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**Report of the individual review of the annual submission of Japan  
submitted in 2009\***

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\* In the symbol for this document, 2009 refers to the year in which the inventory was submitted, and not to the year of publication.

## CONTENTS

	<i>Paragraphs</i>	<i>Page</i>
I. OVERVIEW .....	1–30	4
A. Introduction.....	1–2	4
B. Emission profiles and trends.....	3–4	4
C. Annual submission and other sources of information .....	5–8	6
D. Main findings.....	9–14	7
E. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management .....	15–25	7
F. Follow-up to previous reviews .....	26–27	10
G. Areas for further improvement .....	28–30	10
II. ENERGY .....	31–48	11
A. Sector overview .....	31–37	11
B. Reference and sectoral approaches.....	38–41	12
C. Key categories .....	42–47	13
D. Non-key categories .....	48	14
III. INDUSTRIAL PROCESSES AND SOLVENT AND OTHER PRODUCT USE .....	49–59	14
A. Sector overview .....	49–52	14
B. Key categories .....	53–57	15
C. Non-key categories .....	58–59	15
IV. AGRICULTURE .....	60–68	16
A. Sector overview .....	60–61	16
B. Key categories .....	62–67	16
C. Non-key categories .....	68	17
V. LAND USE, LAND-USE CHANGE AND FORESTRY .....	69–82	17
A. Sector overview .....	69–71	17
B. Key categories .....	72–79	18
C. Non-key categories .....	80–82	19

		<i>Paragraphs</i>	<i>Page</i>
VI.	WASTE .....	83–95	19
	A. Sector overview .....	83–90	19
	B. Key categories .....	91–93	20
	C. Non-key categories .....	94–95	21
VII.	SUPPLEMENTARY INFORMATION REQUIRED UNDER ARTICLE 7, PARAGRAPH 1, OF THE KYOTO PROTOCOL .....	96–116	21
	A. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol .....	96–107	21
	B. Information on Kyoto Protocol units .....	108–114	23
	C. Changes to the national system .....	115	24
	D. Changes to the national registry .....	116	24
VIII.	CONCLUSIONS AND RECOMMENDATIONS .....	117–124	24
IX.	QUESTIONS OF IMPLEMENTATION .....	125	25

#### Annexes

I.	Documents and information used during the review .....	26
II.	Acronyms and abbreviations.....	28

## I. Overview

### A. Introduction

1. This report covers the centralized review of the 2009 annual submission of Japan, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 7 to 12 September 2009 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Bernd Gugele (European Community) and Ms. Barbara Muik (Austria); energy – Mr. Darío Gómez (Argentina), Mr. Hristo Vassilev (Bulgaria) and Mr. Daniel Tutu Benefoh (Ghana); industrial processes – Ms. Lisa Hanle (United States of America) and Ms. Sonia Petrie (New Zealand); agriculture – Mr. Etienne Mathias (France) and Mr. Rob Sturgiss (Australia); land use, land-use change and forestry (LULUCF) – Mr. Leandro Buendia (Philippines) and Ms. Kimberly Klunich (United States of America); and waste – Mr. Eduardo Calvo (Peru) and Ms. Medea Inashvili (Georgia). Mr. Gómez and Mr. Gugele were the lead reviewers. The review was coordinated by Mr. Harald Diaz-Bone (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.

### B. Emission profiles and trends

3. In 2007, the main greenhouse gas (GHG) in Japan was carbon dioxide (CO<sub>2</sub>), accounting for 94.9 per cent of total GHG emissions<sup>1</sup> expressed in CO<sub>2</sub> equivalent (eq), followed by nitrous oxide (N<sub>2</sub>O) (1.7 per cent) and methane (CH<sub>4</sub>) (1.6 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) collectively accounted for 1.8 per cent of the overall GHG emissions in the country. The share of CO<sub>2</sub> is larger than in any other reporting country. The energy sector accounted for 90.6 per cent of the total GHG emissions, followed by industrial processes (5.7 per cent), agriculture (1.9 per cent), waste (1.8 per cent) and solvent and other product use (0.02 per cent). Total GHG emissions amounted to 1,374,255.51 Gg CO<sub>2</sub> eq and increased by 9.1 per cent between the base year<sup>2</sup> and 2007.

4. Tables 1 and 2 show total GHG emissions by gas and by sector, respectively. Table 1 includes emissions from Annex A sources only and excludes emissions and removals from the LULUCF sector.

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<sup>1</sup> In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO<sub>2</sub> eq excluding LULUCF, unless otherwise specified.

<sup>2</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The base year emissions include emissions from Annex A sources only.

**Table 1. Total greenhouse gas emissions by gas, 1990–2007<sup>a</sup>**

Greenhouse gas	Gg CO <sub>2</sub> eq							Change base year–2007 (%)
	Base year <sup>b</sup>	1990	1995	2000	2005	2006	2007	
CO <sub>2</sub>	1 143 201.22	1 143 201.22	1 226 574.81	1 254 635.66	1 287 335.35	1 270 176.76	1 303 781.17	14.0
CH <sub>4</sub>	32 622.19	32 622.19	30 219.89	26 364.66	23 421.29	23 037.03	22 603.97	–30.7
N <sub>2</sub> O	31 993.74	31 993.74	32 843.06	29 275.84	24 846.39	24 739.31	23 791.79	–25.6
HFCs	20 260.58	17 930.00	20 260.58	18 800.50	10 600.86	11 623.37	13 210.14	–34.8
PFCs	14 363.46	5 670.00	14 363.46	9 664.87	7 058.34	7 385.00	6 483.42	–54.9
SF <sub>6</sub>	16 961.78	38 240.00	16 961.78	7 255.19	4 581.68	5 147.13	4 385.01	–74.1

<sup>a</sup> Total GHG emissions includes emissions from Annex A sources only.

<sup>b</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The base year emissions include emissions from Annex A sources only.

**Table 2. Greenhouse gas emissions by sector, 1990–2007**

Sector	Gg CO <sub>2</sub> eq							Change base year–2007 (%)
	Base year <sup>a</sup>	1990	1995	2000	2005	2006	2007	
Energy	1 078,897.71	1 078,897.71	1 156 678.82	1 191 076.38	1 228 393.84	1 210 984.41	1 244 493.26	15.3
Industrial processes	122,479.36	132 733.54	124 344.05	97 430.43	77 532.58	79 775.32	78 802.40	–35.7
Solvent and other product use	287.07	287.07	437.58	340.99	266.41	244.76	244.76	–14.7
Agriculture	31 607.68	31 607.68	30 308.25	27 885.66	26 831.87	26 709.79	26 546.28	–16.0
LULUCF	–74,286.89	–74 286.89	–79 495.72	–80 637.01	–85,587.53	–81 723.39	–81 352.64	9.5
Waste	26 131.15	26 131.15	29 454.89	29 263.26	24 819.22	24 394.31	24 168.81	–7.5
Other	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.0
<b>Total (with LULUCF)</b>	<b>NA</b>	<b>1 195 370.26</b>	<b>1 261 727.86</b>	<b>1 265 359.72</b>	<b>1 272 256.38</b>	<b>1 260 385.21</b>	<b>1 292 902.88</b>	<b>NA</b>
<b>Total (without LULUCF)</b>	<b>1 259 402.97</b>	<b>1 269 657.15</b>	<b>1 341 223.59</b>	<b>1 345 996.72</b>	<b>1 357 843.92</b>	<b>1 342 108.59</b>	<b>1 374 255.51</b>	<b>9.1</b>

*Abbreviation:* LULUCF = land use, land-use change and forestry, NA = not applicable, NO = not occurring.

<sup>a</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The base year emissions include emissions from Annex A sources only.

### C. Annual submission and other sources of information

5. The 2009 annual submission was submitted on 30 April 2009; it contains a complete set of common reporting format (CRF) tables for the period 1990–2007, 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, and changes in the national system and in the national registry. The standard electronic format (SEF) tables were submitted on 8 May 2009. The annual submission was submitted in accordance with decision 15/CMP.1. The Party indicated that the 2009 submission is also its voluntary submission under the Kyoto Protocol.

