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SLOVENIA

REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY SUBMITTED IN THE YEAR 2004[1]

EXECUTIVE SUMMARY

1. This report covers the in-country review of the 2004 greenhouse gas (GHG) inventory submission of Slovenia, 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. The review took place from 4 to 8 October 2004 in Ljubljana, Slovenia, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Mr. William Kojo Agyemang-Bonsu (Ghana), Energy – Mr. Lambert Schneider (Germany), Industrial Processes – Mr. Tinus Pulles (The Netherlands), Agriculture – Mr. Vlad Trusca (Romania), Land-use Change and Forestry – Mr. Göran Stahl (Sweden), Waste – Mr. Seungdo Kim (Republic of Korea). Mr. William Kojo Agyemang-Bonsu and Mr. Tinus Pulles were the lead reviewers. The review was coordinated by Ms. Clare Breidenich (UNFCCC secretariat).

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

3. In the year 2002, the most important greenhouse gas in Slovenia was carbon dioxide (CO_2), contributing 80.2 per cent to total[2] national greenhouse gas emissions expressed in CO_2 equivalent, followed by methane (CH_4) – 11.2 per cent, and nitrous oxide (N_2O) – 7.6 per cent. Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 1.0 per cent of the overall greenhouse gas emissions in the country. The Energy sector accounted for 78.9 per cent of total GHG emissions, followed by Agriculture (10.2 per cent), Waste (5.4 per cent) and Industrial Processes (5.2 per cent).

4. Total greenhouse gas emissions excluding Land-use Change and Forestry (LUCF) amounted to 20,383 Gg CO_2 equivalent and decreased by 1.1 per cent between 1986 and 2002. Tables 1 and 2 provide data on emissions by gas and by sector for 1986 and from 1990 to 2002. Over the period 1986–2002, CO_2 emissions increased by 2.1 per cent, mainly as a result of increased emissions from transport. CH_4 emissions decreased during the same period by 11 per cent, mainly due to a reduction in CH_4 emissions from agriculture (–20 per cent) and energy industries (–29 per cent), and N_2O emissions decreased by 15.8 per cent over the same period due to a decline in the number of animals and a reduction in arable crop production. From the base year (1986) to 1994, HFC emissions were not estimated systematically or continuously; however, measurements made from 1995 to 2002 show an increasing trend of emissions for these gases since 1995. SF_6 emissions are reported to be constant from 1986 to 1994, at 7 Gg CO_2 equivalent per year, and then increased to 25 Gg CO_2 equivalent in 1995 and remained at 21 Gg from 1996 to 2002.

[1] In the symbol for this document, 2004 refers to the year in which the inventory was submitted, and not to the year of publication.

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

Table 1. Greenhouse gas emissions by gas, 1986 and 1990–2002

GHG emissions	Gg CO_2 equivalent														Change from 1986–2002 %
	1986	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
CO_2 (with LUCF)[a]	13,495	10,262	8,770	8,461	8,818	8,597	9,097	10,027	10,472	10,193	9,547	9,637	10,728	10,788	–25.1
CO_2 (without LUCF)	15,998	14,600	13,521	13,549	13,992	13,929	14,772	15,588	16,033	15,754	15,108	15,198	16,289	16,349	2.1
CH_4	2,531	2,344	2,430	2,372	2,380	2,344	2,375	2,346	2,380	2,370	2,355	2,346	2,276	2,281	–11.0
N_2O	1,790	1,518	1,532	1,481	1,494	1,489	1,508	1,536	1,545	1,555	1,620	1,524	1,516	1,546	–15.8
HFCs	0	0	0	0	0	0	31	30	38	34	34	45	56	69	100.0
PFCs	276	257	303	243	251	282	286	240	194	149	106	106	106	116	–137.9
SF_6	7	7	7	7	7	7	25	22	21	21	21	21	21	21	66.7
Total (with CO_2 from LUCF)	18,098	14,389	13,042	12,565	12,950	12,719	13,322	14,200	14,650	14,323	13,683	13,679	14,701	14,821	–22.1
Total (without CO_2 from LUCF)	**20,601**	**18,727**	**17,793**	**17,653**	**18,124**	**18,051**	**18,997**	**19,761**	**20,211**	**19,884**	**19,244**	**19,240**	**20,263**	**20,383**	–1.1

[a] LUCF = Land-use Change and Forestry

Table 2. Greenhouse gas emissions by sector, 1986 and 1990–2002

GHG source and sink categories	Gg CO_2 equivalent														Change from 1986–2002 %
	1986	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
Energy	15,603	14,101	13,212	13,245	13,836	13,626	14,498	15,317	15,775	15,526	14,864	14,933	15,977	16,080	3
Industrial Processes	1,309	1,283	1,120	1,064	898	1,077	1,128	1,084	1,055	973	941	977	1,031	1,051	–20
Solvent Use	128	81	71	61	51	52	48	53	53	51	94	79	73	73	-42
Agriculture	2,564	2,292	2,322	2,243	2,261	2,202	2,188	2,162	2,149	2,159	2,173	2,083	2,045	2,070	–19
LUCF[a]	–2950	–4,339	–4751	–5088	–5,175	–5,332	–5,675	–5,561	–5,561	–5,561	–5,561	–5,561	–5,561	–5,561	88
Waste	997	970	1,067	1,040	1,080	1,094	1,136	1,145	1,179	1,176	1,172	1,169	1,136	1,110	11
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[a] LUCF = Land-use Change and Forestry

5. Slovenia's 2004 submission is a significant improvement over the previous year's submission as common reporting format tables for the base year (1986) and the years 1990–2002 and a national inventory report have been submitted for the first time. The Party used the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC Guidelines) and followed the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the 2003 IPCC good practice guidance. However, in a number of cases Slovenia presents apparently inconsistent time series. Specific cases are provided in the sectoral review findings. In addition, Slovenia does not provide the rationale behind the choice of methods and emission factors and the use of activity data. Slovenia has performed a key source analysis and an uncertainty assessment in accordance with the UNFCCC reporting guidelines and the IPCC Guidelines.

6. The expert review team commended the high level of commitment among the Slovenian experts involved in the preparation of the inventory, and the good analytical and institutional basis they have built up for further improvement of the inventory. The expert review team recommends that Slovenia apply the results of the key source analysis and uncertainty assessment in order to improve the consistency of the time series. Moreover, Slovenia is encouraged to perform simple data checks on the inventory and correct the mistakes in the common reporting format tables. The expert review team recommends that Slovenia should give priority to improving on the emission estimates from LUCF, as this sector alone accounts for about 30 per cent of total national GHG emissions. In addition, the inventory for the Waste sector will need improvement. The expert review team recommends that Slovenia provide inventory data

for the years 1987–1989 in order to ensure a complete time series from the base year (1986). For the long term, the expert review team encourages Slovenia to move from the Excel database management system to a more robust database system in order to minimize data entry errors and improve on its data archiving and storage. Slovenia indicated that it is planning steps to further improve its inventory in future years, taking into account the recommendations of the review team.

I. OVERVIEW

A. Inventory submission and other sources of information

7. Slovenia submitted its national inventory, including a national inventory report (NIR), on 15 April 2004. Its submission includes a complete set of common reporting format (CRF) tables for 1986 and for the years 1990–2002.

8. During the review Slovenia provided the expert review team (ERT) with additional information sources. These documents are not part of the inventory submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in annex 1 to this report.

B. Key sources

9. Slovenia reports both key source tier 1 and tier 2 analyses as part of its 2004 submission. The key source analysis for absolute level of emissions performed by the Party and the secretariat[3] produced similar results. However, there are significant differences between the tier 2 trend assessment from the Party and that of the secretariat. The ERT concluded that Slovenia has applied the tier 2 trend key source analysis according to the IPCC good practice guidance. The result, however, suggests that this procedure yields incomprehensible results in this case. The ERT recommends that the Party only use the tier 1 key source analysis. Slovenia has not used the key source analysis to prioritise the development of the national inventory.

C. Cross-cutting topics

Completeness

10. As required by the IPCC Guidelines, the inventory is complete in terms of geographical coverage and sectors. A complete set of CRF tables is provided for the years 1986 and 1990–2002 for all sectors. However, table 8a has not been completed and emission estimates for the years 1987–1989 are missing.

Transparency

11. The NIR and the CRF tables provide general information on methodologies used and sources covered. However, the ERT recommends that Slovenia improve the transparency of its inventory by providing specific explanations on the choice of methods, emission factors (EFs) and activity data (AD) in the NIR. Additional information sources used should also be better referenced in the NIR. The Party raises issues of confidentiality, for example, the use of AD for the only aluminium plant. The Party has provided AD for this plant in the NIR, although they are confidential in the national statistics, which means that the data are already available on the Internet and therefore can be used and are no longer confidential.

