash production and refrigeration and air-conditioning equipment (see para. 51 below);

(c) In the agriculture sector, new figures for the share of animal waste treatment systems (AWMS) (separated and mixed) of manure by type of livestock and revised estimates of the percentage of manure management by type of livestock (see para. 67 below);

(d) In the LULUCF sector, newly estimated carbon stock changes for settlements remaining settlements and land converted to settlements (see para. 80 below);

(e) In the waste sector, updated AD for the amounts of incinerated municipal and industrial waste and industrial solid waste disposed of at semi-aerobic landfill sites (see para. 112 below).

22. The impact of all of the recalculations on the estimate of total GHG emissions is an increase of 0.01 per cent for 1990 and a decrease of 0.2 per cent for 2009. The decreasing trend in emissions between 1990 and 2009 has changed from 4.5 per cent (2011 annual submission) to 4.7 per cent (2012 annual submission) owing to the recalculations. The rationale for these recalculations is provided in the NIR (in each sectoral chapter and in chapter 10) as well as in CRF table 8(b). However, the information on the rationale for recalculations in the industrial processes sector is limited (see para. 52 below).

Verification and quality assurance/quality control approaches

23. The inventory compilation process and the QA/QC plan, including roles, responsibilities and QA/QC activities, are described in the NIR (chapter 1 and annex 6). The QA/QC plan defines, among other things, the process for the collection of AD, the process for the selection of EFs and estimation methods, the inventory improvement process and QA/QC activities. Japan has a well-developed QA/QC system. QAWG (see para. 15 above) oversees the soundness of the estimation methods, AD and EFs used as well as of the content reported in the CRF tables and in the NIR. In 2011, the QA activities of QAWG included the review of the energy sector inventory by two external experts.

24. Despite the defined QA/QC activities, the ERT identified some discrepancies between the information provided in the NIR and in the CRF tables (see paras. 39, 62, 73

and 113 below). The ERT recommends that Japan improve its QC procedures so as to avoid inconsistencies between the information provided in the NIR and in the CRF tables in its next annual submission.

Transparency

25. The NIR and the CRF tables are generally transparent. Japan has used notation keys throughout the CRF tables and has included explanations in CRF table 9(a) for emissions that have been reported as “NE” or included elsewhere (“IE”). The ERT noted some improvements in the transparency of the NIR since the Party’s previous annual submission, including: additional information regarding the discrepancies between the values reported in the CRF tables and International Energy Agency (IEA) statistics; additional information in NIR tables 6-2 (categorization and assumptions underlying calculations for cattle) and 6-9 (livestock population for cattle); and the reporting of the amount of livestock manure for grazing buffalo, sheep, goats and horses in the pasture, range and paddock column of CRF table 4.B(b). However, the ERT identified some areas where transparency could be improved, which are specified in the sectoral chapters of this report. Japan has stated in chapter 10.4.2 of the NIR that it plans to further improve transparency by examining the descriptions of methodologies, assumptions, data and other elements presented in the NIR and by adding necessary information to the NIR. The ERT welcomes these plans and recommends that Japan describe the planned improvements more specifically in its next annual submission. The ERT encourages Japan to provide a timetable for the implementation of the plans in its next annual submission.

26. The ERT noted that Japan’s use of the notation keys is not always transparent and not always in line with the “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories” (hereinafter referred to as the UNFCCC reporting guidelines). Some improvements have been made (e.g. emissions from prescribed burning of savannas for all years are reported as not occurring (“NO”) following a recommendation made in the previous review report). However, the ERT could not always assess the use of notation keys, for example, if “NE” in some instances should be replaced by “NO” or “IE” (see paras. 10 above and 48 and 107 below). The ERT reiterates the recommendation made in previous review reports that Japan review its use of the notation keys, as appropriate, for its next annual submission.

Inventory management

27. Japan has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these EFs and AD have been generated and aggregated for the preparation of the inventory. The archived information also includes documentation on QA/QC procedures, external and internal reviews, annual key categories and key category identification and planned inventory improvements. The archiving system is run by GIO. The archiving system includes electronic and paper versions of documents.

3. Follow-up to previous reviews

28. Japan has provided information on its follow-up on the recommendations made in the previous review report in NIR table 10-2. In response to a question raised by the ERT during the review, Japan further explained that the late arrival of the review report of its 2011 annual submission (draft report received on 11 March 2012 and final version published on 10 July 2012) did not allow sufficient time for the consideration of all of the points raised in the report. The ERT is aware of the report’s late arrival and acknowledges the improvements nevertheless made by Japan.

29. The documentation of the following up of previous recommendations could be improved and the ERT reiterates the encouragement of Japan to list, in NIR table 10-2, the recommendations made in previous review reports in relation to which action has not yet been taken, including plans and time frames for their implementation. The ERT noted that Japan, since its previous annual submission, has included information on drivers for emission trends in chapter 2 of the NIR, extended the chapter on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol and improved the explanations of the use of “NE”. However, Japan has not, or only partly, addressed some of the recommendations made in previous review reports, including improving transparency (especially in relation to the agriculture sector), improving the use of the notation keys and reporting estimates of actual emissions of HFCs, PFCs and SF₆ for the years 1990–1994.

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

30. During the review, the ERT identified several issues for improvement. These are listed in table 6 below.

31. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report and in table 6 below.

B. Energy

1. Sector overview

32. The energy sector is the main sector in the GHG inventory of Japan. In 2010, emissions from the energy sector amounted to 1,145,611.50 Gg CO₂ eq, or 91.1 per cent of total GHG emissions. Since 1990, emissions have increased by 6.2 per cent, led by the increase in emissions from public electricity and heat production (by 84,076.12 Gg CO₂ eq or 28.2 per cent) and road transportation (by 13,288.56 Gg CO₂ eq or 6.9 per cent), which more than offset the decrease in emissions from other categories, including from chemicals (by 11,030.40 Gg CO₂ eq or 17.0 per cent) and agriculture/forestry/fisheries (by 10,953.53 Gg CO₂ eq or 51.0 per cent). Within the energy sector, 35.6 per cent of the emissions were from energy industries, followed by 30.1 per cent from manufacturing industries and construction, 19.9 per cent from transport and 14.4 per cent from other sectors. The remaining 0.04 per cent were fugitive emissions from fuels.

33. The ERT considered that the information on the drivers of emission trends in the energy sector reported in the NIR is limited. It recommends that Japan improve the transparency of the information on the drivers of emission trends in the energy sector by including additional explanations in its next annual submission such as the drivers for the emissions for subcategories that contribute most to emissions for the sector or that changed most since 1990.

34. Japan has made recalculations for the energy sector between its 2011 and 2012 annual submissions in response to the recommendations made in the 2011 review report and following changes in AD and EFs. The impact of these recalculations on the energy sector is a decrease in the estimated emissions of 0.1 per cent (by 671.93 Gg CO₂ eq) for 2009. The main recalculations took place in the following categories:

(a) Public electricity and heat production: the estimated emissions for 2009 decreased by 529.08 Gg CO₂ eq or 0.1 per cent due to a revision of the fuel consumption figures in the *General Energy Statistics*, coupled with the correction of the gross calorific values for steam coal burned in normal-pressure fluidized-bed boilers and the updating of the amounts of municipal and industrial waste incinerated;

(b) Other industries under other (manufacturing industries and construction): the estimated emissions for 2009 increased by 245.64 Gg CO₂ eq or 0.6 per cent. This was as a result of a revision of the fuel consumption for 2009 in the *General Energy Statistics*,

coupled with the correction of the gross calorific values for steam coal burned in normal-pressure fluidized burners, which led to a recalculation of N₂O emissions, and the updating of the amount of biomass-based plastic products consumed;

(c) Navigation: the estimated emissions for 2009 decreased by 207.46 Gg CO₂ eq or 1.9 per cent due to the revision of the fuel consumption in the *General Energy Statistics*;

(d) Commercial/institutional: the estimated emissions for 2009 decreased by 285.60 Gg CO₂ eq or 0.3 per cent due to the revision of consumption of fuels in the *General Energy Statistics*.

35. The ERT reiterates the recommendation made in the previous review report regarding the inclusion of a more detailed numerical breakdown of recalculations at each category level, as this will improve the transparency and the understanding of the impacts of the individual recalculations.

36. The ERT noted that Japan has provided additional information, particularly with regard to the EFs used, mainly in Japanese. The ERT commends the Party's effort to provide English translations of select parts of this additional information (tables). The ERT further commends Japan for the provision of tables showing relevant EFs in the NIR. However, the ERT noted that some of the references provided are incomplete and recommends that the Party improve its QC procedures to ensure that such references are complete, for example by ensuring that the year of publication is included.

37. Japan has also stated in the NIR that the Environment Agency is considering developing CO₂ EFs for each fuel through direct measurement of carbon content and calorific value. This would be an update on the values contained in the Environment Agency's *Report on Estimation of CO₂ Emissions in Japan*, developed over 15 years ago, which is the source of some country-specific EFs used by Japan. The ERT welcomes this planned improvement and recommends that Japan transparently report any changes to the country-specific EFs used in the estimation of CO₂ emissions in its next annual submission.

2. Reference and sectoral approaches

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

38. The estimate of CO₂ emissions calculated using the reference approach is 1.26 per cent higher than the estimate calculated using the sectoral approach for 2010. As noted in the previous review report, the ERT also noted a relatively large difference (5.26 per cent) in the estimates of CO₂ emissions from the combustion of solid fuels for 2008, which is due to the significant stock change in imported steam coal. In response to a question raised by the ERT during the review, Japan explained that, owing to the economic crisis that started in 2008, some imported coal was not consumed in 2008; hence the reference approach (which uses AD from providers) provided higher estimates of emissions than the sectoral approach (which uses AD from consumers). The situation was reversed in 2009, when more coal was consumed (from the stock) than the providers had sold, and so for 2009 the sectoral approach gave a higher estimation of CO₂ emissions (by 1.85 per cent). The ERT recommends that Japan include this information in its next annual submission and encourages the Party to explain differences greater than 2.0 per cent in the estimated CO₂ emissions calculated using the two approaches, whether in total or by fuel, in the documentation box of CRF table 1.A(c) and in the NIR of its next annual submission.

39. Japan has reported the production of coal as "NO" under the reference approach in CRF table 1.A(b). However, the Party has reported coal-mining activities in its NIR and reported AD and fugitive emissions from coal mining in CRF table 1.B.1. This inconsistency could affect the difference in estimates between the reference and sectoral

approaches. The ERT recommends that Japan address this inconsistency in its next annual submission.

International bunker fuels

40. The AD for bunker fuels are derived from quantities listed as bonded imports and bonded exports (domestic production bond) as provided in the Ministry of Economy, Trade and Industry's *Yearbook of Mineral Resources and Petroleum Products Statistics* and for which import tariffs and petroleum taxes are waived. Domestic AD, on the other hand, are extracted from the *General Energy Statistics* of the Agency for Natural Resources and Energy. The amount of imported crude oil should be equal to the sum of bonded exports (bunker fuels), domestic demand and general export, but the ERT could not assess it. In response to a question raised by the ERT during the review, Japan clarified that the data in the *General Energy Statistics* are derived from the *Yearbook of Mineral Resources and Petroleum Products Statistics*, which ensures consistency and balance between the two data sets.

41. Emissions from the oxidation of fuels used for lubrication in international aviation are excluded from the estimated emissions from international bunkers. In response to a question raised by the ERT during the review, Japan indicated that it will investigate whether this is contributing to discrepancies with international data and incompleteness. The ERT considered that excluding the emissions from the oxidation of such lubricants from the estimated emissions from international bunkers is not in line with the Revised 1996 IPCC Guidelines and therefore recommends that Japan include estimates of these emissions, along with a report on its findings, in its next annual submission.

