UNITED NATIONS
NATIONS UNIES

FRAMEWORK CONVENTION ON CLIMATE CHANGE - Secretariat
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FCCC/WEB/IRI(2)/2003/JPN 21 April 2004

JAPAN

REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY SUBMITTED IN 2003[1]

(In-country review)

EXECUTIVE SUMMARY

1. This report covers the review of the 2003 inventory submission of Japan, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat in accordance with decision 19/CP.8 of the Conference of the Parties. Japan submitted its annual inventory on 25 August 2003, consisting of common reporting format tables for the years 1990–2001 and the national inventory report. The review took place from 20 to 24 October 2003 in Tokyo, Japan, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Mr. Jim Penman (United Kingdom); Energy – Mr. Krzysztof Olendrzynski (Poland); Industrial Processes – Mr. Hongwei Yang (China); Agriculture – Ms. Anna Romanovskaya (Russia); Land-use Change and Forestry (LUCF) – Mr. Justin Ford-Robertson (New Zealand); Waste – Mr. Jose Villarin (Philippines). Mr. Villarin and Mr. Penman were the lead reviewers of this review. The review was coordinated by Ms. Astrid Olsson and Mr. Roberto Acosta (UNFCCC secretariat).

2. In accordance with the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Annex I Parties", a draft version of this report was communicated to the Government of Japan, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

3. In the year 2001, the most important greenhouse gas (GHG) in Japan was carbon dioxide (CO_2), contributing 93.4 per cent to total[2] national GHG emissions expressed in CO_2 equivalent, followed by nitrous oxide (N_2O) – 2.7 per cent, and methane (CH_4) – 1.6 per cent. Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 2.3 per cent of the overall GHG emissions in the country. The Energy sector accounted for 88.5 per cent of total GHG emissions, followed by Industrial Processes with 6.3 per cent, and Agriculture and Waste, each with 2.6 per cent.

4. Total greenhouse gas emissions (excluding Land-use Change and Forestry) amounted to 1,299,443 Gg CO_2 equivalent in the year 2001 and increased by 9.5 per cent from 1990 to 2001. The increase is somewhat overestimated because emissions of fluorinated compounds are included in 2001 but not in 1990. This is because actual emissions estimates for fluorinated compounds were available at the time of the review only for 1995 and subsequent years. Tables 1 and 2 provide data on emissions by gas and by sector from 1990 to 2001. In 1995 fluorinated compounds accounted collectively for some 3.6 per cent of emissions, and total emissions of fluorinated compounds fell by about 37.7 per cent over the period

[1] In the symbol for this document, 2003 refers to the year in which the inventory was submitted, and not to the year of publication. The number (2) indicates that this is an in-country review report.

[2] In this report, the term total emissions refers to the aggregated national greenhouse gas emissions expressed in terms of CO_2 equivalent excluding Land-use Change and Forestry, unless otherwise specified.

1995–2001. Over the period 1990–2001 CO_2 emissions increased by 8.2 per cent, mainly because of increased emissions from transport. CH_4 emissions decreased over the same period by 18 per cent, mainly because of decreased emissions from agriculture and fugitive emissions; N_2O emissions decreased by 12 per cent over the same period because of falls in industrial processes and agriculture. Between 1995 and 2001 emissions from HFCs, PFCs and SF_6 decreased by 22.1 per cent, 13.7 per cent, and 72.9 per cent, respectively, as a result of abatement of industrial emissions, solvent emissions and emissions from electrical equipment, respectively.

5. The expert review team concluded that Japan has produced a carefully considered, reliable greenhouse gas inventory that is generally consistent 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 that the institutional arrangements put in place by Japan are a sound basis for further development, taking account of the expert review team's recommendations as set out below. The expert review team hoped that it would soon be possible to complete the time series for Land-use Change and Forestry and for emissions of fluorinated compounds.

6. The expert review team acknowledged that the publication of the national inventory report, represents a great improvement in relation to the Party's previous greenhouse gas inventories. It complimented Japan on its detailed work on uncertainty analysis and on the transparency introduced by extensive cross-linking of spreadsheets to the common reporting format. The expert review team noted that transparency could be further enhanced by providing more detailed descriptions in the national inventory report or by publishing the results in the peer-reviewed literature, although this is not a formal requirement of the UNFCCC guidelines, and has identified some areas in the following sections where this would be useful.

Table 1. Greenhouse gas emissions by gas, 1990–2001

GHG emissions	Gg CO_2 equivalent												Change from 1990–2001 %
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
Net CO_2 emissions/removals	1,038,214	1,047,338	1,063,177	1,050,349	1,106,641	1,114,203	1,231,207	1,226,819	1,195,039	1,228,242	1,238,699	1,213,658	--
CO_2 emissions (without LUCF)[b]	1,122,117	1,131,205	1,148,747	1,140,431	1,200,185	1,210,908	1,231,207	1,226,819	1,195,039	1,228,242	1,238,699	1,213,658	8.2
CH_4	24,795	24,705	24,545	24,493	24,062	23,426	22,889	22,053	21,514	21,271	20,871	20,340	-18
N_2O	40,196	39,703	39,952	39,691	40,605	40,783	41,710	42,159	40,828	35,111	37,798	35,384	-12
HFCs	NE	NE	NE	NE	NE	20,026	19,632	19,579	18,957	19,533	18,348	15,599	--
PFCs	NE	NE	NE	NE	NE	11,503	11,267	14,013	12,440	11,072	11,489	9,929	--
SF_6	NE	NE	NE	NE	NE	16,737	17,185	14,432	12,822	8,352	5,740	4,534	--
Total (with net CO_2 emissions/removals)	**1,103,205**	**1,111,746**	**1,127,673**	**1,114,532**	**1,171,309**	**1,226,678**	**1,343,891**	**1,339,056**	**1,301,599**	**1,323,580**	**1,332,945**	**1,299,443**	
Total (without CO_2 from LUCF)	**1,187,108**	**1,195,612**	**1,213,243**	**1,204,614**	**1,264,852**	**1,323,383**	**1,343,891**	**1,339,056**	**1,301,599**	**1,323,580**	**1,332,945**	**1,299,443**	**9.5**

[a] Net CO_2 emissions/removals are not shown for 1996 and subsequent years because LUCF emissions and removals have not been estimated for these years.
[b] LUCF = Land-use Change and Forestry.

Table 2. Greenhouse gas emissions by sector, 1990–2001

GHG source and sink categories	Gg CO_2 equivalent												Change from 1990–2001 %
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
Energy	1,058,102	1,065,222	1,081,254	1,073,890	1,130,062	1,140,249	1,160,304	1,156,156	1,128,935	1,163,243	1,171,816	1,149,540	8.6
Industrial Processes	64,762	65,701	66,124	65,019	66,917	115,150	115,656	114,559	104,412	89,243	92,752	82,130	-29[b]
Solvent Use	287	357	413	412	438	438	421	405	377	363	341	344	19.7
Agriculture	38,979	38,787	38,710	38,578	37,967	37,052	36,162	35,387	34,852	34,386	34,110	33,848	-13.2
LUCF[a]	-83,845	-83,775	-85,478	-89,989	-93,450	-96,610	NE	NE	NE	NE	NE	NE	15.2[c]
Waste	24,919	25,454	26,650	26,624	29,374	30,399	31,348	32,550	33,024	32,966	33,926	33,581	34.8
Other	0	0	0	0	0	0	0	0	0	0	0	0	

[a] LUCF = Land-use Change and Forestry, not estimated for 1996 and subsequent years.
[b] This percentage decrease is for the period 1995–2001. The NIR shows that emissions from this sector increased by 26.8 per cent over the period 1990–2001, but this includes emissions of fluorinated compounds included in the 2001 estimate but not in that for 1990, since actual emissions data are available only since 1995, when fluorinated compounds accounted for about 42 per cent of emissions from industrial processes.
[c] This percentage increase in removals refers to the period 1990–1995 since LUCF estimates are not available for more recent years.

I. OVERVIEW

A. Inventory submission and other sources of information

7. Japan submitted common reporting format (CRF) tables on 25 August 2003 and a national inventory report (NIR) on 26 September 2003. This is a delay of 4.5 months from the due date (15 April) agreed by the Conference of the Parties (COP). The expert review team (ERT) noted that the delayed submission restricted the time available to prepare for the review.