Recalculations and time-series consistency

12. The ERT noted that the Party reports recalculations for the base year (1986) and 1990–1996. The effects of the recalculations on the base year estimates have not been provided. The ERT was not able to

[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.

make any meaningful comparison between this submission and the previous submission, as this is the first time Slovenia has submitted a complete set of CRF tables.

13. In a number of cases Slovenia has reported time series that show unexpected jumps and gaps, signalling possible inconsistencies in these time series. The ERT discussed several examples of these with Slovenia (see the sectoral sections of this report below) and established that indeed in several cases inconsistent AD were used or EFs were kept constant as long as no other information was available. The ERT recommends Slovenia to review the time series as part of the inventory compilation process and to try either to explain the unexpected jumps and gaps or to apply interpolation or splicing methods, as presented in the IPCC good practice guidance, to make the time series consistent.

Uncertainties

14. Slovenia has performed a detailed quantitative uncertainty analysis in line with the IPCC good practice guidance and provided the uncertainty ranges for subcategories. However, the ERT realized during the review that the Party is not using the results of the uncertainty analysis in establishing priority areas for improvement. The ERT noted that many uncertainty ranges are presented as "author's estimate". No further information is provided as to what these estimates were based on.

Verification and quality assurance/quality control approaches

15. The Party has performed some initial checks on the quality of the inventory data. Slovenia intends to set up a formal quality assurance/quality control (QA/QC) plan to ensure the continuous improvement of the quality of data reported. This plan was presented during the review. The ERT expects that implementation of this plan will further improve Slovenia's inventory in the future.

Institutional arrangements

16. During the in-country visit, Slovenia explained the institutional arrangements for the preparation of the inventory. The Environmental Agency has overall responsibility for the national inventory. Other organizations, such as the Statistical Office of the Republic of Slovenia, the Agricultural Institute and the Slovenian Forestry Institute are also involved in the preparation of the inventory. The Environmental Agency has direct contact with enterprises that provide data directly to it, even though it does not have formal arrangements in the form of, for example, voluntary agreements with the enterprises. Slovenia indicated during the review that a new regulation on the emissions inventory is to be passed and this should ensure a systematic approach to the collection of GHG emissions data, provide for formal methods of collecting data from different sources, and guarantee that the methodologies of data collection remain the same and that data on specific activities are included in the data collection plan.

17. Given that Slovenia has difficulty in producing consistent time series for AD, the ERT recommends that the inventory experts cooperate closely with statistical experts to apply splicing or other techniques to improve the consistency of the AD time series.

Record keeping and archiving

18. Slovenia has a centralized archiving system. The inventory group at the Environmental Agency stores inventory data while the agency's computer department ensures a daily back-up of the files. The ERT found that, in general, the system worked effectively, in that Slovenia was able to provide data and calculations in response to many of the ERT's questions. However, additional effort is needed to document and maintain records of methodologies and reasons for methodological choice, and to reflect such choices in the NIR.

Follow-up to previous reviews

19. The most significant improvement made by the Party is the preparation and submission of a complete set of CRF tables and an NIR for the first time.

D. Areas for further improvement

Identified by the Party

20. The NIR identifies several areas for improvement. In its response to the issues raised during the review, Slovenia indicates that it is working to improve, among other things, its estimates on CO_2 from cement and lime production, to develop national EFs for lignite and natural gas, and to estimate SF_6 emissions from switchgear.

Identified by the ERT

21. The ERT identifies the following cross-cutting issues for improvement. The Party should:

(a) Provide explanations of the choice of methodologies, EFs and AD in the NIR to improve transparency;

(b) Operationalize the QA/QC management system;

(c) Develop consistent AD time series;

(d) Provide data for the years 1987–1989 in order to ensure a complete time series;

(e) Make use of the uncertainty and key source analysis in setting its priorities for the purposes of improving on its inventory; and

(f) Move from spreadsheet-based data compilation and archiving to a more robust database system.

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 2002, the Energy sector accounted for 78.9 per cent to total national GHG emissions (without LUCF). Fuel combustion was the main source, accounting for 97.9 per cent of GHG emissions in the sector. The most important source within fuel combustion is public heat and electricity production, with 39.9 per cent of emissions in the Energy sector. Emissions come mainly from large lignite-fired power plants. Another important sources are Road Transportation (24.4 per cent), followed by Other sectors (18.3 per cent) and combustion in Manufacturing Industries and Construction (15.0 per cent). In 2002, GHG emissions in the Energy sector were 14.0 per cent above the 1990 level and 3.1 per cent above the level of the base year (1986).

24. Slovenia collects AD on fuel combustion as follows. AD for 1.A.1 Energy Industries and 1.A.2 Manufacturing Industries and Construction are collected directly from emitters if they have more than 10 employees. Fuel consumption in 1.A.3b Road Transportation is determined using the COPERT III model, based on detailed statistical data on the fleet composition and driving modes. Diesel consumption in 1.A.3b, as calculated with COPERT III, does not match the energy supply statistics for 1986 and from 1990 to 1996. The difference – termed "inappropriate fuel use" – is adjusted by subtracting this quantity from the 1.A.4a Commercial and 1.A.4b Residential sectors, assuming that heating oil sold to stationary applications has been used in cars. Fuel consumption in 1.A.4a Commercial and 1.A.4b Residential is determined by subtracting fuel consumption in all other combustion sectors from total fuel consumption according to the national energy balance. Fuel consumption has been allocated between 1.A.4b Residential and 1.A.4a Commercial for the years 1986 and 1990–1997 based on a study prepared as part of the national communication, and for subsequent years on the basis of expert judgement, that is, liquid fuels are allocated one-third to the Commercial sector and two-thirds to the Residential sector. However, this overall approach involves several difficulties:

(a) As fuel consumption in the Residential and Commercial sectors is balanced with the totals from the national energy balance, the reference approach and the sectoral approach will always deliver rather similar results, thus limiting the scope of any comparison between the two approaches.

(b) In 1.A.4b, the Residential sector, overall fuel consumption more than doubles between 1990 and 2002. In 1.A.4, the total for Other sectors, natural gas consumption increased from 1986 to 2002 by almost 900 per cent. These are rather unusual trends. No other Party has reported such extreme trends, and they cannot appropriately be explained by the characteristics of the building stock in Slovenia.

(c) Overall fuel consumption in both the Residential sector and the Commercial sector shows rather large inter-annual fluctuations. For example, aggregated fuel consumption increased by 29 per cent between 1992 and 1993, and by 25 per cent between 1995 and 1996, while in some other years there are decreases of up to 10 per cent. These trends cannot be consistently explained.

(d) The adjustment for "inappropriate fuel use" varies considerably over the time series, amounting up to about 30 per cent of total fuel consumption, and is negative in 1995 and 1996, which would mean that fuel sold for cars would have been used in the Residential and Commercial sectors instead – which seems unrealistic.

25. In order to improve the allocation of fuel consumption to sectors, the ERT encourages Slovenia:

(a) To evaluate the possibilities of estimating fuel consumption in the 1.A.4a Commercial and 1.A.4b Residential sectors on the basis of statistical data on fuel consumption in these sectors; and

(b) To undertake efforts to identify the source of the deviation between diesel consumption calculated applying COPERT III and calculated from the fuel supply statistics, and to reconsider the adjustment of fuel consumption for "inappropriate fuel use". The ERT notes that rationales other than the use of heating oil in cars may apply, including "fuel tourism", problems in the application of COPERT III, or problems in the national energy balance or the fuel supply statistics.

Completeness

26. The CRF includes estimates of almost all gases and sources of emissions from the Energy sector, as recommended by the IPCC Guidelines. Notation keys are not always used appropriately; in particular, AD and emissions are sometimes reported as "0" instead of not occurring ("NO") when they are not occurring. The NIR does not contain background information on 1.A.3d Navigation or 1.A.3e Other Transportation. According to information in the CRF tables, emissions from navigation are included under road transportation. Other transportation is reported as not estimated ("NE"). However, it is unclear which sources have not been estimated. The ERT recommends the Party to check the use of notation keys throughout the sectors and to provide background information on navigation and other transportation in the NIR.

Transparency

27. Generally, the NIR provides good information on the Energy sector. It could be further improved if the generation of AD, in particular for the Residential and Commercial sectors, as well as for Road Transportation, could be explained more precisely. Clearer references to the EFs applied should be provided. Inconsistencies in the time series should be better explained. In the tables on pages 45–47 of the NIR some numbers are in the wrong cells.

Time-series consistency

28. For several emission sources of the Energy sector the time series of AD, implied emission factors (IEFs) and emissions appear to be inconsistent. During the review, different reasons for these variations were identified: the generation of AD from different statistical sources; changes in the method of calculating emissions; and actual changes in the type of fuel used or fuel combustion quantities reported. As Slovenia is a small country, actual changes in one company often significantly influence the quantities reported for a single IPCC category. This may explain time-series variations in a number of cases. The ERT recommends Slovenia to analyse the reasons for inconsistencies in some time series, as described more specifically below, to reassess its methods and statistical sources where appropriate, and to provide explanations in the NIR for actual changes.

