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CROATIA

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 the Republic of Croatia, 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 6 to 10 September 2004 in Zagreb, Croatia, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Mr. Jim Penman (UK), Energy – Mr. Michael Strogies (Germany), Industrial Processes – Mr. Domenico Gaudioso (Italy), Agriculture – Mr. Tomoyuki Aizawa (Japan), Land-use Change and Forestry – Mr. Aquiles Neuenschwander (Chile), Waste – Mr. Eduardo Calvo (Peru). Mr. Neuenschwander and Mr. Penman were the lead reviewers. The review was coordinated by Ms. Astrid Olsson (UNFCCC secretariat). Inventory experts from Bosnia and Herzegovina and Serbia and Montenegro were invited to attend as observers during this in-country review of Croatia to gain insight into the review process. The observers were Ms. Mirjana Žabić from Bosnia and Herzegovina and Mr. Miroslav Spasojević from Serbia and Montenegro.

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 Croatia, 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 Croatia was carbon dioxide (CO_2), contributing an estimated 76.8 per cent to total[2] national greenhouse gas emissions expressed in CO_2 equivalent, followed by methane (CH_4) – 12.3 per cent, and nitrous oxide (N_2O) – 10.7 per cent. Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.2 per cent of the overall greenhouse gas emissions in the country. The Energy sector accounted for an estimated 75.4 per cent of the total GHG emissions followed by Agriculture (10.4 per cent), Industrial Processes (9.7 per cent) and Waste (4.4 per cent).

4.   Total greenhouse gas emissions (excluding Land-use Change and Forestry) amounted to 27,962 Gg CO_2 equivalent in 2002 and were 11.5 per cent lower than in 1990. Tables 1 and 2 provide data on emissions by gas and by sector from 1990 to 2002. Between 1990 and 1994, CO_2 emissions decreased by almost 32 per cent owing to economic contraction. Subsequently they have increased again, and by 2002 had returned to about 6.5 per cent below the 1990 level; the energy industries, transport and buildings-related sectors were responsible for most of the increase. In 1994, CH_4 emissions reached a low point of about 19 per cent below the 1990 level. By 2002 they were back to 10 per cent below the 1990 level, mainly because of increases in emissions related to waste disposal and to energy production and

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[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.

use. Emissions from Agriculture, the other main source of CH_4, fell throughout the period 1990–2002. N_2O emissions decreased to 25.5 per cent below the 1990 level in 1995. Since then they have averaged around 17 per cent below the 1990 level, mainly driven by the trend in agricultural emissions. Emissions from fluorinated compounds are much lower than in 1990 because of the closure of the Croatian aluminium industry.

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

GHG emissions	Gg CO₂ equivalent													Change from 1990–2002 %
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
CO₂ (with LUCF)[a]	16,465	10,196	9,259	9,894	9,169	9,746	8,907	9,988	10,887	11,609	11,310	12,321	12,484	−24.2
CO₂ (without LUCF)	22,970	16,702	15,765	16,399	15,674	16,251	16,976	18,057	18,956	19,679	19,379	20,390	21,484	−6.5
CH₄	3,815	3,612	3,419	3,291	3,097	3,104	3,146	3,244	3,098	3,180	3,210	3,361	3,432	−10.0
N₂O	3,886	3,843	3,898	3,093	3,087	2,896	3,165	3,523	3,070	3,285	3,484	3,093	2,996	−22.9
HFCs	0	0	0	0	0	8	60	91	18	9	23	49	49	0.0
PFCs	939	648	0	0	0	0	0	0	0	0	0	0	0	−100.0
SF₆	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Total (with CO₂ from LUCF)	**25,104**	**18,299**	**16,577**	**16,278**	**15,353**	**15,754**	**15,278**	**16,846**	**17,073**	**18,083**	**18,028**	**18,823**	**18,961**	**−24.5**
Total (without CO₂ from LUCF)	**31,609**	**24,804**	**23,082**	**22,783**	**21,858**	**22,259**	**23,348**	**24,915**	**25,142**	**26,152**	**26,097**	**26,892**	**27,962**	**−11.5**

