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Report of the individual review of the greenhouse gas inventory of Croatia submitted in 2006*

* In the symbol for this document, 2006 refers to the year in which the inventory was submitted, and not to the year of publication.

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I. Overview

A. Introduction

1. This report covers the centralized review of the 2006 greenhouse gas (GHG) inventory submission of Croatia, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 15 to 19 January 2007 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: generalist – Ms. Inga Konstantinaviciute (Lithuania) and Mr. Paul Filliger (Switzerland); energy – Mr. Christo Christov (Bulgaria), Mr. Francis Yamba (Zambia) and Mr. Javier Gonzalez (Spain); industrial processes – Mr. Hongwei Yang (China) and Mr. Menouer Boughedaoui (Algeria); agriculture – Mr. Paul Duffy (Ireland) and Mr. Mahmoud Medany (Egypt); land use, land-use change and forestry (LULUCF) – Mr. Sandro Federici (Italy) and Mr. Leandro Buendia (Philippines); waste – Ms. Tatiana Tugui (Moldova) and Mr. Hiroyuki Ueda (Japan). Ms. Tatiana Tugui and Mr. Paul Duffy were the lead reviewers. The review was coordinated by Mr. Javier Hanna (UNFCCC secretariat).

B. Inventory submission and other sources of information

2. In its 2006 submission, Croatia has submitted a complete set of common reporting format (CRF) tables for the years 1990–2004 and a national inventory report (NIR). Where needed the expert review team (ERT) also used the previous year's submission, additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

3. In 2004, the most important GHG in Croatia was carbon dioxide (CO_2), contributing 76.6 per cent to total[1] national GHG emissions expressed in CO_2 equivalent, followed by nitrous oxide (N_2O), 12.5 per cent, and methane (CH_4), 10.2 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6) taken together contributed 0.6 per cent of the overall GHG emissions in the country. The energy sector accounted for 74.9 per cent of total national GHG emissions, followed by agriculture (12.1 per cent), industrial processes (10.8 per cent) and waste (2.2 per cent). Total GHG emissions in 2004 amounted to 29 431.86 Gg CO_2 equivalent (CO_2 eq), which was 5.4 per cent less than the total in 1990. Croatia's emissions decreased sharply between 1990 and 1994 (by 31.0 per cent), but since then a steady increase is observed. From 2000 to 2004 the increase was 16.5 per cent. Emissions in 2004 were only 0.8 per cent higher than they were in 2003 due to lower emissions from public electricity and heat production (lower production in thermal power plants and a switch from liquid and solid fuels to gaseous fuels). The LULUCF sector represented a net sink of 16 320.78 Gg of CO_2 which offset 72.4 per cent of total national CO_2 emissions.

D. Key categories

4. Croatia has reported a key category tier 1 analysis, both level and trend assessment and both including and excluding LULUCF, as part of its 2006 submission. In addition Croatia has used a qualitative approach to identify its key categories. The key category analyses performed by Croatia and the secretariat[2] produced slightly different results. The Croatian key category analysis includes only

[1] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LULUCF, unless otherwise specified.

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

sources that add up to a cumulative total of more than 94 per cent. This is not in line 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), which defines key categories as "those that, when summed together in descending order of magnitude, add up to over 95 per cent of total". In the light of this definition, three more key categories would be identified, and the analysis of Croatia would be comparable with that of the secretariat, although some small differences would remain due to differences in the aggregation level. The figures given in table A1-6 Key categories – summary (excluding LULUCF) and table A1-7 Key categories – summary (including LULUCF) in the NIR are not completely consistent with those given in table A1-2 Key categories analysis – level assessment – tier 1 (excluding LULUCF) and table A1-5 Key categories analysis – trend assessment – tier 1 (including LULUCF) in the NIR, and table 7 in the CRF. The ERT encourages Croatia to follow the IPCC good practice guidance for the key category analysis, to implement a tier 2 analysis for future submissions and to use it further to prioritize the development of the inventory.

E. Main findings

5. The inventory is well documented and the NIR and the CRF are in conformity with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines) and the IPCC good practice guidance. The ERT recognized the improvements made since the previous submission: Croatia has now reported the LULUCF sector as required by decision 13/CP.9. The completeness of the inventory should be given high priority, and the improvement plan presented in the NIR will be an excellent basis for this task. The quality assurance/quality control (QA/QC) system, which is under development, should be fully implemented and documented.