6. In addition, the expert review team (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 and its comparison report) and on the national registry.<sup>3</sup>

7. 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 the annex to this report.

#### Completeness of inventory

8. The inventory covers all sectors for the whole period 1990–2007 and is complete in terms of geographical coverage. Japan has submitted a complete set of CRF tables covering all years, almost all categories and almost all gases. Japan is commended for having reported emissions of GHGs for all categories for which the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and/or the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) provide methodologies for estimation. Actual emissions of fluorinated gases in 1990–1994 are not estimated and Japan states that this is because of a lack of AD; the ERT recommends that Japan calculate these emissions following the IPCC good practice guidance. In all sectors, emissions from a few categories have not been estimated mainly because the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance do not provide methods to estimate these emissions. The ERT acknowledges that these emissions might be small; nevertheless, it encourages the Party to explore approaches available in the scientific literature, to estimate emissions for categories that do not have methodologies prescribed in the Revised 1996 IPCC guidelines or the IPCC good practice guidance, with a view to enhancing further, to the extent possible, the completeness and accuracy of its inventory. HFC emissions from fire extinguishers and CO<sub>2</sub> emissions from agricultural lime application have been estimated for the first time in this year's submission. The ERT commends Japan for its efforts and encourages it to explore ways to further improve the completeness of its inventory.

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<sup>3</sup> 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 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 and its 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. The SIAR is not publicly available.

#### **D. Main findings**

9. The 2009 inventory submission is generally in line with the Revised 1996 IPCC Guidelines, 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). It is generally of a high quality, and the ERT welcomes the improvements made by Japan in response to previous reviews – namely, inclusion of its base year key category analysis; reallocation of emissions from waste incineration with energy recovery from the waste sector to the energy sector; and inclusion of information on category-specific QA/QC procedures undertaken for the LULUCF sector.

10. However, the ERT notes the need to address other recommendations made in previous review reports, such as to provide better documentation of the drivers of emission trends and to provide estimates of actual emissions of HFCs, PFCs and SF<sub>6</sub> for the years 1990–1994. The ERT also identified a need for further improvements in the following areas: inclusion of more detailed information on the country-specific emission factors (EFs) used in all sectors, particularly the EFs associated with CO<sub>2</sub> emissions from combustion (which constitute a major part of Japan's total GHG emissions); provision of the rationale for all recalculations; and better documentation of category-specific quality assurance/quality control (QA/QC) procedures in all sectors, including the QA procedures used in the agriculture and waste sectors.

11. The Party has submitted, in part, on a voluntary basis supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol in accordance with Part I of the annex to decision 15/CMP.1. Japan did not report on a voluntary basis supplementary information on implementation of Article 3 paragraph 14. The Party has reported on a voluntary basis information on activities under Article 3, paragraph 3, and elected activities under Article 3, paragraph 4, of the Kyoto Protocol in accordance with section I.D of the annex to decision 15/CMP.1. It has also reported information on its accounting of Kyoto Protocol units in accordance with section I.E of the annex to decision 15/CMP.1, and used the SEF tables as required by decision 14/CMP.1.

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

13. The ERT encourages Japan to explore reporting its next annual submission using the annotated outline of the NIR, and guidance contained therein, that can be found on the UNFCCC website.<sup>4</sup>

14. In the course of the review, the ERT formulated a number of recommendations relating to the completeness of the annual submission (paragraphs 8 and 24) and transparency (paragraphs 22 and 24).

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

##### 1. Overview

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

16. The NIR described the institutional arrangements for the preparation of the national inventory. The Ministry of Environment (MoE) has overall responsibility for the inventory. The Greenhouse Gas

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<sup>4</sup> <[http://unfccc.int/files/national\\_reports/annex\\_i\\_ghg\\_inventories/reporting\\_requirements/application/pdf/annotated\\_nir\\_outline.pdf](http://unfccc.int/files/national_reports/annex_i_ghg_inventories/reporting_requirements/application/pdf/annotated_nir_outline.pdf)>.

Inventory Office of Japan (GIO), part of the Centre for Global Environmental Research of the National Institute for Environmental Studies, is responsible for the calculations, inventory compilation and the archiving of all data. Other agencies and ministries are also involved in the preparation of the inventory and have clearly defined roles and responsibilities. The Committee for Greenhouse Gas Emissions Estimation Methods (hereinafter referred to as the Committee) is responsible for the selection of methods and parameters. The Greenhouse Gas Inventory Quality Assurance Working Group (QA-WG) is responsible for QA carried out by personnel not directly involved in the inventory preparation process.

17. Additional information submitted by Japan together with the NIR provided detail on changes in the national system since the previous annual submission. The ERT noted that these changes have strengthened the institutional arrangements in Japan. They are discussed in chapter VII.C of this report.

## 2. Inventory planning

18. In the NIR Japan describes the annual cycle of the inventory development process, including milestones in the reporting cycle and defined responsibilities. These responsibilities begin with discussions at the beginning of the cycle on improving the inventory (MoE, GIO). The Committee meets regularly during the first eight months of the cycle. Once data for the inventory have been collected (MoE, GIO, relevant ministries and agencies) and draft CRF tables and a draft NIR have been prepared (GIO), external QC is undertaken by private consultants and relevant ministries and agencies are consulted. The NIR and CRF tables are then finalized (MoE, GIO) and the inventory is submitted and officially announced (MoE, Ministry of Foreign Affairs, GIO). Meetings of the QA-WG are held after submission, parallel to the discussions on inventory improvement. The ERT commends Japan for this well-structured planning process but encourages it to reconsider the internal schedule so that the inventory can be submitted by 15 April each year.

## 3. Inventory preparation

### Key categories

19. Japan has reported key category tier 1 and tier 2 analyses, both level and trend assessment, as part of its 2009 submission. The key category analysis performed by the Party and that performed by the secretariat<sup>5</sup> produced similar results, but Japan (by applying the tier 2 analysis) additionally identified 13 key categories due to their contribution to inventory uncertainty. Japan has included the LULUCF sector in its key category analysis, which was performed in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT welcomes the inclusion of Japan's 1990 key category analysis in the NIR following a recommendation made by previous ERTs. Japan uses the key category analysis as a driving factor for the development and improvement of the inventory.

20. Additional information submitted together with the NIR provided detail on the key category analysis undertaken for the Party's Article 3, paragraphs 3 and 4, activities. As part of this additional information, Japan reported on the relationship between these activities and the associated key categories in the national inventory and identified afforestation, reforestation and deforestation (ARD), forest management and revegetation activity as key for 2007.

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<sup>5</sup> The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. 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.



### Uncertainties

21. Japan has reported uncertainties for all sources and sinks reported in the inventory and followed the tier 1 approach to calculate the total emission uncertainty in accordance with the IPCC good practice guidance. This results in a level of uncertainty of 1 per cent for emissions in 2007 and 2 per cent for the trend of total emissions. The ERT noted that this is lower than the uncertainty levels reported by other Parties, but it acknowledges that in the Japanese emission profile, CO<sub>2</sub> emissions from fuel combustion, which are generally associated with low uncertainty, amount to 90 per cent of total emissions and the share of N<sub>2</sub>O emissions from agriculture in total emissions is relatively low. During the review the ERT was informed that Japan considers the implementation of a tier 2 uncertainty analysis as a long-term issue.