B. Reference and sectoral approaches

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

29. CO_2 emissions from fuel combustion have been calculated using the reference approach and the sectoral approach. For the year 2002, there is a difference of –0.87 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations are provided in the documentation box of the CRF table. In addition, annex 4 of the NIR contains detailed background information on the reference approach. Differences between the sectoral approach and the reference approach are systematically low for Slovenia, as Slovenia balances consumption in the Commercial and Residential sectors with national fuel consumption statistics.

30. The treatment of liquid fuels in the reference approach appears to be incorrect. Some secondary fuels produced in the Lendava refinery (specialno topilo, white spirit, specialni bencini, petroleji, skupaj derivati, izgube) are not included in the reference approach. According to information provided by Slovenia during the review, some of these fuels are not combusted but used as feedstocks and should accordingly be reported under feedstocks. Carbon stored due to feedstocks is currently taken into account by reporting virtual exports of crude oil, which do not actually occur in practice. The ERT encourages Slovenia to revise the balance of liquid fuels in the reference approach and to allocate production, use as feedstock and exports of fuels correctly.

31. The conversion factor (TJ/kt) for residual fuel oil is far too high in 1986, 1990 and 1991. Slovenia identified the source of the problem and will revise the estimate in its next submission.

32. Fuel consumption reported in the CRF partly deviates from apparent fuel consumption reported to the International Energy Agency (IEA):

(a) The classification of coal products (in particular sub-bituminous coal, lignite and coke oven/gas coke) is not the same in the two data sets. Coke oven coke is reported by mistake under coking coal.

(b) The classification of gas/diesel oil and residual fuel oil is not consistent. In the CRF, light heating oil has been included under residual oil, but it should be included under gas/diesel oil.

(c) Data on naphtha, bitumen, lubricants, petroleum coke, refinery feedstocks and other oil are not reported in the CRFs but are partly reported to the IEA, resulting in a higher (6.4 per cent) apparent consumption of liquid fuels according to the IEA data.

(d) Exports of crude oil reported in 1986, 1990, 1991 and 1992 are not consistent with the data reported to the IEA (see also the remarks on exports of crude oil in the reference approach above).

(e) The time series of stocks of petroleum products are not consistent.

(f) The consumption of jet kerosene reported to the IEA is considerably higher (by 36.2 per cent) than the consumption reported in the CRF.

(g) The consumption of gasoline reported to the IEA is 4.5 per cent higher than the consumption reported in the CRF.

(h) The consumption of solid biomass reported to the IEA is considerably higher (by 58.5 per cent) than the consumption reported in the CRF.

33. The ERT encourages Slovenia to identify the discrepancies between the two data sets and to recalculate AD where appropriate.

International bunker fuels

34. Slovenia separates national from international aviation emissions by fuel type. Consumption of jet kerosene and aviation gasoline for turboprop engines is accounted as international bunkers, while consumption of aviation gasoline for piston engines is accounted as national emissions. This approach is appropriate, as Slovenia has only one large airport, near Ljubljana, and there are no national flights with turboprop engines or jets. International fuel consumption of gasoline for piston engines is estimated to be negligible.

35. The CH_4 and N_2O EFs used for international bunkers are far too high. Slovenia intended to use IPCC default EFs and will apply these in its next submission. The ERT also encourages Slovenia to provide information on the AD, EFs and emission trends in its NIR.

36. Slovenia allocates all fuel consumption from navigation to national use. This is appropriate, as Slovenia has only very small harbours without any regular international sea traffic and as rivers are too small for any relevant international transport to other countries. Slovenia uses the notation key not applicable ("NA") for maritime international bunkers. The ERT recommends Slovenia to use "NO".

Feedstocks and non-energy use of fuels

37. As indicated above, not all feedstocks that are in the national energy statistics have been reported in the CRF. The ERT encourages Slovenia to provide information on all fuel types used as feedstock.

C. Key sources

Fuel combustion: solid, liquid, biomass and other fuels – CO_2

38. Slovenia provides most EFs and net calorific values (NCVs) in the NIR. However, the choice of NCVs, CO_2 EFs and oxidation factors is in many cases not documented transparently. Clear references are mostly not provided. The ERT encourages Slovenia to explain the choice of these values and to provide clear references.

39. Slovenia uses country-specific CO_2 EFs for lignite and natural gas based on Institut Za Energetiko (1998) and EIMV/HSE (2004), which is appropriate. However, while in Institut Za Energetiko (1998) the CO_2 EF for natural gas indicates some minor variations and is only available from 1986 to 1996, Slovenia applies a constant value of 55 t/TJ for the whole time series. This may be appropriate, but should be documented transparently and justified in the NIR.

40. For all other fuels, IPCC default values are used for CO_2 EFs. The ERT encourages Slovenia, in accordance with the IPCC good practice guidance, to collect CO_2 EFs and NCVs from fuel suppliers wherever possible. Oxidation factors for solid fuels should be discussed with large power plant operators.

41. For residual fuel oil, the CO_2 EFs used (73.3 t/TJ) deviate from the IPCC default value (77.4 t/TJ). Also, the CO_2 EF for diesel (73.7 t/TJ) deviates slightly from the IPCC default value (74 t/TJ). The ERT recommends Slovenia to check the consistency of these EFs and to provide clear references for the factors used.

Energy industries: gaseous fuels – all gases

42. Fuel consumption of liquid fuels and gaseous fuels varies considerably over time in 1.A.1 Energy Industries. Liquid fuel consumption amounts to about 4 PJ in 1986, 1990 and 1991 and decreases sharply thereafter to about 2 PJ in 1992. Fuel consumption also decreases sharply between 1998 and 1999 (by 57 per cent) and increases again considerably thereafter, being nearly three times as high in 2001 as in 1999. Gaseous fuel consumption decreases sharply between 1990 and 1991, by 53 per cent. The 1996 value is also somewhat higher than that for other years. In 1.A.1c Manufacture of Solid Fuels and Other Energy industries, fuel consumption of gaseous fuels is rather irregular, with 1,067 TJ in 1986 and much smaller or zero quantities in all other years reported. There are also very large variations in the consumption of liquid and gaseous fuels in 1.A.1b Petroleum Refining. Consumption of gaseous fuels in 1990 (2,297 TJ) is considerably higher than in 1986 or 1991 (795 and 473 TJ). Gas consumption decreases sharply from 1,308 TJ in 1996 to a level of 13–52 TJ between 1997 and 2002. The consumption of liquid fuels varies between 170 TJ and 1024 TJ in the time series. Slovenia explained during the review that the use of fuel types varied considerably over time due to varying price relations between fuels. In petroleum refining, the change seems to be due to the use of different statistical sources. The ERT recommends Slovenia to check the consistency of the allocation of fuels in Energy Industries, to use the IPCC recommended methods to report a consistent AD time series, and to provide explanations for actual variations and trends in the NIR.

Iron and steel and non-ferrous metals: liquid fuels – all gases

43. The time series of liquid fuel consumption in 1.A.2a Iron and Steel varies considerably. Fuel consumption amounts to 1,825 TJ in 1986, 708 TJ in 1990, and 348 TJ in 1991, is then much smaller from 1992 to 1996 (19–78 TJ), and is again significantly higher during the period 1997–2002 (491–700 TJ). From 1997, fuel consumption in the Non-ferrous Metals sector has been included under Iron and Steel because of changes in the statistical classification. This explains the sharp increase from 1996 to 1997. The CO_2 IEF (64.82 t/TJ) for liquid fuels in the Non-ferrous Metals sector is about 10 per cent lower in 1996 than in all other years reported. The ERT recommends Slovenia to check the consistency of the figures for liquid fuels from 1986 to 1992, explain this trend in the NIR, check the time-series consistency of the CO_2 EFs for liquid fuels in Non-ferrous Metals, and use the relevant notation keys in the Non-ferrous Metals sector from 1997 onwards.

Chemicals: all fuels – all gases

44. Fuel consumption of all fuels in 1.A.2c Chemicals varies considerably over the time series. Solid fuel consumption is not reported in 1999 and 2000, and the CO_2 IEF varies between 92.7 and 105.2 t/TJ. Fuel consumption of gaseous fuels in 1.A.2c Chemicals is considerably lower in 1986 (291 TJ) than in all other years reported (1,092 to 3,763 TJ). Biomass consumption is reported only since 1997, and other fuels are only reported until 1997, with the 1996 CO_2 IEF being 24.1 per cent lower than that used for 1995.