F. Cross-cutting topics

1. Completeness

6. The inventory presents emissions for all years and the whole territory of the Party, but it is not complete. Annex 4 to the NIR and table 9 in the CRF identify more than 100 potential missing sources and sinks. All sectors are mentioned, but LULUCF is the sector where most missing sources/sinks have been identified (only sources/sinks from forest land remaining forest land are reported under LULUCF). CO_2 and N_2O emissions from solvents and other product use and actual HFC emissions are not estimated. The inventory seems to be most complete in the energy sector. The ERT recommends the Party to make a first calculation of the emissions from the missing sources and sinks by estimating activity data (AD) using expert judgement and IPCC tier 1 methods. Then a prioritization should be carried out which should be used to start collecting data for the most important missing sources which could be key categories.

2. Transparency

7. The NIR follows the structure recommended by the UNFCCC reporting guidelines. It is comprehensive and covers information on key categories, methods, emission factors (EFs), AD, information on completeness and future improvements, uncertainty estimates, institutional arrangements, and general QA/QC and verification procedures. The transparency of the presentation of cross-cutting issues is good. In some sectoral chapters transparency should be improved (see the respective sector sections below). In the CRF tables more extensive use of the documentation boxes is recommended; this would increase transparency considerably. The ERT appreciated the clear documentation on potential missing sources and future improvements.

3. Recalculations and time-series consistency

8. The ERT noted that recalculations of the time series 1990–2003 have been undertaken in all sectors. However, it was not possible for the ERT to use tables 8(a) of the CRF for checking the recalculations, as these tables do not contain the correct values for the previous submission due to technical problems of data transfer. The ERT therefore based its review of the recalculations on chapter 9 and table 9.2-1 of the NIR, where the values are correct.

9. A major recalculation was noted in the waste sector. In response to the recommendation of the 2005 review, Croatia has used the IPCC first order decay (FOD) model to estimate CH_4 emissions from solid waste disposal on land and the estimate of HFC emissions in 2003 has been corrected by a factor of 5. The changes resulting from other recalculations are very small. The recalculations result in decreases in the estimates of total national GHG emissions in 1990 by 2.0 per cent, and in 2003 by 2.3 per cent. A short description of the rationale for these recalculations is provided in chapter 9 of the NIR. The ERT recommends Croatia to provide a more extensive justification for the recalculations in its future NIRs.

4. Uncertainties

10. Croatia has performed a tier 1 uncertainty analysis for the level (2004) and the trend analysis both including and excluding LULUCF. It has been done in accordance with the *IPCC Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). The total uncertainty excluding LULUCF is 14.1 per cent. The analysis shows that the combined uncertainty as a share of total emissions is dominated by CH_4 emissions from fugitive emissions from oil and gas operations (uncertainty of 13.6 per cent). The ERT recommends Croatia to focus on future improvements to its data for this source, as this would reduce the overall inventory uncertainty considerably. The uncertainty introduced into the trend in total national emissions is estimated to be 3.4 per cent. The total uncertainty including LULUCF sector has been estimated for the first time (28.2 per cent for 2004), and is considerably higher than the total uncertainty excluding LULUCF (14.1 per cent for 2004). The uncertainty in the trend excluding LULUCF has been estimated as 3.4 per cent, and including LULUCF as 16.4 per cent. This is an indication that LULUCF sources/sinks are quite uncertain and improvements in the LULUCF sector are necessary. Table 5.2 in the NIR contains a combined uncertainty of 43.08 per cent for limestone and dolomite use which is obviously incorrect, and this should be corrected in the Party's next inventory submission.

5. Verification and quality assurance/quality control approaches

11. In chapter 1.6 in the NIR the Party mentions that a QA/QC framework plan has been drafted in parallel to the preparation of the 2006 submission and refers to annex 8 to the NIR. This annex contains a checklist as an example of a QC element but no further description of the QA/QC framework plan. In addition, chapter 1.6 in the NIR mentions the preparation of methodological guidelines to support inventory team members by using inventory data record sheets which contain details of persons and/or organizations responsible for emission estimates, sources of AD and methodology. The NIR also states that comparisons with other countries are made (although it gives no further details) and that a final audit by a QA/QC manager is done before the inventory is submitted. Until now, no national review by independent experts as part of a QA process has been carried out. All background documents that are mentioned in the NIR are not included in the annexes or available on the Internet. The ERT recommends Croatia to document the different QA/QC elements systematically in an annex to the NIR or in a separate QA/QC document.