### Recalculations and time-series consistency

22. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that recalculations reported by Japan for the years 1990–2006 have been undertaken to take into account updated activity data (AD) for the energy and agriculture sectors, new parameters and/or EFs for the estimates for industrial processes, agriculture and waste, and new methods used for industrial processes. The effect of the recalculations was a decrease of 0.20 per cent in the estimate of total GHG emissions in 1990 and an increase of 0.15 per cent in the estimate of total GHG emissions in 2006. The major changes were: the revision of the energy statistics, leading to a decrease in the estimate of total GHG emissions in 2006 (–0.3 per cent); a revision of the calculation of HFCs, PFCs and SF<sub>6</sub> emissions (+0.5 per cent); removal of double-counted amounts of waste incinerated in 1990–2006 (–0.1 per cent); a revised estimate of CH<sub>4</sub> emissions from solid waste disposal in 1990–2006 (–0.1 per cent); a revised estimate of N<sub>2</sub>O emissions from agricultural soils in 1990–2006 (–0.1 per cent); and the allocation of emissions from waste incineration in conjunction with energy use and recovery under fuel combustion instead of waste incineration, following the recommendation of the previous review report, which did not affect the total emission estimates. Information on these recalculations is provided in the NIR and in CRF table 8(b), but the rationale for the recalculations is not always provided. The ERT recommends that Japan improve the transparency of the NIR by including the rationale for all recalculations.

### Verification and quality assurance/quality control approaches

23. Japan has a QA/QC plan in place and has implemented general and category-specific QA/QC procedures in accordance with the IPCC good practice guidance. In 2008 the QA/QC plan was revised following the recommendations of the previous review report. As a QA activity, Japan established the QA-WG in order to implement a detailed review of each category. The QA-WG is composed of experts not directly involved in the inventory preparation process. The ERT also noted that Japan has included additional descriptions in the NIR of the QA/QC process carried out across the LULUCF sector, and welcomes this improvement in transparency. During the review the ERT was informed that QA procedures are being implemented this year for the agriculture and waste sectors. It noted that the documentation in the NIR of category-specific QA/QC measures could be improved for all sectors and encourages Japan to address this in its next annual submission, especially for key categories where transparency is limited owing to confidentiality of data.

### Transparency

24. The NIR and the CRF tables are generally presented in a transparent way. Japan uses notation keys throughout the CRF tables and includes explanations in table 9(a) for emissions that are not estimated (“NE”) or are included elsewhere (“IE”). The reallocation of emissions from waste incineration with energy recovery has also increased transparency of the inventory. However, the ERT

noted that transparency of the NIR could be improved in several sectors. Japan does not report disaggregated AD and EFs for many of the subcategories and gases in the consumption of halocarbons and SF<sub>6</sub>, and the ERT recommends that Japan do so in its next annual submission to increase completeness and transparency. It also recommends that Japan include more detailed information in the NIR on the energy balance and country-specific EFs used, justifications for all recalculations in the industrial processes sector, and descriptions of the methods used for agriculture.

#### 4. Inventory management

25. Japan has a centralized archiving system, managed by GIO, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes documentation on QA/QC procedures, external and internal review documents, and documentation on annual key categories and key category identification, and planned inventory improvements. During the review, the ERT requested and was provided with additional archived information.

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

26. The ERT acknowledges the improvements that Japan has made in response to previous reviews. These include: incorporating its base year key category analysis; reallocating emissions from waste incineration with energy recovery from the waste sector to the energy sector; and including information on category-specific QA/QC procedures undertaken for the LULUCF sector.

27. However, the ERT noted that Japan has not followed up on some of the recommendations of previous review reports, such as the recommendation to provide better documentation of the drivers of emission trends and to provide estimates of actual emissions of HFCs, PFCs and SF<sub>6</sub> for the years 1990–1994.

#### G. Areas for further improvement

##### 1. Identified by the Party

28. The 2009 NIR reports planned improvements in all sectors as well as the following two broader improvements:

- (a) To review, through the Committee, the estimation methods, AD, EFs and other elements of the inventory process. Japan will prioritize key categories and issues raised in the review reports of previous inventory submissions;
- (b) To examine descriptions of methodologies, assumptions, data and other elements in the NIR and add the necessary information to improve transparency.

##### 2. Identified by the expert review team

29. The ERT identifies the following cross-cutting issues for improvement:

- (a) The provision in future NIRs of an overview of the main drivers of emission trends in order to enhance the transparency of the emission estimates;
- (b) The provision in future NIRs of the rationale for all recalculations;
- (c) The improvement in transparency of the reporting on country-specific EFs used in all sectors by providing sufficient background information;

- (d) The improvement of the documentation of category-specific QA/QC procedures in all sectors, including the QA procedures that are being implemented for the agriculture and waste sectors.

30. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

## II. Energy

### A. Sector overview

31. The energy sector is the main sector in the GHG inventory of Japan. In 2007, emissions from the energy sector amounted to 1,244,493.26 Gg CO<sub>2</sub> eq, or 90.6 per cent of total GHG emissions. Since 1990, emissions have increased by 15.3 per cent. The key driver for the rise in emissions is energy industries. Within the sector, 36.2 per cent of the emissions were from energy industries, followed by 30.9 per cent from manufacturing industries and construction, 19.7 per cent from transport and 13.2 per cent from other sectors. Oil and natural gas and solid fuels accounted for 0.03 and 0.004 per cent, respectively.

32. The CRF tables and the NIR are almost complete for this sector. The ERT commends Japan for reporting emissions of GHGs for all energy categories for which the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance provide methodologies for estimation. Some minor categories, for which no such methodologies are available, have been reported “NE”; these include CO<sub>2</sub> emissions from underground and surface mining, distribution of oil products and solid fuel transformation. The ERT commends Japan for reporting emissions from waste incineration with energy recovery in the energy sector following the recommendation of the previous review report. For the sake of completeness, Japan is recommended to report the corresponding AD in the sectoral background table 1.A(a).

33. The energy sector reporting in the NIR is generally transparent. Japan has provided a complete set of GHG EFs used to estimate emissions, and the sources of the AD. Following a recommendation of the previous review report, Japan included an electronic copy of the energy balance as part of the additional information provided to the ERT. The ERT commends Japan for this and recommends that it include in the NIR of its next annual submission a brief summary of the information provided in the additional worksheets.

34. The NIR reports that most CO<sub>2</sub> EFs are country-specific; however, Japan has not provided background information. To improve transparency, in particular regarding the key role of CO<sub>2</sub> emissions from the energy sector, the ERT recommends that Japan:

- (a) Provide sufficient information about the estimation and updating of country-specific CO<sub>2</sub> EFs;
- (b) Expand on the discussion on the carbon balance assessment that was conducted for the 2005 inventory submission as part of a study on EFs used.

35. Despite a recommendation made in the previous review report, Japan has not provided information or an explanation of the drivers of energy sector emission trends. The ERT reiterates this recommendation and emphasizes the importance of providing information on the underlying variables both in general and particularly as they relate to the trends in CO<sub>2</sub> emissions from energy industries, transport and the commercial/institutional and residential categories, and N<sub>2</sub>O emissions from stationary combustion and transport.

36. In the 2009 submission, Japan has provided recalculations of estimates for the energy sector for the whole time series. For 2006, this implied an overall increase of 1.4 per cent in energy sector emissions. This is mainly attributable to the reallocation of emissions from waste to the energy sector, following previous recommendations. As a result of the recalculations, the largest increase in the 2006 emission estimates can be observed in the energy industries sector (+2.3 per cent, from 388,509.45 Gg CO<sub>2</sub> eq to 397,595.77 Gg CO<sub>2</sub> eq).

37. Japan's planned improvements for the reporting in this sector include: (1) reassessing the MAP survey (for reporting AD for furnaces and the consumption of fuels not included in the general energy statistics); (2) considering the development of country-specific N<sub>2</sub>O EFs for certain types of vehicle; (3) collecting information on kilometres travelled by natural gas powered vehicles and by motorcycles; (4) collecting AD for four-wheel motorcycles; (5) establishing more suitable non-CO<sub>2</sub> EFs for diesel trains and ships; and (6) considering the development of methods to estimate CH<sub>4</sub> emissions from the transport of natural gas by lorries and trains, provided that sufficient data can be obtained in future. The ERT acknowledges the importance of these planned improvements, commends Japan for this initiative and encourages the Party to make efforts to implement these activities.