42. The ERT noted that the CO₂ implied emission factor (IEF) for jet kerosene reported in CRF table 1.C (67.1 t/TJ based on gross calorific value, or 70.7 t/TJ based on net calorific value (NCV)), is lower than the EF for jet kerosene included in the Revised 1996 IPCC Guidelines (19.5 t C/TJ, or 71.5 t CO₂/TJ). In response to a question raised by the ERT during the review, Japan confirmed that the CO₂ EF is country-specific and the Party noted that the value is within the range included in table 3.6.4 in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (69.9–74.4 t CO₂/TJ). To improve transparency, the ERT recommends that Japan include additional information on how the CO₂ EF for jet kerosene is estimated in its next annual submission.

Feedstocks and non-energy use of fuels

43. The ERT commends Japan for revising and explaining the allocation of CO₂ emissions from feedstocks and non-energy use of fuels in its NIR. However, the ERT reiterates the recommendation made in the previous review report that Japan complete the columns "Associated CO₂ emissions" and "Allocated under" of the additional information table of CRF table 1.A(d), which continue to be reported as "NE", in its next annual submission.

44. In the previous review report it was recommended that Japan report CO₂ emissions from the use of solid fuels in the category non-ferrous metals under the industrial processes sector and not under the energy sector. In response to a question raised by the ERT during the review, Japan explained that all emissions from the use of solid fuels in the production of non-ferrous metals continue to be reported under the energy sector. The ERT reiterates the recommendation made in the previous review report that Japan report these emissions under the industrial processes sector, as required by the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines).

45. The previous review report recommended that Japan explain in the NIR which EFs are used to estimate CO₂ emissions from the use of lubricants and paraffin waxes and the allocation of these emissions under the energy and waste sectors. The ERT noted that CO₂ emissions from the use of lubricants and paraffin waxes are not mentioned in section 3.2.9 of the NIR on feedstocks and non-energy use of fuels, or in the CRF tables for emissions from transport, or in CRF table 1.A(d). In response to a question raised by the ERT during the review, Japan explained that work to address the recommendation made in the previous review report has started. The ERT reiterates the recommendation made in the previous review report that the Party explain in the NIR which EFs are used to estimate CO₂ emissions from the use of lubricants and paraffin waxes and the allocation of these emissions under the energy and waste sectors in the next annual submission.

3. Key categories

Civil aviation: jet kerosene – CO₂

46. Japan has used a country-specific CO₂ EF for jet kerosene. The ERT noted a discrepancy between the EF reported for “kerosene” in the NIR (18.5 t carbon (C)/TJ in NIR table 3-2, or 67.8 t CO₂/TJ) and in CRF table 1.A(a) (where the CO₂ IEF for “jet kerosene” is 67.1 t CO₂/TJ). In response to a question raised by the ERT during the review, Japan explained that, in NIR table 3-2, “jet fuel” (18.3 t C/TJ, or 67.1 t CO₂/TJ) refers to jet kerosene and “kerosene” refers to the kerosene used outside aviation. To improve transparency, the ERT recommends that the Party include this information in its next annual submission.

Road transportation: diesel oil – CO₂

47. Japan has used a country-specific CO₂ EF for diesel oil used in road transportation. The ERT noted that the CO₂ IEF reported in in CRF table 1.A(a) (68.7 t CO₂/TJ based on gross calorific value, or 72.3 t/TJ based on NCV) is one of the lowest among those of the reporting Parties, for which the range is 69.4–98.5 t/TJ. In response to a question raised by the ERT during the review, Japan explained that the quality standard for diesel oil in Japan is different from the standards used by other Parties. To improve transparency, the ERT recommends that Japan include information on this standard in the NIR of its next annual submission.

Coal mining and handling: solid fuels – CO₂ and CH₄

48. The ERT noted that Japan has reported fugitive CO₂ emissions from coal mining and handling as “NE” in CRF table 1.B.1 for both underground and surface mines. Japan reported that it does not have the necessary measurements to estimate these emissions. The ERT encourages Japan to estimate these emissions or, if such CO₂ emissions do not occur, to report them as “NO” in its next annual submission.

49. Japan has reported all CH₄ emissions from recovery/flaring as “NE” for both underground and surface mines in CRF table 1.B.1. However, the NIR reports that the underground mines are shallower and/or have been previously mined. The ERT considered that the recovery or flaring of CH₄ may not occur in surface mines (and maybe not in some underground mines) and that, if this is the case, these emissions should be reported as “NO”. In response to a question raised by the ERT during the review, Japan explained that the execution status of CH₄ recovery/flaring in the underground coal mines had not been surveyed; hence the use of the notation key “NE” rather than “NO”. However, Japan expressed the will to undertake such a survey. The ERT recommends that Japan implement the survey and report on its findings in its next annual submission.

C. Industrial processes and solvent and other product use

1. Sector overview

50. In 2010, emissions from the industrial processes sector amounted to 65,898.05 Gg CO₂ eq, or 5.2 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 98.95 Gg CO₂ eq, or 0.01 per cent of total GHG emissions. Since the base year, emissions have decreased by 45.1 per cent in the industrial processes sector and decreased by 65.5 per cent in the solvent and other product use sector. The key drivers for the fall in emissions in the industrial processes sector are: for CO₂, the decrease in clinker production and limestone and dolomite use; for N₂O, the use of abatement technologies in adipic acid production; for HFCs, the use of abatement technologies in the production of HCFC-22, although the decrease was partly offset by the increase in HFC emissions from refrigeration, where HFCs have replaced ozone-depleting substances; for PFCs, the promotion of substitute materials and the capture and destruction of PFCs; and for SF₆, the strengthening of the management of the handling of the gas, such as gas recovery, for electrical equipment. Within the industrial process sector, 36.1 per cent of the emissions were from cement production (CO₂), followed by 25.9 per cent from refrigeration and air-conditioning equipment (HFCs), 12.3 per cent from limestone and dolomite use (CO₂) and 9.5 per cent from lime production (CO₂). Semiconductor manufacture accounted for 4.0 per cent (HFCs, PFCs and SF₆) and ammonia production accounted for 3.2 per cent (CO₂) of the sectoral emissions. All other categories accounted for the remaining 9.0 per cent of the emissions from the industrial processes sector.

51. Japan has made recalculations for the industrial processes sector between its 2011 and 2012 annual submissions in response to the 2011 review report and following changes in AD. The impact of these recalculations on the industrial processes sector is a decrease in the estimated emissions of 0.2 per cent for 2009. The recalculations were due mainly to the revision of AD. The main recalculations took place in the following categories:

(a) Limestone and dolomite use: for 2009, the estimate of CO₂ emissions increased by 5.50 Gg CO₂ eq (0.1 per cent) due to the update of the AD for limestone use;

(b) Refrigeration and air-conditioning equipment: for 2009, the estimate of HFC emissions decreased by 117.56 Gg CO₂ eq (0.8 per cent) due to the update of the AD for HFCs.

52. The reasons for the recalculations are briefly described in the NIR and in CRF table 8(b) and, in response to a recommendation made in the previous review report, the types of changes (in AD, EFs or methods) are specified in CRF table 8(b). However, justifications, as described by the IPCC good practice guidance, and a time series for previously reported and new emission estimates showing the differences per year are not provided in the NIR. In response to a question raised by the ERT during the review, Japan explained that it will consider including this information in its next annual submission. The ERT recommends that Japan provide this information in the recalculation section of its next annual submission, as recommended by the IPCC good practice guidance.

53. The inventory of emissions from the industrial processes and solvent and other product use sectors is generally complete, with emission estimates provided for most categories, except for PFC emissions from aluminium production (see para. 64 below) and actual F-gas emissions from consumption of halocarbons and SF₆ (see para. 57 below).

54. The ERT noted that the recommendations made in the previous review report for Japan to improve the transparency of the methodological descriptions in the NIR have not been implemented, except, partially, for HFC emissions from consumption of halocarbons and SF₆ and from production of halocarbons and SF₆, where the transparency is still limited. In response to a question raised by the ERT during the review, Japan explained that

the draft review report was received on 11 March 2012, just over a month before the 2012 annual submission was due, and that the final version of the review report was published on 10 July 2012. The ERT acknowledges that there was limited time available for the consideration of all of the recommendations made in the previous review report. Therefore, the ERT reiterates the recommendation made in the previous review report that Japan improve the transparency of the information on methodologies, data sources and EFs, and the rationale for their selection for categories with high degrees of abatement of emissions (including adipic acid production, production of halocarbons and SF₆ other than HCFC-22, and semiconductor manufacture), in its next annual submission. The ERT considered that including information on the number of facilities equipped with recovery or destruction units, the type of units and their efficiency, the QA/QC procedures implemented by the facilities for the monitoring of emissions and the representativeness of the sampling in relation to annual average emissions may improve the transparency of the information provided for these categories.

55. Japan has continued to report CO₂ emissions from the use of fuels as anodes or reducing agents in industrial processes (e.g. in production of soda ash, iron and steel production, except for electric arc furnace facilities, and ferroalloys and aluminium production) under the energy sector and not under the industrial processes sector. This is not in line with the IPCC good practice guidance, as these CO₂ emissions should be allocated to the appropriate category under the industrial processes sector. In response to a question raised by the ERT during the review, Japan explained that the Committee for the Greenhouse Gas Emissions Estimation Methods will consider the allocation issue. However, Japan also explained that the use of the *General Energy Statistics* and the reporting of all CO₂ emissions under the energy sector ensures the complete accounting of all emissions and avoids double counting. However, the ERT noted that Japan's allocation of emissions, in addition to not being in line with the IPCC good practice guidance, reduces comparability with other Parties and may distort the key category analysis (some categories under the industrial processes sector that are not key at the moment may become key categories). The ERT reiterates the recommendation made in previous review reports that Japan allocate CO₂ emissions from industrial activities in line with the IPCC good practice guidance in its next annual submission.

2. Key categories

Production of halocarbons and SF₆ – HFC-23

56. The ERT noted that Japan has not addressed the recommendation made in the previous review report for the Party to provide information on the HFC-23 abatement system showing that the reported emissions have not been underestimated (in addition to the information provided in the note to NIR table 4-32). In response to a question raised by the ERT during the review, Japan explained that the delay in the publication of the previous review report (see para. 28 above) did not allow it time to address all of the recommendations therein, but that it is now considering the pending recommendation and that it will be addressed in the next NIR. The ERT reiterates the recommendation made in the previous review report that Japan expand the information provided on this category, as indicated, in its next annual submission.

Consumption of halocarbons and SF₆ – HFCs, PFCs and SF₆

57. The ERT noted that, for the period 1990–1994, actual F-gas emissions from consumption of halocarbons and SF₆ are still reported as “NE”, despite reiterated recommendations in previous review reports that the Party provide estimates for these years, using extrapolation if necessary. In response to a question raised by the ERT during the review, Japan explained that it examined the possibility of estimating emissions of

HFCs, PFCs and SF₆ for the years 1990–1994, but that its analysis showed that there is not enough information available to conduct extrapolation. The ERT noted that, whether basic AD are available or not, the IPCC good practice guidance provides estimation methods, for example using extrapolation to calculate the missing emission estimates. Although this will result in less accurate estimates, there is no reason not to provide such estimates. Therefore, the ERT again strongly recommends that Japan report these missing estimates of F-gas emissions for the years 1990–1994 in its next annual submission and explain the method used to calculate the estimates.

58. In response to a question raised by the ERT during the review, Japan explained that estimates of HFC emissions from refrigeration and air-conditioning equipment are calculated using a model that considers the type of device and year of production. With regard to time-series consistency from 1995 onward, data on the amounts of HFC production is provided by the same industry organization as the equipment manufactures and the country-specific EFs used are those reported by the Ministry of Trade and Industry in 2009. The ERT recommends that Japan include this information in its next annual submission, in order to improve transparency.