6. Follow-up to previous reviews

12. Croatia has used the CRF Reporter and reported the LULUCF sector for the first time as required by decision 13/CP.9, and the uncertainty and key category analyses have been extended to include LULUCF. A new methodology has been used to calculate CH_4 emissions from solid waste disposal on

land. The notation keys are used consistently in the CRF tables. No progress could be found in the reporting of the fluorinated gases.

G. Areas for further improvement

1. Identified by the Party

13. A national GHG inventory improvement strategy builds the basis of a sound improvement plan. The NIR mentions general improvements concerning the institutional arrangements and the inventory preparation process, as well as steps to improve the inventory in each sector. These are divided in short- and long-term goals. The strategy is consistent and the ERT considers the improvement plan as a solid basis for further development of the inventory.

2. Identified by the ERT

14. The ERT identified the following cross-cutting issues for improvement. The Party should:

(a) Include additional sources in the key category analysis so that the sources add up to over 95 per cent of total GHG emissions;

(b) Carry through the improvement plan to make the inventory more complete;

(c) Use tier 2 methods to identify the key categories; and

(d) Develop further the QA/QC management system and document it better.

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

II. Energy

A. Sector overview

16. In 2004, the energy sector was the main source of GHG emissions in Croatia, accounting for 74.9 per cent of total national emissions. CO_2, CH_4 and N_2O emissions represented 92.4 per cent, 6.6 per cent and 1.0 per cent of energy sector emissions, respectively. Annual emissions from the sector declined by 30.9 per cent between 1990 and 1994, but after 1994 a slow and steady increase can be observed, followed by a slight decrease of 2.2 per cent between 2003 and 2004, resulting in an overall decrease of 2.0 per cent between 1990 and 2004.

17. The reporting of the energy sector is transparent. The methodologies are well documented in the NIR with sufficient back-up information to make it possible to replicate the inventory. A qualitative uncertainty analysis has been performed for most of the subsectors in the energy sector, with the exception of power plants, where a quantitative assessment was undertaken for the five years 2000–2004. Croatia is encouraged to consider undertaking a higher-tier uncertainty assessment of the inventory. As a follow-up to the recommendations of the previous ERT, recalculations have been undertaken to take account of the change in methodology for road transportation, and changes of AD in civil aviation and navigation.

B. Reference and sectoral approaches

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

18. Emissions of CO_2 from fuel combustion have been estimated using the reference approach and the sectoral approach. For the year 2004, there is a difference of 5.42 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. When only solid and liquid fuels are compared, these differences are much smaller. In response to questions from the ERT, Croatia stated that the differences are due to the large amount of natural gas used for non-energy uses and natural gas losses

from pipelines. As the total fugitive emissions from natural gas reported in CRF table 1.B.2 (61.669 Gg CH_4) account for less than 0.3 per cent of gas consumption, they contribute to the difference between the reference and sectoral approaches for natural gas (21.9 per cent). The difference originates in the non-energy use of natural gas that should be accounted for in the reference approach. The ERT recommends Croatia to consider providing a category-specific reconciliation between the reference and sectoral approaches.

2. International bunker fuels

19. Emissions from international bunker fuels are reported separately from those associated with domestic operations. International marine bunkers are included in the national energy balance for the period 1994–2004, as separate data. Until the year 1994, the inventory for international marine bunkers is based on expert estimation. Transparency would be greatly enhanced if Croatia could include a clear description of the rationale for the expert judgement used. Data on international aviation bunkers were included in the national energy balance for the first time for the year 2004.

3. Feedstocks and non-energy use of fuels

20. The apparent consumption for Croatia is larger than that reported to the International Energy Agency (IEA) for all years, with differences of up to 10 per cent, but within only 2 per cent for the last five years. CRF files have been submitted for all years from 1990, but data for Croatia are available to the IEA only from 1992. The total apparent consumption differs between the CRF and the IEA data by 6.8 per cent for 1992 and by 1.2 per cent for 2004. The growth rate for the total apparent consumption over the period 1992–2004 is 35 per cent according to the CRF and 28 per cent according to the IEA data. The reason for the differences is not explained in the NIR, and the ERT recommends Croatia to explain it in future submissions. The Party is encouraged to reconcile the data provided to international organizations.