Pulp and paper: solid fuels, biomass – CO_2

45. The CO_2 IEF for solid fuels in 1.A.2d Pulp, Paper and Print amounts to about 107.6 t/TJ in 1986 and from 1990 to 1996, and decreases thereafter sharply to a level of between 96.9 and 99.8 t/TJ. Biomass fuel consumption is only reported since 1997 and the CO_2 IEF for solid fuels until 1996 corresponds to the CO_2 IEF for biomass from 1997 onwards. The ERT recommends Slovenia to check the consistency of the data reported and whether biomass has been reported under Solid Fuels up to 1996.

Food processing, beverages and tobacco: solid fuels – CO_2

46. The CO_2 IEF for solid fuels in the Food Processing, Beverages and Tobacco sector is lower in 1986 (99.6 t/TJ) and in 2000 (99.2 t/TJ) than in other years (for which it is 102.9–106.0 t/TJ). The ERT recommends Slovenia to check the consistency of the estimates.

Residential and commercial/institutional: all fuels – all gases

47. Slovenia states in the NIR that it has used a tier 2 approach to estimate emissions from 1.A.4a Commercial/Institutional and 1.A.4b Residential. However, in practice a tier 1 approach is used with IPCC default values. This should be corrected in the NIR.

Residential and commercial/institutional: liquid fuels – CO_2

48. The CO_2 IEF for liquid fuels in 1.A.4a Commercial/Institutional and 1.A.4b Residential seems somewhat lower in 1986 than in other years reported. The ERT recommends Slovenia to check the estimates for 1986.

Agriculture/forestry/fisheries: gaseous, solid, other fuels and biomass – all gases

49. Slovenia reports only fuel consumption of liquid fuels. The appropriate notation keys should be used for other fuels.

Fugitive emissions from coal mining – CH_4

50. Slovenia uses a tier 3 mine-specific method to estimate CH_4 emissions from coal mining. EFs for mining and post-mining activities are based on a study undertaken as part of the first national communication, where measurements were made in each of the six coal mines in Slovenia. The study covers the years 1986–1996; from 1997 onwards constant (average) values have been used. The CH_4 IEF for underground coal-mining activities is considerably lower (0.4–2.1 kg/t) than the range of the IPCC tier 1 global average (6.7–16.75 kg/t). EFs might be lower in Slovenia, as Slovenia has rather untypical mines (with underground mining of lignite). However, as the national EFs are quite different from the IPCC default range, the ERT encourages Slovenia to commission an independent peer review of the study on national EFs. One possibility is to submit the national EFs and the study to the IPCC Emission Factor Database (EFDB). The extrapolation of EFs from 1997 onwards appears to be appropriate.

D. Non-key sources

Fuel combustion: all fuels – CH_4, N_2O

51. In a number of cases, the IPCC default EFs for CH_4 and N_2O are not applied correctly. In 1.A.1b Petroleum Refining and 1.A.1c Manufacture of Solid Fuels and Other Energy, the CH_4 EFs are 2 kg/TJ (instead of 3 kg/TJ) for liquid fuels, 5 kg/TJ (instead of 1 kg/TJ) for natural gas, and 10 kg/TJ (instead of 1 kg/TJ) for solid fuels. In 1.A.2f Other Industries, the CH_4 and N_2O IEFs for liquid fuels are significantly higher (4.0–9.5 kg CH_4/TJ and 5.2–11.5 kg N_2O/TJ) than the IPCC default EFs (2 kg CH_4/TJ and 0.6 kg N_2O/TJ) which have been used for all other industry sectors in 1.A.2. In 1.A.3a Civil Aviation, the CH_4 EF for gasoline (1 kg/TJ) deviates from the IPCC default value (0.5 kg/TJ). The ERT recommends Slovenia to check the application of IPCC default EFs in general and recalculate N_2O and CH_4 emissions from these sources.

Manufacturing industries and construction: other fuels – all gases

52. Fuel consumption and CO_2 IEFs for Other Fuels in 1.A.2 Manufacturing Industries and Construction vary considerably over time. For example, fuel consumption increases by 29.7 per cent between 1997 and 1998 and by 59.8 per cent between 1998 and 1999, and decreases by 26.9 per cent in between 2000 and 2001. The CO_2 IEF is 92.3 t/TJ in 1986 and from 1990 to 1995, 70 t/TJ from 1996 to 1998, 74.6 t/TJ in 1999, 73.5 t/TJ in 2000, and again 70 t/TJ in 2001 and 2002. Slovenia explains that this trend is due to varying fuel consumption and varying fuel types (lubricants, fats, etc.) in one cement plant. In 1.A.2c Chemicals, consumption of other fuels is only reported up to 1996, and CH_4 and N_2O emissions are not reported. In 1.A.2f Other Industries, CH_4 and N_2O emissions are not reported. The ERT recommends Slovenia to check the consistency of the data reported, report complete time series of CH_4 and N_2O emissions, and provide explanations on the fuel types and underlying EFs in the NIR.

Road transportation: diesel – CH_4, N_2O

53. The N_2O IEF for diesel consumption in 1.A.3b Road Transportation shows a very strong increase from 1996 to 2002, and is relatively high compared to the IEFs reported by other Parties. The 2002 N_2O IEF for diesel oil (6.86 kg/TJ) is at the higher end of range among European countries. The CH_4 IEF shows a serious decrease in the period 1997–1999, with inter-annual changes of –12.4 per cent, –14.2 per cent and –16.6 per cent. The ERT recommends Slovenia to check the application of the COPERT model for diesel cars.

Railways: solid fuels – all gases

54. In the NIR (page 68) Slovenia states that emissions from brown coal for 1.A.3c Railways are not included in the GHG inventory. However, AD and CO_2 emissions are included in the CRF tables, while CH_4 and N_2O emissions are reported as "NE". The ERT recommends Slovenia to make its information consistent as between the NIR and the CRF and to report CH_4 and N_2O emissions.

Fugitive emissions from oil and natural gas – CH_4

55. Slovenia uses a country-specific approach to estimate fugitive emissions from natural gas processing, transmission and distribution. Data on absolute CH_4 emissions are provided in a document by the natural gas distribution company. However, the emissions reported (21,000 to 45,000 kg/PJ) are lower by a magnitude of 10 than the IPCC range for East European countries according to the tier 1 EFs in table 1-61 of the IPCC Guidelines (340,000 to 715,800 kg/PJ). In addition, it is rather unclear from the document how these data have been generated. The ERT recommends Slovenia to estimate fugitive CH_4 emissions from natural gas using the IPCC tier 1 approach as a first basis. If this source becomes a key source, tier 2/3 approaches may be required to estimate emissions appropriately. Slovenia may also contact the natural gas distribution company to seek clarification on its estimates.

56. Slovenia reports emissions from venting and flaring as "NE". As these are included under 1.B.2b Natural Gas, the appropriate notation key included elsewhere ("IE") should be used.

Fugitive emissions from coal mining, oil and natural gas – CO_2

57. Slovenia does not estimate CO_2 emissions from coal mining. The ERT encourages Slovenia to report CO_2 emissions from coal mining, gas and oil activities.

E. Areas for further improvement

Identified by the ERT

58. In addition to the recommendations above, the ERT generally recommends Slovenia to analyse any inconsistencies in the time series. Where possible, consistent methods should be used over the whole time series to estimate emissions. Any actual variations in fuel consumption that are considerable should be explained in the NIR. When integrating data from national allocation plans of the European Union Emissions Trading Scheme in the GHG inventory, time-series consistency should be carefully taken into account.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

59. Emissions from industrial processes in Slovenia account for about 7 per cent of total national GHG emissions, excluding Land Use, Land-use Change and Forestry (LULUCF). They amounted to 1,309 Gg CO_2 equivalent in the base year, 1986, and 1,051 Gg CO_2 equivalent in 2002. The share of the sector in total nation GHG emissions has hardly changed over time. Total emissions from solvent use amount to about 0.6 per cent of the national total excluding LULUCF (129 Gg CO_2 equivalent in the base year and 73 Gg CO_2 equivalent in 2002). There are no major changes in the relative contributions of these sectors to the national total.

60. Over time, CO_2 accounted for 70–80 per cent of GHG emissions from industrial processes. The greater part of the remainder are emissions from PFCs. Emissions from solvent use are about equally divided between non-methane volatile organic compounds (NMVOCs) and N_2O.

Transparency

61. The data and EFs used in the estimates are well described and were made available to the ERT in all details, including reports from individual companies. The NIR describes the information in full detail.

62. In a number of cases (among them CO_2 from aluminium production and iron and steel production, and PFCs in aluminium), Slovenia has obtained detailed data on process parameters, allowing estimation of the emissions on the basis of carbon electrodes used or number of anode effects occurring instead of a more general EF relating to metal production itself. Where this happens, this is clearly indicated in both the NIR and the CRF tables. However, by doing so, comparability is reduced. The ERT recommends that in such cases Slovenia report metal production as the relevant AD in the CRF and use the (measured) anode use or number of anode effects as explanations of the country-specific EF in the NIR.