59. With regard to commercial refrigeration, the ERT reiterates the recommendation made in the previous review report that Japan improve the transparency of the reporting on commercial refrigeration by including information on whether the emission level and trend are calculated in accordance with the IPCC good practice guidance and how time-series consistency is maintained (e.g. when different sources are used over time for AD and EFs). The ERT also reiterates the recommendation made in the previous review report that Japan, in its next annual submission, report specific references to the sources of information on AD, on how EF trends, as reported in the NIR tables, were determined and how time-series consistency was maintained in the case of missing data.

60. The ERT welcomed the improvement made by Japan by reporting HFC emissions from commercial refrigeration under a unspecified mix of HFCs separately for manufacturing, stocks and disposal in CRF table 2(II).F. However, the ERT noted that HFC-125, HFC-134a and HFC-32 emissions from stocks and from disposal continue to be reported as “IE” (these emissions are reported together with the emissions from manufacturing). To improve transparency and facilitate comparison between Parties, the ERT reiterates the strong recommendation made in the previous review report that, in order for this major key category to comply with the UNFCCC reporting guidelines, Japan revise CRF table 2(II).F for the subcategory commercial refrigeration by reporting separately the emissions from manufacturing, stocks and disposal, if possible per substance, and by including the AD, where appropriate.

61. The ERT noted that Japan reports all potential HFC emissions from consumption of halocarbons and SF₆ under the category other non-specified. The ERT reiterates the recommendation made in the previous review report that Japan explain and justify why it reports all potential HFC emissions under the category other non-specified in its next annual submission. The ERT also reiterates the recommendation made in the previous review report that Japan include in its NIR information on the methodological tiers used and specify which EFs are country-specific and which are default EFs. Japan could further improve the transparency of the information provided on this key category by providing the annual average product-life factor over time of the six subtypes of commercial refrigeration/air-conditioning systems listed in NIR table 4-39.

62. The ERT noted that Japan has reported potential emissions of SF₆ for other (consumption of halocarbons and SF₆) incorrectly in CRF table 2(I). For example, for 2010 Japan has reported 53,559.90 Gg SF₆ for potential emissions of SF₆ for this category, although the Party has reported just 2.24 Gg SF₆ for the aggregated potential SF₆ emissions for consumption of halocarbons and SF₆. The ERT considered that Japan may be reporting

the potential emissions for other (consumption of halocarbons and SF₆) in Gg CO₂ eq and not in Gg SF₆ as required. Therefore, the ERT recommends that Japan address this inconsistency and improve the QC procedures in its next annual submission.

3. Non-key categories

Carbide production – CO₂

63. As indicated in the previous review report, Japan has estimated CO₂ emissions from reducing agents used in calcium carbide production using the default EF from the Revised 1996 IPCC Guidelines for the period 1990–2007 and a country-specific EF, based on measurements, for 2008 onward. The country-specific EF, which is confidential,⁷ is significantly lower than the default EF and one of the lowest reported by Parties, so the consistency of the time series is unclear. In response to a question raised by the ERT during the review, Japan explained that it believes that the country-specific EF accurately represents the national circumstances. Japan also explained that it has considered using the country-specific EF for the whole time series 1990–2010, but that the lack of measurements for the period 1990–2007 would increase the uncertainty compared with using the default EF. The ERT agreed that the use of this country-specific EF results in more accurate estimates of CO₂ emissions from reducing agents; however, the consistency of the time series should also be considered. It therefore recommends that Japan ensure the consistency of the time series in its next annual submission.

Aluminium production – PFCs

64. The ERT noted that, for the period 1990–1994, PFC emissions from aluminium production are still reported as “NE”, despite reiterated recommendations in previous review reports that the Party provide estimates for these years, using extrapolation if necessary. In response to a question raised by the ERT during the review, Japan explained that it examined the possibility of estimating these missing emissions, but that its analysis showed that there is not enough information available to conduct extrapolation. The ERT noted that, whether basic AD are available or not, the IPCC good practice guidance provides estimation methods, for example using extrapolation to calculate the missing emission estimates. Although this will result in less accurate estimates, there is no reason not to provide such estimates. Therefore, the ERT again strongly recommends that Japan report these missing estimates of PFCs emissions for the years 1990–1994 in its next annual submission and explain the method used to calculate the estimates.

Solvent and other product use – CO₂

65. In the solvent and other product use sector, Japan has continued to report CO₂ emissions from degreasing and dry cleaning and from chemical products, manufacture and processing as “NE” and those from paint application and from other as not applicable (“NA”), partly because Japan does not convert the quantity of carbon released in the form of non-methane volatile organic compounds into CO₂ eq emissions. In response to a question raised by the ERT during the review, Japan stated that, at present, it does not intend to report estimates of these CO₂ emissions. The ERT noted that reporting estimates of these emissions is encouraged by the UNFCCC reporting guidelines and that most Parties do report them. As in the previous review report, the ERT encourages Japan to report estimates of these emissions in its next annual submission.

⁷ Japan granted the ERT access to the EF during the review, but the value remains confidential.

D. Agriculture

1. Sector overview

66. In 2010, emissions from the agriculture sector amounted to 25,499.61 Gg CO₂ eq, or 2.0 per cent of total GHG emissions. Since 1990, emissions have decreased by 18.4 per cent. The key drivers for the fall in emissions are the decreasing population of dairy cattle, the decrease in CH₄ emissions from rice cultivation as a result of the decline in crop acreage, and the decreasing application of nitrogen (N) fertilizers to cropland. Within the sector, 30.1 per cent of the emissions were from manure management, followed by 26.2 per cent from enteric fermentation, 22.0 per cent from agricultural soils and 21.4 per cent from rice cultivation. The remaining 0.3 per cent were from field burning of agricultural residues. The ERT commends Japan for addressing the recommendation made in the previous review report that it revise the notation key reported for prescribed burning of savannas, which is now reported as “NO” for the entire time series 1990–2010.

67. The Party has made recalculations for the agriculture sector between its 2011 and 2012 annual submissions following changes in AD and EFs. The impact of these recalculations on the agriculture sector is an increase in the estimated emissions of 0.7 per cent for 2009. The main recalculations took place in the following categories:

(a) Manure management: the estimate of emissions for this category increased by 433.63 Gg CO₂ eq for 2009 (by 6.1 per cent). The main recalculations for manure management relate to:

(i) The revision of the percentages for the distribution of AWMS, which affected mainly N₂O emissions from solid storage and dry lot, which decreased by 415.11 Gg CO₂ eq (by 50.4 per cent), and from other AWMS, which increased by 918.68 Gg CO₂ eq (by 23.6 per cent);

(ii) The amount of nitrogen excreted during the grazing of sheep, buffalo, goats and horses being newly reported under pasture, range and paddock in CRF table 4.B(b);

(iii) The decrease in the estimate of CH₄ emissions from swine by 112.80 Gg CO₂ eq (by 39.0 per cent) for 2009. The shift of swine manure management from a liquid system to other AWMS in the latest inventory year (2010) affected the estimate for 2009, as Japan reports three-year averages (see para. 72 below);

(b) Agricultural soils and field burning of agricultural residues: the nitrogen contents of crop residues for some crops have been revised. For 2009, the estimate of emissions from agricultural soils decreased by 148.27 Gg CO₂ eq (by 2.5 per cent) and the estimate of emissions from field burning of agricultural residues by 5.33 Gg CO₂ eq (by 6.4 per cent).

68. Japan has stated in its NIR that tier 1 QC activities have been conducted for the agriculture sector inventory in accordance with the IPCC good practice guidance. The QC activities focus on the verification of the parameters for AD and EFs and the archiving of reference materials. The ERT welcomes Japan’s efforts to assess the quality of its inventory and encourages the Party to implement further QA/QC procedures and to report on its respective findings in the NIR of its next annual submission. Specifically, the ERT recommends that Japan place special emphasis on ensuring consistency between the individual subcategories under the agriculture sector and improve the reporting on:

(a) The consistency of the fraction of nitrogen volatilized during manure management and manure application between manure management, animal manure applied to soils and atmospheric deposition;

(b) The consistency of the fraction of crop residues burned between the categories N₂O emissions from crop residues and field burning of agricultural residues;

(c) The animal manure not applied to agricultural soils but disposed of as waste and consequently reported under the waste sector.

69. Japan has estimated uncertainties for all categories of agricultural emissions. However, some of the uncertainty estimates are rather high compared with the estimates usually reported by other Parties. For example, the uncertainty of the AD for buffalo, sheep, goats and horses (100.0 per cent), the EFs for direct soil emissions (138.2 per cent for synthetic fertilizers, 151.3 per cent for animal waste applied to soils, 210.6 per cent for crop residues and 711.6 per cent for organic soils) and of the AD (50 per cent for maize, rice, all beans and peanuts) and EFs (129.5–481.0 per cent for CH₄ and 153.8–423.0 per cent for N₂O) for field burning of agricultural residues. The ERT commends Japan for the degree of detail of the uncertainty analysis and encourages the Party to increase the transparency of the information on how the estimates are obtained for the AD and EFs indicated in the next annual submission.

70. Japan has identified several planned improvements for the agriculture sector inventory in the category-specific subchapters of the NIR. During previous reviews Japan has explained that the corresponding issues are considered in the annual meetings of the breakout group on agriculture of the Committee for Greenhouse Gas Emissions Estimation Methods, and that most of them are considered “long-term issues”. The ERT welcomes the planned improvements and encourages Japan to provide a more specific time frame for the implementation of such improvements in the next annual submission.

2. Key categories

Manure management – CH₄ and N₂O⁸

71. In the previous review report it was recommended that Japan revise the information presented in the NIR concerning CH₄ emissions from manure management, in order to enhance the transparency of the inventory. The ERT noted that the methane conversion factors for all livestock are reported as “NE” in the additional information table of CRF table 4.B(a) and that the information provided in the NIR is still not sufficiently transparent. Japan has reported the CH₄ EFs used for manure management in NIR table 6-13 in g CH₄/g organic matter. Some of these EFs are reported as being based on the default values from the Revised 1996 IPCC Guidelines, but the IPCC good practice guidance is also mentioned as source. It seems as if B₀ values were taken from the Revised 1996 IPCC Guidelines and MCF values were taken from the IPCC good practice guidance (e.g. the EF for pit storage of manure from dairy cattle is given as 3.9 gram CH₄ per gram organic matter. 3.9 divided by B₀ (=0.13) and divided by the density of methane (=0.67) equals 45 per cent, which is the MCF default value for pit storage > 1 month in the IPCC good practice guidance). Accordingly, the ERT reiterates the recommendation made in previous review reports that the Party increase the transparency of the estimation of CH₄ emissions from manure management, particularly by providing more information on the calculations and data sources of the EFs reported in NIR table 6-13, in its next annual submission.

72. The allocation of AWMS for swine changed considerably for the last inventory year (2010). From 1990 until 2009, the share of liquid systems was 27.4 per cent and the share of solid storage was 3.5 per cent. However, for 2010, the share of liquid systems was only 8.4 per cent and the share of solid storage was 0.2 per cent, with a corresponding increase

⁸ Not all emissions related to all gases under this category are key categories, particularly CH₄ emissions. However, since the issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

of the “other” AWMS. The ERT could not find sufficient information in the NIR to explain the shift of swine manure management from liquid systems to other AWMS for 2010. Therefore, the ERT recommends that Japan provide further information on the change in the allocation of swine manure to the different waste management systems in the NIR of its next annual submission.