8. In its 2003 submission Japan has provided a complete set of common reporting format (CRF) tables for the years 1990–2001 and the ERT made extensive use of these during the review. Japan also provided worksheets linked to the CRF. The full list of materials used during the review is provided in annex 1 to this report.

B. Key sources

9. Japan has reported a key source tier 1 analysis, both level and trend assessment, as part of its 2003 submission. The key source analyses performed by the Party and the secretariat[3] produced similar results for the level assessment. The assessment conducted by the Party was somewhat more disaggregated than the secretariat's, and this explains differences in respect of the selection of some key sources, such as CH_4 from rice cultivation and N_2O from soils (in the Party's assessment but not the secretariat's) and N_2O from manure management (vice versa). Japan has used the key source analysis in using decision trees from the IPCC good practice guidance to decide its choice of methodology.

C. Cross-cutting topics

Completeness

10. The inventory reported by Japan in 2003 is largely complete except for Land-use Change and Forestry (LUCF) categories. These are not reported for years later than 1995, pending adoption of the relevant IPCC good practice guidance for the Land Use, Land-use Change and Forestry (LULUCF) sector. The ERT encouraged Japan to provide LUCF data for all inventory years, using the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC Guidelines) if necessary, because this is a reporting requirement and because of the need to maintain the time series. Japan has provided a complete series of potential emissions of fluorinated compounds and actual emission estimates for 1995 and subsequent years. The ERT noted that Japan hoped to be able to extend the estimates of actual emissions of fluorinated compounds to earlier years. Some other sources of emissions, although they are not large, are also not reported under other inventory categories, mainly in the Energy and Industrial Processes sectors. These are identified in CRF table 9 and are addressed under the appropriate sections below. The NIR identifies these omissions which are under review.

Transparency

11. The ERT noted that the publication of the NIR represents a major advance in transparency. It further complimented Japan on the transparency provided by the detailed worksheets, which are clearly cross-referenced to the CRF tables in the NIR. The work of the ERT was greatly facilitated by making use of the information in the worksheets during the review. The NIR contains documentary references to all the sources used in preparing the inventory. It also noted that, subject to availability of resources, transparency

[3] The secretariat had identified, for each individual Party, those source categories which are key sources in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. Key sources according to the tier 1 trend assessment were also identified for those Parties providing a full CRF for the year 1990. Where the Party has performed a key source analysis, the key sources presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key source assessment conducted by the secretariat.

could be improved by publishing the relevant technical information on methods and emission factors (EFs) in the international scientific literature, although this is not a formal requirement of the UNFCCC guidelines. This would promote understanding of the Japanese inventory as well as making valuable work more widely available worldwide.

12. As explained more fully in the Energy section of this report, adjustments made to avoid double counting in the form of amounts subtracted from the total of other subsectoral estimates appear in the Manufacturing Industries and Construction and Transport sectors. These adjustments arise because of the way in which the high degree of integrated data on industrial energy consumption are used in the Japanese inventory, and because of the way in which bottom–up data are used to allocate transport emissions to subsectors. The ERT noted that the nature of the adjustments could be misunderstood and if they continue to be used recommends greater use of the documentation boxes to explain them, and possible publication of a supplementary short paper on the matter.

Recalculations and time-series consistency

13. The ERT noted that recalculations reported by the Party of the time series 1990–2001 had been undertaken because of revisions in the energy statistics, the inclusion of cement used as a solidification agent, and other revisions of activity data (AD). The recalculations increase the figures for emissions in 1990 and 2000 by 0.19 per cent and 0.10 per cent, respectively. The NIR identifies these revisions and the corresponding CRF tables have been completed. The ERT noted that the revisions are relatively small and considered them justified, but believed that a somewhat fuller discussion in the NIR would increase transparency, which will be important if larger adjustments occur in future.

14. The NIR identifies the possibility of using the calendar year rather than the fiscal year as the basis for reporting in the inventory, and this was discussed at some length during the in-country review. Japan's main national statistics are produced on a fiscal year basis. The Party informed the ERT that it would be possible to shift to a calendar year basis for the 2006 inventory submission (which would provide data for the year 2004), but that detailed inventory estimates could not be made to recalculate the time series back to 1990. The ERT noted that shifting the basis in this way would introduce an inconsistency into the time series in 2004, which would be inconsistent with the overriding requirement in the IPCC good practice guidance for time-series consistency. Changing to a calendar year basis could also make validation more difficult if published AD for the inventory year were not available for cross-checking. The ERT therefore concluded that it would be preferable for Japan to continue to report to the UNFCCC on a fiscal year basis, but encourages Japan to continue its work on the possibilities for conversion.

Uncertainties

15. Appendix 3 of the NIR provides a detailed discussion of level uncertainties using the IPCC tier 1 method. This introduces a classification of EFs and activity uncertainties according to whether they are based on sampling data, expert judgement or (for EFs) IPCC default values. The NIR also describes national guidelines developed by Japan on how to assess the uncertainties of individual data items within this framework, and says that specific responsibility for assessing uncertainties has been given to the Committee for Greenhouse Gas Estimation Methods set up by the Ministry of the Environment (MOE). Appendix 4 quantifies uncertainties by sector and in combination for the inventory as a whole; the latter is found to be between 2 per cent and 3 per cent in 2001. This is an unusually low uncertainty in a total emissions estimate, given the values quoted by other Annex I Parties. Exploratory calculations by the ERT indicate that the reason for this is that emissions of N_2O from agricultural soils (which commonly dominate the uncertainty in total emissions in other countries) are unusually low in Japan, reflecting the pattern of land use. The uncertainties for other categories are comparable with those in other national inventories. The ERT complimented Japan on its careful and systematic approach to uncertainty assessment. This could be developed to provide an estimate of the uncertainty in the trend as well as in the level of emissions, and could be used in conjunction with the key source analysis in prioritizing the methodological development of the inventory.

Verification and quality assurance/quality control approaches

16. The NIR provides information on quality assurance and quality control (QA/QC) as part of the description of the overall inventory preparation process. The compilation process provides opportunities for computational checks by the MOE and by stakeholder organizations which are provided with copies of the relevant worksheets for this purpose. The MOE has specific responsibility for making improvements based on internal review of the inventory for the previous year. The sectoral breakout groups described below carry out review and evaluation of methodologies and about 60 experts participate in this process. There are plans to introduce independent third-party review. The additional effort required to put in place a formal QA/QC plan as set out in the IPCC good practice guidance would not be great and the ERT believes that this would be a useful step to take. The ERT also noted that more use could be made for verification purposes of energy balance calculations by fuel and sector.

Institutional arrangements

17. The MOE has overall responsibility for the national inventory and has established a Committee for Greenhouse Gas Estimation Methods with five breakout groups covering the main sectors (Energy and Industrial Processes, Transportation, Agriculture, Waste and Fluorinated Gases). Other ministries (notably the Ministry of the Economy, Trade and Industry (METI), the Ministry of Land, Infrastructure and Transport, the Ministry of Agriculture, Forestry and Fisheries, and the Ministry of Health, Welfare and Labour) and stakeholder organizations are involved. Actual compilation is undertaken with the assistance of consultants by the Greenhouse Gas Inventory Office in the National Institute for Environmental Studies. The ERT noted the importance of coordination and believed that the institutional arrangements set up by Japan are a good basis for maintaining this coordination.

Record keeping and archiving

18. CRF spreadsheets together with the linked worksheets and printed material are archived each year in the Greenhouse Gas Inventory Office. Confidential material relating to emissions of some fluorinated compounds is archived each year at METI. These arrangements could usefully be formalized as part of the QA/QC plan.

Follow-up to previous reviews

19. The ERT expressed its appreciation to Japan for providing the NIR, which overcomes major problems in transparency of the Japanese inventory identified in the previous review, and noted the need to complete the response to cover all the issues raised during the previous reviews and previous review stages, such as explanation of outlier implied emission factors (IEFs) and unstable trends, and the lack of data on actual emissions of fluorinated gases for the years 1990–1994.

D. Areas for further improvement

Identified by the Party

20. The NIR identifies the need to develop estimates for sources currently reported as not estimated ("NE") in the CRF, and the need to review the use of default estimation methods where these are used in the inventory.

Identified by the ERT

21. The ERT agreed with the NIR assessment and also identifies the following cross-cutting issues for improvement:

(a) Fuller use of key source analysis in choice of methodology;

(b) Provision of a quantified uncertainty estimate for the trend in emissions;

(c) Development of a QA/QC plan as described in chapter 6 of the IPCC good practice guidance.