Recalculations and time-series consistency

63. In several source categories the available AD show discontinuities or gaps. An example of these discontinuities is found in the CO_2 emissions from iron and steel production, where coke usage was accounted for under Energy during the early years, whereas it is included in Industrial Processes for the year 2002. An example of the gaps is SF_6 emissions from electrical equipment. The Party has filled in the gaps using the assumption that the missing years will have the same emissions as the latest year for which data are available. Both practices lead to apparently inconsistent time series. The ERT recognizes that sometimes methods change between different inventory years and that it is not feasible to redo the full time series using the same method for all years. The IPCC good practice guidance provides some help with this issue. The ERT recommends that in future submissions the Party apply methods that smooth out the abrupt changes in the time series either by applying a surrogate method (IPCC good practice guidance, page 7.20) or by splicing (IPCC good practice guidance, section A1.5.2).

Verification and quality assurance/quality control approaches

64. Slovenia has used AD obtained from individual industries to estimate emissions. The data are compared with national statistics insofar as these are available. When differences occur, the facility data are still used as they are considered more reliable. The ERT encourages Slovenia to continue this practice.

B. Key sources

2.A.1 Cement production – CO_2

65. Slovenia has used facility-specific AD and a default EF. The NIR, however, indicates that the presence of magnesium carbonate ($MgCO_3$) in the clinker will lead to a higher EF. Measurement data on this are now available and will be used in the next submission.

2.A.2 Lime production – CO_2

66. Slovenia has used facility-specific AD and a default EF. The NIR, however, indicates that a somewhat lower EF could apply, due to the presence of magnesium oxide (MgO), for the later years in the time series. Nevertheless, Slovenia has applied the default EF for the complete time series. It would have been more realistic to assume that in the earlier part of the time series an EF equal to or similar to the measured EFs in the later years would have applied. The ERT recommends Slovenia to apply the country-specific EF for the complete time series. If needed, an averaged or linear extrapolated value could be used for those years for which no measurements are available.

C. Non-key sources

2.B.4 Carbide production – CO_2

67. The time series for emissions from carbide production is inconsistent since the Party includes the emissions from carbide use. However, the methods employed for the carbide use statistics changed in 1999. Slovenia may have made a mistake in interpreting the pre-1999 data and will investigate this problem.

2.C.1 Iron and steel production – CO_2

68. Coke usage in iron and steel production is included in the Energy sector for all years except 2002. This results in an inconsistent time series. The ERT recommends that Slovenia estimate coke use in Iron and Steel for all years, subtract the emissions associated with this from the Energy sector, and include the emissions in Industrial Processes. If direct data are not available, Slovenia is encouraged to use iron and steel production as a proxy to estimate coke use.

2.F Consumption of halocarbons and SF_6 – SF_6

69. Slovenia has assumed that emissions in this sector remained constant and equal to the latest measured value during those years where no measurement is available. The ERT recommends that Slovenia use a linear interpolation over time or a proxy, such as the added value in a relevant economic sector.

3.A Paint application: activity data

70. Slovenia does not report AD in this sector. Such data have, however, been used in the estimation method for several subcategories within this source category. The ERT recommends that Slovenia aggregate these data to a total for paint and coating use in the country and report it in the CRF.

D. Areas for further improvement

Identified by the Party

71. Although the quality of the inventory in the Industrial Processes and Solvent and Other Product Use sectors has greatly improved, Slovenia indicates that better use of country-specific EFs is possible and will be implemented in future submissions.

Identified by the ERT

72. The ERT recognizes the difficulties resulting from the changes in the national statistics system since the early 1990s, resulting in partly inconsistent time series in activity statistics. Rather than simply using these inconsistent AD time series, Slovenia could further improve the inventory by using methods and interpolation algorithms as provided in the IPCC good practice guidance to repair such inconsistent time series.

IV. AGRICULTURE

A. Sector overview

73. In the year 2002 the Agriculture sector accounted for 10.1 per cent of total national GHG emissions, reaching 2,069 Gg CO_2 equivalent, compared with 12.4 per cent of total national GHG emissions in the base year (1986), or 2,564 Gg CO_2 equivalent. In the period 1986–2002, emissions decreased by 19 per cent. In 2002, CH_4 emissions contributed 41.1 per cent of the total CO_2 equivalent emissions of the sector. N_2O emissions accounted for the remaining 58.9 per cent. Enteric Fermentation, Manure Management and Agricultural Soils were the only Agriculture sector source categories in this year, contributing 33 per cent, 20.1 per cent and 46.9 per cent, respectively. Rice Cultivation and Prescribed Burning of Savannas are reported as "NO" and Field Burning of Agricultural Residues is reported as "NE". From 1986 to 2002, CH_4 emissions from enteric fermentation decreased by 13.8 per cent because of a reduction of the livestock

population in the country. Emissions from manure management systems also declined by 39.5 per cent from 1986 to 2002. N_2O emissions from agricultural soils have decreased by 10.3 per cent since 1986 mainly because of a decline in the volume of animal wastes applied on soils.

74. Slovenia reports a detailed characterization of the key sources in the NIR, which shows approximately the same outcomes as the secretariat's analysis of the Agriculture sector key sources. CH_4 from Enteric Fermentation, CH_4 and N_2O emissions from Manure Management, and N_2O emissions from direct and indirect emissions in Agricultural Soils are key sources. The only non-key source is N_2O from animal production from agricultural soils.

Completeness

75. The CRF includes estimates of CH_4 and N_2O from enteric fermentation, manure management and agricultural soils from the Agriculture sector, as recommended by the IPCC Guidelines. Rice Cultivation and Prescribed Burning of Savannas are reported as "NO" and Field Burning of Agricultural Residues as "NE", not being practised in Slovenia, although it probably occurs on a small scale. Buffalo, Camel and Llama Populations are reported in the CRF tables as "NO" and Mules and Asses as "NE", but no information is provided either in the CRF documentation boxes or in the NIR.

Transparency

76. The NIR provides detailed information on methodology, methods and EFs. However, the ERT encourages Slovenia to provide more information on the different sources of AD used, as well as explanations for the choice of AD, methods and EFs. According to the NIR, the source of all AD for the Agriculture sector is the Statistical Office of the Republic of Slovenia (SORS), but the ERT noticed during the review that other sources were also used. The CH_4 and N_2O emission trends in the Agriculture sector show some fluctuations over the period 1986–2002, and the NIR does not provide enough information to support the trend analysis. The ERT noted that different sets of statistical data have been used and the information provided in the NIR is not sufficient. However, the methodology used for developing country-specific EFs is transparently documented, and Slovenia also provided enough information during the review to support the methodology.

77. There is no sectoral information provided in the NIR on the institutional arrangements and archiving system. However, the Slovenian experts provided information during the review about the national inventory system, and indicated that both electronic and hard-copy archiving procedures are in place. There is no list of reference documents presented in the NIR, although some experts and studies consulted are mentioned in the Agriculture sector. The ERT encourages Slovenia to provide more information on institutional arrangements and references in its future submissions.

Recalculations and time-series consistency

78. Because Slovenia's 2003 submission included only IPCC tables for the year 1986 and 1990–1996, and the SORS has recalculated the statistical data for the period 1992–1996. Slovenia has accordingly recalculated the inventories for 1992–2002 for the 2004 submission. The statistical data for the base year (1986), 1990, and 1991 have not been recalculated and there is no plan to do this at the SORS. The impact of the recalculations on the emission trend is not presented in the NIR.

79. The statistical data provided by the SORS and used in the Agriculture sector show several discrepancies and different levels of disaggregation over different time periods, which result in inconsistent time-series throughout the sector. The ERT identified a time-series inconsistency in the AD provided by the SORS, by using three-year average, two-year average and one-year data in the livestock population characterization. However, a single livestock characterization has been used which is consistent across all the source categories, in accordance with the IPCC good practice guidance. The information in the NIR does not adequately explain the selection of AD used over the entire time series. The ERT recommends that Slovenia use three-year averages for the livestock characterization over the

entire time series (including the base year), recalculate the emission values and provide more information in the NIR.

Uncertainties

80. A quantitative uncertainty analysis is provided in annex 7 of the NIR and for each source category in the Agriculture sector. However, the ERT noted that the uncertainties are based on the IPCC good practice guidance, and not on expert judgement, as the NIR mentions. The quantitative uncertainty analysis for animal production from agricultural soils contains incorrect information. The uncertainty estimates for direct emissions from agricultural soils calculated in accordance with the IPCC good practice guidance show different values compared with the expert judgement values provided during the review. The ERT encourages Slovenia to use expert judgement uncertainty analysis for the EFs used and to provide more information in the NIR on this analysis.