73. Japan has used a country-specific methodology to estimate N₂O emissions from grazing cattle. As assessed during previous reviews, the reporting is not consistent with the IPCC good practice guidance and not completely transparent. For example, the ERT noted that the sum of the nitrogen excretion (N_{ex}) from all cattle AWMS in CRF table 4.B(b) is inconsistent with the N_{ex} calculated as the product of the livestock population with the specific N_{ex} rates. Additionally, the AWMS distribution in the additional information table of CRF table 4.B(a) for cattle sums to 100.0 per cent, although pasture, range and paddock is reported as “NE”. In response to a question raised by the ERT during the review, Japan explained the reasoning behind its approach, but could not entirely clarify the issue. The ERT reiterates the recommendation made in previous review reports that Japan improve the reporting of N₂O emissions from pasture, range and paddock in its next annual submission, specifically that it:

- (a) Provide information on whether or not the N_{ex} rates of cattle include nitrogen excreted on pasture, range and paddock;
- (b) Estimate and report the percentage of nitrogen excreted on pasture, range and paddock for all livestock for which information is currently reported in the additional information table of CRF table 4.B(a) regarding CH₄ emissions;
- (c) Report the amount of nitrogen excreted from cattle on pasture, range and paddock in CRF table 4.B(b);
- (d) Report the total amount of nitrogen excreted by all animal categories on pasture, range and paddock, as well as the respective N₂O emissions, in CRF table 4.D;
- (e) Improve the transparency of the information on N₂O emissions from grazing provided in the NIR.

74. Japan has used an EF of 0.32 g N₂O-N/head/day for grazing cattle. The estimate is based on a study by Yamamoto (1995),⁹ which was provided to the ERT during the review. The ERT found that by using a similar approach based on default values from the Revised 1996 IPCC Guidelines (an annual average N_{ex} rate/head of 100 kg N/year; and an N₂O EF for the manure management system pasture, range and paddock of 0.02 kg N₂O-N/kg nitrogen excreted), an EF of 5.48 g N₂O-N/head/day would result. This is considerably higher than the EF used by Japan. No information could be found in the study that would explain this difference. Accordingly, the ERT recommends that Japan revise the EF for N₂O emissions from cattle grazing or provide more specific information to justify the value used in the estimations in its next annual submission.

3. Non-key categories

Enteric fermentation – CH₄

75. In response to recommendations made in previous review reports, Japan has improved the information on animal characterization (NIR tables 6.2 and 6.9). The ERT welcomes the improvements made. However, the ERT considered that the characterization

⁹ Yamamoto K. 1995. *Emission of Trace Gases Contributing Greenhouse Effect from Grassland*. Final report of the Global Environmental Research Fund, B-2.4.2, FY 1994. Ministry of Agriculture, Forestry & Fisheries. Available at <<http://www.env.go.jp/earth/suishinhi/wise/e/pdf/E94B0242.pdf>>.

of animal livestock is still not sufficiently transparent, particularly the grouping of cattle into dairy and non-dairy cattle. Furthermore, no data to support the lower CH₄ EFs for swine, goats and sheep are provided in the NIR (e.g. Japan has used a CH₄ EF for swine of 1.1 kg/head/year and a CH₄ EF for sheep of 4.1 kg/head/year, while the default EFs from the Revised 1996 IPCC Guidelines are 1.5 kg/head/year and 8 kg/head/year, respectively). In response to a question raised by the ERT during the review, Japan provided further information on these issues as well as additional background material¹⁰ that supports the validity of the country-specific estimates. Accordingly, the ERT reiterates the recommendation made in previous review reports that Japan improve the information provided on cattle and livestock characterization and include the additional information provided during the review in the NIR of its next annual submission. The ERT also recommends that Japan report the most relevant data on livestock characteristics in CRF table 4.A and in the documentation boxes of the appropriate CRF tables in its next annual submission.

76. The value reported for milk yield for dairy cattle for 2010 (30.7 kg/day) is the highest value of all of the reporting Parties (range: 6.2–30.7 kg/day). In response to a question raised by the ERT during the review, Japan stated that it intends to verify the milk yield. The ERT welcomes this planned improvement and recommends that Japan revise the milk yield used for the estimates, or provide more information that supports the validity of the current value, in the NIR of its next annual submission.

Agricultural soils – N₂O

77. To estimate direct N₂O emissions from soils and indirect N₂O emissions from animal manure applied to soils, Japan has assumed the rates of application of animal manure by crop type rather than estimated the nitrogen left in the manure after passing through AWMS. In response to a question raised by the ERT during the review, Japan explained that the approach used by it is more accurate than the default approach described in the IPCC good practice guidance, because the estimated amount of manure nitrogen available for field application is associated with a rather high uncertainty and the amount of manure fertilizer application per area by each type of crop is consistently based on more reliable historical data. Japan also explained that the nitrogen flow in the whole agriculture sector has been and still is continuously monitored by the Committee for Greenhouse Gas Emissions Estimation Methods. The ERT welcomes these efforts and recommends that Japan include the information provided during the review in its next annual submission, in order to clearly explain the reasons for and the implications of the country-specific approach. Furthermore, the ERT encourages Japan to provide an overview of the nitrogen flow in the whole agricultural sector and a comparison and discussion of the differences of the estimates obtained using the Party's approach and the default approach described in the IPCC good practice guidance in its next annual submission.

E. Land use, land-use change and forestry

1. Sector overview

78. In 2010, net removals from the LULUCF sector amounted to 73,179.09 Gg CO₂ eq. Since 1990, net removals have increased by 4.4 per cent. Within the sector, net removals occurred from forest land and grassland (76,674.57 Gg CO₂ eq and 215.86 Gg CO₂ eq, respectively), while net emissions occurred from settlements, cropland, other land and wetlands (2,518.29 Gg CO₂ eq, 458.59 Gg CO₂ eq, 383.22 Gg CO₂ eq and 82.13 Gg CO₂

¹⁰ Saito M. 1988. Methane emissions in fattening pigs and pregnant sows. *Japanese Journal of Zootechnical Science*. 59(9): pp.778–783.

eq, respectively). The remaining 270.12 Gg CO₂ eq were reported under other and refer to CO₂ emissions from agricultural lime application to cropland and grassland.

79. Net removals from the LULUCF sector increased by 4.4 per cent between 1990 and 2010 and by 1.8 per cent between 2009 and 2010. The ERT noted that Japan has reported these percentages as 4.0 and 1.5, respectively, on page 7-1 of its NIR, and therefore recommends that Japan improve the consistency of the information reported between the NIR and the CRF tables in its next annual submission. Net removals increased nearly continuously from 1990 to 2003, from 70,075.44 Gg CO₂ eq to 98,165.38 Gg CO₂ eq, but decreased continuously between 2003 and 2009, down to 71,856.36 Gg CO₂ eq. Japan explains that this declining trend in removals in the period 2003–2009 is due largely to the maturity of Japanese forests. A small reversal in this decreasing trend in net removals occurred between 2009 and 2010 (removals increasing from 71,856.36 Gg CO₂ eq in 2009 to 73,179.09 Gg CO₂ eq in 2010), owing to a reduction in emissions from land converted to cropland and land converted to settlements. The ERT reiterates the recommendation made in the previous review report that Japan provide more information on the changes in the trend in net removals and the relevant drivers, including, if applicable, a description of the policies that can better explain the trend, in its next annual submission, in order to improve transparency.

80. Japan has made recalculations for the LULUCF sector between its 2011 and 2012 annual submissions. The recalculations were due mainly to: revised AD (improved data and error correction); the inclusion of previously non-estimated pools (particularly the soils pool); updated and corrected EFs, particularly for annual CO₂ removals from land converted to forest land and biomass burning; and the reallocation of land in the settlements category. The impact of these recalculations on the estimated net removals for 1990 and 2009 was an increase by 0.7 per cent and 0.5 per cent, respectively. The main recalculations took place in the categories settlements remaining settlements and land converted to settlements, owing to revisions to the carbon stock changes in living biomass and litter, and estimates for carbon stock changes in soils have replaced the notation key “NE” reported in previous annual submissions. For 2009, the impact of the recalculations was:

(a) For settlements remaining settlements, an increase in the estimated net removals by 292.90 Gg CO₂ eq (38.3 per cent). Japan recalculated the AD and net CO₂ emissions for the country-specific subcategory “urban green areas subject to revegetation”;

(b) For land converted to settlements, a decrease in the estimated net emissions by 46.58 Gg CO₂ eq (2.9 per cent).

81. The ERT noted that Japan has implemented the recommendation made in the previous review report that it include in the NIR a quantification of the impact of the recalculations at the level of aggregation where the recalculations were made, especially for 1990 and for the latest reported year, to increase the transparency of the reporting.

82. The ERT encourages the Party to include in an annex to the NIR a detailed explanation of the methods used to determine the land use and land-use change matrix and also encourages the Party to revise the title of NIR table 7-3 (from method of determining land-use category to criteria for land-use category allocation; and from method of determining area to sources of data and information to determine area) to improve transparency in its next annual submission.

83. Japan has provided inventory data for all years from 1990 to 2010 and submitted all of the required CRF tables. However, some mandatory subcategories were not reported and were reported as “NE” in the CRF tables. These missing estimates include: carbon stock change in soils (mineral and organic) for cropland remaining cropland; carbon stock change in organic soils for land converted to cropland (forest land, grassland, wetlands and other land); for grassland remaining grassland, carbon stock changes for all pools for wild land (a

country-specific sub-division), and for the soil pool for grazed meadow and pasture land (country-specific sub-division); carbon stock change in organic soils for forest land, cropland and wetlands converted to grassland; carbon stock change in soils for other land converted to grassland; changes in carbon stock in soil for all land categories converted to wetlands and for forest land, cropland and grassland converted to other land; and non-CO₂ emissions from biomass burning on cropland (controlled burning), grassland (controlled burning and wildfires) and land converted to wetlands (wildfires). The ERT reiterates the recommendation made in the previous review report that Japan calculate the missing mandatory estimates and report them in its next annual submission, in order to improve completeness.

84. The ERT welcomed the improvement in transparency due to the inclusion of table A5-4 in annex 5 to the NIR, which lists the categories reported as “NE” and the plans to improve the completeness of reporting in future annual submissions. The ERT commends Japan for its efforts to provide, in its 2012 annual submission, estimates for carbon stock changes in soils that were previously reported as “NE”, in particular for forest land, cropland and grassland converted to settlements, and urban green areas subject to revegetation in settlements remaining settlements. The ERT also commends the Party for providing estimates for non-mandatory pools, including net carbon stock changes in dead organic matter for cropland and grassland, and carbon stock changes in dead organic matter and soils for settlements remaining settlements.

85. Japan has assessed and reported the uncertainties associated with the LULUCF sector, including by individual categories. The combined uncertainty for the sector is 12 per cent and the combined uncertainty as a percentage of the total national emissions is 0.7 per cent. The uncertainties reported are based on measured data, expert judgement and default values from the IPCC good practice guidance for LULUCF. Forest land is the category for which the Party provides more disaggregated uncertainty estimates, including for area, country-specific volume of timber per area, biomass expansion factors and wood density parameters. Japan has reported uncertainty estimates for the dead organic matter and soil pools that resulted from the CENTURY-jfos model (an adaptation of the CENTURY model¹¹ to customize the model to the Japanese conditions, including tree species, soil type under specific tree stands and climate).

86. The Party has indicated in the NIR that uncertainty estimates for individual parameters for forest land, land converted to grassland and to wetlands, settlements and other land will be reported in future annual submissions, but the Party has not indicated this planned improvement for cropland. The ERT commends the Party for its plan to present uncertainties in a more disaggregated way, which will improve the transparency of the reporting, and encourages Japan to do the same for cropland. To improve transparency, the ERT encourages Japan to report the expected timing for the implementation of these improvements, in its next annual submission.