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

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

38. CO<sub>2</sub> emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For the year 2007, there is a difference of -1.67 per cent in the CO<sub>2</sub> emission estimates between the reference approach and the sectoral approach. Explanations for this are not provided in the documentation box of CRF table 1.A(c) and are not needed as the difference is below 2 per cent. However, the NIR provides an explanation for the fluctuations in the differences between the two approaches over the years.

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

39. AD for international bunker fuels are estimated using the bonded fuel concept, which in Japan applies to those fuels used for international aviation and navigation that are exempt from certain taxes. During the review, Japan confirmed to the ERT that this allocation is in line with the IPCC good practice guidance because aircraft and ships that depart in Japan for arrival in another country never drop off passengers or freight when they make a further stop in Japan. The ERT recommends that Japan include this explanation in its next annual submission.

40. The ERT also recommends that in CRF table 1.A(b), Japan include emissions from bonded imports under the imports column, exclude emissions from bonded exports from the exports column and replace "NA" (not applicable) by a figure representing the amount of fuel that goes to international bunkers (bonded imports plus bonded exports). This would improve transparency and the consistency of AD between the reference approach and the consumption figures reported under the sectoral approach in CRF table 1.A(c).

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

41. Japan uses country-specific ratios to account for the fraction of carbon stored in the reference approach. The ERT reiterates recommendations made in previous review reports that Japan include an explicit discussion on this issue in the NIR of its next annual submission, together with documentation justifying the fractions.

### C. Key categories

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

42. The previous ERT noted that the CO<sub>2</sub> implied emission factor (IEF) for combustion of liquid fuels in other (manufacturing industries and construction) (70.47 t/TJ) is among the lowest of all reporting Parties (25.79–91.81 t/TJ) and asked Japan to provide information on the carbon content, gross calorific values and density of the component fuels being consumed, and the portions of these components consumed through the time series and ultimately contributing to the low IEF. The present ERT reiterates this recommendation and notes that the recommendations of paragraph 34 above also apply here.

#### 2. Road transportation: liquid fuels – CO<sub>2</sub>

43. The CO<sub>2</sub> EF for diesel oil (72.29 t/TJ) used in road transportation is among the lowest of all reporting Parties (69.19–76.14 t/TJ). Japan explains in the NIR that the quality standard for diesel oil in Japan is different from that of other countries and requires a unique production process, which uses lighter hydrocarbons as feedstock. Japan also refers to the carbon balance of its refineries and the statistical comparison of carbon content of fuels used in Japan with those of other Organisation for Economic Co-operation and Development countries. The ERT appreciates the effort made by Japan to improve clarity on this issue but finds that there is still room for improvement. It notes that the recommendations of paragraph 34 above also apply to this case. To improve transparency, the ERT recommends that Japan provide supplementary information (e.g. technical reports) on the main characteristics of the production process, to help explain the production of such fuels, and the composition range of the feedstock used.

#### 3. Road transportation: liquid fuels – CH<sub>4</sub> and N<sub>2</sub>O

44. According to the NIR, most non-CO<sub>2</sub> EFs for road transportation are country-specific; however, default uncertainty values are adopted from the IPCC good practice guidance. During the review, Japan indicated to the ERT that it had adopted the default uncertainty range having followed the decision tree for uncertainty assessment for EFs described in annex 7 to the NIR. The implication of this is that the country-specific EFs have been generated based on measurements of sample sizes of less than or equal to five. The ERT encourages Japan to expand the sample size to improve the accuracy of the emission estimates.

#### 4. Coal mining and handling – CH<sub>4</sub>

45. CH<sub>4</sub> EFs from underground mining have steadily and sharply decreased over the time series, from 17.9 kg CH<sub>4</sub>/t coal produced in 1990 to 1.4 kg CH<sub>4</sub>/t in 2007. During the review, Japan informed the ERT that CH<sub>4</sub> emissions per unit of coal production have decreased because coal mining is presently conducted at sites that have already been partially mined and where much of the CH<sub>4</sub> that is usually associated with mining has therefore already escaped. The ERT recommends that Japan include this information in the NIR of its next annual submission.

46. Emissions are estimated using plant-specific data based on CH<sub>4</sub> measurements in the mines and surveys of coal production that were reported in the *Yearbook of Production, Supply and Demand of Petroleum, Coal and Coke* prepared by the Ministry of the Economy, Trade and Industry (METI) until 2000. During the review, Japan informed the ERT that:

- (a) Coal mine companies are required by law to monitor continuously, control and report concentrations of CH<sub>4</sub> and other gases in coal pits for safety purposes. QC checks are performed regularly and every observation of a rise or fall in CH<sub>4</sub> concentrations is

validated. In addition, METI controls the reporting of this monitoring on a monthly basis;

- (b) Data on coal consumption as reported by METI until 2000 were provided by the Japan Coal Energy Center (J-Coal). Since then, the data have been obtained from J-Coal directly.

47. The ERT recommends that Japan provide this information in the NIR of its next annual submission.

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

##### Coal mining and handling – CO<sub>2</sub>

48. CO<sub>2</sub> emissions from underground mining of solid fuels are not estimated, based on the hypothesis that CO<sub>2</sub> concentrations inside Japanese mines are equal to atmospheric levels; however, the Party does not have any measurements that could substantiate this hypothesis. Although the Revised 1996 IPCC Guidelines and the IPCC good practice guidance do not provide methods to estimate these emissions, they do indicate that (1) countries with significant quantities of CO<sub>2</sub> in their coal seam gas should make an effort to quantify these emissions, and (2) burning of coal in coal deposits may occur. The ERT encourages Japan to investigate the potential occurrence of emissions under the circumstances indicated by the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. If the Party has done this already, it is recommended to report its conclusions in the NIR. If Japan maintains the hypothesis regarding the concentrations of CO<sub>2</sub> inside the coal mines, the Party is encouraged to provide further information underpinning its assumption.

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

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

49. In 2007, emissions from the industrial processes sector amounted to 78,802.40 Gg CO<sub>2</sub> eq, or 5.7 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 244.76 Gg CO<sub>2</sub> eq, or 0.02 per cent of total GHG emissions. Since 1990, emissions have decreased by 40.6 per cent in the industrial processes sector and by 14.7 per cent in the solvent and other product use sector. The key driver for the fall in emissions in the industrial processes sector is events in the chemical industry, particularly a decline in adipic acid production (–96.4 per cent) and cement production (–20.8 per cent) from the mineral products category. Within the industrial processes sector, 63.7 per cent of the emissions were from mineral products, followed by 26.0 per cent from consumption of halocarbons and SF<sub>6</sub>, 5.4 per cent from chemical industry and 3.2 per cent from production of halocarbons and SF<sub>6</sub>. The remaining 1.6 per cent were from metal production.

50. Recalculations were carried out for mineral production (lime production), chemical industry, metal production, and production and consumption of halocarbons and SF<sub>6</sub>. The ERT commends Japan for improving the accuracy of these estimates. Explanations for these recalculations were provided in the NIR; however, the ERT would welcome further justification, such as providing more details on why it was deemed appropriate for methodologies and emission factors to be updated.

51. The reporting of the industrial processes and solvents and other product use sectors is generally complete, with emissions estimated for most categories. The ERT noted that the notation key “NE” is used for PFC emissions from aluminium production and for actual emissions from consumption of halocarbons and SF<sub>6</sub> for the years 1990–1994. During the review Japan explained that it is investigating ways to provide estimates for these years. The ERT welcomes these efforts and recommends that Japan estimate emissions for these years in its next annual submission.

52. The ERT encourages Japan to continue to improve the transparency of the reporting of this sector in the NIR by including explanations of the emission trends in all categories across the time series.

## **B. Key categories**

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

53. Japan's cement industry takes in large amounts of waste materials and by-products from other industries and recycles them as substitute raw materials for cement production. The clinker therefore contains lime from sources other than limestone or dolomite. The ERT commends Japan for the comprehensive information provided in the NIR and additional information sheets explaining the lime content of cement, the types of waste materials used in producing the clinker and the lime concentrations of these materials.