22. Recommended improvements relating to specific source categories are presented in the relevant sector sections of this report.

II. ENERGY

A. Sector overview

23. In the year 2001, the Energy sector, including fugitive emissions, contributed approximately 1,149,540 Gg of CO_2 equivalent or 88.5 per cent of total emissions in Japan. Energy sector emissions contributed to the overall growth in emissions, increasing by 8.6 per cent between 1990 and the year 2001, while total emissions increased by 9.5 per cent in the same period. However, compared to the year 2000, greenhouse gas (GHG) emissions from the Energy sector fell by 1.9 per cent.

24. The major sources of emissions in the sector are stationary combustion of fuels (mainly imported steam coal, liquefied natural gas (LNG), heating oil A, kerosene, coke and town gas (also called gas works gas) and mobile sources (gasoline and diesel oil). In Japan, as in many other countries, electricity is produced mainly from fossil fuels combustion. Compared to other countries, the share of fugitive emissions is relatively small. Most of Japan's key sources are in the Energy sector.

25. Japan has developed a GHG emissions inventory of good quality in the Energy sector with comprehensive and transparent archiving system of numerous linked spreadsheets with supporting data that provide direct and automatic input to the CRF. Country-specific methods are widely used, with country-specific data being derived from dedicated studies (e.g., surveys of AD and direct measurements of emissions or EFs). Uncertainty analysis has been carried out for both AD and EFs for 2001, and the results are published in the NIR.

Completeness

26. The CRF includes estimates of all gases and sources of emissions from the Energy sector, as recommended by the IPCC Guidelines, and following the UNFCCC reporting guidelines. All relevant CRF tables (1990–2001) are complete, apart from minor gaps and inconsistencies within the tables that are identified below. Particular features of the way in which data have been allocated are explained in the documentation boxes and in the NIR.

Transparency

27. The information presented in both the CRF and the NIR is transparent and generally follows the IPCC Guidelines and the IPCC good practice guidance, although explanations are still needed regarding questions raised in previous 2003 review activities concerning apparently unstable trends for some non-CO_2 greenhouse gases and IEFs identified as outliers. Japan clarified during the review that the outliers are likely to be linked to national fuel standards, but the provision of more transparent information on this and an explanation for the apparently unstable trends would be useful. Energy balance data are provided in the worksheets. References to background studies/reports with descriptions of country-specific methodologies are given in the NIR and additional useful information was provided to the ERT during and after the review.

Recalculations and time-series consistency

28. Recalculations have been made for the years 1990–2000. The recalculations in the Energy sector concern both 1.A Fuel Combustion – CO_2, CH_4 and N_2O and 1.B Fugitive Emissions – CO_2 and CH_4. The largest corrections in both absolute and percentage terms are in sectors 1.A.4 Other Sectors and 1.B.2 Oil and Natural Gas. The former involves mainly CO_2 and the latter mainly CH_4 emissions. The revisions may be large in percentage terms for the gases and source categories concerned, and the overall effect on annual total national emissions is of the order of –1.56 per cent to +1.13 per cent, which is significant in terms of

the trend. As stated in CRF tables 8(b) for 1990–2000, the recalculations were mainly due to corrections of errors in CH_4 emissions (1.B.2), the revision of EFs for CH_4, the revision of the number of wells drilled, and a complete revision of the national energy balance sheets. The recalculations indicate reductions of more than 90 per cent in CO_2 emissions from biomass (which are recorded as a memo item in accordance with the IPCC Guidelines and not included in the national total), and previously missing data for international bunkers have been included. These recalculations demonstrate Japan's determination to continuously improve its GHG inventory by updating relevant information and eliminating identified errors.

Uncertainties

29. The NIR presents level uncertainties estimated by the responsible MOE committee as described above. Individual uncertainties by fuel have been reconciled with uncertainties given in the Japanese *General Energy Statistics*. This is consistent with the approach to dealing with correlation between categories set out in the IPCC good practice guidance. The ERT noted that it would be possible to extend the uncertainty analysis to include trend assessment.

Verification and quality assurance/quality control approaches

30. The NIR contains general information on verification and QA/QC, but no significant sector-specific information is provided.

B. Reference and sectoral approaches

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

31. In the CRF reference approach table, physical units (Gg for solid and liquid fuels, million m^3 for gaseous fuels) rather than energy units should be used up to the conversion factor column. The part referring to biomass should be completed. All the values in the fraction of carbon oxidized column are assumed in the 2003 submission to be 1.0, whereas country-specific or default IPCC values (p. 1.29 of the Reference Manual) could have been used. Missing notation keys should be added. Similar remarks apply to the reference approach tables in the CRFs for the preceding years.

32. The AD for liquid fuels in CRF table 1.A(c) (Reference Approach vs. National Approach for CO_2 Emissions from Fuel Combustion) differ by more than 20 per cent, and these emissions correspond to 2.38 per cent of total national CO_2 emissions. This difference should be explained.

International bunker fuels

33. In its response to previous 2003 review activities, Japan explained that the differences between the IEFs for CO_2 for jet kerosene as between domestic and international aviation stem from the use of different calorific values – net calorific value (NCV) for international and gross calorific value (GCV) for domestic aviation – when assessing the respective AD. The same calorific value should be used in future submissions.

Feedstocks and non-energy use of fuels

34. The source category Manufacturing Industries and Construction given in table 1.A(d) Sectoral Background Data for Energy: Feedstocks and Non-Energy Use of Fuels is too general to be very informative, and it would be useful to provide a more detailed description of the relevant subsectors.

C. Key sources

35. The ERT noted that the list of key sources indicated by the UNFCCC secretariat differs from the list identified by Japan (2001 NIR). The differences arise mainly because the secretariat applied a tier 1 method with aggregated fuel categories such as Stationary Combustion: Coal, Gas – CO_2, while Japan in general has used for the analysis individual fuels such as steam coal (imported or indigenous – the latter further disaggregated into open pit and underground), coke, blast furnace gas, coke oven gas and pulverized coal

injection (PCI) coal. In the case of the Energy sector, Japan has identified 28 key sources (for both level and trend assessment) and described them in detail in appendix 2 of the NIR, while the estimate by the secretariat covers only seven corresponding key sources. The level of disaggregation used by the Party provides more useful information to help an understanding of the Japanese inventory. When the respective individual key source categories indicated by Japan are summed to obtain level assessment estimates for aggregated fuel categories, the resulting estimates largely agree with the secretariat's estimates. This is not, however, the case with the trend assessment contribution, where there are significant differences. These are briefly discussed in the next paragraph.

36. For level uncertainty the most important sectors within the Energy sector involve CO_2 emissions only and they include stationary combustion of coal and oil (including secondary fuels), with contributions exceeding 28 and 27 per cent, respectively; and mobile combustion – road transport, with a contribution of over 19 per cent. For trend uncertainty, the largest contributions come from mobile combustion: road transport – CO_2, with 13.6 per cent; and stationary combustion: oil and gas – CO_2, with 13 and 12.9 per cent, respectively. Japan's estimates sometimes differ significantly from the secretariat's.

Stationary combustion: all fuels – CO_2

37. For all types of fuel, country-specific CO_2 EFs have been used (table 3.1 of the NIR). For all fuels (except coke and coke-derived gases and town (gas works) gas) the EFs are constant over the entire period 1990–2001. There is a jump in the EFs used for coke between 1999 and 2000. The values for the years 1990–1999 (approximately 28 t C/TJ gross) are reasonable, leading to a CO_2 EF for coke of approximately 100 Tg CO_2/GJ, while the value for the year 2000 (25.91 t C/TJ gross) seems to be too low. The EFs for coke oven gas are different in different NIR tables (NIR tables 3-1 – Sectoral Approach and 3-3 – Reference Approach). These inconsistencies should be explained and corrected as necessary.

38. Many of the IEFs (for mostly liquid and gaseous fuels) in subsectors 1.A.1, 1.A.2 and 1.A.4 are among the lowest of reporting Parties. Japan explained that this was because of fuel quality standards. This information should be provided in the NIR with appropriate references to the standards themselves.

Mobile combustion

39. The NIR sets out that emissions from road transport have been calculated using the tier 3 method. EFs for CH_4 and N_2O have been established for each type of fuel in each category of vehicle, using actual Japanese data (tables 3-6 and 3-7). The method used to establish EFs was to take a weighted average estimated for each category of running speed, using the proportion of mileage by each running speed for each category given in the Ministry of Land, Infrastructure and Transport's *Road Transport Census*. The EFs reflect motor vehicle operation in Japan by using the proportion of mileage by each running speed during times of congestion.