2. Key categories

Forest land remaining forest land – CO₂

87. In 2010, the net CO₂ removals in this subcategory accounted for 99.6 per cent of the total net CO₂ removals from forest land. The net CO₂ removals have decreased by 0.5 per cent compared with in 1990 and have increased by 4.1 per cent relative to that reported in the 2011 annual submission. The ERT recommends that Japan include explanations for changes in the removals trend, particularly for those that occur from one year to the next, in its next annual submission.

¹¹ Available at <<http://www.nrel.colostate.edu/projects/century/>>.

88. Japan has disaggregated forest land remaining forest land into four subcategories: intensively managed forests, semi-natural forests (with a share of more than 50 per cent of the total forest land area), forests with less standing trees and bamboo. In the CRF tables, changes in carbon stock in all pools are reported as “NA” for bamboo. For forests with less standing trees, the Party has reported only losses (which in fact represents the net gains and losses) in carbon stock in biomass and has reported carbon stock changes in the dead organic matter and soil pools as “NA”. However, Japan does not provide in the NIR any information to justify the use of this notation key. The ERT recommends that Japan provide, in its next annual submission, an explanation for reporting carbon stock pools in bamboo forest as “NA”, as well the reasons for using “NA” to report the dead organic matter and soil pools in forests with less standing trees.

89. For the dead organic matter and soil pools, Japan applied the CENTURY-jfos model for its estimations (see para. 85 above). The Party included in the NIR information on its adaptation of the model. The model provides aggregated estimates of changes in carbon stock for mineral and organic soils. The ERT recommends that Japan report estimates for carbon stock changes in mineral and organic soils separately, for example by improving the CENTURY-jfos model, in its next annual submission.

90. Japan has reported uncertainty estimates for several country-specific parameters, including area, biomass expansion factors and wood density, that were already reported in the 2011 annual submission. However, in the 2012 annual submission, Japan has also included uncertainty estimates for the volume of timber per area as well as for the dead organic matter and soil pools. In previous review reports Japan was encouraged to review the uncertainty values because they seemed low. The Party has revised the uncertainty analysis and a higher value has been reported: the combined uncertainty estimate for the forest land remaining forest land subcategory increased from 5 per cent in 2009 to 11 per cent in 2010. The ERT commends the Party for the improvements introduced.

Land converted to forest land – CO₂

91. In 2010, land converted to forest land represented a minor component of the forest land category (0.4 per cent), accounting for net CO₂ removals of 304.80 Gg CO₂. The estimated net removals have decreased by 10.7 per cent relative to 2009 and by 83.3 per cent since 1990, but the Party has not provided reasons for the steady decrease in net removals from land converted to forest land since 1990. The ERT recommends that Japan explain the drivers for this decreasing trend in removals in the NIR of its next annual submission.

92. The forest area data in the National Forest Resources Database does not differentiate between forest land remaining forest land and land converted to forest land. According to page 7-19 in the NIR, the latter includes afforestation/reforestation, forest land restored from degraded land by natural succession and non-forest land converted to forest land for other reasons. However, according to the same page, Japan has used the area of afforestation/reforestation and forested cropland from the Statistics on Cultivated Land and Planted Area as a proxy for the area of land converted to forest land. The ERT noted that using this proxy may lead to an underestimation of the actual area of land converted to forest land, owing to the omission of forest land restored from degraded land by natural succession if this conversion is considered anthropogenic. The ERT encourages the Party to explore other sources of data and information so as to ensure the provision of a more accurate estimate of the annual area converted to forest land in future submissions.

93. Japan has reported the areas of wetlands and settlements converted to forest land as “IE”. In the NIR the Party explains that these areas are reported together with the area under other land converted to forest land, owing to the lack of statistics. The ERT

recommends that the Party report disaggregated data in its next annual submission, in order to improve the transparency and accuracy of the reporting.

94. For carbon stock changes in living biomass, Japan has recalculated the estimates, but the ERT considered that the transparency of the explanations on page 7-21 of the NIR could be improved. The ERT therefore recommends that Japan improve the transparency of this information in its next annual submission. In addition, the ERT noted that Japan has reported carbon stock changes in living biomass for the conversions of wetlands and settlements to forest land as “NO” on page 7-21 of the NIR. However, Japan has reported these changes as “IE” and “NA” in CRF table 5.A. The ERT recommends that Japan improve the consistency of its reporting in its next annual submission.

Land converted to cropland – CO₂

95. 98.0 per cent of the area converted to cropland in 2010 was forest land or other land. Japan has used a tier 2 method to estimate the losses in carbon stock for forest land converted to cropland and a tier 1 method for the remaining subcategories. For forest land converted to cropland, the losses are estimated for all carbon pools (including dead organic matter), except for organic soils (owing to a lack of data). Carbon stock changes for other land converted to cropland are reported as “NA” for living biomass and as “NE” for dead organic matter and soils. For the living biomass pool, Japan has followed the tier 1 method from the IPCC good practice guidance for LULUCF and assumed that the biomass present in the land prior to and after the conversion is zero. The Party has not estimated the changes in carbon stock in soils for other land converted to cropland and therefore reports them as “NE”. For other land converted to cropland, the ERT recommends that Japan provide an estimate of the changes in carbon stock in soils, for mineral and organic soils separately, and provide a better justification for the assumption of zero gains and losses in its next annual submission.

96. The methodologies used to estimate carbon stock changes for land converted to cropland are in line with the IPCC good practice guidance for LULUCF. Most of the parameters were obtained from the IPCC good practice guidance for LULUCF (in the case of biomass in grassland) and some others are country-specific, including the biomass stock in forest land before the conversion and the carbon stock changes in soils, obtained with the use of the CENTURY-jfos model. However, the ERT recommends that, in its next annual submission, Japan improve the transparency of the information on:

- (a) Land-use classification and representation;
- (b) The different sources of information used for the estimations. The NIR reports as data sources: the Forestry Status Survey (before 2004), the National Forest Resources Database (after 2005), the Statistics on Cultivated Land and Planted Area, the World Census of Agriculture and Forestry, the Land Use Status Survey, the Survey of Forestry Regions, areas of deforestation obtained using orthophotos and satellite images, and the Forestry Agency’s records for the conversion ratios of private forest to other land-use categories;
- (c) The appropriateness of the use of the ratio for conversion of private forest land to other land uses that has been applied to forest land converted to cropland.

97. The ERT noted that the implied loss of carbon stock in living biomass and the dead organic matter pool more than doubled between 2009 and 2010 (from $-0.65 \text{ Mg C ha}^{-1}$ to $-1.46 \text{ Mg C ha}^{-1}$; and from $-0.21 \text{ Mg C ha}^{-1}$ to $-0.47 \text{ Mg C ha}^{-1}$, respectively). From 2009 to 2010, the area of land converted to cropland decreased by 11.2 per cent. The ERT recommends that the Party provide an explanation for the reversal of the decreasing trend in emissions from land converted to cropland in its next annual submission.

Land converted to settlements – CO₂

98. Of the total area converted to settlements in 2010, 56.0 per cent was from forest land and 37.3 per cent from cropland. The area of forest land converted to settlements decreased by 65.2 per cent from 1990 to 2010, whereas that of cropland converted to settlements decreased by 56.4 per cent over the same period. To improve transparency, the ERT recommends that the Party provide explanations for the large changes in area and/or net emissions from one year to another in its next annual submission.

99. The methodologies used for this category are appropriate and in line with the IPCC good practice guidance for LULUCF. The ERT commends the Party for providing estimates of carbon stock changes in dead organic matter using country-specific data. The ERT also commends the Party for providing in its 2012 annual submission improved estimates of carbon stock changes in soils for this category, following a recommendation made in the previous review report. The methodology applied is country-specific, since no default methodology is provided in the IPCC good practice guidance for LULUCF.

3. Non-key categoriesCropland remaining cropland – CO₂

100. Japan has reported the changes in carbon stock in the living biomass and dead organic matter pools as “NA” and for soils as “NE”. In response to a question raised by the ERT during the review, the Party explained that it has reported the cases where the carbon stock changes are estimated using the IPCC default assumption of zero change as “NA”. The ERT encourages the Party to include in the documentation box of the appropriate CRF tables an explanation stating that the zero value could not be included in the tables owing to a limitation of CRF Reporter. Regarding the soil carbon pool, the Party explained that it is in the process of analysing the appropriate data and EFs for mineral and organic soils, with a view to reporting the changes in carbon stock in this pool in its next annual submission. The ERT commends the Party for its initiative to improve the completeness of its inventory.

Grassland remaining grassland – CO₂

101. For the subcategories grazed meadow and pasture land under grassland remaining grassland, the living biomass and dead organic matter pools were assumed to be in a steady state, hence the changes in carbon stock were assumed to be zero. However, the Party has reported the carbon stock changes in these pools as “NA”, owing to a limitation of CRF Reporter (see para. 100 above). The ERT encourages the Party to explain in the documentation box of the appropriate CRF tables that the reported value is zero. The changes in carbon stock in the soil pool were reported as “NE”. The Party clarified that it is investigating appropriate AD and EFs to be used for mineral and organic soils and will provide estimates in its next annual submission. The ERT commends the Party for these planned improvements in completeness and accuracy. The ERT noted that Japan has reported all carbon stock changes for wild land under grassland remaining grassland as “NE”. The ERT encourages Japan to report estimates for these carbon stock changes in its next annual submission.

Land converted to grassland – CO₂

102. Japan has reported the changes in carbon stock in the dead organic matter pool as “NA” (except for forest land converted to grassland, for which estimates are reported, and for other land converted to grassland, reported as “NE”), assuming that these changes are zero. For biomass, the Party has reported estimates for gains and losses in carbon stock only for land conversion from forest land, assuming that the losses are zero for the other

land-use categories (reported as “NA” in CRF table 5.C). Carbon stock changes in the soil pool are estimated for all land converted to grassland, except other land (reported as “NE”) and settlements (reported as “IE”). The carbon stock changes in mineral and organic soils are estimated together and reported under mineral soils, since Japan is presently assessing the appropriate AD and EFs to report these estimates separately in its next annual submission. The ERT commends the Party for its efforts to improve the completeness and accuracy of its inventory.

103. The Party has reported all carbon stock changes for settlements converted to grassland as “IE” in CRF table 5.C and indicated that the changes are included under other land remaining other land. The ERT considered that this allocation decreases the transparency of the inventory and therefore recommends that Japan report these categories separately in its next annual submission.

Settlements remaining settlements – CO₂

104. In its 2012 annual submission, Japan has corrected an error in the land area of “urban green areas subject to revegetation”. For example, the area reported for 2009 changed from 0.07 kha to 68.52 kha. Japan has also reported carbon stock changes in the soil pool, previously reported as “NE”.

Other land remaining other land – CO₂

105. Japan has estimated the area of other land remaining other land by subtracting the total area for all other land-use categories from the national territorial area. This is in line with the IPCC good practice guidance for LULUCF. Japan has reported that this subcategory also includes abandoned cultivated areas. However, Japan has reported that it is investigating the appropriateness of this allocation and will report accordingly in future annual submissions. The ERT noted that changes in carbon stock for other land remaining other land are not generally reported, owing to the lack of default methodologies and default EFs, and that it is unlikely that the allocation of abandoned cultivated areas under other land remaining other land is correct, since changes in carbon stock in living biomass and soils may still occur after abandonment. The ERT commends the Party for its initiative to investigate the land uses presently allocated under other land and recommends that the Party report on this issue in its next annual submission. The ERT also recommends that the Party report abandoned cultivated areas as a special subcategory under cropland remaining cropland, in order to increase the transparency and accuracy of the reporting, while avoiding double counting.