54. Japan is encouraged to clarify in the NIR whether the limestone data used for estimating clinker production from 1990 to 1999 includes only limestone consumed in cement production or includes limestone used in all industry in Japan (i.e. including limestone used in iron and steel production and glass production) and to explain the rationale for using limestone consumption data including cement hardening agent in the calculation of clinker production to limestone consumption ratios. Also, the ERT would welcome further explanation in the NIR of how the 'connection coefficient' of 0.99 was arrived at.

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

55. Japan has recalculated emissions from lime production for the entire time series, replacing the default IPCC EFs (0.75 for high-calcium lime and 0.86 for dolomitic lime) with country-specific EFs (0.75 for high-calcium lime and 0.82 for dolomitic lime). The ERT commends Japan for this improvement in accuracy. The ERT recommends that Japan provide an explanation in the next NIR on the reasons behind the lower country-specific EF for dolomitic lime compared with the IPCC default.

### **3. Adipic acid production – N<sub>2</sub>O**

56. The ERT acknowledges that Japan provides information on emissions from adipic acid production in a form that can maintain confidentiality; however, it recommends the Party to make effort to provide further information on the QA/QC procedures implemented to ensure the accuracy of these data.

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

57. Following a recommendation made in the previous review report, Japan has provided estimates of HFC emissions from fire extinguishers. The methodology and calculated estimates are reasonable and the ERT commends Japan on this improvement.

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

### **1. Nitric acid production – N<sub>2</sub>O**

58. Information on the nitric acid production process is not included in the NIR, but was provided by Japan during the review. To increase transparency in the NIR the ERT recommends that Japan provide this information in the NIR of its next annual submission.

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

59. Emissions from iron and steel production are all reported under the energy sector (iron and steel), but the notation key "IE" is used for such emissions in the industrial processes sector. The ERT

recommends that Japan report CO<sub>2</sub> emissions resulting from the consumption of reducing agents in iron and steel production under iron and steel production, consistent with the IPCC good practice guidance.

## IV. Agriculture

### A. Sector overview

60. In 2007, emissions from the agriculture sector amounted to 26,546.28 Gg CO<sub>2</sub> eq, or 1.9 per cent of total GHG emissions. Since 1990, emissions have decreased by 16.0 per cent. The key driver for the fall in emissions is a decline in emissions from manure management and agricultural soils reflecting, in part, a fall in cattle and swine numbers and decreased use of nitrogenous fertilizers. Within the sector, 27.3 per cent of the emissions came from manure management, followed by 26.8 per cent from enteric fermentation, 23.9 per cent from agricultural soils and 21.3 per cent from rice cultivation. Field burning of agricultural residues accounted for 0.7 per cent.

61. Japan has included estimates for agriculture categories for which the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance provide methodologies for estimation. The reporting of the sector is generally transparent and the estimates are consistent across the time series. The transparency of the inventory could be improved with the inclusion of more information in the NIR on the choice of EFs, the methods used and any planned improvements. Recalculations of the emissions in 2006 from this sector have reduced the estimates by 658.39 Gg CO<sub>2</sub> eq, or 2.41 per cent.

### B. Key categories

#### 1. Enteric fermentation – CH<sub>4</sub>

62. To estimate emissions from dairy and beef cattle, Japan uses a country-specific approach based on estimates of dry matter intake, which is consistent with the IPCC tier 2 approach. The transparency of the reporting could be improved by an explanation of the cattle types as shown in table 6-2 of the NIR along with the corresponding dry matter intake and resulting EFs. The ERT recommends that Japan include this information or the details of the equations for individual animal types in the NIR. As this is a tier 2 approach, the ERT also encourages Japan to conduct tier 2 QC tests to compare the emissions estimates for dairy and beef cattle with estimates obtained using the IPCC tier 2 method and to report the results to improve the transparency and quality of the estimates.

63. Japan uses country-specific EFs for enteric fermentation for swine, sheep and goats which are lower than the IPCC defaults: swine 1.1 kg/head/year (IPCC default 1.5 kg/head/year); goats 4.1 kg/head/year (IPCC default 5 kg/head/year); and sheep 4.1 kg/head/year (IPCC default 8 kg/head/year). The estimates developed by Japan are documented in published papers. The ERT reiterates previous recommendations that more information should be included in the NIR on how these EFs are derived.

#### 2. Rice cultivation – CH<sub>4</sub>

64. Japan uses IPCC methods to estimate CH<sub>4</sub> emissions from rice cultivation with country-specific EFs derived from data taken between 1992 and 1994 and reported in a study by Yagi in 2000.<sup>6</sup> The ERT encourages Japan to undertake a systematic review of the available literature on estimates of emissions from paddy fields in the country to assess whether these EFs should be updated. Japan has not reported estimates of the quantities of organic amendments used for rice cultivation in CRF table 4.C. The ERT

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<sup>6</sup> Yagi, Kazuyuki: *A Report on an Investigation of how to quantify the amount of Greenhouse Gas Emissions reduced in 2000F.Y.* page 27. Establishment of GHGs reduction model, Incorporated foundation, Society for the Study of Agricultural Technology.



also reiterates the recommendation made in the previous review report that Japan provide this information

### 3. Agricultural soils – N<sub>2</sub>O

65. Japan uses tier 1 methods and a mix of country-specific and IPCC default EFs to estimate agricultural soil emissions. The country-specific EFs are used for fertilizers, animal manure, nitrogen fixing by crops and leaching. The IPCC default factors are used for crop residues and atmospheric deposition. Japan may wish to consider, given the wide variety of conditions that occur across Japan and the high reported uncertainties of the country-specific EFs, whether there would be benefits from developing a disaggregated approach that uses region-specific EFs.

66. For pasture, range and paddock manure, animal manure applied to soils, Japan uses assumptions for the rates of application of animal manure by crop type rather than estimates of nitrogen available for application derived from data used to estimate emissions from enteric fermentation and manure management. This approach could be considered inconsistent with equation 4.23 of the IPCC good practice guidance. The ERT recommends that Japan review the AD used to estimate emissions from the application of manure to agricultural soils to ensure consistency with the IPCC good practice guidance. Japan may wish to consider whether the preparation of a nitrogen balance would help to ensure that all nitrogen is accounted for in the calculations.

67. Japan has estimated emissions from the cultivation of histosols using a country-specific EF (1.2 kg/ha/year compared with the IPCC default value of 8 kg/ha/year) for the first time. The ERT considers that this EF is reasonable and recommends that Japan improve the transparency of the derivation of the factor by including more information in the NIR on the inputs to the calculation.

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

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

68. Japan's CH<sub>4</sub> IEFs (63.11–63.40 kg/head/year) are among the highest of reporting Parties (2.31–66.05 kg/head/year) across the entire time series. Japan attributes the relatively high IEFs for CH<sub>4</sub> emissions from manure management for dairy cattle to the practice of “piling”, which refers to composting of domestic livestock faeces. The ERT reiterates the recommendation made in the previous review report that Japan include additional information on the practice of piling in order to explain this outcome.

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

### A. **Sector overview**

69. In 2007, net removals from the LULUCF sector amounted to 81,352.64 Gg CO<sub>2</sub> eq. Since 1990, net removals have increased by 9.5 per cent. The key driver for the rise in removals is the sequestration of carbon in forest land remaining forest land; other sink categories are land converted to forest land, land converted to grassland and settlements remaining settlements. The removals, however, were partly offset by CO<sub>2</sub> emissions from land converted to settlements, other land, cropland and wetlands. Liming application in all land-use categories was another source of CO<sub>2</sub> emissions.