4. Country-specific issues

21. Croatia reports CO_2 scrubbing to reduce the excessive CO_2 content (more than 15 per cent) found in the domestic raw natural gas. The estimates of CO_2 generated are based on the mass balance of the scrubbing plants, as there is no recommended IPCC method for estimating emissions from this process. The ERT supports the recommendation of a previous ERT that CO_2 from scrubbing be reported in the appropriate subcategory 1.B.2.b(ii) Production and processing instead of 1.B.2.d Other.

C. Key categories

1. Public electricity and heat production, all fuels – CO_2

22. Croatia uses a bottom-up approach to estimate CO_2 emissions for the public electricity and heat production subsector for the period 2001–2004 only. This approach is inconsistent with the rest of the time series. The collection of data from individual plants and the use of a higher-tier approach for the whole time series are recommended in order to avoid time-series inconsistency and to explain variations in the figures for production volume and fuel consumption.

23. As indicated in previous 2006 review stages the CO_2 implied emission factor (IEF) for solid fuels for public electricity and heat production (89.47–92.71 t/TJ) is lower than the IPCC default range (94.60–106.70 t/TJ) for all years. In its response, Croatia explained that this is because the fraction of carbon oxidized is taken into account. The low IEF originates from the low EF used for coal combustion. Croatia is recommended to provide more information on how the EF is derived, including information on the carbon and volatile compounds content and net calorific value (NCV) of the coal, as well as the analysis of the carbon non-oxidized in the power plant ash, if the oxidation factor used is less then 0.98.

2. Civil aviation: liquid fuels – CO_2

24. The trend in fuel consumption in civil aviation fluctuates. Fuel consumption decreased by 46.2 per cent between 1990 and 2004. Although the trends of fuel consumption and CO_2 emissions vary in very similar ways, their inter-annual fluctuations over the period are very strong. The ERT recommends that Croatia explain the fluctuations in the trend in its next submission.

3. Road transportation: liquid fuels – CO_2 and N_2O

25. In response to the recommendations of the 2005 review, the time series for road transportation has been recalculated based on the tier 1 method for all years. Croatia uses tier 1 to estimate CO_2 emissions from road transportation as AD are not available for the period 1990–2000 (the COPERT model cannot be used for the whole time series). Data are available for the period 2001–2004, and the COPERT model was used for these years for quality control of the tier 1 estimates. N_2O emission estimates are based on the COPERT III model for the years 2001–2004. For the years 1990–2000 interpolation of emission factors has been used to estimate N_2O emissions. The ERT recommends that Croatia explain how it has ensured that the time series is consistent for N_2O emissions.

4. Fugitive emissions: oil and natural gas – CH_4

26. The tier 1 method with the average emission factors given in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) has been used to estimate the fugitive emissions of CH_4 from oil and natural gas. Since the source has been identified as key category, contributing 4.5 per cent to total national emissions for 2004, Croatia is strongly recommended to use higher-tier methods in its future submissions.

D. Non-key categories

1. Road transportation: liquid fuels – CH_4

27. The CH_4 emission estimates are based on the COPERT III model for the years 2001–2004. For the years 1990–2000 interpolation of emission factors has been used to estimate CH_4 emissions. The ERT recommends that Croatia explain its considerations on the appropriateness of the time series consistency in its next inventory submission.

2. Other sectors: solid fuel – CO_2

28. The CO_2 IEFs for solid fuels in other sectors decrease from 92.66 t/TJ in 1990 to 72.56 t/TJ in 2004, with inter-annual variations and a lowest value of 71.76 t/TJ in 1992. The values are lower than the IPCC default range (94.60–106.70 t/TJ) and are among the lowest of the reporting Parties. No explanation is provided in the NIR. The ERT recommends that Croatia document the significant decrease of the IEFs within the time series in its next submission.

III. Industrial processes and solvent and other product use

A. Sector overview

29. In 2004, total emissions from this sector amounted to 3 181.43 Gg CO_2 equivalent, accounting for 10.8 per cent of total national GHG emissions. Emissions from mineral products and chemical industry accounted for 94.1 per cent of total industrial processes emissions. Emissions from this sector had decreased by 19.0 per cent compared to the base year (1990) mainly due to a decrease in emissions from chemical industry (by 7.3 per cent) and the shutting down of pig iron and aluminium production in 1992. However, emissions from mineral products increased by 32.7 per cent over the same period. Emissions from solvent and other product use are reported as either not estimated ("NE") or not applicable ("NA").