40. Several CO_2 IEFs in road transport (for diesel oil, other fuels – liquefied petroleum gas (LPG)), civil aviation (for jet kerosene and aviation gasoline) and navigation (for diesel oil – heavy oil) are among the lowest of reporting Parties. Japan explained that this was because of fuel quality standards. This information should be provided in the NIR with appropriate references to the standards themselves.

Fugitive emissions

41. CH_4 emissions from 1.B.1 Coal Mining and Handling in 2001 are identified as a key source in trend assessment (tier 1). Emissions are estimated based on domestic research (NIR). The secretariat's analysis does not show this category as a key source.

D. Non-key sources

42. Japan reports negative emissions for CH_4, N_2O, carbon monoxide (CO), nitrogen oxide (NO_x) and sulphur dioxide (SO_2) in subsectors 1.A.1, 1.A.2, 1.A.4 for all fuel types (solid, liquid, gaseous) in several source categories. This results from the use of negative EFs. As explained to the ERT, the negative EFs are country-specific values derived from surveys of installations and research on measured emissions. Negative

EFs for CH_4 and N_2O are derived because measured concentrations of these GHGs in flue gases are lower than in the ambient air. In some cases the signs of the respective EFs may be negative for one gas (e.g., CH_4) and positive for another (e.g., N_2O). The ERT noted that negative EFs are not consistent with the current IPCC Guidelines or the IPCC good practice guidance, which count the positive emissions in the flue gases rather than the difference between flue gas and ambient concentrations. The ERT believes that the measurements and survey work should still be used in the inventory, but that emissions should be calculated using the *positive* EFs calculated from the data that reflect the *actual* emissions in the flue gases. The ERT encourages the Party to use the NIR to provide information on the specifics of the mass balance used, and suggests that it consider publication of the survey work and associated measurements in the peer-reviewed literature.

43. The ERT was informed that for all types of fuel country-specific EFs for CH_4 and N_2O are used. The estimates are based on actual measurements (Ministry of the Environment, *Research of Air Pollutant Emissions from Stationary Sources*, called the *MAP Survey*). Extensive MAP surveys were carried out in fiscal years 1992, 1995, 1996 and 1999, covering all facilities emitting soot and smoke. In the years 1990, 1991, 1993 and 1994, sampling surveys were conducted only at large-scale facilities and operating sites (NIR). The ERT learned that for some source categories different AD are used for calculating CO_2 emissions (generally based on energy statistics) and non-CO_2 emissions (based on consumption figures). The ERT recognized the importance of the MAP surveys as a source of information for estimating non-CO_2 emissions. However, AD should in principle be consistent and statistical work to establish the relationship between data sources should be considered.

44. Many of the IEFs (mostly for liquid and gaseous fuels) in subsectors 1.A.1, 1.A.2 and 1.A.4 are among the lowest of reporting Parties. Japan explained that this was because of fuel quality standards. This information should be provided in the NIR with appropriate references to the standards themselves.

E. Country-specific issues

Duplication adjustments

45. CRF table 1 includes two duplication adjustments for CO_2, CH_4, N_2O, NOx, CO and SO_2 for subsectors 1.A.2 and 1.A.3. These adjustments have been made to eliminate double counting of emissions that would otherwise occur. During the review, Japan explained that adjustment is needed in sector 1.A.2 Manufacturing Industries and Construction because of the high degree of integration in industrial energy use in Japan. Many of the industrial plants in Japan operate in two or more industrial subsectors. For example, iron and steel plants are often combined with chemical plant, making it difficult for those plants to disaggregate fuel use between two or more distinct industrial activities. Consequently, the entire fuel use in a plant is attributed in the statistical reporting to two or more industry sectors. As a result, emissions for individual industry sectors are overestimated because fuel consumption is counted twice or more often at plant level. However, the total fuel consumption for such plants is known, and the double counting can be corrected by means of the duplication adjustment, which is a lump figure that is applied to the entire sector 1.A.2.

46. In the case of the Transport sector, the potential for double counting results from the application of the bottom–up consumption statistics to allocate emissions. These statistics tend to overestimate (by about 7 per cent in energy terms) total fuel use as compared to statistics of fuel supply.

47. The duplication adjustments can be misinterpreted and may also complicate analyses of policies and inter-sectoral comparisons. The ERT recommends that Japan give consideration to approaches to the allocation of emissions that would avoid the need for duplication adjustments, though without loss of transparency, for use in its future inventories.

Activity data

48. Japan uses different AD for calculating some CO_2 and non-CO_2 emissions. As explained to the ERT, the AD for CH_4 and N_2O differ from those used for CO_2 because they are derived from surveys, whereas the energy data used for CO_2 estimates come from the national energy statistics. In principle, and

in accordance with the IPCC good practice guidance, there should be only one consistent figure for AD for a given combination of subsector and fuel. The ERT recommends the use of identical AD for CO_2 and non-CO_2 emissions estimates. If necessary statistical scaling based on stratified sampling could be used to establish the relationships between the data sets.

F. Areas for further improvement

Identified by the Party

49. In several of the CRF tables the notation "NCV" has been used instead of "GCV", which should be used to reflect Japanese energy data. This is simply an editorial matter – it does not affect the emissions estimates and will be corrected in Japan's future submissions. Japan indicated during the review that there is an imbalance in the carbon budget between input and output data for petroleum refineries. For 1990 data, carbon input is larger by 5 million tonnes than output, while in 2001 the opposite is true and the output exceeds the input by 3 million tonnes of carbon. Japan is studying the cause of the apparent trend in emissions estimates and may make a proposal on how to deal with it. The ERT noted that any proposal of this type should be transparently documented and based on actual understanding of the reasons for the trend, rather than simply adjusting one set of figures to agree with another.

Identified by the ERT

50. Some questions posed in previous 2003 review activities are still pending. Although use of national standards and survey data help explain IEFs which appear low compared with values derived using data from other countries, these factors do not self-evidently account for the unstable emission trends identified in subsectors 1.A.1–1.A.4.

51. The following main areas have been identified by the ERT:

(a) The use of duplication adjustments, especially for the Transport sector (1.A.3). The data reported in this source category should be presented without the adjustments, provided this is analytically feasible without loss of transparency;

(b) The use of negative EFs for some non-CO_2 emissions (fuel combustion). The ERT recommends Japan to replace the use of negative EFs for non-CO_2 emissions by the corresponding positive EFs for flue gases, based on domestic surveys and research;

(c) The application of different AD for calculation of CO_2 and non-CO_2 emissions for some source sectors. The ERT recommends Japan to establish the statistical relationship between the AD sets so that consistent AD can be used.

52. A number of minor corrections/additions to CRF and NIR have also been identified, which the ERT recommends Japan to correct:

(a) In applying the reference approach, physical units (Gg for solid and liquid fuels, million m^3 for gaseous fuels) rather than energy units should be used up to the conversion factor column, biomass data should be provided, and IPCC default[4] or country-specific data should be used for the fraction of carbon oxidized, rather than assuming 1.0; and missing notation keys should be added;

(b) The jump in the EFs for coke between 1999 and 2000 (NIR tables 3-1, 3-3 and 3-4) should be explained. The numbers for coke oven gas currently used are significantly different from the IPCC default values. This difference should be explained;

(c) Unrealistic calorific values are obtained in some cases (e.g., for crude oil streams) when emissions data from the reference approach table 1.A(b) are combined with Japanese energy balance data published by IEA;

[4] See p. 1.29 of the Reference Manual.

(d) Some very large EFs (e.g., 127,000,000 kg/TJ for N_2O in (table 1.A(a)) sector 1.A.1.b for Solid Fuels should be checked;

(e) The AD for liquid fuels in CRF table 1.A(c) (Reference Approach vs. National Approach) should be checked; the difference between the reference approach and the national approach exceeds 20 per cent;

(f) Japan should use the NIR to explain the reasons for the very high/low IEFs and unstable emission/IEF trends. The questions raised in the context of previous 2003 review activities, such as the synthesis and assessment (S&A) review, may be used as an indication of which issues merit the provision of more detailed information in future NIRs.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

53. In the year 2001, emissions from the Industrial Processes sector represented approximately 6.3 per cent of Japan's total GHG emissions, (excluding LUCF), as reported in Japan's 2003 submission. CO_2 contributed about 3.9 per cent, HFCs about 1.2 per cent, PFCs about 0.8 per cent and SF_6 about 0.3 per cent.