Direct N₂O emissions from nitrogen fertilization – N₂O

106. Japan has reported that fertilization in forests is extremely rare and that it has assumed that the fertilizer applied to forests is included in the amount of fertilizer reported under the agriculture sector (Japan has reported the relevant AD and N₂O emissions as “IE” in CRF table 5(I)). To improve comparability, the ERT encourages Japan to report estimates for direct N₂O emissions from forest land in CRF table 5(I) in its next annual submission, following the guidance included in section 3.2.1.4.1.3 of the IPCC good practice guidance for LULUCF. If reporting estimates is not possible, the ERT recommends that Japan explicitly indicate in its next annual submission that these N₂O emissions are reported in the agriculture sector in the documentation box of that CRF table and explain, in the NIR, why the IPCC guidance could not be followed.

Non-CO₂ emissions from drainage of soils and wetlands – CH₄ and N₂O

107. Japan has reported in section 7.11 of the NIR that, according to experts, soil drainage of forest and wetland soils is very rare in Japan and the resulting N₂O emissions

extremely low. Japan has reported the area drained and the resulting CH₄ and N₂O emissions as “NO” in CRF table 5(II). The ERT noted that Japan has reported that this practice does occur, although very rarely, and that the associated CH₄ and N₂O emissions are not estimated. Therefore, the ERT recommends that Japan report these AD and emissions as “NE” or report corresponding estimates in its next annual submission.

N₂O emissions from disturbance associated with land-use conversion to cropland – N₂O

108. Japan has applied the method included in the IPCC good practice guidance for LULUCF and used a country-specific carbon to nitrogen ratio in the soil organic matter (11.3), which is within the range of values included in the IPCC good practice guidance for LULUCF. To improve transparency, the ERT recommends that the Party, when reproducing equations in the NIR, also reproduce the definition of the parameters and variables as presented in the IPCC good practice guidance for LULUCF.

CO₂ emissions from agricultural lime application – CO₂

109. Japan has estimated CO₂ emissions from lime application using the method and default EFs for calcic limestone and dolomite included in the IPCC good practice guidance for LULUCF. Japan has reported all CO₂ emissions from lime application for all land-use categories together (under other) in CRF table 5(IV), distinguishing between emissions from dolomite and limestone but not between emissions from cropland and grassland. The ERT encourages the Party to report any planned improvements to report these emissions separately in the NIR of its next annual submission. In addition, the ERT recommends that Japan improve the transparency of the information on recalculations for this category in its next annual submission.

Biomass burning – CO₂, CH₄ and N₂O

110. For forest land, Japan has reported estimates of CO₂, CH₄ and N₂O emissions from wildfires aggregated under forest land remaining forest land in CRF table 5(V). The ERT encourages the Party to report these emissions separately in its next annual submission. The Party has reported that controlled burning is quite rarely implemented on forest land and land converted to forest land and reports it using the notation key “NO” in CRF table 5(V). Even if controlled burning on forest land rarely occurs, the ERT recommends that Japan report the associated emissions as “NE” for the years that they occur in its next annual submission. The ERT noted that Japan has reported the AD and emissions for all other land-use categories as “NE” or “NO”, and that Japan has reported as “NO” categories where emissions are negligible, for example emissions from wildfires on cropland. The ERT recommends that Japan report emission estimates for all categories under cropland and grassland and for land converted to wetlands where biomass burning occurs and which are now reported as “NE” or “NO”. If emissions occur but are not estimated, the ERT recommends that Japan report them as “NE” in its next annual submission.

F. Waste

1. Sector overview

111. In 2010, emissions from the waste sector amounted to 20,873.76 Gg CO₂ eq, or 1.7 per cent of total GHG emissions. Since 1990, emissions have decreased by 19.1 per cent. The key drivers for the fall in emissions are the reduction in the amount of organic waste disposal in landfills, improved waste incineration technology and increased compost production. Within the sector, 68.8 per cent of the emissions were from waste incineration, followed by 15.7 per cent from solid waste disposal on land and 11.5 per cent from wastewater handling. The remaining 4.1 per cent of emissions were from other (waste),

which includes emissions from the decomposition of petroleum-derived surfactants from cleaning products discharged into wastewater treatment facilities and from the composting of organic waste.

112. Japan has made recalculations for the waste sector between its 2011 and 2012 annual submissions following changes in AD for solid waste disposal on land, waste incineration, other (waste) and wastewater handling. The impact of these recalculations on the waste sector is a decrease in the estimated emissions of 5.6 per cent for 2009 and an increase of 0.9 per cent for 1990. The main recalculations took place in the following categories:

(a) Managed waste disposal on land: the estimated emissions increased by 211.87 Gg CO₂ eq (6.5 per cent) for 2009;

(b) Waste incineration: the estimated emissions decreased by 1,689.07 Gg CO₂ eq (10.8 per cent) for 2009;

(c) Compost production under other (waste): the estimated emissions increased by 176.42 Gg CO₂ eq (378.2 per cent) for 2009. The recalculations were due to the revision of the amount of animal, plant and food waste composted and of the ratio of waste disposed of in high-speed composting facilities.

113. The ERT considered that the inventory for the waste sector is complete in terms of gases, years and mandatory IPCC categories and generally transparent. However, the ERT noted that some information in the CRF tables continues to be inconsistent with the information provided in the NIR for wastewater handling (see para. 117 below). Therefore, the ERT recommends that Japan improve its QA/QC procedures in order to avoid discrepancies between the information in the NIR and in the CRF tables in its next annual submission. Country-specific methods and EFs are applied in the calculation of most estimates for the sector. The QA/QC plan, including general (tier 1) and category-specific (tier 2) QC procedures, is described in annex 6 to the NIR. Uncertainty estimates are provided for all categories and gases and are well documented in annex 7 to the NIR.

114. The ERT noted that the Party plans to make the following improvements, which are based on long-term efforts in scientific research, in future annual submissions: (a) determining the value of the methane correction factor, taking into account the conditions of the management of landfill sites; (b) determining the gas conversion rate for each type of biodegradable waste; (c) determining the country-specific half-life of sludge at final disposal sites; (d) improving the EFs for emissions from industrial wastewater treatment, for which currently the EFs for sewage treatment plants are used; and (e) determining the amount of CH₄ recovery from industrial wastewater treatment. The ERT commends Japan for its plans to improve the inventory for the waste sector and encourages the Party to include information on the time frames for the implementation of the above-mentioned improvements in its next annual submission.

2. Key categories

Solid waste disposal on land – CH₄

115. Japan used the revised first order decay method from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* with country-specific parameters to estimate CH₄ emissions from solid waste disposal on land. Emissions amounted in 2010 to 3,270.04 Gg CO₂ eq, continuing the decreasing trend since 1990 (when emissions amounted to 7,645.06 Gg CO₂ eq). This trend is the result of the decrease in the amount of biodegradable waste landfilled, as more and more waste is incinerated to reduce waste volume in Japan. The ERT considered that the transparency of the information on how the Party has estimated the historical data back to 1954 still lacks transparency, and therefore

reiterates the encouragement made in the previous review report for Japan to improve the transparency of this information in its next annual submission.

Waste incineration – CO₂

116. The emissions from the incineration of plastic and synthetic textiles from municipal solid waste, industrial solid waste and special control waste are included in this category. Japan used country-specific EFs based on the carbon content and efficiency of the combustion. CO₂ emissions from waste incineration amounted to 12,657.57 Gg CO₂ eq in 2010. The ERT reiterates the encouragement made in the previous review report for Japan to conduct the planned research into the estimation of CO₂ emissions from waste paper, leather and rubber containing fossil fuel derived carbon and to report thereon in its next annual submission. The ERT noted the substantial recalculations made for this category (for 2009, CO₂ emissions decreased by 12.4 per cent) but the information on this recalculation is very limited. To improve transparency, the ERT recommends that the Party explain this recalculation in the next annual submission.

3. Non-key categories

Wastewater handling – CH₄

117. CH₄ emissions from wastewater handling in 2010 amounted to 1,269.65 Gg CO₂ eq and were estimated applying a country-specific method (multiplying biological oxygen demand-based AD and country-specific EFs). Japan has estimated together the emissions from wastewater and from sludge. To improve transparency, the ERT recommends that Japan report these emissions separately in its next annual submission. Japan has elaborated country-specific EFs by process type and plant scale in a complete manner.

118. According to section 8.3.2.5 of the NIR, CH₄ recovery does occur in domestic and commercial wastewater plants in the country and Japan has estimated the associated emissions. However, as indicated in the previous review report, Japan has reported emissions from CH₄ recovery for industrial, domestic and commercial wastewater as “NE” in CRF table 6.B. The ERT recommends that Japan report these emissions in CRF table 6.B and make the information in the NIR and the CRF tables consistent in its next annual submission.

Other (waste) – CO₂, CH₄ and N₂O

119. In 2010, emissions from other (waste) amounted to 846.84 Gg CO₂ eq. Japan has estimated and reported CO₂ emissions from the decomposition of petroleum-derived surfactants and CH₄ and N₂O emissions from the composting of organic waste. The ERT appreciates Japan’s efforts and encourages the Party to continue its efforts to estimate the emissions from other sources. However, the documentation box of CRF table 6 has not been used to provide information regarding activities covered in the category other (waste) or a reference to the relevant section of the NIR. To improve transparency, the ERT recommends that Japan include this information in the documentation box of CRF table 6 in its next annual submission.

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

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

Overview

120. Japan has reported emissions and removals from all mandatory and elected activities (forest management and revegetation) under Article 3, paragraphs 3 and 4, of the Kyoto Protocol (KP-LULUCF activities). All estimates were provided in the appropriate KP-LULUCF CRF tables for the years 2008, 2009 and 2010 (and also for 1990, for revegetation). The reporting has been prepared in line with the IPCC good practice guidance for LULUCF. Japan has provided all of the supplementary information in accordance with decision 15/CMP.1, annex, paragraphs 5–9.

121. Japan has made recalculations for the KP-LULUCF activities between its 2011 and 2012 annual submissions in order to improve the completeness and accuracy of the estimates, especially for revegetation. Japan has explained these recalculations in section 11.4.1.4 of the NIR. The impact of these recalculations on each KP-LULUCF activity for 2009 is:

(a) For afforestation and reforestation, a decrease in the estimated net removals by 0.05 Gg CO₂ eq (0.01 per cent);

(b) For deforestation, an increase in the estimated net emissions by 28.58 Gg CO₂ eq (0.9 per cent);

(c) For forest management, a decrease in the estimated net removals by 0.19 Gg CO₂ eq (0.0004 per cent);

(d) For revegetation, an increase in the estimated net removals by 357.50 Gg CO₂ eq (47.4 per cent), owing to the estimation for the first time of carbon stock changes in soils, improvements in the accuracy of the estimates for living biomass and litter and the reclassification of some units of land.

122. In 2010, the area afforested and reforested amounted to 28.75 kha, contributing to net removals of 426.11 Gg CO₂ eq. This value is consistent with the area of land converted to forest land in 2010 and the corresponding net removals reported under the Convention. In 2010, deforestation was a net source of emissions (4,822.89 Gg CO₂ eq), with an area of 13.29 kha deforested in 2010. Forest management and revegetation contributed to net removals of 53,251.78 Gg CO₂ eq and 1,130.14 Gg CO₂ eq, respectively, in 2010.

123. All forests under the forest planning system in Japan are in line with the forest definition selected by the Party. The information (area, tree age, tree species and volume) surveyed at each of the 47 prefectures in the country is compiled in Forest Registers, which constitute the basic source of data for the reporting under the Convention and the Kyoto Protocol. These data and other information (such as satellite imagery and orthophotos) are included in the National Forest Resources Database, developed by the Forestry Agency for estimating the emissions and removals from forests to be reported.

124. The key category analysis for KP-LULUCF activities was carried out following the IPCC good practice guidance for LULUCF. All KP-LULUCF activities were identified as key categories.