30. Croatia uses two different sources of AD for dolomite use and soda ash use across the reporting years – data for 1990–1995 from the Central Bureau of Statistics, and the results of a voluntary survey for

the years 1996–2004. During the review Croatia explained that it was not possible to collect AD by the same data sets for the entire period. The ERT recommends that Croatia explain how it has ensured that the time series is consistent for the resulting CO_2 emissions.

B. Key categories

1. Cement production – CO_2

31. Croatia has improved its methodology for estimating emissions from the cement production category by considering cement kiln dust (CKD) and disaggregating cement into two parts – Portland cement and aluminate cement – using the corresponding IPCC default EFs. Croatia explained that aluminate cement has been included in the inventory from 2000 onwards and that recalculation for Portland cement has been done for the period 2000–2004. Croatia also plans source-specific improvements by collecting the actual fraction of CKD from individual plants. The ERT recommends Croatia to develop country-specific EFs and its CKD correction factor in order to improve the estimates.

2. Ammonia production – CO_2

32. The inter-annual changes of the CO_2 IEF for this category fluctuate over the period 1990–1996 (ranging from –9.6 to +9.7 per cent). The IEF decreased by 4.8 per cent between 1990 and 1991 and by 93.0 per cent between 1990 and 2004. The EF used by Croatia is based on the carbon content of natural gas used as feedstock. The ERT noted that the changes in carbon content reported in the NIR do not correspond to the changes in the CO_2 IEFs reported in the CRF tables. For example, the increase of 1.1 per cent in carbon content for 1990–1991 is not consistent with the decrease of the CO_2 IEF by 4.8 per cent, and the overall decrease in carbon content over the period 1990–2004 – of 2.3 per cent – does not correspond to the decrease of the CO_2 IEF – by 9.3 per cent. The ERT recommends Croatia to explain these IEF fluctuations and inconsistencies with the reported carbon contents of natural gas in its next submission.

3. Nitric acid production – N_2O

33. Croatia has used an EF (0.009 t/t) taken from the default IPCC good practice guidance recommended range (0.002–0.019 t/t) for the estimations under this category. Descriptions of the process technology used in the country are provided in the NIR and show the appropriateness of the EF for the existing plant. However, the ERT considered that Croatia should improve the calculation methodology by using plant-specific data, in accordance with the IPCC good practice guidance, in its next submission.

4. Ferroalloys production – CO_2

34. The production of ferrochromium and associated emissions are reported as not occurring ("NO") in 1999, and 2002–2004. Croatia explained that data for 1999 are not available and interpolation will be used in the next submission for the estimation of CO_2 emissions. The ERT recommends that Croatia recalculate the time series for this category to improve the completeness and consistency of the inventory.

5. Consumption of halocarbons and SF_6 – HFC

35. Croatia has only reported potential emissions of HFCs for refrigeration and air conditioning equipment. The NIR states lack of data as the reason. Potential emissions of HFC-143a for the period 1990–1995 and of HFC-32 for the period 1990–1999 have not been estimated. Following the recommendations of the previous review, the ERT strongly recommends Croatia to collect relevant data and estimate actual emissions of HFCs and potential emissions of HFC-143a and HFC-32 for the complete time series in its next submission.

C. Non-key categories

1. Consumption of halocarbons and SF_6 – SF_6

36. Potential and actual emissions of SF_6 are reported as "NE" and "NO". The ERT recommends Croatia to collect relevant data and report these emissions in its next submission.

2. Solvent and other product use

37. CO_2 and N_2O emissions are reported as "NE", and AD are reported as either "NA" or "NE" in the CRF tables. However, some AD from this sector have been used for the estimation of non-methane volatile organic compounds (NMVOCs) and are reported in table 5.1-1 in the NIR. The NIR states that estimates are not provided because of lack of data and of methodology. The information regarding AD that is provided in the CRF tables is not consistent with that given in the NIR. The ERT encourages Croatia to estimate CO_2 and N_2O emissions in its next submission and to improve consistency as between the NIR and the CRF tables.