70. Japan has provided summary tables on the definition of land-use categories, and on how the land-use categories and areas are determined. The ERT reiterates the concerns in the 2006 and 2008 review reports<sup>7</sup> which recommended that the AD in the land-use transition matrices be provided in a

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<sup>7</sup> FCCC/ARR/2006/JPN, paragraph 58, and FCCC/ARR/2008/JPN, paragraph 62.

transparent manner, and that Japan should in particular ensure that the allocation of land to the land-use category other land meets the definition in the IPCC good practice guidance for LULUCF, as it constitutes 2.86 million ha, or 7.6 per cent of Japan's total land area. In response to questions raised during the review, Japan informed the ERT that it will re-examine the area estimates for the land-use categories and include the results in its future submissions.

71. In annex 6 to the NIR, Japan has described its general QA/QC procedures, which apply to all sectors. For the LULUCF sector, since the inventory method relies so much on periodic sampling, which in most cases is extrapolated or interpolated, and since it uses a sophisticated model (CENTURY-JFOS), the ERT believes that additional description and documentation of the QA/QC procedures is needed to enhance the transparency of the estimates, and recommends that Japan include a summary table in its next annual submission.

## **B. Key categories**

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

72. CO<sub>2</sub> from forest land remaining forest land and CO<sub>2</sub> from land converted to forest land are key categories. The methods used to estimate changes in carbon stocks in living biomass are based on the tier 2 stock change method, while the CENTURY model (tier 3), adjusted to the Japanese forest environment, was used for dead organic matter and soil pools. The methods are appropriate and consistent with the IPCC good practice guidance for LULUCF. However, the ERT suggests that key assumptions and parameters be included in the NIR to improve transparency.

73. The country-specific parameters used in estimating changes in carbon stocks (e.g. biomass expansion factor, root–shoot ratio and wood density) are reasonable. However, to enhance transparency, the tables of parameters (EFs) in the NIR should be supported with sources of information or references.

74. The ERT noted that Japan reports changes in carbon stocks in dead organic matter in forest land only for the years 2005–2007, and uses “IE” and “NA” for previous years. This is an issue of time-series consistency which was also pointed out in the previous review report. In response to a question raised by the ERT during the review, Japan explained that it has moved to a higher tier method to estimate this category and that it intends to report on the complete time series in its next annual submission. The ERT welcomes this intention and recommends that Japan provide a consistent time series for changes in carbon stocks in dead organic matter in forest land in its future submissions.

75. For soils, the submission contains estimates of changes in carbon stocks using two methods: a tier 2 method for 1990–2004 and a tier 3 modelling method for 2005–2007. This has resulted in a strong decline in estimates, from 358.00 Gg C in 1990 to 2.38 Gg C in 2007. Japan recognized this problem during the review.

76. Japan reports the following types of land as land converted to forest land: orchard converted to forest land; upland field converted to forest land; and rice field converted to forest land. However, for the estimate of changes in carbon stocks, the three were grouped together in the category rice field converted to forest land. The ERT recommends that Japan explain the rationale for this approach in the NIR and the CRF documentation box of its next annual submission.

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

77. A tier 2 method was used to estimate changes in carbon stock in living biomass in forest land converted to cropland, while a tier 1 method was used for other land-use categories converted to cropland. The methods generally follow the IPCC good practice guidance for LULUCF. Japan reports the land areas and the estimates of changes in carbon stocks in forest land converted to orchards, rice

fields and upland fields in the single category “forest land converted to rice field”. To improve transparency, the ERT recommends that Japan provide separate land area figures and estimates for the three subdivisions in its next annual submission.

### 3. Land converted to settlements – CO<sub>2</sub>

78. The method used to estimate changes in carbon stocks in land converted to settlements is consistent with the IPCC good practice guidance for LULUCF. However, Japan does not provide sources of information or references for the assumptions of biomass stock and biomass growth values that are given in the NIR. To improve the transparency of reporting, the ERT suggests that Japan include this information in its next annual submission.

79. The carbon stock changes in soils are currently reported as “NE”. The ERT noted that Japan recognized this issue during the review and that it will report estimates from this category once it has considered the estimation method and new data and information become available.

## C. Non-key categories

### 1. Other land – CO<sub>2</sub>

80. Other land in Japan constitutes about 7.6 per cent of the total land area. This other land includes areas abandoned after cultivation, areas used for national defence and the northern territories of the country. Japan considers improving the consistency in the classification of these lands to be a long-term challenge, and the methodologies for doing so have been considered regularly by the Committee. Japan informed the ERT during the review that it will continue to perform breakdown analysis and re-classification, and the results are expected to be reported in its next annual submission.

### 2. Other – CO<sub>2</sub>

81. The ERT acknowledges Japan’s reporting of CO<sub>2</sub> emissions from liming in response to a recommendation made in the previous review report. It observed that the total amount of lime applied has decreased significantly over the years: from 1,250,486 Mg/year in 1990 to 523,482 Mg/year in 2007 (almost 60 per cent less). Japan explained that one of the reasons for the decline is that the amount of calcium carbonate fertilizer applied in the country has decreased in line with the decrease in the crop acreage. For the sake of transparency, the ERT recommends that Japan include this explanation in the NIR of its next annual submission.

82. During the review, Japan informed the ERT that the uncertainty of this category is estimated by using the tier 1 error propagation equation provided in the IPCC good practice guidance for LULUCF and the resulting uncertainty value (51 per cent) is greatly affected by the default uncertainty of the default EF. The ERT recommends that Japan provide this information in its next annual submission.

## VI. Waste

### A. Sector overview

83. In 2007, emissions from the waste sector amounted to 24,168.81 Gg CO<sub>2</sub> eq, or 1.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 7.5 per cent. This was mainly attributed to a decrease in CH<sub>4</sub> emissions of 43.3 per cent since 1990, partly compensated by increases in CO<sub>2</sub> and N<sub>2</sub>O emissions of 14.8 and 23.0 per cent, respectively. Within the sector, 58.9 per cent of the emissions in 2007 were from CO<sub>2</sub> from waste incineration, followed by 18.7 per cent from CH<sub>4</sub> emissions from solid waste disposal on land, 9.5 per cent from N<sub>2</sub>O emissions from waste incineration, 5.6 per cent from CH<sub>4</sub> emissions from wastewater handling and 4.8 per cent from N<sub>2</sub>O emissions from wastewater handling.

84. Annual sectoral emissions have shown little fluctuation since 1990, peaking in 1997 and decreasing steadily thereafter. Within the sector, CO<sub>2</sub> emissions from waste incineration have been growing steadily, posting an overall increase of 16.9 per cent since 1990. CH<sub>4</sub> emissions from solid waste disposal on land (SWDL) have declined steadily from year to year and by 45.4 per cent overall since 1990. However, N<sub>2</sub>O emissions have fallen only in the wastewater handling category, by 10.1 per cent since 1990. N<sub>2</sub>O emissions from waste incineration and the category other have increased over the time series by 51.3 and 14.9 per cent, respectively.

85. The reporting of the sector is complete and covers all GHGs and categories for which the Revised 1996 IPCC Guidelines and the IPCC good practice guidance provide methodologies for estimation. Categories reported as “NE” in the CRF tables have been explained in the NIR.

86. The NIR does not provide explanations of the inter-annual fluctuations in the following categories: CO<sub>2</sub> and N<sub>2</sub>O from waste incineration, CO<sub>2</sub> from other and N<sub>2</sub>O from wastewater handling. The ERT recommends that the Party explain the causes of these fluctuations in its next annual submission.

87. Recalculations have been made in many categories to reflect updated data, methodology changes (in the case of solid waste disposal on land) and changes in reporting (emissions from municipal waste incineration with energy recovery having been moved to the energy sector). The result is a considerable decrease in the estimates of sectoral emissions in comparison with those in the previous inventory submission: -56.4 and -44.6 per cent for CO<sub>2</sub> (from waste incineration), -10.2 and -7.4 per cent for total CH<sub>4</sub> (from SWDL, wastewater handling and waste incineration) and -15.9 and -12.4 per cent for total N<sub>2</sub>O (from wastewater handling, waste incineration and other) for 2006 and 1990, respectively.

88. Uncertainty estimates are provided for all categories and gases. For every gas and category, the separate estimates for each parameter are provided along with the aggregate figures. Approaches and assumptions to the estimates are well documented, and references for further information are given in annex 7 to the NIR.