125. Japan has clearly described in the NIR the land area related information for all KP-LULUCF activities and the process to detect land uses and land-use changes. For afforestation, reforestation and deforestation activities, Japan has detected the changes using remote sensing techniques, and for forest management the land-related information is

based on a field survey at sample plots, which are selected randomly from the National Forest Resource Database. The area for revegetation is estimated using several sources of information, including the Urban Parks Status Survey and the Road Tree Planting Status Survey.

126. Japan has reported uncertainty estimates for afforestation and reforestation, deforestation, forest management and revegetation. Compared with the previous annual submission, uncertainty estimates for emissions and removals for all of the activities under Article 3, paragraph 3, of the Kyoto Protocol, have increased: from 6 per cent to 36 per cent for afforestation and reforestation and from 3 per cent to 26 per cent for deforestation. For the elected activities under Article 3, paragraph 4, of the Kyoto Protocol, the uncertainty estimates have decreased: from 27 per cent to 11 per cent for forest management and from 70 per cent to 17 per cent for revegetation. Although the Party explained the recalculation of these uncertainties, the uncertainties values are presented only as combined estimates for AD and EFs. To improve the transparency of the uncertainty estimates, the ERT recommends that Japan report, where possible, disaggregated uncertainty estimates for AD and EFs in its next annual submission.

127. Japan has reported direct N₂O emissions from nitrogen fertilization for afforestation and reforestation (units of land not harvested since the beginning of the commitment period) and for forest management as “IE” in CRF table 5(KP-II)1, since these emissions are reported under the agriculture sector. The Party acknowledged that fertilization in urban parks occurs in the country. The ERT encourages Japan to provide an estimate of the N₂O emissions from nitrogen fertilization for afforestation, reforestation and forest management in its next annual submission, for example by assuming that the ratio of fertilizer used in a land-use category to the total amount of fertilizer used in the country is the same as the ratio of the area of that land-use category and the total area of the country in which fertilizers are used.

128. Japan has reported CO₂ emissions from lime application for deforestation and revegetation, separately for limestone and dolomite application. The amounts of calcic limestone and dolomite applied in urban parks and green areas on roads are estimated from surveys. The Party has also reported N₂O emissions from disturbance associated with land-use conversion to cropland. The ERT considered that the approaches used are adequate.

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

Afforestation and reforestation – CO₂

129. Afforestation and reforestation activities and the associated net emissions are reported in line with the requirements of the annex to decision 15/CMP.1. The emissions and removals have been estimated in accordance with the IPCC good practice guidance for LULUCF and are consistent with the area and emissions reported for land converted to forest land under the Convention.

130. The previous ERT recommended that Japan improve and complete the information on how the afforestation and reforestation activities detected using satellite imagery could be considered directly human-induced. The Party has provided additional information in its 2012 annual submission, explaining that this is inferred from the imagery through signs of human activity, such as uniform tree species and uniform tree height, artificial forestation blocks or work roads for forestation. The ERT considered the explanation satisfactory and commends the Party for implementing the recommendation.

Deforestation – CO₂

131. At present, Japan is not able to estimate separately the deforestation occurring only in areas under forest management in managed forests (some areas of managed forest do not meet the Party's definition of forest management). The deforested areas in forests under forest management are reported in KP-LULUCF CRF table NIR-2 as "IE". The area estimates are provided in KP-LULUCF CRF table NIR-2 under the subcategory other. The ERT encourages the Party to provide an estimate of the area deforested in forest areas under forest management by multiplying the estimated area of forest under forest management by the deforestation ratio (total area deforested to total area of managed forest), and report the remaining deforestation under other, in its next annual submission.

132. In 2010, 13.29 kha were deforested, an increase of 59.4 per cent compared with in 2009. The estimated net emissions from deforestation increased by 54.8 per cent between 2009 and 2010. The ERT noted that the total area reported for deforestation under the Kyoto Protocol is close to that reported under the Convention for forest land converted to other land uses for 2010 (13.29 kha and 13.25 kha (calculated from values in NIR table 7-2), respectively). However, the ERT noted that the estimated net CO₂ emissions from deforestation reported under the Kyoto Protocol (4,818.27 Gg CO₂) and under the Convention (4,377.94 Gg CO₂) differ by 10.0 per cent for 2010, and recommends that the Party explain the difference in the emission estimates, despite the similarity of the areas reported, in its next annual submission.

133. The ERT commends the Party for reporting gains and losses in carbon stock in the below-ground biomass pool separately. The previous ERT recommended that the Party use the notation key "IE" instead of "NO", but in its 2012 annual submission the Party has provided separate estimates for the losses and gains in carbon stock.

134. The previous ERT recommended that Japan improve and complete the information on how the Party identifies deforestation from remotely-sensed images and distinguishes deforestation from harvesting. Japan has reported, in section 11.5.2 of its NIR, that deforestation is only recognized when land is excluded from the forest plan, which occurs when forest land is converted to other land uses. Using satellite imagery, this corresponds to identifying the conversion of forest areas to non-forest. The Party noted that the agreement between the areas classified as deforestation from images and the areas calculated from annual observation in the field surveys is 70 per cent. The ERT commends the Party for the additional clarification provided and recommends that the Party provide information on the possible over or underestimation of the rate of deforestation based on the use of satellite imagery in its next annual submission.

Activities under Article 3, paragraph 4, of the Kyoto Protocol*Forest management – CO₂*

135. The estimated area under forest management increased by 795.72 kha between 2009 and 2010, resulting in a total estimated area of 15,110.57 kha. Since the field surveys carried out at each prefecture cover the entire area of managed forests (including areas that meet the forest management definition and areas that do not), new areas under forest management are identified every year owing to the introduction of practices and activities in areas that did not previously meet the forest management definition. This explains the annual increases in the area under forest management, which are stimulated by the narrow approach (as described in the IPCC good practice guidance for LULUCF) adopted by the Party and incentives provided to the land owners.

136. Japan has provided detailed information on how it identifies land under forest management. For forest management, the Party distinguishes between activities carried out

in “Ikusei-rin” forests, consisting of regeneration (land preparation, soil scarification and planting), tending, thinning and harvesting since 1990, and in “Tennensei-rin” forests, consisting of practices for the protection or conservation of forests, including controlling logging activities and land-use changes mandated by law. The ERT noted that, for the latter, Japan does not make reference to practices or activities undertaken since 1990. Therefore, the ERT recommends that the Party include the appropriate references to the legislation that has motivated these practices or activities to take place in its next annual submission.

Revegetation – CO₂

137. The Party has provided very detailed information on how it defines and identifies areas subject to revegetation activities since 1990, which include urban parks, green areas on roads, at ports, around sewage treatment facilities, around government buildings, along rivers and erosion control sites and around public rental housing.

138. Japan has only reported net emissions from litter and soils for some revegetation subcategories (green areas at ports and in urban parks) and it has indicated that interim results from ongoing research indicate that these carbon pools are increasing and are thus not sources of emissions. The ERT encourages the Party to continue its research in order to improve knowledge on the behaviour of these carbon pools on all land under revegetation and recommends that the Party report them as “NE” instead of “NA” in CRF table 5(KP-I)B.4 in its next annual submission.

139. The Party has conducted recalculations for revegetation owing to: improved estimates of changes in carbon stock in soil for green areas at ports and in urban parks; more accurate data for living biomass and litter; and the reclassification of land. The recalculations resulted in an increase in the estimated net removals from revegetation by 48.2 per cent for 2008 and 47.4 per cent for 2009. The ERT recommends that the Party include in its next annual submission the disaggregated effect of each improvement introduced on the area and the emissions and removals, as applicable, in order to improve the transparency of the reporting.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

140. Japan has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings included in the SIAR on the SEF tables and the SEF comparison report.¹² The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterates the main findings contained in the SIAR. No recommendations are reported in the SIAR.

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

¹² The SEF comparison report is prepared by the ITL administrator and provides information on the outcome of the comparison of data contained in the Party’s SEF tables with corresponding records contained in the ITL.

discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

National registry

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

Calculation of the commitment period reserve

143. Japan has reported its commitment period reserve in its 2012 annual submission. Japan reported that its commitment period reserve has not changed since the initial report review (5,335,431,899 t CO₂ eq), as it is based on the assigned amount and not on the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

144. Japan reported that its national system has not changed since the previous annual submission. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

145. Japan reported minor changes in its national registry since the previous annual submission. The changes relate to the information publicly available on unit holdings and transactions to meet the requirement specified in decision 14/CMP.1 and the installation of security patches on the server. The ERT concluded that the Party's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP).

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

146. Japan did not provide information on changes in its reporting on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol in its 2012 annual submission. However, the ERT noted that Japan has slightly extended its introduction to the reporting on the minimization of adverse impacts and has removed the information on withdrawing support for the use of environmentally unsound and unsafe technologies since the previous annual submission. In addition, in response to a recommendation made in the previous review report, Japan has clarified where it gives priority to actions in implementing its commitments under Article 3, paragraph 14, of the Kyoto Protocol. In response to a question raised by the ERT during the review, Japan acknowledged these changes. The ERT concluded that, taking into account the confirmed changes, the information provided is complete and transparent. The ERT recommends that the Party, in the next annual submission, report any changes in the information provided under Article 3, paragraph 14, of the Kyoto Protocol in accordance with decision 15/CMP.1, annex, chapter I.H.

147. The ERT noted that Japan has given priority to the following actions:

(a) Technical assistance in the energy and environmental sectors, by cooperating in human resources development by accepting trainees and dispatching experts in the area of energy conservation and renewable energy in East Asia and the Middle East;

(b) Assistance to oil-producing countries in diversifying their economies, for example including the formulation of various projects as well as the provision of training opportunities;

(c) The development of carbon capture and storage technologies by implementing a large-scale demonstration project.

III. Conclusions and recommendations

A. Conclusions

148. Japan made its annual submission on 12 April 2012. The annual submission contains the GHG inventory (comprising CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol; Kyoto Protocol units; changes to the national system and the national registry; and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1.

149. The ERT concludes that the inventory submission of Japan has been prepared and reported generally in accordance with the UNFCCC reporting guidelines (see para. 26 above). The inventory submission is complete and Japan has submitted a complete set of CRF tables for the years 1990–2010 and an NIR; these are complete in terms of geographical coverage, years, gases and sectors, and generally complete in terms of categories (see paras. 9, 10, 41, 53 and 83 above). Under the industrial processes sector, actual emissions of HFCs, PFCs and SF₆ were reported as “NE” for the years 1990–1994, despite there being methodologies for calculating the missing emission estimates available in the IPCC good practice guidance. Under the LULUCF sector (see para. 83 above), there are, in spite of improvements made, still several mandatory source/sink categories reported as “NE”.

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

151. The Party’s inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, except for the issues, mainly a lack of transparency, mentioned in the sectoral chapters of this report.

152. Japan has made recalculations for the inventory between its 2011 and 2012 annual submissions in response to the recommendations made in the previous review report and in order to rectify identified errors. The impact of these recalculations on the national totals is a decrease in the estimated emissions of 0.15 per cent for 2009. The main recalculations took place in the following sectors:

(a) Energy: the revision of fuel consumption data in the energy statistics and of the EFs used for the estimation of CH₄ and N₂O emissions from road transportation;

(b) Industrial processes: the revision of the AD for limestone and dolomite use, soda ash production and refrigeration and air-conditioning equipment;

(c) Agriculture: new estimates of the proportion of separated and mixed treatment of manure by type of livestock and revised estimates of the percentage of manure management by type of animal;

(d) LULUCF: newly estimated carbon stock changes for settlements remaining settlements;

(e) Waste: the revision of the AD for incinerated municipal and industrial waste and industrial solid waste disposed of at semi-aerobic landfill sites.