IV. Agriculture

A. Sector overview

38. In 2004, GHG emissions from the agriculture sector accounted for 12.1 per cent of total national emissions. The most important GHG in the sector for Croatia was N_2O, contributing 8.7 per cent to total national emissions, followed by CH_4, with 3.4 per cent of total national emissions. Total emissions from the sector amounted to 3 558.38 Gg CO_2 equivalent in 2004 and decreased by 19.2 per cent since 1990. The emissions of the most important categories in the sector decreased over the time series – CH_4 from enteric fermentation by 39.3 per cent, and N_2O from agricultural soils by 5.3 per cent.

39. Croatia has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2006 submission. The results of the key category analyses performed by Croatia and the secretariat differ slightly. Croatia has not identified as a key category N_2O emissions from 4.D.2 pasture, range and paddock manure, which was identified by the secretariat as a key category in the level assessment.

B. Key categories

1. Enteric fermentation – CH_4

40. Croatia has used the tier 1 method and IPCC default EFs (for cool conditions in Eastern Europe), and explained that accurate AD for significant species are not available. Although dairy cattle are the major source of CH_4 emissions from enteric fermentation (more than 50 per cent), followed by non-dairy cattle (about 30 per cent), the Party has used a tier 1 method for CH_4 emissions for this category. This is not in line with the IPCC good practice guidance (see IPCC good practice guidance figure 4.2). The ERT encourages Croatia to use a tier 2 method with country-specific data, especially for dairy and non-dairy cattle, for its next submission.

2. Manure management – N_2O

41. Croatia has used the tier 1 method and IPCC default EFs, which is in line with the IPCC good practice guidance. N_2O emissions decreased by 37.6 per cent between 1990 and 2004 in line with a general decrease in the size of the animal populations. In CRF table 4.B(b) the sums of nitrogen (N) excreted by different animal types to each of the animal waste management systems (AWMS) do not add up to 100 per cent. The ERT recommends that Croatia review and correct this discrepancy in its next submission.

3. Direct soil emissions – N_2O

42. Croatia has used the tier 1a method and IPCC default EFs, which is in line with the IPCC good practice guidance. The EFs for nitrogen input to soils (synthetic fertilizers, animal manure applied to soil, N-fixing crops and crop residue) are reported as 0.125 kg N_2O-N/kg N in the NIR, but as 0.0125 in CRF table 4.D. The values of the fractions used in the calculations are those recommended by the Revised 1996 IPCC Guidelines except for $Frac_{NCRBF}$, the value that Croatia used (0.015) being lower than that in the Revised 1996 IPCC Guidelines (0.03). The fractions reported in the NIR and in the CRF tables are the same, except for $Frac_{GASM}$, which is 0.20 in the NIR and 0.15 in the CRF. The ERT recommends Croatia to review both values and use the correct value consistently in both the CRF tables and the NIR.

4. Indirect emissions – N_2O

43. Croatia has used the tier 1 method and IPCC default EFs, which is in line with the IPCC good practice guidance. The ERT encourages Croatia to apply country-specific EFs in order to reduce the uncertainty levels in its next submission.

C. Non-key categories

Manure management – CH_4

44. Croatia has used the tier 1 method and IPCC default EFs for its estimations. Croatia allocates all manures to AWMS in cool climate regions. The CH_4 IEF reported in the CRF tables for horses in 1993 (1.04 kg CH_4/head/yr) differs of those reported for all the other years (1.09 kg CH_4/head/yr). The ERT recommends Croatia to review this EF for horses and report it correctly in its next submission.

V. Land use, land-use change and forestry

A. Sector overview

45. In 2004, the LULUCF sector in Croatia represented a net sink of 16 320.78 Gg of CO_2 which offset 72.4 per cent of total national CO_2 emissions. Comparing net CO_2 removals by the sector in 2004 with those for 2003 (16 648.22 Gg), the removals show a slight decrease of 2.0 per cent. Since 1990 the LULUCF sector has been a net sink of CO_2 over the whole time series and in 2004 had increased by 13.0 per cent from its 1990 value (14 436.82 Gg).

46. For many categories, Croatia has used both the "NO" and the "NE" notation keys in order to justify the absence of estimates, while CRF table 9(a) clearly states that these categories have not been estimated because of difficulties in collecting adequate AD. The use in the CRF tables of "NE" and an additional "NO" for the same category is neither needed nor explained. The ERT recommends Croatia to use the notation keys in an appropriate manner in order to explain the status of each reported category clearly. The ERT also encourages Croatia to use the documentation boxes in all the CRF tables to provide explanations of and information on its choices of notation keys.