54. Five of the key sources identified by Japan come from the Industrial Processes sector. These are: CO_2 from cement production identified by tier 1 level and trend assessment; CO_2 from limestone and dolomite use identified by tier 1 level assessment; N_2O from adipic acid production identified by tier 1 trend assessment; HFCs and SF_6 from production of halocarbons and SF_6 identified by tier 1 level and trend assessment; and HFCs and PFCs from consumption of halocarbons identified by tier 1 trend assessment. This key source assessment is similar to the level assessment made by the secretariat.

55. The total GHG emissions of this sector as recorded in the inventory increased by about 26.8 per cent between 1990 and 2001, but this apparent percentage increase is overstated because actual emissions of fluorinated compounds are not estimated before 1995. By gas, emissions of CO_2, CH_4 and N_2O decreased by 11.3 per cent, 61.1 per cent and 81.9 per cent, respectively, between 1990 and 2001. Emissions of HFCs, PFCs and SF_6 decreased by 22.1 per cent, 13.7 per cent and 72.9 per cent, respectively, between 1995 and 2001. The ERT encourages Japan to complete the time series of actual emissions of HFCs, PFCs and SF_6 in order to give a better picture of the trend in emissions from this sector.

Completeness

56. The ERT noted that Japan has reported actual emissions of HFCs, PFCs and SF_6 for 1995 and subsequent years and that some source categories are reported as "NE" or "included elsewhere" ("IE"). The ERT suggests that the time series of actual emissions of HFCs, PFCs and SF_6 be extended back to 1990 on a consistent basis if at all possible, and that soda ash production and use, asphalt roofing, road paving with asphalt, and carbide production be separately identified.

Transparency

57. The ERT noted that Japan has greatly improved the transparency of its inventory compared to those previously submitted. These improvements include the submission of an NIR for the first time, the linking of detailed worksheets to the CRF, and the estimation of emissions from cement production and lime production disaggregated from those associated with limestone and dolomite use. Estimates for the adipic acid production category and the production of halocarbons and SF_6 category are based on measurements. The ERT suggests that Japan provide relevant information on what kind of measurements has been done and how the accuracy of the measurements in the NIR can be ensured.

Recalculations and time-series consistency

58. Japan reports recalculations in the CRF tables for inventory years 1990–2000. In 1990, the result was an increase in the figures for total emissions of 0.2 per cent. For the Industrial Processes sector, the recalculations resulted in increases in the figures for CO_2 emissions by about 0.7 per cent and for CH_4 emissions by 229.8 per cent. No information is provided in the NIR to explain the substantial change of CH_4, although the share of CH_4 in the total emissions is very small. The ERT suggests that Japan include the necessary information in order to provide transparency about the recalculations in the NIR.

Uncertainties

59. Japan provides a quantitative assessment of the uncertainty in the Industrial Processes sector. The results indicate the estimated uncertainties of 4 per cent for non-fluorinated gases and 34 per cent for fluorinated gases (F-gases). Source categories noted as "NE" were not included in the uncertainty analysis.

Cross-cutting issues with the Energy sector

60. CO_2 emissions from ammonia production are estimated using the IPCC Guidelines and reported under Industrial Processes. CO_2 and CH_4 emissions from iron and steel production, CO_2 and CH_4 emissions from ferroalloys production, and CH_4 emissions from carbide production are reported as being included in the Energy sector under 1.A Fuel Combustion.

B. Key sources

Cement production – CO_2

61. CO_2 from cement production accounted for 64 per cent of total CO_2 emissions from the Industrial Processes sector in 2001, equivalent to 39.6 per cent of the total GHG emissions from the sector in that year. Japan uses limestone consumption for cement production as the AD. This method is not in line with the IPCC good practice guidance, which uses clinker production for the AD. Japan explained that there are no clinker data in the existing national statistics. Considering the importance of this source, the ERT considers that the recommended IPCC good practice guidance method based on clinker could be simpler and more appropriate to use, and could overcome some of the shortcomings of the country-specific method such as the need to determine the purity of limestone, the rate of decomposition of limestone, loss of limestone feedstock and water content in limestone.

Limestone and dolomite use – CO_2

62. Country-specific EFs based on average calcium oxide (CaO) content in limestone and the average CaO and magnesium oxide (MgO) contents in dolomite have been used to substitute the IPCC default EFs used for previous inventories. To improve the accuracy of the inventory, the ERT suggests that weighted averages should be used for the calculation of EFs and that the contents of MgO in limestone should be taken into consideration as well.

Adipic acid production – N_2O

63. It is good practice that Japan uses plant measurements data for the estimates. There is only one company producing adipic acid in Japan. An N_2O abatement unit was installed there in 1999 and its N_2O emissions have been abated since then. The EF remained constant from 1990 to 1998 at 250 kg/t, and then declined to 25 kg/t in 1999 and 19 kg/t in 2001, with a spike in 2000 at 101 kg/t. During the discussions with the ERT, Japan explained that the spike in 2000 was the result of the low utilization of the abatement unit in 2000. The ERT suggests that such background information about the N_2O abatement be provided in the NIR in order to improve transparency.

Production of halocarbons and SF_6 – HFCs and SF_6

64. It is good practice that Japan uses plant measurements data for the estimates of HFC-23 emissions from HCFC-22 production (chlorodiflouromethane). A bottom–up approach has been used to estimate HFC-23 emissions, based on the direct measurement results for all the five plants in Japan. The generation factors and EFs Japan reports are actually the implied values. This may be useful to other Parties for comparative purposes. The ERT suggests that Japan provide relevant information on the rationale for its choice of methodology, the determination of generation factors and the IEFs used in the NIR.

65. SF_6 fugitive emissions from production of halocarbons and SF_6 are based on reference material contained in Chemical and Bio Sub-Group documents prepared by METI. The EFs show a declining trend. In the discussions with the ERT, Japan explained that this is due to the improvement of the abatement system. The ERT suggests that the NIR could usefully include the information about the abatement system.

Consumption of halocarbons – HFCs and PFCs

66. Both potential and actual emissions have been estimated for most of the sub-source categories, except actual HFC emissions from solvents and potential and actual emissions from Other (for research, medical use etc.), which are absent. Actual and potential HFC and PFC (except HFC-23 and tetrafluoromethane (CF_4)) emissions are aggregated for confidentiality reasons. The ERT suggests that Japan describe in the NIR how the QA/QC of these confidential data is addressed.

C. Non-key sources

Lime production – CO_2

67. The ERT noted that Japan has developed country-specific EFs based on a detailed survey that covers all the lime plants in Japan. This helps increase the accuracy of the estimates. The ERT noted that the NIR provides a useful comparison between the weighted average EF and the IPCC default value.

Iron and steel production – CO_2

68. CO_2 emissions from steel production are not considered because the carbon contents of iron to steel have been reduced. The ERT suggests that Japan include an estimate by using equation 3.6B in the IPCC good practice guidance.

Carbide production – CO_2

69. CO_2 emissions from silicon carbide and calcium carbide production are noted as “NE” in the CRF. The number of these plants is small in Japan. The ERT noted that Japan intends to estimate and report these emissions in its future submissions.

D. Areas for further improvement

Identified by the Party

70. Japan intends to extend the application of IPCC good practice guidance methods in estimating emissions from lime production, iron and steel production and F-gases.

71. Japan intends to report emissions of PFCs that are additional GHGs, as required in paragraph 20 of the revised UNFCCC reporting guidelines (FCCC/CP/2002/8), and intends to compare the emissions of these PFCs by checking the mass balance between actual and potential emissions.

Identified by the ERT

72. The ERT noted that background information about the estimates is provided in Excel worksheets. This helps to achieve transparency, and the ERT suggests that this could be further improved if the worksheets or the NIR contained information about or references to where information can be found on the

methodologies, assumptions, EFs and AD used, as well as on the rationale for the selection of methods as set out in the UNFCCC reporting guidelines. The information should cover the entire time series and any recalculations or other changes to previously submitted inventories.

73. The ERT suggests for the sake of the completeness of the inventory that it is preferable to follow the tier 1 IPCC Guidelines and the IPCC good practice guidance methods rather than not to estimate the emissions.