[a]   LUCF = Land-use Change and Forestry

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

GHG source and sink categories	Gg CO₂ equivalent													Change from 1990–2002 %
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
Energy	22,463	16,568	15,468	16,526	15,494	16,353	17,076	18,037	18,872	19,256	18,817	19,875	21,089	−6.1
Industrial Processes	3,892	2,976	2,653	2,067	2,317	2,021	2,095	2,365	2,002	2,454	2,815	2,785	2,717	−30.2
Solvent Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Agriculture	4,321	4,344	4,061	3,278	3,109	2,891	3,192	3,479	3,186	3,282	3,303	3,036	2,921	−32.4
LUCF[a]	-6,505	-6,505	-6,505	-6,505	-6,505	-6,505	-8,069	-8,069	-8,069	-8,069	-8,069	-8,069	-9,000	38.4
Waste	933	917	901	912	937	995	984	1,034	1,082	1,161	1,162	1,197	1,234	32.3
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0

[a]   LUCF = Land-use Change and Forestry

5.   The expert review team concluded that Croatia has produced a carefully considered inventory which provides a sound basis for consideration by Parties. The inventory submitted in April 2004 has complete geographical coverage determined by the borders of Croatia, as required by the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC Guidelines) for all years from 1990 to 2002. Sectoral coverage is complete. Coverage of source categories within the sectors is complete with a few exceptions which are noted below. Croatia has responded to issues raised by the previous review[3] and in particular the adjustment based on per capita CO_2 emissions from energy consumption in the former Yugoslavia is no longer present in the inventory.

6.   The inventory has been produced using the IPCC Guidelines and the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). It is transparent when the common reporting format, the national inventory report and information supplied to the expert review team during the in-country visit are taken into account. The main recommendations from this review are that more summary information on methodologies and cross-cutting issues could usefully be brought into the national inventory report, and

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[3] The review report of the inventory submitted in association with Croatia's First National Communication can be found in FCCC/IDR.1/HRV and FCCC/IDR.1/HRV/Add.1.

that the possibility of adopting more detailed (higher-tier) methodologies should be considered where appropriate, bearing in mind the availability of data in Croatia.

7.   The expert review team noted the good analytical and institutional basis for further development of the inventory, and the high level of commitment among all those involved in the work.

I. OVERVIEW

A. Inventory submission and other sources of information

8.   Croatia submitted a national inventory report (NIR) on 15 April 2004.

9.   In its 2004 submission, Croatia submitted a largely complete set of common reporting format (CRF) tables for the years 1990–2002.

10.   During the review Croatia 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. In addition, prior to the review, the secretariat had brought to the attention of the ERT material provided by Bosnia and Herzegovina and Serbia and Montenegro that was relevant to the review. The full list of materials used during the review is provided in annex 1 to this report.

B. Key sources

11.   Croatia has reported a key source tier 1 analysis, both level and trend assessment, as part of its 2004 submission. The key source analysis performed by the Party is slightly more disaggregated than that of the secretariat[4] but is consistent with it. Croatia recognizes the relevance of key source analysis to choice of methodology. The methods currently used are mainly tier 1 because of lack of data. Croatia is using the key source analysis to help prioritize inventory development and has introduced country-specific net calorific values in the estimation of CO_2 from fuel combustion, which is a tier 2 recommendation.

C. Cross-cutting topics

Completeness

12.   As required by the IPCC Guidelines, the inventory is complete in terms of geographical coverage as defined by the borders of the Republic of Croatia. This applies to all years. Data are provided for the period 1990–2002 and for all sectors defined in the IPCC Guidelines. The ERT identified a few omissions, notably in waste-water treatment and Land-use Change and Forestry (LUCF). The intention is to address these in future inventory submissions. It is unlikely that this will make much difference to the overall level and trend of the emissions.

13.   CRF tables 2(II).C, E (Metal Production; Production of Halocarbons and SF_6) are missing for the years 1992–2002 inclusive; tables 2(II).F (Consumption of Halocarbons and SF_6) and 3.A-D (Sectoral Background Data for Solvent and Other Product Use) are missing for 2001–2002; and table 6.C (Waste Incineration) is not provided for any year. In some cases tables are missing because the source has not been estimated, and in other cases because the source does not occur or no longer occurs. The ERT recommends that all CRF tables be provided for all years and that systematic use be made of notation keys and documentation boxes in all tables, in order to avoid possible confusion as to the status of source categories, subcategories and gases.