B. Key sources

Enteric fermentation – CH_4

81. Slovenia has applied the IPCC tier 2 method for the significant sub-source categories Cattle and Swine, and the IPCC tier 1 method for all other animal species, which is in line with the IPCC good practice guidance. Country-specific EFs have been used for cattle and partially for swine, while default values have been applied for other animal species (sheep, goats, horses, poultry, and partially for swine) using the tier 1 method. Milk yield, which is one of the parameters used in the EF calculation method after 2000, shows an important increase from 1999 to 2000 as a result of different disaggregation of cattle population categories. The figures for cattle population used in the period 1986–1999 show some differences compared with the figures provided by the SORS even taking into account the differences in the three-years and two-years average data. Slovenia is encouraged to recalculate the emissions in this source category for the entire time series using a consistent data set to improve consistency.

82. The population values for sheep and swine reported by Slovenia differ from those published by the Food and Agriculture Organization of the United Nations (FAO). During the review the Slovenian experts explained this difference as possibly being due to different reporting periods and/or different accounting of some young animal categories. The ERT considered this explanation reasonable.

83. The ERT identified some inconsistencies related to animal population trends and emissions along the time series, as the population of diary cows showed a significant decrease from 1999 to 2000 and non-dairy cattle presented an important increase between the same years. Sheep and goat populations show the same values for 1986 and 1990 due to a lack of statistical data for the base year, and the horse population shows the same values for the years 2000–2002. The figures for the sheep population also present an increase of 400 per cent in the period 1986–2002. Slovenia acknowledged that there are some gaps in the livestock population data. The ERT recommends that the inconsistencies be corrected and more information be provided in the NIR regarding the AD.

Manure management – CH_4

84. Slovenia has applied the IPCC tier 2 method for the significant sub-source categories Cattle and Swine and the IPCC tier 1 method for all other animal species in line with the IPCC good practice guidance. Country-specific EFs are used for cattle and swine while default values have been applied for the other animal species (sheep, goats, horses, poultry), which contribute to a small proportion of the total emissions in this source category, using the tier 1 method.

85. Some inconsistencies were identified during the review in this source category: the allocation to the cool climate region of different animal waste management systems (AWMS) is not consistent over the entire time series for swine, sheep, goat and horse populations. Additionally, the overall cattle population shows the same value for the entire time series. The ERT encourages Slovenia to correct the inconsistencies in the time series.

Manure management – N_2O

86. There is not enough information in the NIR to explain the choice of method and EFs used. The NIR mentions that the methodology for calculating CH_4 emissions was used for calculating the manure nitrogen (N) fraction produced in different AWMS for cattle and swine, and the IPCC method and default EFs were used for the other livestock population categories. The ERT recommends that Slovenia explain the rationale for these choices in the NIR.

87. The N excretion values between different AWMS, and between the periods 1989–1999 and 2000–2002, show some inconsistencies: the values increase for liquid systems and pasture range and paddock AWMS, but decrease for anaerobic lagoons, and solid storage and dry lot AWMS at a higher rate than would be expected. Slovenia reports that spreading of manure from AWMS is not done. The N_2O implied EF for the Other AWMS subcategory (0.001 kg N_2O-N/kg N) is below the IPCC default value because Slovenia uses a country-specific EF from anaerobic digesters for swine, which is in line with the IPCC good practice guidance. The ERT recommends that Slovenia recalculate the emissions in this source category over the entire time series following the IPCC good practice guidance requirements for key sources.

Direct emissions from agricultural soils – N_2O

88. The IPCC tier 1 method and default EFs have been applied in this key source category although the IPCC good practice guidance recommends country-specific information and a tier 1a or tier 1b method. The NIR provides general information regarding the AD taken from the SORS, and indicates a deficiency in gathering real data on the consumption and sale of mineral fertilizers. The EFs used are reported in the NIR but there is no information on the rationale for choosing the default value and the lack of country-specific information. The ERT identified an inconsistency between the CRF tables and the graph presented in the NIR regarding total N_2O emissions in the Agricultural Soils category. Slovenia indicates it will correct this in the next submission. The ERT encourages Slovenia to provide more information in the NIR regarding the methodology, EFs and AD used in this source category.

89. Emissions from histosols are reported as "NE", which is appropriate in light of the explanation provided in the NIR. The AD for N-fixing crops show some trend fluctuation and the Slovenian experts explained this as being on the result of new, corrected data on crop production after 1992 provided by the SORS. The ERT noted that different values are used for the partitioning fractions, and no information is provided in the NIR on the use of these parameters, although IPCC default values for EFs are reported in the NIR (e.g., $Frac_{NCRO}$, $Frac_{NCROBF}$, $Frac_R$). The $Frac_{BURN}$ value was reported as 0 due to the lack of activity for crop residue burning in Slovenia. The ERT recommends Slovenia to provide more information in its NIR on the selection of parameters and AD used, and to recalculate the emission values for the entire time series based on the new statistical data provided by the SORS and consistent parameters.

Indirect emissions from agricultural soils – N_2O

90. The IPCC tier 1 method and default EFs have been applied in this key source category although the IPCC good practice guidance recommends country-specific EFs, rigorously documented country-specific partitioning fraction values, and a tier 1a or tier 1b method. The NIR provides information on the methodology used but not enough information on the AD and the selection of EFs. The ERT encourages Slovenia to provide more information in its NIR and to use a higher-tier method if possible.

C. Non-key sources

Animal production from agricultural soils – N_2O

91. The IPCC tier 1 method and default EFs have been applied in this source category. The information provided in the NIR on the methodology, EF and AD used is not sufficient. N excretion on pasture, range and paddock and the estimates of emissions from this category increased by 158 per cent between the years 1999 and 2000, and the $Frac_{GRAZ}$ also shows an increase of 154 per cent between the

same years. The ERT recommends that the values of N excretion and $Frac_{GRAZ}$ be checked over the entire time series and documented for the next submission.

D. Areas for further improvement

Identified by the Party

92. Slovenia indicated that it plans to reflect the recalculations of livestock population over the entire time series in its future submissions. A QA/QC Plan and Manual of Procedure is under preparation and will be used for future submissions, covering the Agriculture sector as well.

Identified by the ERT

93. The ERT recommends Slovenia to recalculate all the sources as indicated in the sections above in order to correct the errors detected and ensure consistency of the time series reported. In addition, the ERT encourages Slovenia to use the same approach (i.e., single-year, two-year or three-year averages) regarding the livestock population over the entire time series and to provide information in the NIR on the sources of data. Slovenia may wish to obtain country-specific information on the Agricultural Soils category. Slovenia may also wish to use expert judgment on uncertainty analysis in the Agriculture sector. The ERT recommends better use of statistical AD and the provision of more information in the NIR.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

94. Slovenia is a country dominated by forests and the LUCF sector is important when estimating the net emissions of GHGs. According to the figures reported by the Party, removals in the LUCF sector amount to almost 30 per cent (5.6 Tg CO_2 equivalent) of total emissions from the other sectors. The most important category is the removal of CO_2 due to increased biomass stocks. The last thorough assessment of the LUCF sector was made in 1996. Since then the Party has assumed stable conditions and reported the same figures for the entire period up to and including 2002.

Completeness

95. The CRF tables include estimates of most of the relevant sources and sinks of GHGs in the sector. The main sources and sinks are change in tree biomass stocks in managed forests, and change in biomass and soil organic carbon (SOC) due to regrowth of trees on former agricultural land. Emissions/removals of CO_2 from soils in managed lands other than abandoned farmland are not reported. Nor are other biomass components than stem wood included.

Transparency

96. Although the figures reported are based on thorough work, it was difficult for the ERT to make a detailed assessment of the relevance of all parts of the inventory because the background reports are in Slovenian. The NIR contains the basic final results but does not provide the relevant methodological details needed for a thorough review. Instead, the ERT received this information through discussions with the people involved in the reporting and acquisition of background data. These discussions have been characterized by openness towards the ERT and the messages have been coherent, pointing to the same general strengths and weaknesses of the figures reported.

97. The text in the NIR is not entirely consistent with the figures in the CRF tables: for example, the figure for total GHG removals reported in the NIR is lower than that in the CRF tables, and it is stated that all biomass components of trees are included whereas according to the calculations only the stem wood parts are included. The NIR also contains some information that is not relevant for the current reporting (e.g., estimated gross removals in harvested wood products, a figure which is not reported in the CRF tables). It appears that the NIR is composed of translated pieces of text from the existing thematic

reports in the area; however, it does not provide a transparent description of the derivation of the figures actually reported in the CRF tables.

98. It is recommended that future NIR submissions provide better descriptions of the data and the methods used to derive the figures in the CRF tables. The text would probably benefit from a more direct involvement of experts in LUCF. Currently their role appears to have been to compile background reports that have later been partly translated and summarized at a central level.