153. Japan has reported emissions and removals from activities under Article 3, paragraph 3, of the Kyoto Protocol (afforestation, reforestation and deforestation) as well as emissions and removals from forest management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol. Japan has fulfilled the requirements of reporting as set out in decision 15/CMP.1, annex, paragraphs 5–9.

154. Japan has made recalculations for the KP-LULUCF activities between its 2011 and 2012 annual submissions in order to improve the completeness and accuracy of the estimates, especially for revegetation (see para. 121 above). The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) For afforestation and reforestation, a decrease in the estimated net removals by 0.05 Gg CO₂ eq (0.01 per cent);

(b) For deforestation, an increase in the estimated net emissions by 28.58 Gg CO₂ eq (0.9 per cent);

(c) For forest management, a decrease in the estimated net removals by 0.19 Gg CO₂ eq (0.0004 per cent);

(d) For revegetation, an increase in the estimated net removals by 357.50 Gg CO₂ eq (47.36 per cent), owing to the estimation for the first time of carbon stock changes in soils, improvements in the accuracy of the estimates for living biomass and litter and the reclassification of some units of land.

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

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

157. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the CMP.

158. Japan has extended the information under decision 15/CMP.1, annex, chapter I.H, “Minimization of adverse impacts in accordance with Article 3, paragraph 14”, as part of its 2012 annual submission. Taking into account the confirmed changes, the reported information is considered complete and transparent.

B. Recommendations

159. The ERT identifies issues for improvement as listed in table 6 below.

Table 6
Recommendations identified by the expert review team

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph reference</i>
Cross-cutting	Completeness	Report estimates of actual emissions of fluorinated gases (F-gases) for the period 1990–1994	9
	Transparency	Report estimates for all relevant species of F-gases in common reporting format (CRF) table 2(II), or, if notation keys are used, revise the use of not estimated (“NE”) and explain the reporting in the documentation box of CRF table 2(II) and in the national inventory report (NIR)	10
	Completeness	Report estimates for carbon stock changes for all mandatory categories	10
	Consistency	Improve the quality control procedures so as to avoid inconsistencies between the information in the NIR and in the CRF tables	24
	Transparency	Describe the planned improvements more specifically	25
		Review the use of the notation keys	26
Energy	Overview	Improve the transparency of the information on the drivers of emission trends in the energy sector	33
		Include a more detailed numerical breakdown of the recalculations at each category level	35
		Ensure that references to sources of information are complete	36
		Report transparently any changes to the country-specific emission factors (EFs) used in the estimation of carbon dioxide (CO ₂) emissions	37
	Reference approach	Improve the information on the reasons for the difference in the estimated CO ₂ emissions between the reference and the sectoral approaches in the documentation box of CRF table 1.A(c) and in the NIR	38
		Address the inconsistency in the information on coal production between CRF table 1.A(b), CRF table 1 and the NIR	39
	International bunker fuels	Report the emissions from the oxidation of fuels used as lubricants in international aviation	41
		Include additional information on how the CO ₂ EF for jet kerosene is estimated	42
	Feedstocks and non-energy use of fuels	Complete the columns “Associated CO ₂ emissions” and “Allocated under” of the additional information table of CRF table 1.A(d)	43

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph reference</i>
		Report CO ₂ emissions from the use of solid fuels in the category non-ferrous metals under the industrial processes sector and not under energy sector	44
		Explain in the NIR which EFs were used to estimate CO ₂ emissions from the use of lubricants and paraffin waxes and the allocation of these emissions under the energy and waste sectors	45
	Civil aviation: jet kerosene – CO ₂	Improve the transparency of the information on the CO ₂ EF for jet kerosene	46
	Road transportation: diesel oil – CO ₂	Include additional information on how the CO ₂ EF for diesel oil is estimated	47
	Coal mining and handling: solid fuels – methane (CH ₄)	Survey the CH ₄ recovery and flaring activities in the underground coal mines	49
Industrial processes	Overview	Improve the justification provided for the recalculations undertaken for the industrial processes sector and report the differences between the previous and current estimates	52
		Report estimates of perfluorocarbon (PFC) emissions from aluminium production and of actual F-gas emissions from consumption of halocarbons and sulphur hexafluoride (SF ₆) for the period 1990–1994	53
		Improve the transparency of the information on methodologies, data sources and EFs, and the rationale for their selection for categories with high degrees of abatement of emissions	54
		Report estimates of CO ₂ emissions from the use of fuels as anodes or reducing agents in industrial processes under the industrial processes sector	55
	Production of halocarbons and SF ₆ – hydrofluorocarbon (HFC)-23	Provide information on the abatement system and on the category-specific quality assurance/quality control activities which showed that the reported emissions have not been underestimated, and explain the country-specific circumstances that resulted in very low emission levels	56
	Consumption of halocarbons and SF ₆ – HFCs and SF ₆	For refrigeration and air-conditioning equipment, report additional information on the model and EFs used to estimate HFC emissions and on time-series consistency	57

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph reference</i>
		Improve the transparency of the reporting on commercial refrigeration by including: information on whether the level of and trend in emissions were calculated according to the <i>IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories</i> and how time-series consistency was maintained (e.g. when different sources are used over time for activity data (AD) and EFs); information on how EF trends, as reported in the NIR tables, were determined and how time-series consistency was maintained in the case of missing data; and specific references to the sources of AD	59
		For commercial refrigeration, report separately the AD and emissions from manufacturing, stocks and disposal, if possible per substance	60
		Explain and justify why all potential HFC emissions are reported under other non-specified and include in the NIR information on the methodological tiers used and on which EFs are country-specific and which are default EFs	61
		Address the inconsistency in the values reported for potential emissions of SF ₆ for other (consumption of halocarbons and SF ₆) in CRF table 2(I)	62
	Carbide production – CO ₂	Ensure the consistency of the time series	63
Agriculture	Overview	Improve the consistency and the transparency of the reporting of nitrous oxide (N ₂ O) emissions from manure management, application and disposal, and from crop residues burned	68
	Manure management – CH ₄	Increase the transparency of the estimation of CH ₄ emissions from manure management, particularly by providing more information on how the EFs reported in NIR table 6-13 are obtained and on the reallocation of swine manure to the different animal waste management systems. and of the estimation of N ₂ O emissions from pasture, range and paddock	71 and 72
	Manure management – N ₂ O	Increase the transparency of the estimation of N ₂ O emissions from pasture, range and paddock and from cattle grazing	73 and 74
	Enteric fermentation – CH ₄	Improve the information on cattle and livestock characterization in the NIR and report the most relevant data on livestock characteristics in CRF table 4.A and in the documentation boxes of the appropriate CRF tables	75
		Revise the milk yield used for the estimates or provide more information that supports the validity of the current value	76
		Improve the information on the country-specific methodology	77

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph reference</i>
Land use, land-use change and forestry (LULUCF)	Overview	Improve the consistency of the information in the NIR and in the CRF tables	79
		Improve the transparency of the information on trends and drivers for the LULUCF sector and categories	79, 87 and 91
		Report the missing emission estimates for mandatory categories	83
	Forest land remaining forest land – CO ₂	Explain the reporting of carbon stock changes in bamboo forests and, for forests with less standing trees, the carbon stock changes in the dead organic matter and soil pools	88
		Report carbon stock changes in organic soils by disaggregating the soil pool into mineral and organic soils	89
	Land converted to forest land – CO ₂	Report separate estimates for the areas of wetlands and settlements converted to forest land	93
		Improve the transparency and consistency of the information on carbon stock changes in living biomass	94
	Land converted to cropland – CO ₂	Report separately the changes in carbon stock in mineral and organic soils, and provide a better justification for the assumption of zero gains and losses for the conversion of other land to cropland	95
		Improve the transparency of the information on land-use classification and representation, sources of data and the ratio of the conversion of private forest land to other land uses	96
		Explain the reversal in the trend in the emissions from land converted to cropland	97
	Land converted to settlements – CO ₂	Explain the large changes in areas and net emissions	98
	Land converted to grassland – CO ₂	Report all carbon stock changes for settlements converted to grassland separately in CRF table 5.C	103
	Other land remaining other land – CO ₂	Investigate the allocation of abandoned cultivated land under other land	105
	Direct N ₂ O emissions from nitrogen fertilization of forest land and other	If appropriate, indicate that the estimates for direct N ₂ O emissions from forest land are reported under the agriculture sector in the documentation box of CRF table 5(I)	106
Non-CO ₂ emissions from drainage of soils and wetlands – CH ₄ and N ₂ O	Report the areas and CH ₄ and N ₂ O emissions as “NE” or report estimates	107	

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph reference</i>
	N ₂ O emissions from disturbance associated with land-use conversion to cropland	To improve transparency, reproduce the definition of the parameters and variables as presented in the IPCC good practice guidance for LULUCF when reproducing equations in the NIR	108
	CO ₂ emissions from agricultural lime application	Improve the transparency of the information on recalculations	109
	Biomass burning – CO ₂ , CH ₄ and N ₂ O	Use “NE” and not “not occurring” when emissions are not estimated	110
Waste	Overview	Improve the consistency of the information between the NIR and the CRF tables	113
	Wastewater handling – CH ₄	Report the emissions from wastewater and sludge separately	117
		Report emissions from CH ₄ recovery	118
	Other (waste) – CO ₂ , CH ₄ and N ₂ O	Include information on the activities covered in this category and a reference to the additional information in the NIR in the documentation box of CRF table 6	119
Activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol	Overview	Where possible, report uncertainty estimates for AD and EFs separately	126
	Deforestation – CO ₂	Explain the difference in the estimated CO ₂ emissions reported under the Convention and under the Kyoto Protocol	132
		Provide information on the possible over or underestimation of the rate of deforestation based on the use of satellite imagery	134
	Forest management – CO ₂	Include references to the legislation	136
	Revegetation – CO ₂	Report the carbon pools not estimated as “NE” and not as “not applicable”	138
		Improve the transparency of the information on recalculations	139
Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol		Report any changes in the information provided under Article 3, paragraph 14, of the Kyoto Protocol in accordance with decision 15/CMP.1, annex, chapter I.H	146

IV. Questions of implementation

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

Annex I

Documents and information used during the review

A. Reference documents

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

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

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

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

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

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

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

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

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

Status report for Japan 2012. Available at <http://unfccc.int/resource/docs/2012/asr/jpn.pdf>.

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

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

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

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Elsa Hatanaka, Mr. Takefumi Oda and Mr. Kohei Sakai (Greenhouse Gas Inventory Office of Japan, Center for Global Environmental Research, National Institute for Environmental Studies), including additional material on the methodologies and assumptions used. The following documents¹ were also provided by Japan:

K Yamamoto. 1995. *Emission of Trace Gases Contributing Greenhouse Effect from Grassland*. Final Report of Global Environmental Research Fund, B-2.4.2, FY 1994, Environmental Agency. Available at <http://www.env.go.jp/earth/suishinhi/wise/e/pdf/E94B0242.pdf>.

M Saito. 1988. *Methane emissions in fattening pigs and pregnant sows*. The Japanese Journal of Zootechnical Science; vol. 59, No. 9, pp. 778–783.

¹ Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
CH ₄	methane
C	carbon
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO ₂	carbon dioxide
CO ₂ eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
ERT	expert review team
F-gas	fluorinated gas
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ without GHG emissions and removals from LULUCF
GJ	gigajoule (1 GJ = 10 ⁹ joule)
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1,000 grams)
KP-LULUCF	land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
Mg	megagram (1 Mg = 1 tonne)
N	nitrogen
N ₂ O	nitrous oxide
NA	not applicable
NCF	net calorific value
N _{ex}	nitrogen excretion
NE	not estimated
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF ₆	sulphur hexafluoride
SIAR	standard independent assessment report
TJ	terajoule (1 TJ = 10 ¹² joule)
UNFCCC	United Nations Framework Convention on Climate Change