89. A number of tier 1 QC procedures have been carried out. There are some discrepancies between some figures in the NIR and the CRF tables (e.g. figures of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions in CRF table 6.C and table 8-27 in the NIR). The ERT encourages Japan fix these inconsistencies.

90. No major sector-specific improvements are planned by the Party for the next annual submission. It intends to carry out some minor improvements to country-specific parameters and EFs for SWDL, wastewater handling and industrial waste incineration and composting of organic waste. The Party is recommended to carry out category-specific QC procedures for key categories.

## **B. Key categories**

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

91. All legal solid waste disposal sites in Japan fall into the category managed, and their emissions are reported accordingly under managed waste disposal on land. Small parts of landfills that do not meet the legal requirements are reported as inappropriate disposal in the category other. Emissions are estimated in line with IPCC good practice guidance using country-specific parameters. EFs and AD for each type of solid waste disposed on landfills are taken and/or calculated from official statistical and scientific surveys or studies referenced in the NIR. Only general QC checks have been carried out in this category. The ERT recommends that the Party implement tier 1 category-specific procedures according to the IPCC recommendations for key categories.

## 2. Wastewater handling – N<sub>2</sub>O

92. Sludge (except that which is incinerated and reported under waste incineration) is reported together with wastewater under wastewater handling, since the corresponding treatment processes are combined in Japan. Industrial wastewater is reported in a single category, but domestic/commercial wastewater is estimated and reported in four categories. The emissions are estimated by Japan's country-specific method of combining emissions from different volumes of wastewater treated with different practices of treatment. A revision of the EF for sewage treatment plants to address the high uncertainty of estimates is planned by Japan for its next annual submission. The ERT welcomes this planned improvement. Japan used tier 1 QC checks for this category, and is encouraged to implement tier 2 category-specific QC procedures.

## 3. Waste incineration – CO<sub>2</sub> and N<sub>2</sub>O

93. Japan has reported only emissions from waste incinerated without energy recovery under the waste incineration category, while the emissions from waste incinerated with energy recovery have been moved to the energy sector. For consistency, the emissions with and without energy recovery have been estimated in the same manner. Japan has eliminated previous double counting in the specially controlled industrial waste subcategory. The ERT commends Japan for these improvements. It encourages the Party to study the issue of energy recovery from specially controlled industrial waste and make the corresponding changes in its next annual submission, and to carry out category-specific QC procedures.

### C. Non-key categories

#### 1. Wastewater handling – CH<sub>4</sub>

94. No information is provided in the NIR about the state of CH<sub>4</sub> recovery from industrial wastewater handling in the country. The ERT recommends that the Party provide this information and use appropriate notation keys for this item.

#### 2. Other – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

95. Japan reports CO<sub>2</sub> emissions from decomposition of petroleum-derived surfactants and CH<sub>4</sub> and N<sub>2</sub>O emissions from composting of solid waste. The latter has been reported separately from SWDL for the first time. The ERT commends Japan for estimating and reporting these emissions and encourages it to continue detailing subcategories, according to different types of waste, in estimation of the emissions.

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

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

#### 1. Overview

96. Japan's submission includes the *Report on Japan's Supplementary Information on LULUCF activities under Article 3, Paragraphs 3 and 4, of the Kyoto Protocol* (KP-NIR) and the completed Kyoto Protocol LULUCF CRF tables. These documents and tables contain information on what Japan has reported pursuant to the requirements outlined in paragraphs 5 to 9 of the annex to decision 15/CMP.1.

97. The KP-NIR provides the selected minimum values of the parameters used for defining forest land, which are consistent with the relevant Food and Agriculture Organization data and the IPCC good practice guidance for LULUCF. Japan has elected forest management and revegetation as activities under Article 3, paragraph 4, and has chosen commitment-period accounting.

2. Information on the geographical location of the boundaries of the areas that encompass units of land subject to activities under Article 3, paragraphs 3 and 4

98. Japan reported that the Forestry Agency has developed the National Forest Resources Database, in which forest registers (the base data for estimating and reporting, administrative information including a forest planning map and forest resource monitoring surveys) are archived, as well as forest stand information and geographical information including orthophoto and satellite images. This database is maintained to ensure that units of land and areas of land are identifiable.

99. A land transition matrix has been included in Kyoto Protocol CRF table NIR-2 to report land area and changes in land area subject to various activities in the inventory year, and the methodology used to develop the matrix is described in the KP-NIR. The ERT finds the methodology presented consistent with the IPCC good practice guidance for LULUCF.

3. Information on the spatial assessment unit used to determine the area of accounting for afforestation, reforestation and deforestation

100. Japan has identified the change in forest cover in each sample plot by using orthophotos taken at the end of 1989 and satellite images (taking into account a spatial assessment unit of 0.3 ha). Japan calculated afforestation, reforestation and deforestation (ARD) land areas based on satellite image data; the detailed procedures are described in the KP-NIR.

4. Information on anthropogenic greenhouse gas emissions by sources and removals by sinks resulting from activities under Article 3, paragraphs 3 and 4

101. Japan has provided information on GHG emissions and removals resulting from activities under Article 3, paragraphs 3 and 4, in the Kyoto Protocol CRF tables. The ERT finds the information to be complete and the methodology consistent with the IPCC good practice guidance for LULUCF.

102. For the Article 3, paragraph 3, activities, Japan has provided estimates of changes in carbon stocks in all pools. Non-CO<sub>2</sub> emissions from biomass burning are reported for afforestation and reforestation activities. Deforestation activities include non-CO<sub>2</sub> emissions from disturbance associated with land-use change to croplands and CO<sub>2</sub> emissions from liming. The ERT recommends that Japan explain in the KP-NIR of its next annual submission why CO<sub>2</sub> emissions from liming are not estimated under afforestation and reforestation activities.

103. As regards the elected Article 3, paragraph 4, activities, Japan has reported changes in all carbon pools for forest management, including non-CO<sub>2</sub> emissions from biomass burning. CO<sub>2</sub> emissions from liming on forest land are not estimated because, as stated in the KP-NIR, information on lime application on forest land is not available in Japan. For revegetation activities, Japan reports changes in carbon stocks from all pools (except CO<sub>2</sub> emissions from soils) and CO<sub>2</sub> emissions from liming.

5. Information on factoring out the effect of elevated carbon dioxide concentrations above pre-industrial levels and indirect nitrogen deposition

104. Japan indicates that its reporting under Article 3, paragraphs 3 and 4, has not factored out indirect and natural GHG emissions or removals.

6. Specific information for Article 3, paragraph 3

105. According to decision 15/CMP.1, each Annex I Party is required to provide information that demonstrates that activities under Article 3, paragraph 3, began on or after 1 January 1990 and before 31 December of the last year of the commitment period. Japan reports that the information on changes in

forest cover derived from the orthophoto and satellite images can be used to demonstrate that ARD activities have occurred since 1 January 1990 and are directly human-induced.

#### 7. Specific information for Article 3, paragraph 4

106. To demonstrate that activities under Article 3, paragraph 4, have occurred since 1 January 1990, Japan reports that forest management activities (which have been implemented since 1 January 1990) were verified by sampling, field surveys, interviews with the Forest Owner's Association, obtaining administrative information on subsidized forest practices, and so on. For revegetation, Japan provided information in a table (table 3-33 in the KP-NIR) which demonstrates that revegetation activities have occurred since 1 January 1990 and are human-induced.

107. Japan has not reported any information as to what extent anthropogenic GHG removals by sinks has offset the debit incurred under activities under Article 3, paragraph 3. The ERT recommends that Japan submit this information in its next annual submission.

### **B. Information on Kyoto Protocol units**

#### 1. Standard electronic format and reports from the national registry

108. 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 and recommendations included in the SIAR on the SEF and the SEF comparison report.<sup>8</sup> The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

109. Information on the accounting of Kyoto units has been prepared and reported in accordance with section I.E of the annex to decision 15/CMP.1, 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 (CDM) registry, and meets the requirements set out in paragraph 88(a) to (j) of the annex to decision 22/CMP.1. 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 non-replacement has occurred.