74. The ERT suggests that Japan include in the NIR information about different possible QA/QC activities that it may choose to use, such as comparison of emissions estimates using different approaches, review of plant-level data, checking of direct emission measurements, verification of emissions estimates and independent expert review.

IV. AGRICULTURE

A. Sector overview

75. In the year 2001, the Agriculture sector accounted for 33,848 Gg CO_2 equivalent or approximately 2.6 per cent of total national GHG emissions in Japan, having fallen some 13.2 per cent since 1990. CH_4 contributed 40.4 per cent of the total emissions from the sector and N_2O the remaining 59.6 per cent. Manure management, agricultural soils, enteric fermentation and rice cultivation were the major source categories, contributing 37.5, 24.0, 19.8 and 17.5 per cent, respectively, to the total emissions for the sector. Field burning of crop residues was a minor contributor. Between 1990 and 2001, GHG emissions from manure management and enteric fermentation decreased by 12.3 and 7.4 per cent, respectively, because of a decrease in livestock population. Emissions from agricultural soils and rice cultivation declined by 16.5 per cent each over the same period because of a fall in the area of agricultural land. Emissions from field burning of agricultural residues have declined by 8.4 per cent since 1990. The key source analysis conducted by Japan identified rice cultivation and indirect N_2O emissions from agricultural soils as key sources, whereas the secretariat's more aggregated analysis found N_2O from manure management and animal production instead. The ERT recommends the use of a more aggregated level of sub-sources, as proposed by table 7-1 of the IPCC good practice guidance, because of the general correlation of estimation methods.

Completeness

76. The CRF includes estimates of all gases and sources of emissions from the Agriculture sector recommended by the IPCC Guidelines, with the exception of NO_x emissions from field burning of agricultural residues and N_2O from manure management of sheep, goats and horses. Japan may wish to include these emissions for the period 1990–2001 in its next submission. CO_2 emissions from agricultural soils (which Parties have the flexibility under the CRF to report under either 4.D or 5.D) are reported as "NE". Japan has completed all the relevant tables for the Agriculture sector for the period 1990–2001 (4.A, 4.B(a), 4.B(b), 4.C, 4.D and 4.F). The category prescribed burning of savannas is reported as "not occurring" ("NO") because there are no savannas in Japan. The CRF tables are filled in completely. The ERT regards the information in the NIR as functionally complete.

Transparency

77. The Agriculture sector of the NIR provides detailed information on methodology, AD, EFs and references for all source categories, and the CRF presents information in the documentation boxes. AD were collected from surveys conducted by the Ministry of Agriculture, Forestry and Fisheries, and from statistical summaries collated by the Food and Agriculture Organization of the United Nations (FAO) for populations of sheep, goats and horses. The ERT noted that the data taken from FAO compilations could in principle be transferred directly between agencies within Japan.

78. Most of country-specific EFs are based on actual measurements conducted over the whole territory. The country-specific EFs for manure management (CH_4 and N_2O), rice cultivation, direct N_2O emissions from agricultural soils and animal production have technical references published without peer review. The

ERT encourages the Party to provide summary information on the methodologies used for these measurements. Country-specific categories have been defined for cattle categories and animal waste management systems (AWMS). To increase transparency, the ERT suggests that the NIR that accompanies the next submission should provide descriptions of the national categories and indicate where these differ substantially from the defaults in the IPCC Guidelines.

Recalculations and time-series consistency

79. Emissions from all sources other than field burning of agricultural residues have been recalculated because of revision of the AD. EFs have also been revised for N_2O from manure management and from agricultural soils. The recalculations have been made for the whole time series and do not have a significant impact on the trend. Although these are not large emission sources, in previous submissions the figures for populations of sheep, goats and horses differed from the FAO data. According to the 2003 submission, the data used to estimate emissions from these animals are consistent with data published by FAO and the accuracy of the inventory has improved. Again, this suggests the need for better internal coordination, since the FAO data will presumably have originated in Japan. The AD on area of rice fields and number of grazing animals have also been revised. Japan is encouraged to provide relevant information on the reasons for these revisions in the NIR, cross-referenced to CRF table 8.

Uncertainties

80. The uncertainty of agricultural emissions is estimated to be 18 per cent in 2001. The uncertainty of direct N_2O emissions from agricultural soils is lower than the default value (130 per cent as compared with 500 per cent) because Japan has undertaken actual measurements. However, it is unclear from the NIR if the duration of the experiment was one year or several years. The low uncertainty of the EF could be associated with the short duration of the experiment. This issue is also discussed below under non-key sources, direct emissions from agricultural soils – N_2O.

B. Key sources

Rice cultivation – CH_4

81. The assumption is made that the proportions of intermittently and continuously flooded fields in the total paddy area of the country are 98 per cent and 2 per cent, respectively, although the reference source is not clear. In response to a question from the ERT, Japan explained that the data of the International Rice Research Institute were used in calculating rice field area. The Party is encouraged to report the references used in the inventory clearly, making use of cross-references between the NIR and the worksheets.

82. The documentation box of CRF table 4.C provides information on the country-specific methodology used and its results. The difference between practices used for intermittently flooded fields in Japan and these identified in the IPCC Guidelines is clearly explained in the NIR. This is useful.

Indirect N_2O emissions – N_2O

83. The use of country-specific EFs is reported in the NIR (page 6.22) and summary 3s2 of the CRF, but only default EFs are applied in the calculations. Japan is undertaking a review of the use of default EFs and plans to complete this in time for its next submission. The ERT encourages this work. Nitrogen (N) excretion of animals was determined on the basis of default methodology, but for cattle, swine and poultry country-specific data are available and were actually used in the category manure management. The ERT encourages the inventory team to use country-specific data on N excretion in future submissions.

C. Non-key sources

Manure management – N_2O

84. The major AWMSs in use in Japan are deposition, composting and pit storage. Further information on these systems would be useful. The relevant EFs seem to be high given the values used by other Parties.

The ERT believes that it would be useful to provide a scientific discussion of the values used. The values for N excretion from cattle, swine and poultry are lower by a factor of 50–100 than those reported by other Parties and the default values. The comments of Japan in response to the previous 2003 review activities suggest that the description of N excretion is incorrect in the CRF and should be revised. Emissions, however, are reported correctly. The N excretion rate of poultry reported in the background calculation table and used for calculations is higher by a factor of 2 than those calculated by the ERT on the base of tables 6-6 and 6-7 of the NIR, and the evidence for this should be reviewed. The data on age structure of livestock population were not used in the calculations of faeces and urine excreted. The ERT encourages Japan to consider the possibility of including these data in the estimates. The NIR is unclear on whether the poultry category includes only hens and broilers and the ERT suggests that the treatment of other categories of poultry be clarified in the next NIR. The ERT encourages this work.

Enteric fermentation – CH_4

85. The volume of dry matter feed intake is based on the data of Japan Feed Standards compiled by the Japan Livestock Industry Association. Since there may be some variation with respect to the standard, the ERT encourages the Party to consider the possibility of updating these volumes annually using actual measurements or survey data. The ERT noted that calves less than six months old have been excluded from the estimates, and emissions from enteric fermentation could be therefore underestimated to some extent. The ERT recommends that Japan investigate the feeding of calves less than six months old and any associated emissions, and provide the reference in the NIR. Although country-specific values are indicated in the CRF and the NIR, the IPCC default EF is used for horses. The default EFs indicated in CRF summary 3s2 should therefore be replaced by (CS,D).

Direct emissions from agricultural soils – N_2O

86. Actual measurements have been carried out to calculate direct N_2O emissions from soils, although it is unclear from the NIR whether isotope methods were used. Following discussion, the ERT believes that this was not in fact the case, and the measurements therefore probably also include enhanced background N_2O emissions from soils, implying a slight overestimation of direct emissions from synthetic and organic fertilizers. The ERT recommends that Japan revise the EFs for direct N_2O emissions from soils and consider how to make the best use of the actual measurements of total direct N_2O emissions. Then, to the extent that the sub-source of enhanced background N_2O emissions from agricultural soils (additional to the IPCC methodology) is included in the calculation, the relevant sub-sources should be reported as "IE". However, if this method is to be applied, the ERT recommends, subject to availability of resources, that Japan update its measurements of N_2O emissions from soils annually, otherwise the uncertainty will increase. Alternatively country-specific EFs for the relevant sub-sources could be made using the N isotope technique, also subject to availability of resources. Emissions from crop residues and cultivation of histosols are not reported because the default values are not applicable to the particular circumstances of Japan, and the ERT encourages the Party to provide justification, referenced in the NIR, as to why the default EFs for these sub-sources are inapplicable.