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[4] 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.

14.   The NIR is partly structured along the lines set out in the UNFCCC reporting guidelines. Some sections, including those on quality assurance/quality control (QA/QC), time-series consistency, recalculations and planned improvements, are not provided. It was clear to the ERT that Croatia has useful information to communicate under all chapters and sub-headings of the structure of the NIR in the guidelines and the ERT suggests that full use be made of the structure set out in the UNFCCC reporting guidelines in future.

Transparency

15.   The NIR gives a clear impression of levels and trends in emissions and removals by source category and an indication of the methods used. It is also well referenced. While recognizing that it is not possible within an NIR of manageable length to provide full details of every calculation necessary to reconstruct an inventory, the ERT believes that the transparency of the report could be significantly improved by the provision of rather more detail on methodology, including summary tables of emission factors (EFs) and other key parameters. The ERT noted with appreciation that in every case during the in-country visit information was in fact readily available to make the estimates transparent.

Recalculations and time-series consistency

16.   Minor recalculations have been made in the estimated emissions in 2001 for CH_4 and N_2O from the Waste sector, but no other recalculations have been made.

17.   The ERT established that energy balances are available back to 1988 for the territory within the borders of the Republic of Croatia, and that this information has been used to calculate a consistent emissions time series for the period 1990–2002. The ERT found that the energy balance data are consistent with fuel consumption, as estimated by bottom–up calculation based on the capacity and hours of operation of thermal power plants within the borders of Croatia in 1990. Thus the energy balances and emissions estimated from them cover the same territory throughout the period 1990–2002.

Uncertainties

18.   The NIR provides the results of a tier 1 level and trend uncertainty assessment as set out in the IPCC good practice guidance. The EF and activity data (AD) uncertainties which feed in to this estimate are mostly IPCC default values or derived from expert judgement. As is commonly the case, the analysis suggests that emissions of nitrous oxide from agricultural soils dominate the level uncertainty and are the single most important contributor to the trend uncertainty. Croatia has used the IPCC default method to estimate emissions of nitrous oxide from agricultural soils, which the ERT agrees is the appropriate choice given the state of scientific knowledge. Formal use has not so far been made of uncertainty analysis in helping prioritize future inventory development, although an appreciation of the relative uncertainties and the scope for reducing them has helped prioritize research, notably on the characteristics of landfill sites.

Verification and quality assurance/quality control approaches

19.   The NIR provides summary information on verification done by using inventory workshops to allow stakeholders to scrutinize the estimates, by comparison with the inventories of other countries, and by cross-checking CO_2 emissions from energy use and road transport with independently compiled international data and the results of modelling. The ERT noted that additional verification was provided by cross-checks between independent surveys on the characteristics of landfill sites, and by the annual analysis of emissions from thermal power plants conducted by EKONERG under contract to the industry. This provides an emissions estimate based on point source data which is cross-checked with the inventory estimate.

20.   Although the NIR does not provide information on QA/QC, the ERT heard that a draft QA/QC plan exists. The ERT noted that two important elements of QA/QC are in fact in place:

(a)   Data record sheets which contain details of the person and organization responsible for an emissions estimate, the sources of AD and EFs used, the methods, data gaps, ways to cross-check, suggestions for future improvement in the estimates, and relevant bibliographic references; and

(b)   Source category summaries which provide an overview of the source and approach to estimation (in the Croatian language) for future use in inventory preparation.

21.   The ERT believes that a sound basis exists for developing a QA/QC plan along the lines set out in the IPCC good practice guidance, and that this should be described in the next NIR.

Institutional arrangements

22.   During the in-country visit, Croatia explained the institutional arrangements for preparation of the inventory. The Ministry of Environmental Protection, Physical Planning and Construction (MEPPPC) has overall responsibility for the national inventory, including submission to the UNFCCC. EKONERG is the national lead institution responsible for inventory estimation, verification, QA/QC development and reporting, and is under contract to the MEPPPC. EKONERG assembles the inventory on the basis of data from the Central Bureau of Statistics, the Energy Institute (Hrvoje Požar), the Power Utility Company (HEP), the oil and gas industry (Industrija Nafte (INA)), the Ministry of the Interior, the Waste Management Company, the Ministry of Agriculture and Forestry, the Croatian Forests Company (Hrvatske Šume), the constituent counties and the customs authorities, and from direct contact with stakeholders.