Recalculations and time-series consistency

99. Slovenia has many good sources of information about forests, forestry and other land use. Regarding forest information, there has been a shift over time from methods based on visual assessment towards more reliable methods based on objective sample plot surveys. One problem in the figures reported is that the figures for the base year (1986) are largely based on visual assessment methods, whereas the more recent figures are based on objectively assessed data. Thus, there is a time-series inconsistency that needs to be addressed in future submissions. According to people involved in the forest inventories it would be possible to make recalculations back to 1986 that would be fairly consistent.

100. Moreover, recalculations would also be beneficial from the point of view of assessing what has occurred in the sector from 1996 until 2002, a period during which the Party has reported identical figures every year. The ERT recommends that Slovenia recalculate emissions for forestry back to 1986 to ensure a consistent time series.

Uncertainties

101. Uncertainties are only very briefly mentioned in the NIR. They are provided as one general percentage figure for all kinds of AD in the sector and a corresponding percentage figure for all kinds of EFs. However, the actual uncertainty of the figures for the different categories can be expected to vary greatly. For example, biomass growth figures are probably much more reliable than figures on harvest.

Verification and quality assurance/quality control approaches

102. Regarding both QA and QC it would probably be beneficial to establish a small formal group to work on LUCF issues. Currently the LUCF team appears to be very small (both in number of persons and in time allotted) and thus it has been difficult for the people involved to cover all parts of the rather complicated LUCF sector. One fact that underlines the importance of this kind of group is that in the near future there will be a need to develop the LUCF reporting even beyond what is currently required in order to meet the requirements of the IPCC's new (2003) good practice guidance for the sector. This involves revision and expansion of the UNFCCC general reporting as well as the additional reporting requirements due in future under articles 3.3 and 3.4 of the Kyoto Protocol.

B. Sink and source categories

Change in biomass stocks – CO_2

103. The general approach chosen by the Party to estimate the change in tree biomass in managed forests is relevant and correct. Total growth is estimated and from this figure harvest is deducted. However, in both cases the biomass expansion factor applied refers to a transformation from stem wood volume to stem wood biomass (and not to total biomass of trees). The Party should evaluate whether biomass expansion factors that account for all parts of a tree should be applied in future submissions. Such factors would increase the removals of CO_2 in this category. (This would also need to be accounted for when assessing emissions due to harvest in that case.)

104. Currently the growth estimates appear to be of high quality whereas they are believed previously (e.g., for the base year) to be underestimates due to the use of a different type of data. The estimation of quantities harvested is based on measurements of trees marked for felling by the Slovenian Forest Service. Such markings are mandatory according to the Slovenian Forest Act. However, the general perception is that some "unendorsed" cuttings take place (i.e., trees are cut that were not marked for

felling according to the regulation in the Forest Act). As a result, the official harvest figures have been increased by 10 per cent in the report. Even so, the uncertainty of the reported harvests is considered to be high by national experts. This is also highlighted by the fact that a recent survey on household consumption of fuel wood suggests much higher figures than the official figures. Moreover, recent case study evaluations of the harvest figures reported, made by the Slovenian Forest Service, indicate that harvest figures may be underestimated by 20–30 per cent on private land (almost 75 per cent of the forest area).

105. Although there is reason to believe that the uncertainty of the harvest figures will remain rather high (as in many other countries), as far as possible the level of cutting should reflect actual cutting levels rather than officially reported cutting. Thus, continued use of an adjustment factor is recommended unless new sources of data become available. Another possibility for future improvement of the figures reported regarding change of biomass stocks would be to base the estimates on repeated measurements of the extensive network of permanent sample plots that exists in Slovenia. If this were done, there would be no need to make separate assessments of growth and harvest. This alternative should be considered for future submissions, at least for purposes of verification.

106. Natural mortality of trees and decay of wood in the forest appear not to be accounted for in the calculations. However, this is probably a very minor source of error.

Abandonment of managed lands – CO_2

107. The areas of forest have increased in Slovenia over a long period because of the abandonment of agricultural land (both arable land and grazing land).

108. The area estimates for this category are calculated as the net change in forest area according to data from forest surveys. While this probably corresponds closely to reality, it should be pointed out that the actual areas of this type might be slightly larger since there are at least some minor forest areas that are deforested. In future submissions (as required under the Kyoto Protocol) such deforested areas, as well as afforested and reforested areas, must be specifically assessed and reported.

109. To estimate the biomass change a country-specific default figure based on expert judgement (3.5 m^3/ha/yr) for the average growth on abandoned areas was applied. While this figure may appear high in young forests, some forestry experts in Slovenia judge it to be low.

Emissions and removals from soils – CO_2

110. The removals reported under this category refer to an increase of soil carbon in abandoned lands. IPCC default figures have been used for the "removal factors" due to lack of country-specific data. The proportions of soils classified as "high activity" and "low activity" are based on expert judgement.

111. It is unclear exactly how the calculations for this category have been performed. It appears that a gradual transition from "0" to the actual default value for soil carbon stocks under natural vegetation has been assumed over a 20-year period. If this is the case, this would lead to CO_2 removals in this category being overestimated by a considerable amount. Thus, the calculations performed for this category need to be further addressed by the Party in order to assess whether the methods applied really provide realistic values about the CO_2 removals.

C. Areas for further improvement

Identified by the Party

112. The Party has identified a need for major improvement of the reporting in this sector, largely due to the new requirements in the IPCC's new (2003) good practice guidance for the sector. This is planned for the 2006 submission.

Identified by the ERT

113. The ERT agreed with the Party that, although the current reporting of emissions and removals in the LUCF sector is relevant, there is a need for major improvement. The problems of time-series consistency need to be addressed and there is a need to develop the reporting to comply with the new reporting requirements for the sector. In this development, an important issue to consider is the setting up of a consistent system for tracking land-use changes (partly for estimating areas of afforestation, reforestation and deforestation). The Party has different ongoing forest and land-use surveys that could probably be developed into a consistent system for tracking land-use changes. Another important issue to consider is the methodological approach for estimating changes in biomass stocks. Also, country-specific methods might be needed in order to track carbon stock changes in soils.

114. For future submissions (as is required under the new IPCC good practice guidance), the Party should examine what category the areas currently reported under "abandoned lands" should be assigned to. Although these are generally not actively planted, tree regrowth occurs shortly after areas are "actively" abandoned and thus these areas might most accurately be classified as afforestation areas in future reporting.

VI. WASTE

A. Sector overview

115. In Slovenia, the reported sources of GHG emissions in the Waste sector are Solid Waste Disposal Sites (SWDS) and Waste-water Handling. Only SWDS is classified as a key source – on the level assessment 4.7 per cent and on the trend assessment 2.5 per cent. Only CH_4 and N_2O are reported emitted from the Waste sector. The CH_4 is generated from SWDS and waste-water handling, while N_2O is only from waste-water handling. Total emissions of GHGs from the Waste sector in 2002 amounted to 1,109.55 Gg CO_2 equivalent, of which SWDS contributed 85.6 per cent and waste-water handling 14.4 per cent. CH_4 emissions are responsible for 95.8 per cent of total GHG emissions in the sector and N_2O for 4.2 per cent. In 2002, GHG emissions from the Waste sector increased by 11.2 per cent compared with those of the base year, 1986. The annual rate of increase is about 1 per cent and recently the emissions have started to decrease.

116. The ERT recognizes that, as a result of the shift within a short period from reporting using the IPCC tables to using the CRF tables, Slovenia has not been able to make use of specific expertise in reporting emissions from this sector. As a result the reporting of emissions in this sector is not very well documented and a number of items of background data have not been reported. During the review Slovenia accepted this shortcoming and it has identified this sector as one area for improvement in its future submissions.

Completeness

117. The CRF includes estimates of CH_4 and N_2O emissions as well as SWDS and waste-water handling, which are major sources of emissions from the Waste sector, although the IPCC Guidelines recommend waste incineration together with the two sources. The emission sources in the Waste-water Handling sector are domestic and commercial waste-water handling, industrial waste-water handling, and human sewage. Since there is no incineration plant in Slovenia, emissions from incineration are reported as "NO". Although the AD and EF for industrial waste-water handling in 2002 are noted as "NE", CH_4 emissions from the source are reported as "IE" for waste water and as 3.77 Gg CH_4 for sludge in CRF table 6. B. The same problem is also observed in the case of N_2O in the domestic and commercial waste-water handling. Also, N_2O emissions from human sewage are not estimated. The ERT believes that the N_2O emissions from the domestic waste-water handling reported by the Slovenian expert may have been confused with those from human sewage. The ERT recommends that Slovenia move the emissions from N_2O from domestic and commercial waste-water handling to N_2O from human sewage in CRF table 6.B.