Animal production – N_2O, CH_4

87. The NIR is unclear as to which categories of grazing animals occur and whether a common EF is acceptable for them. Comments from Japan suggest that the grazing animals are cattle, and EFs have been developed for cattle only. The ERT recommends that Japan examine this point closely and provide the relevant information on the population of grazing animals in its next NIR. Only N_2O emissions are reported in the CRF. AD and the IEF are reported as "NE". The ERT recommends that the Party provide AD and country-specific EFs in the documentation box of CRF table 4.D in its next submission.

Agricultural residues burned – N_2O, CH_4, CO

88. Data on biomass of rice residues burned were used directly for the estimation of residues from other cereals burned without calculating the proportions of different residues burned. The ERT recommends that

this methodology be revised, especially if the quantity of other crop residues produced and burned on the field is large. The ERT suggests that the GHG emissions from this source be recalculated for the whole time series.

D. Areas for further improvement

Identified by the Party

89. The differences between national statistical data should be assessed. Some sub-sources reported as "NE" do occur (N_2O emissions from direct soil emissions – crop residue, cultivation of histosols). The inconsistency between the N excretion ratios for manure management and indirect emissions should be addressed in future.

Identified by the ERT

90. The ERT encourages the further work being done by the inventory team on issues identified by the Party. It also recommends that Japan improve its national statistical reporting in the sector, in particular the data on populations of sheep, goats and horses, statistics on grazing animals and dry matter intake by ruminant animals. Revision of the methodologies used for estimating direct and indirect N_2O emissions from agricultural soils and crop residues burned on fields is recommended, if resources allow. The Party is encouraged to recalculate emissions from these category sources for the whole time series by the next submission. Japan may wish to develop country-specific EFs for indirect N_2O emissions.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

91. Japan reports a 15.2 per cent increase in removals over the period 1990–1995. Removals in 1995 were 7.3 per cent of emissions in that year and 8.1 per cent of base year (1990) emissions, so the sector is significant. However, emissions and removals for the LUCF sector have not been estimated since 1996 so it is not possible to assess their contribution or trend over the whole period.

Completeness

92. The CRF includes few estimates of sources and sinks of CO_2, and no estimates of CH_4 or N_2O, from the LUCF sector since 1996, largely because of the lack of AD. Table 5.A (Changes in Forest and Other Woody Biomass Stocks) contains estimates of removals by 'parks and green space conservation zones' but not by the major forest categories. No estimates of emissions are reported in table 5.A. Tables 5.B (Forest and Grassland Conversion), 5.C (Abandonment of Managed Land) and 5.D (CO_2 Emissions and Removals from Soils) contain only notation keys.

93. Japan acknowledges that the LUCF sector inventory in CRF table 7 is only partially complete. The ERT noted that reporting on LUCF is a requirement under the relevant COP decisions and recommends that the CRF be completed using the IPCC Guidelines. The ERT recognized that the good practice guidance for LULUCF is under development by IPCC but noted that it is not necessary to wait for its completion since the IPCC Guidelines are available and were used by Japan in preparing the time series up to 1995. Application of the IPCC good practice guidance would probably be facilitated by keeping the time series up to date.

Transparency

94. The sectoral background tables themselves provide limited transparency but this is improved by the data and information supplied in the worksheets. The NIR focuses on emissions and removals for 1990–1995 (fiscal years) for categories 5.A and 5.B; no data or methodologies are provided for 5.C or 5.D.

95. The ERT recommends that Japan provide further information in the NIR to explain the assumptions underlying and the rationale for its choices of data, methods and other inventory parameters, and improve its cross-referencing to external sources.

Recalculations and time-series consistency

96. No recalculations are reported for LUCF, although a forest category has been renamed. The time series is consistent over the period 1990–1995, but the absence of data means that consistency from 1990 to 2001 has not been assessed. The ERT recommends that these issues be revisited when the inventory is completed.

Uncertainties

97. These have not been assessed because of lack of data.

Verification and quality assurance/quality control approaches

98. These have not been assessed because of lack of data.

B. Sink and source categories

Changes in forest and other woody biomass stocks

99. Methodologies are based on the IPCC Guidelines, with a combination of country-specific and default EFs. Japan explained that the tentative EF values included in the worksheets for 1996–2001 would be reassessed.

100. AD are lacking for 1996–2001. It is recommended that the available data be assessed and estimates determined using the approach set out under the paragraph on Completeness above.

101. Grasslands are reported as "NO", but estimates in Japan's Third National Communication include almost 1 per cent of the country as natural grassland or grazing land. Japan agreed with the ERT's recommendation that this item be reviewed and their extent and status (source/sink) be determined.

102. The average annual growth rate for the Temperate Other category of table 5.A should be reported as the average rather than the sum of the constituent subcategories. Japan acknowledged that this should be revised.

103. The ERT recommends that forest categories and definitions be clarified before identifying appropriate AD and methodologies. Categories should be defined according to national circumstances and applied consistently.

104. The growth rate reported in table 5.A for Others (Bamboo etc.) is reported as "0.00". The worksheets indicate that this category includes bamboo and "forest where no tree grows". The latter category was explained as meaning temporarily unstocked, that is, recently harvested, areas, and may have a zero growth rate until replanted but should be included in the managed forest area if it is part of the normal rotation. Bamboo is not included as a forest ecosystem in the IPCC Guidelines, but could be treated as such provided the data are available to estimate gains and losses. It is recommended that bamboo be reported separately if this course is taken, since the characteristics are likely to differ from those of other forest types.

105. Harvested wood should be reported in table 5.A and included as emissions from temperate forests in table 5.

Forest and grassland conversion

106. Grassland conversion is reported as "NO". The ERT noted that the 2000 centralized review regarded this as unlikely. Japan agreed that it may occur and will investigate.

Abandonment of managed land

107. Emissions and removals have not been estimated for the years 1996–2001. Japan notes in the CRF that these activities occur, but data are lacking. It is recommended that these data be provided.

CO_2 emissions and removals from soils

108. Emissions and removals have not been estimated for the years 1996–2001. Japan noted in the CRF that these activities occur, but data are lacking. It is recommended that these data be provided.

C. Areas for further improvement

Identified by the Party

109. Japan noted that emissions and removals will be reported using the IPCC good practice guidance for LULUCF along with new AD (land areas) to provide a complete inventory. EFs for 1996–2001 will also be reviewed. The methodological framework is expected to be in place by 2006 but a complete inventory is unlikely to be possible before 2007.

Identified by the ERT

110. Until new guidance is available and can be applied, the ERT recommends that Japan provide a complete inventory in accordance with the IPCC Guidelines for the period 1996–2001, as required by the UNFCCC reporting guidelines, having determined appropriate AD (area estimates). If country-specific factors are unavailable, IPCC default values can be applied.

111. Several of the notation keys used in table 5 are inconsistent with the background tables. The total reported in table 5 is not the sum of the values provided in the same table. It is recommended that data and values be carefully transcribed to ensure consistency within and between tables.

VI. WASTE

A. Sector overview

112. Although total emissions from the Waste sector comprised only about 2.6 per cent of Japan's total GHG emissions in 2001 (excluding LUCF), the rate of growth is quite significant: emissions have increased by about 8,662 Gg CO_2 equivalent (or about 35 per cent) compared to 1990 levels. This corresponds to an annual growth rate of approximately 2.8 per cent. Of the three subcategories that make up this sector (solid waste disposal, waste-water handling and waste incineration), waste incineration contributed the most to the increase (it increased from 18,535 Gg CO_2 equivalent in 1990 to 26,859 in 2001). CH_4 emissions from solid waste disposal have remained fairly constant over time, decreasing slightly from 192.6 Gg to about 183.5 Gg between 1990 and 2001.

113. Extensive research on waste has been done in Japan and this supports the country-specific estimation methodologies and EFs found in the inventory for this sector. A first-order decay (FOD) method has been employed to calculate the time-dependent release of GHGs from solid waste. Emissions associated with incineration are estimated on the basis of local studies and using local factors.

Completeness

114. The inventory is complete except for N_2O from industrial waste-water handling. The waste incineration subsector is complete for all gases, including GHG precursors. Precursors have not been estimated for the other two subsectors.