23.   The contract between the MEPPPC and EKONERG is currently renewed annually. The ERT suggests that a longer contract period, perhaps three years, could have advantages in terms of planning and continuity. Institutional arrangements are currently under review because of the establishment of the Croatian Environmental Agency, whose regional offices may provide a useful focus for collecting data for the purpose of estimating emissions not only to the atmosphere but also to other parts of the environment.

Record keeping and archiving

24.   EKONERG is responsible for the archiving of relevant data and documentation of the AD, EFs and methods used. At present it uses a combination of paper records and electronic data storage. The ERT found that the system worked effectively in terms of the response to requests for information during the in-country visit. The ERT noted that there is at present no formal provision for freezing the archive associated with each year's submission and believes that this would be a useful development. The ERT heard that a single archive is under consideration to serve the needs of reporting under all international agreements. This would help ensure consistency of emissions estimates.

Follow-up to previous reviews

25.   The greenhouse gas inventory available at the time was reviewed as part of the in-depth review of the First National Communication of Croatia in the first half of 2002. This previous review, summarized in FCCC/IDR.1/HRV and FCCC/IDR.1/HRV/Add.1, found that the emissions estimate made using the IPCC Guidelines had been adjusted on the basis of average per capita emissions from fuel combustion in the former Yugoslavia. During the present review the ERT found that this adjustment is no longer present in the inventory, and total emissions reported in the inventory submitted in April 2004 are as a consequence 7,782 Gg CO_2 equivalent lower than those in the First National Communication.[5] The ERT considers that the removal of the adjustment has brought the Croatian inventory into line with the UNFCCC reporting guidelines, the IPCC Guidelines and the IPCC good practice guidance.

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[5] This difference also includes a small correction (335 Gg CO_2 equivalent) for double counting of emissions from iron and steel production that was identified after the previous review.

26.   The issue of adjustments has also been discussed in the context of emissions from power plants outside the borders of Croatia. The ERT confirms, on the basis of examination of the national energy balance data, that the emissions inventory for Croatia does not show emissions from power plants outside the boundaries of Croatia for 1990 or subsequent years. This is because the data on fuel consumption, by power plant, recorded in the national energy balance are consistent with the capacity and hours of operation of the one coal burned thermal plant in Croatia (TPP Plomin) at the time. The ERT also found that the data on CO_2 emissions in the Croatian Strategy for Energy Development are consistent with the total GHG emissions in the inventory and do not indicate that there has been any adjustment in other parts of the inventory. The ERT therefore believes that the inventory relates to the geographical area of Croatia for all years, including 1990, as required by the IPCC Guidelines.

27.   The previous review also noted that emissions based on non-energy use of fuels and statistical differences were reported under Other in the Energy sector. These items are still present under Other in the inventory submitted in April 2004. The ERT suggests that emissions associated with non-fuel energy use should be considered for allocation to specific source categories, and that emissions based on statistical differences are not normally included in GHG inventories unless investigation of the difference reveals an actual source of emissions. The ERT believes that the case for including the estimate linked to the statistical differences (less than 0.3 per cent of emissions in 1990) should be re-examined in this light.

D. Areas for further improvement

Identified by the Party

28.   The NIR does not identify specific areas for improvement, although it draws attention to the source-specific suggestions contained in the data record sheets.

Identified by the ERT

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

(a)   The structure of the NIR should be made fully consistent with that set out in the UNFCCC reporting guidelines, including sections on QA/QC, time-series consistency, recalculations and planned improvements;

(b)   The Party should use the NIR to improve transparency by providing brief summaries of methodological approaches and tables of EFs or other key parameters used in the estimates, and consider submitting calculation worksheets or similar as supplementary material;

(c)   The Party should consider more extensive use of higher-tier methods for key source categories, based on both the sectoral and the cross-cutting advice in the IPCC good practice guidance.