Transparency

118. For SWDS in the NIR, the tier 1 method has been introduced to estimate CH_4 emissions. Most parameter values are IPCC defaults except for degradable organic carbon (DOC) and methane recovery (R), which are estimated to be 0.118 and 0.0676, respectively. However, no supporting information is provided to confirm the appropriateness of the estimated values. Also, the uncertainties of AD and EF that were derived from expert judgement are reported to be 30 and 40 per cent, respectively. Since there is a lack of information on waste generation, waste composition, and types of SWDS, the uncertainties for AD and EFs may be higher than those reported. It is therefore desirable to show how expert judgement can obtain the uncertainties. For waste-water handling in the NIR, the fraction of DOC removed as sludge is assumed to be 0.4, but there is no explanation of how this fraction is obtained. Moreover, no mention is made in the NIR of the values of other key parameters or how the other key parameters are determined. Owing to the lack of information on the key parameters, it was almost impossible for the ERT to judge whether the methodology used for estimating the GHG emissions has been applied appropriately and the parameter values have been determined correctly. The N_2O emissions in the NIR originate from human sewage, but domestic and commercial waste-water handling is responsible for the emissions reported in the CRF tables. As with the case of SWDS, the uncertainties are reported without proper explanation of how they were obtained. The ERT recommends that Slovenia supply information on how the parameter values used in the NIR and the CRF tables are derived.

Recalculations and time-series consistency

119. No recalculations have been made. However, there are several findings that should lead to recalculations. The main problems with GHG emissions in the Waste sector are the lack of information and the unsupported assumptions that have been used to estimate GHG emissions. If key parameters are determined again from sound information, recalculations should be made on the basis of the new parameter values.

Uncertainties

120. Annex 7 of the NIR demonstrates the uncertainty analysis results derived from expert judgement. However, no underlying information is presented to confirm whether or not the uncertainty values are correctly estimated.

Verification and quality assurance/quality control approaches

121. There is no information on QA/QC procedures for the Waste sector. The Slovenian experts were not able to show how QA/QC is done for the emissions data for the sector.

B. Key sources

Solid waste disposal sites – CH_4

122. According to the IPCC good practice guidance, Slovenia should adopt the tier 2 method to estimate CH_4 emissions from SWDS. To this end, Slovenia is encouraged to obtain or estimate the disposal AD of previous years. The EF has been derived based on a tier 1 method and is regarded as a combination of country-specific and IPCC default. As already mentioned in the sector overview above, the key parameters, DOC and R, have been used without proper verification. The R value is especially critical to estimating CH_4 emissions. A methodology should be established for estimating the R value accurately. In view of the current situation in Slovenia, the best way to evaluate the R value at present is to calculate the quantities emitted from gas extraction wells from managed landfills. The quantities of CH_4 emitted from gas extraction wells can be considered as the quantities recovered and used to calculate the R value.

C. Non-key sources

Waste-water handling – CH_4

123. The IPCC method has mainly been used, with country-specific parameters, but neither the NIR nor the CRF tables explain clearly how their values were obtained. Only one parameter value is reported for DS (fraction of degradable organic component removed as sludge). However, the DS value of 0.4 is much lower than would be normal (>0.7). Owing to the lack of information in the NIR and the CRF tables, it was difficult for the ERT to judge whether or not the proper methodology has been applied and whether the relevant parameters have been determined correctly.

Waste-water handling – N_2O

124. The NIR indicates that the N_2O emissions in the sector are related to human sewage. However, the CRF table shows that the N_2O emissions originate from domestic and commercial waste-water handling. Since the methodology for estimating N_2O described in the NIR is the methodology associated with human sewage, the ERT recommends that Slovenia correct the source for N_2O emissions. The EF used here is the same as that introduced by the IPCC.

D. Areas for further improvement

Identified by the Party

125. The Slovenian experts realize that the GHG emissions from the Waste sector have been estimated without proper verification. Unfortunately, they do not have any solid plan to improve the quality of the emissions data. The ERT recommends that the Slovenian experts more fully assess the Waste sector to identify and understand the exact problems related to the GHG emissions in this sector.

Identified by the ERT

126. For SWDS, because of lack of information on the composition and quantity of waste for previous years, the ERT recommends that Slovenia adopt a tier 1 method to estimate CH_4 emissions until such information is available. To obtain reliable emissions data from the tier 1 methodology, the ERT recommends the following:

(a) Classification of existing SWDS into managed, unmanaged deep, and unmanaged shallow in terms of landfilled amount;

(b) Evaluation of DOC values with more extensive analyses of the composition of wastes; and

(c) Estimation of the R value with careful investigation of the recovery systems of landfill sites.

127. Eventually, the tier 2 methodology should be applied. To this end, the AD as well as the waste compositions of previous years should be estimated or predicted using reasonable assumptions. The methane generation rate constant, k, should be estimated together with methane generation potential (L_0). Research may be necessary to estimate the two key parameters in order to apply the tier 2 methodology.

128. For waste-water handling, the ERT recommends Slovenia to estimate GHG emissions in line with the IPCC method and country-specific parameters. The key parameters described in the IPCC method should be evaluated with solid and scientific approaches in agreement with other experts.

ANNEX 1: MATERIALS USED DURING THE REVIEW

A. Support materials used during the review

2003 and 2004 Inventory submissions of Slovenia. 2004 submission including a set of CRF tables for 1990–2002 and an NIR.

UNFCCC secretariat. "Report of the individual review of the greenhouse gas inventory of Slovenia submitted in the year 2003" (Centralized review). FCCC/WEB/IRI(3)/2003/SVN (available on the secretariat web site at http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/slocentrep03.pdf

UNFCCC secretariat. "2004 Status report for Slovenia" (available on the secretariat web site at http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/svn04.pdf.

UNFCCC secretariat. "Synthesis and assessment report of the greenhouse gas inventories submitted in 2004. Part I": FCCC/WEB/SAI/2004 (available on the secretariat web site at http://unfccc.int/resource/webdocs/sai/2004.pdf) and Part II – the section on *Slovenia* (unpublished).

UNFCCC secretariat. Review findings for Slovenia (unpublished).

Slovenia's comments on the draft "Synthesis and assessment report of the greenhouse gas inventories submitted in 2004" (unpublished).

UNFCCC secretariat. "Handbook for review of national GHG inventories". Draft 2004 (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", "Part II: UNFCCC reporting guidelines on national communications" and "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention." FCCC/CP/1999/7 (available on the secretariat web site at <http://www.unfccc.int/resource/docs/cop5/07.pdf>).

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

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

B. Additional materials

Responses to questions during the review were received from Ms. Tajda Mekinda Majaron and Mr. Matej Gasperič from the Environmental Agency including additional material on the methodology and assumptions used.

EIMV/HSE, 2004. Nacionalni emisijski faktor za lignit iz premogovnika Velenje. Pregled kemijskih analiz lignita [National emission factor for lignite from the Velenje coal mine. A Review of the Chemical Analysis of Lignite]. Ljubljana, april.

Erico Velenje Določitev emisijskih faktorjev metana pri izkopu premoga za leto 1986 in leta v obdobju 1990–1996. Inštitut za ekološke raziskave, januar 1999.

Verbič Jože – "GHG emissions from agriculture - estimates and possibilities of decreasing" ("Emisije toplogrednih plinov v kmetijstvu - ocene in možnosti za zmanjšanje", 1999).

Verbič Jože – "A simplified methodology for estimation of GHG emissions from agriculture" ("Poenostavljena metodika za oceno izpustov toplogrednih plinov iz kmetijstva", 2003).

Verbič Jože – "Annex to the report: Estimate of the potential lowering of GHG emissions in agriculture sector taking into consideration the EU 'quota'" (Dodatek k poročilu: Ocena potencialnih zmanjšanj izpustov toplogrednih plinov v sektorju kmetijstvo ob upoštevanju kvot, ki smo jih dosegli v predpristopnih pogajanjih z Evropsko unijo", 2004).

Statistical Office of the Republic of Slovenia – Statistične Informacije Rapid Reports - Agriculture and Fishing no. 109, 256/ 2003.

Inštitut za energetiko, 1998. Doličitev emisijskega faktorja CO_2 pri energetski izrabi zemeljskega plina [Short study on CO_2 EFs of natural gas for 1986 and 1990–1997]. Ljubljana, november.

Inštitut za energetiko, 1998. Emisijski faktor za emisijo metana pri transportu in distribuciji zemeljskega plina. Ljubljana, november.

Letno porocilo 1986. Delovna skupnost samoupravnih interesnih skupnosti energetike v SR Sloveniji [Slovenian Annual Energy Yearbook, from 1986].

Experts consulted during the review

Jože Verbič, Agricultural Institute Slovenia

Barbara Kutin, Statistical Office of the Republic of Slovenia (SORS)

Prof. Dr. Milan Hočevar, Slovenian Forest Institute

Dr. Primoz Simončič, Slovenian Forest Institute

Dr. Marko Kovač, Slovenian Forest Institute

Ms. Nike Krajnc, Slovenian Forest Institute

Mr. Gal Kušar, Slovenian Forest Institute

Mr. Dragan Matijašič, Slovenian Forest Service

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