47. The CRF for 2004 includes only estimates for CO_2 emissions/removals under the category forest land remaining forest land. Moreover, no changes of carbon stocks in dead organic matter and soils are reported for this category. The ERT encourages Croatia to provide in its future submissions estimates of the changes in carbon stocks in all pools and non-CO_2 gases not only from forest land but also for the other relevant land-use categories.

B. Key categories

Forest land – CO_2

48. Croatia has used the tier 1 method and default EFs in estimating changes in carbon (C) stocks in forest land. Since this is a key category, it is good practice to use a higher-tier method, and the ERT recommends Croatia to do so for its next inventory submission. Moreover, the ERT encourages Croatia

to report, in its future submissions, not only the changes in C stocks in living biomass but also dead organic matter pool and soils.

49. The ERT noted a general problem of completeness and transparency in the inventory submission that derives from the omission from the NIR of information on the Croatian definition of forest land and the system applied for detection and tracking of this land use. The ERT also noted that in the Food and Agriculture Organization of the United Nations (FAO) Forest Resources Assessment 2005 (table 12, page 252),[3] data on net annual change in above-ground biomass for Croatian forests are four times lower than data derived from table 7.3 of the NIR. Considering that the tier 1 methodology and EFs are not adequate for a key category, the ERT recommends Croatia to provide estimates for this category using a higher-tier method in its next submission.

50. For estimates of net C stock change in living biomass per area for forest land remaining forest land, the ERT noted that Croatia has reported data in CRF tables incorrectly: data for the period 1986–2000 have been included instead of data for the period 1990–2004, while table 7.3 of the NIR contains the correct data.

51. Considering the information provided in the FAO Forest Resources Assessment 2005 (table 11, page 246), where an average growing stock of 165 m^3/ha has been reported for Croatian forests, the ERT noted that the correct root-to-shoot ratios (R), which Croatia should select from the IPCC good practice guidance for LULUCF (table 3A.1.8, page 3.168) in order to estimate the below-ground portion of the living biomass, should be 0.23 (instead of 0.32) for conifers and 0.24 (instead of 0.26) for broadleaved trees.

52. The ERT noted that for biomass expansion factors (BEF1 and BEF2) Croatia has used default values from the Revised 1996 IPCC Guidelines, while updated (and more consistent) values are presented in the IPCC good practice guidance for LULUCF (table 3A.1.10). The ERT therefore recommends Croatia to use the BEF values of 1.15 for conifers and 1.2 for broadleaves from the IPCC good practice guidance for LULUCF, instead of the unique value of 1.9 reported in the NIR (table 7.2, page 110).

53. The ERT noted that for basic wood density (factor D) Croatia has used the default value from the Revised 1996 IPCC Guidelines, while updated (and more consistent) values are presented in the IPCC good practice guidance for LULUCF (table 3A.1.9-1). Moreover, the factor D values adopted by Croatia are on average higher than the values reported in that table, and Croatia is therefore recommended to document the choice of this value or use the values of the IPCC good practice guidance for LULUCF in its next submission.

C. Non-key categories

1. Biomass burning – CH_4 and N_2O

54. Croatia has reported AD, CH_4 and N_2O IEFs, and CH_4 and N_2O emissions as "NE" or "NO", while the CO_2 IEFs and CO_2 emissions are reported variously as "NO", "NE" or "NA". On the other hand, the *Timber Bulletin*, Volume LV (2002),[4] edited by the United Nations Economic Commission for Europe and the FAO, reports information on forest area affected by fire in Croatia (1991–2001). The order of magnitude of those data is thousands of hectares. The ERT therefore recommends Croatia to estimate emissions from biomass burning in forest land, applying at the least a tier 1 methodology, for its next submission.

[3] See <http://www.fao.org/forestry/site/fra2005/en/>.
[4] ECE/TIM/BULL/2002/4. Available at <http://www.unece.org/trade/timber/ff-stats.html>.

VI. Waste

A. Sector overview

55. In 2004, emissions from the waste sector in Croatia amounted to 641.81 Gg CO_2 equivalent, or 2.2 per cent of total national GHG emissions. From 1990 to 2004, emissions from the sector increased by 115.1 per cent. The emissions reported include the categories solid waste disposal on land, waste-water handling and waste incineration. For this inventory submission, Croatia has introduced several improvements compared to the 2005 submission.