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

II. ENERGY

A. Sector overview

30.   In the year 2002, the Energy sector in Croatia accounted for 75.4 per cent of the national total GHG emissions (without LUCF). These emissions came mainly from combustion (90.7 per cent). CO_2 represented 98.5 per cent of the combustion-related emissions. CH_4 emissions (0.5 per cent) and N_2O emissions (0.9 per cent) from fuel combustion were not significant. Fugitive emissions contributed 9.3 per cent to the emissions from this sector.

31.   Subsector 1.A.1 Energy Industries was the major source category in the Energy sector, accounting for 34.1 per cent of the combustion-related emissions (1.A). Subsectors 1.A.2 Manufacturing

Industries and Construction and 1.A.3 Transport contributed 20.1 per cent and 25.7 per cent, respectively, to the emissions from the sector in 2002. During the period 1990–2002, GHG emissions from the Energy sector decreased by 6.1 per cent, primarily because of reductions in emissions in 1.A.2 Manufacturing Industries and Construction. Total emissions from Energy increased by 6.1 per cent in 2002 compared with 2001. Croatia attributes this to an increase in electricity production.

32.   The key source analysis performed by the Party shows that the Energy sector is important for both the level and the trend assessment. The level assessment identified seven energy-related key sources, contributing 73.3 per cent of total emissions, and for the trend assessment nine energy-related key sources were identified, contributing 69.0 per cent. The key sources found in the Energy sector by Croatia agree with those identified in the secretariat's tier 1 analysis (level and trend assessment).

33.   With respect to combustion sources, in general IPCC and/or CORINAIR default values for EFs were used for all GHGs.

Completeness

34.   The CRF includes estimates of almost all gases and sources of emissions from the Energy sector, as recommended by the IPCC Guidelines. Emission estimates of indirect GHGs and sulphur dioxide (SO_2) are also reported. Croatia does not estimate emissions from military energy use. The inventory agency indicates that military fuel consumption is included in the national energy balance, but together with other fuel consumption data in appropriate sector (Transport and Other sectors), for reasons of confidentiality. Further information should be obtained so that these emissions can be included in future.

35.   Notation keys are used extensively in the CRF tables but not always consistently. Croatia frequently uses "0.00" as a notation key, instead of using the proper notation keys "NE" (not estimated), "NO" (not occurring), "NA" (not applicable) or "IE" (included elsewhere). The use of "0.00" is unclear as there is no specification as to whether this indicates negligible amounts, "no available data","not estimated" or "not occurring". The use of the notation keys "IE" and "NE" should be supported by explanations in table 9 (Completeness), as required.

36.   The estimates of all energy-related emissions are in general based on tier 1 approaches. Since Croatia has provided a key source analysis in line with the IPCC good practice guidance, the ERT encourages the Croatian experts to proceed with the decision process that has been started for the use of appropriate higher-tier methods.

37.   The methods used are described in a general way. Sources and references for methods, AD and EFs are documented. However, detailed assumptions and input data for the different steps in the estimation, which would allow reconstruction of the inventory from the underlying data, are only provided on an aggregated level. The ERT recommends that Croatia include more detailed information on the assumptions used and so on, which is in general available, in its next NIR.

38.   During the in-country review supplementary documentation was made available to the ERT, including the full set of national energy balances. The ERT recommends that the Croatian team include the explanations and the additional materials provided during the in-country review in the next NIR.

39.   The process of compiling the national energy statistics and energy balances is not described in detail in the NIR. To improve transparency a short detailed description of the data flow and the institutional arrangements behind the energy balance should be given. The Hrvoje Požar energy institute is responsible for the national energy balance and for completing the questionnaires that are sent to the International Energy Agency (IEA) and Eurostat. The transparency of the methodologies used for compiling the underlying energy data should be improved and the minor differences that do exist between the national and the IEA energy statistics resolved. The ERT also suggests incorporating the national energy balance as an annex to the NIR, as the UNFCCC reporting guidelines recommend.