110. The ERT noted that Japan did not report on discrepancies, CDM notifications, non-replacements or invalid units in its submission. During previous stages of the review Japan stated that no such incidences occurred, which is confirmed by the ITL. The ERT recommends that Japan improve its reporting on discrepancies, CDM notifications, non-replacements and invalid units by clearly stating that there is no information to report, if there are no occurrences.

111. To improve the transparency of its reporting, the ERT further recommends that Japan use the reporting formats developed by the administrator of the ITL in cooperation with registry system administrators and documented in the independent assessment report common operational procedure developed pursuant to decision 16/CP.10.

#### 2. National registry

112. 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.

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<sup>8</sup> The SEF comparison report is prepared by the administrator of the international transaction log (ITL) and provides information on the outcome of the comparison of data contained in the Party's SEF tables with corresponding records contained in the ITL.

The 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.

113. The national registry has adequate procedures in place to minimize discrepancies.

### 3. Calculation of commitment period reserve

114. Japan has reported its commitment period reserve in its 2009 annual submission. The Party reported that its commitment period reserve has not changed since the initial report review (5,335,431,899 t CO<sub>2</sub> eq), as it is based on the assigned amount and not the most recently reviewed inventory. The ERT agrees with this figure.

## **C. Changes to the national system**

115. Japan has reported on changes in its national system since the previous annual submission, in accordance with section I.F of the annex to decision 15/CMP.1. These changes were triggered by the revision of the QA/QC plan and include clarification of the roles and responsibilities of each entity in the inventory preparation process and establishment of the QA-WG to carry out detailed reviews for each category. The ERT concluded that the reported changes have strengthened the institutional arrangements and that Japan's national system continues to be in accordance with the requirements of national systems set out in decision 19/CMP.1.

## **D. Changes to the national registry**

116. Japan has reported on changes in its national registry in accordance with section I.G of the annex to decision 15/CMP.1. These changes include: adding the name and contact information of the registry administrator; changes to ensure conformance with technical standards; and adding a list of the information that is publicly accessible. The SIAR mentioned only one significant change as a result of conforming with technical standards, namely that the internal checks conducted by the national registry have been modified to be consistent with the checks carried out by the ITL. As the SIAR identified no problems with the changes made, the ERT concluded that Japan's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions.

## **VIII. Conclusions and recommendations**

117. Japan made its annual submission on 30 April 2009. The Party indicated that the 2009 annual submission is a voluntary submission under the Kyoto Protocol. The annual submission contains the GHG inventory (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, and changes to the national system and the national registry). This is in line with decision 15/CMP.1.

118. The ERT concludes that the inventory submission of Japan has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1990–2007 and an NIR; these are complete in terms of geographical coverage, sectors, categories and gases and generally complete in terms of years. Emissions of HFCs, PFCs and SF<sub>6</sub> in the industrial processes sector for the period 1990–1994 were



reported as “NE”, as well as a few minor categories in all sectors for which there are no methods in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance.

119. The submission on a voluntary basis of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1. Japan did not report on a voluntary basis supplementary information on implementation of Article 3 paragraph 14.

120. The Party’s inventory is in line with the UNFCCC reporting guidelines, the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT commends Japan for the improvements made in response to previous reviews, which include: incorporating its base year key category analysis; reallocating emissions from waste incineration with energy recovery from the waste sector to the energy sector; and including information on category-specific QA/QC procedures undertaken for the LULUCF sector.

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

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

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

124. In the course of the review, the ERT formulated a number of recommendations<sup>9</sup> relating to the transparency, recalculations and time-series consistency and QA/QC of Japan’s information presented in its annual submission. The key recommendations are that Japan:

- (a) Include more detailed information in the NIR on the country-specific EFs used in all sectors and particularly the EF associated with CO<sub>2</sub> emissions from combustion (which constitute a major part of Japan’s total GHG emissions);
- (b) Provide the rationale for all recalculations in the NIR;
- (c) Improve the documentation of category-specific QA/QC procedures in all sectors, including the QA procedures that are being implemented for the agriculture and waste sectors;
- (d) Provide information and explanations for the drivers of emission trends for all sectors;
- (e) Follow up on recommendations made in this review report and recommendations in previous review reports that are still pending.

## **IX. Questions of implementation**

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

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<sup>9</sup> For a complete list of recommendations, the relevant chapters of this report should be consulted.

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

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

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

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gp/lulucf/gp/lulucf.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 2009. Available at <<http://unfccc.int/resource/docs/2009/asr/jpn.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2009. Available at <<http://unfccc.int/resource/webdocs/sai/2009.pdf>>.

FCCC/ARR/2008/JPN. Report of the individual review of the greenhouse gas inventories of Japan submitted in 2007 and 2008. Available at <<http://unfccc.int/resource/docs/2009/arr/jpn.pdf>>.

UNFCCC. *Standard Independent Assessment Report*, Parts I and II. Unpublished document.

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

Responses to questions during the review were received from Mr. Kohei Sakai (National Institute for Environmental Studies), Ms. Yuriko Hayabuchi, Centre for Global Environmental Research, and Ms. Elsa Hatanaka (Greenhouse Gas Inventory Office of Japan, Centre for Global Environmental Research, National Institute Environmental Studies), including additional material on the methodology and assumptions used.

Akiyama H, Yan X, Yagi K (2006). *Estimations of emission factors for fertilizer-induced direct N<sub>2</sub>O emissions from agricultural soils in Japan: Summary of available data. Soil Science and Plant Nutrition* 52:774-787.

Japanese Livestock Industry Association (2006). *Japanese Feeding Standard for Dairy Cattle*, edited by the National Agriculture and Food Research Organization (only in Japanese).

Kainou K (2008). *Why Japanese Oil CEF seems to be low?*

Nagata O, Samejima R (2006). *Effect of land use change in Ishikari peatland on greenhouse gas emission*. National Agricultural Research Center for Hokkaido Region (only in Japanese).

Nagata O, Sugito T, Kobayashi S, Sameshima R (2009). *Nitrous oxide emissions following the application of wheat residues and fertilizer under conventional-, reduced-, and zero-tillage systems in central Hokkaido, Japan*. *Journal of Agricultural Meteorology* 65(2):151-159.

Annex II**Acronyms and abbreviations**

AD	activity data	IEF	implied emission factor
ARD	afforestation, reforestation and deforestation	IPCC	Intergovernmental Panel on Climate Change
BOD	biological oxygen demand	ITL	international transaction log
CDM	clean development mechanism	J-Coal	Japan Coal Energy Center
CH <sub>4</sub>	methane	LULUCF	land use, land-use change and forestry
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol	METI	Ministry of the Economy, Trade and Industry
COD	chemical oxygen demand	Mg	megagram (1 Mg = 1 tonne)
Committee	Committee for Greenhouse Gas Emissions Estimation Methods	MoE	Ministry of Environment
CO <sub>2</sub>	carbon dioxide	NA	not applicable
CO <sub>2</sub> eq	carbon dioxide equivalent	NE	not estimated
CRF	common reporting format	N <sub>2</sub> O	nitrous oxide
EF	emission factor	NIR	national inventory report
ERT	expert review team	PFCs	perfluorocarbons
ERU	emission reduction unit	QA/QC	quality assurance/quality control
Gg	gigagram	QA-WG	GHG Inventory Quality Assurance Working Group
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs and SF <sub>6</sub> without GHG emissions and removals from LULUCF	SEF	standard electronic format
GIO	Greenhouse Gas Inventory Office of Japan	SF <sub>6</sub>	sulphur hexafluoride
HFCs	hydrofluorocarbons	SIAR	standard independent assessment report
IE	included elsewhere	SWDL	solid waste disposal on land
		UNFCCC	United Nations Framework Convention on Climate Change

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