56. Croatia has used the IPCC tier 2 method for estimating CH_4 emissions from solid waste disposal on land and the IPCC tier 1 method and default EFs for CH_4 and N_2O emissions from waste-water handling. Information on the methodologies and parameters used for the estimations is provided briefly in the NIR. All the CRF tables for the sector and the additional information boxes are provided.

57. In its 2006 submission Croatia has recalculated emissions from solid waste disposal on land for the entire time series using the FOD model, as recommended in the 2005 review report. The ERT noted that the recalculations have led to decreases in the estimates of CH_4 emissions in 1990 of 72.1 per cent, and in 2003 of 61.4 per cent. The ERT recommends Croatia to explain and document the changes due to recalculations in its next inventory submission.

B. Key categories

Solid waste disposal on land – CH_4

58. CH_4 from solid waste disposal on land is a key category in both the level and the trend assessments, and accounted for 1.7 per cent of total national GHG emissions (and 16.1 per cent of total CH_4 emissions) in 2004. They have been estimated for managed and unmanaged disposal sites separately.

59. The IPCC tier 2 method and country-specific and default EFs have been used for estimating CH_4 from this category. Historical data on solid waste disposal on land have been estimated based on a national rate for waste generation and a fraction of municipal solid waste disposed at different types of solid waste disposal sites. In order to distinguish between managed and unmanaged landfills, Croatia has carried out surveys of landfill characteristics, as stated in the NIR.

60. The ERT noted some inconsistencies in the CRF tables: for instance, a value of 17.0 per cent for degradable organic carbon (DOC) is reported in CRF table 6.A instead of the fraction of DOC dissimilated (DOC_F), which is 55 per cent. The default oxidation factor is reported as "0" in the additional information box, although managed landfills exist in the country. Croatia is encouraged to revise the oxidation factor or provide an explanation of the value used and report the correct figure for DOC_F in its next submission.

C. Non-key categories

1. Waste-water handling – CH_4 and N_2O

61. In 2004, emissions from waste-water handling were not significant and accounted for only 0.5 per cent of total national GHG emissions. Emissions from waste-water handling amounted to 24.1 per cent of total sectoral emissions. Due to lack of AD, CH_4 estimates for commercial and domestic waste water are provided only for 2004. The ERT recommends Croatia to assess the possibility of obtaining AD for the calculation of CH_4 emissions from this category in order to improve the completeness of the time series and its coverage of sources.

62. The N_2O emissions estimated in this category correspond to the discharge of human sewage in aquatic environments. These emissions amounted to 0.29 Gg N_2O in 2004. The calculation follows the

method in the Revised 1996 IPCC Guidelines and uses default emission parameters. The source of the data on protein consumption per capita used in the calculation is documented in the NIR.

2. Waste incineration – CO_2

63. CO_2 emissions from incineration of clinical waste are reported only for the year 2004 due to lack of AD. The NIR states that between 1998 and 2002 a hazardous waste incinerator was functioning in the country, but emissions were not estimated due to lack of data for different types of waste. The ERT encourages Croatia to examine the possibility of estimating and providing information on CO_2 emissions from waste incineration for all years of the time series in order to improve the consistency and completeness of the inventory.

Annex

Documents and information used during the review

A. Reference documents

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories, 2000. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

IPCC. Good practice guidance for land use, land-use change and forestry, 2003. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.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>.

UNFCCC. Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories. FCCC/SBSTA/2004/8. Available at <http://unfccc.int/resource/docs/2004/sbsta/08.pdf>.

UNFCCC. 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. Status report for Croatia. 2006. Available at <http://unfccc.int/resource/docs/2006/asr/hrv.pdf>.

UNFCCC secretariat. Synthesis and assessment report on the greenhouse gas inventories submitted in 2006. FCCC/WEB/SAI/2006 (in preparation).

UNFCCC secretariat. Croatia: Report of the individual review of the greenhouse gas inventory submitted in the year 2005. FCCC/WEB/ARR/2005/HRV. Available at <http://unfccc.int/resource/docs/2006/arr/hrv.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Davor Vešligaj (Atmospheric Protection Department Manager, EKONERG – Energy Research and Environmental Protection Institute) including additional material on the methodology and assumptions used.

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