115. Japan is encouraged to fill out the CRF sectoral background tables. These tables enable the validation of emissions estimates and make it easier to compare AD, EFs and IEFs across the Parties.

Transparency

116. The submission of the NIR has addressed most of the concerns raised in previous reviews. Documentation on the methods and data used for the calculations in the Waste sector are amply provided by the NIR.

117. Entries in the CRF are ultimately traceable to local inventory worksheets. For example, the application of the FOD method (e.g., the Sheldon Arleta model) is demonstrated clearly in the worksheets that were provided. It is suggested that certain important information, which can be inferred from these local worksheets, be included and described in future submissions of the NIR. The current NIR merely

points to these local worksheets and makes reference to local research papers. A brief description in the NIR of the processes involved and of the technical bases of Japan's GHG estimation algorithms will facilitate understanding of its use of non-default methodologies and factors. In addition, the NIR could include information such as that requested in the CRF sectoral background tables, for example, on waste composition and per capita waste generation rate.

Recalculations and time-series consistency

118. Recalculations have been done for the years 1990–2000. As a result, estimated base year emissions in this sector decreased by 4.5 per cent. These changes are due to an increase of 10 per cent for CO_2, a decrease of 30.8 per cent for CH_4 emissions, and a minimal change in N_2O emissions for the base year. The latest year of recalculation (2000) showed an overall decrease of 4.7 per cent, which when disaggregated is due to an increase in CO_2 emissions of 2.9 per cent, and decreases in CH_4 and N_2O emissions of 21.1 per cent and 3.1 per cent, respectively. Japan explained that CH_4 emissions associated with solid waste disposal were changed because estimates of the amount of municipal solid waste (MSW) disposed to landfills had been revised; changes in CH_4 and N_2O emissions from waste-water handling were due to revision of EFs; and CO_2, CH_4 and N_2O estimates were recalculated because estimates of the amount of MSW incinerated had been revised.

Uncertainties

119. Japan has quantified uncertainty in this sector using the tier 1 approach of the IPCC good practice guidance. Appendices 3 and 4 of the NIR detail these calculations. According to the NIR, uncertainty in this sector is 32 per cent, and the Waste sector is ranked second to Energy in terms of contribution to the overall uncertainty of the inventory (NIR table 1–2, page 1.6). Within the Waste sector, the top two categories that contribute significantly to the uncertainty are incineration of municipal and industrial solid waste (CO_2) (NIR table 11 in appendix 4, page appendix 4.7). These two are also found to contribute greatly to the total uncertainty (NIR table 1–3). It is therefore recommended that the ambiguities in these two important sectors be addressed in order to reduce the overall uncertainty.

Verification and quality assurance/quality control approaches

120. Extensive technical and scientific information on emissions from waste is available in Japan and this could usefully be part of the third-party review stage which is referred to in the NIR. This could cover the negative CH_4 EFs that are also cited in this sector and are discussed more fully in the Energy sector of this review. The ERT believes that the underlying data are sound but that the EFs should be based on the actual emissions from combustion plants, rather than the estimated difference between input and output concentrations multiplied by flow.

B. Key sources

Waste incineration – CO_2

121. Calculations in this source category have been based mainly on country-specific information and are largely comprehensive and complete as far as the estimation of GHGs and GHG precursors is concerned. This is noteworthy in view of the significance of this subsector within the Waste sector and as a key source in the entire inventory.

122. Since waste incineration in Japan leads to energy production, the IPCC good practice guidance recommends that this be classified under the Energy sector. During the in-country review, Japan replied that the reasons for placing this source category under Waste are the fact that the primary purpose of incineration is waste treatment and not power production. The fraction of non-biogenic carbon needs to be stated clearly since CO_2 from non-biogenic carbon would count towards total national emissions.

C. Non-key sources

Solid waste disposal – CH_4

123. Further refinement of the information is suggested in a number of areas. These are: municipal waste should be differentiated from industrial waste (for carbon content calculation); the amount of CH_4 capture should be indicated; and the use of the dry basis for estimating emissions should be clarified because of the implication for CH_4 emissions estimates from MSW disposed to landfill sites.

124. The total amount of MSW disposed to landfills and subject to incineration is not consistent with the per capita waste generation rate of Japan because a part of MSW undergoes intermediate processing.

Waste-water handling – CH_4

125. Clarification is needed on the distinction between emissions associated with waste-water and with sludge treatment. The use of simple averages of EFs for both water and sludge treatment and the application of these collectively to waste water is only a first approximation to estimation. The IPCC good practice guidance indicates (page 5.18) the need for separate calculations if sludge separation is practised. National circumstances in Japan should be clarified; the inclusion of sludge incineration under waste incineration suggests a degree of separation, although exploratory calculations suggest that it may not be the norm.

126. In the calculation of its CH_4 EFs for industrial waste water, Japan clarified that the biochemical oxygen demand (BOD) levels used were actual rather than anticipated values. Future NIR submissions should state this clearly and differentiate between the BOD values of municipal and industrial waste water.

127. The use of the notation keys "IE" and "NE" should be reviewed: in some instances "IE" might be more appropriate, for instance, in the case of waste-water information requested in CRF sectoral background table 6.B. The NIR does in fact contain descriptions and references to country-specific methodologies and EFs that are used to estimate waste-water emissions. This kind of information should be indicated in the appropriate documentation boxes in the CRF sectoral background tables, with references to the NIR for more detailed explanation.

Waste incineration – CH_4 and N_2O

128. CH_4 and N_2O emissions from the incineration of biogenic waste are indicated as "IE" in CRF table 6.C but are not clearly identified elsewhere in the CRF. Japan explained to the ERT that the value entered as AD for non-biogenic waste, about 57,254 Gg (as indicated in CRF table 6.C), is actually the total for both biogenic and non-biogenic waste. This should be clarified by distinguishing more clearly between the amounts of biogenic and non-biogenic waste subject to incineration.

D. Areas for further improvement

Identified by the Party

129. The NIR identified three issues for future work, namely:

(a) Emissions due to synthetic agents in waste water;

(b) The proper placement of waste incineration within the inventory;

(c) Emissions from incineration of synthetic fibres (as opposed to plastic, where the treatment is already regarded as sufficient).

Identified by the ERT

130. Japan is encouraged to address the gaps pointed out under the paragraph on Completeness above. The overall picture of waste generation and management which can be inferred from the sector inventory

and the NIR should be better reconciled with the information provided in the national communication of Japan.

131. Since extensive research on waste has already been conducted in Japan, it is recommended that the results of these studies be published for better dissemination within the international community, although this is not a formal requirement of the UNFCCC guidelines.

ANNEX 1: MATERIALS USED DURING THE REVIEW

A. Support materials used during the review

2002 and 2003 Inventory submissions of Japan. 2003 submissions including CRF for years 1990–2001 and an NIR.

UNFCCC secretariat (2002). "Report of the individual review of the greenhouse gas inventory of Japan submitted in the year 2000 (Centralized review)". FCCC/WEB/IRI(3)/2000/JPN (available at http://unfccc.int/program/mis/ghg/countrep/jpncentrev.pdf).

UNFCCC secretariat. "2003 Status report for Japan" (available at http://unfccc.int/program/mis/ghg/statrep2003.html).

UNFCCC secretariat. "Synthesis and assessment report of the greenhouse gas inventories submitted in 2003. Part I": FCCC/WEB/SAI/2003 (available at http://unfccc.int/program/mis/ghg/s_a2003.html) and Part II – the section on Japan) (unpublished).

Japan's comments on the draft "Synthesis and assessment report of the greenhouse gas inventories submitted in 2003" (unpublished).

UNFCCC secretariat. "Handbook for review of national GHG inventories." Draft 2003 (unpublished).

UNFCCC secretariat. "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/CP/1999/7 (available at http://www.unfccc.int/resource/docs/cop5/07.pdf).

UNFCCC secretariat. "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).

UNFCCC secretariat. Database search tool – *Locator* (unpublished).

IPCC. *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000* (available at http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm).

IPCC/OECD/IEA. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volumes 1–3, 1997* (available at http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm).

B. Additional materials

Institute of Energy Economics, Japan. *Japan Energy and Economy Statistics 2002* (in Japanese)

Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan. *Statistical Yearbook 2003*

International Energy Agency, 2003. *Energy Statistics of OECD Countries, 2000–2001*.

International Energy Agency, 2003. *Energy Balances of OECD Countries, 2000–2001*.

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