40.   The estimation of the national CO_2 emissions is based on national data on energy consumption and IPCC default EFs together with country-specific net caloric values (NCVs). These country-specific

NCVs are generally somewhat lower than the IPCC values (e.g., for gas/diesel oil 42.71 t/TJ has been used, while the IPCC default is 43.3 t/TJ; for lignite 10.52-12.15 t/TJ and for sub-bituminous coal 16.75-18.84 t/TJ have been used, while the IPCC default is 14.6 t/TJ for lignite and sub-bituminous coal). The ERT noted that country-specific data are generally to be preferred in inventory development and suggests that additional information about the origin of these data, and the reasons why they better reflect the national circumstances, be provided. This would improve the transparency of the inventory, and the ERT encourages the Croatian experts to provide this information in the next NIR.

41.   Transparency could be improved significantly by including the underlying reasons for specific trends at the sub-source category level.

Recalculations and time-series consistency

42.   No recalculations have been made in the Energy sector since the previous submission.

43.   There are no time-series consistency problems for the years for which a complete CRF has been submitted. Emissions trends are explained only on a highly aggregated level and on a qualitative basis in the NIR on the level of main source categories (1A.1, 1A.2, 1A.3 etc.). It would be helpful if relevant background data were provided in more detail, including trends for specific subcategories (e.g., Public Energy and Heat Production, Petroleum Refining or the different transport systems), in the NIR, in order to explain the observed trends better. This would allow better judgement about the consistency of the time series on the basis of the NIR. However, during the review the national experts provided this necessary information. The ERT encourages the Croatian experts to insert this information in the next NIR.

44.   For the subcategory 1A.2 Manufacturing Industries and Construction, detailed estimates for the sub-sources (e.g., iron and steel, chemical industry) are not provided in the CRF or the NIR for the years before 2001. The use of the detailed approach for the years when data are only reported at the aggregated level would allow better judgement about the consistency of the time series, and the ERT encourages the Party to include these data in future submissions.

45.   Because energy consumption is responsible for almost three-quarters of the total GHG emissions of Croatia, the annual publication on the national energy balance was checked for the time series. The energy consumption figures which have been used for the estimation were published with the national energy balance for the years 1990–1994 in 1995, and since then have always been published on an annual basis. The published data used in the inventories were checked for consistency for a number of years, including the base year (1990). The ERT encourages the Croatian experts to explain in more detail the procedure and the underlying assumptions they have used to fill the gaps, for example, for use of fuels for international transport in the early 1990s.

Uncertainties

46.   Croatia has provided the results of a qualitative and quantitative uncertainty analysis for the 2002 inventory. The overall uncertainty for CO_2 emissions estimates from fossil fuel combustion is considered to be within 7 per cent. The uncertainty for CH_4 emissions is estimated to ±50 per cent, while the uncertainty of N_2O emissions is estimated to a factor of 2 (i.e., the emissions could be twice as much or half of those estimated). These values seem reasonable. The ERT encourages the Croatian experts to proceed with more detailed investigations in order to collect more detailed results and describe them on a quantitative basis.

Verification and quality assurance/quality control approaches

47.   QA/QC activities for the Energy sector are reported in the NIR in a brief and general way in the form of activities planned and already carried out in order to improve the inventory. However, a formal QA/QC plan has not been adopted.

48.		No specific QA/QC procedures were reported for the compilation of Energy sector emissions. The national energy balance has a QA/QC procedure but it does not cover the calculation and compilation of emissions in the national inventory.

49.		For verification purposes the ERT focused especially on the estimates of CO_2 emissions released in the base year from coal-fired power plants. By using basic assumptions for load factor, the carbon (C) content of the coal used and the known capacity, it was possible to trace the estimates back to the energy consumption figure given in the national energy balance.

50.		In future it will be possible to use EPER (the European Pollution Emissions Register) data for additional verification exercises and consistency checks. Croatia indicated that in addition to that it may be possible to use plant-specific information from Cadastre, a central database of plant-specific data. Descriptions of any results obtained by comparing information provided in the questionnaires and information obtained through EPER would enhance the quality of the estimates in the Energy sector.

B. <u>Reference and sectoral approaches</u>

<u>Comparison of the reference approach with the sectoral approach and international statistics</u>

51.		CO_2 emissions from fuel combustion have been calculated using the reference and the sectoral approaches for the entire time series. The differences between the reference and sectoral approaches range between 0.6 per cent and 5.2 per cent, and are mostly more than 2 per cent. For the year 2002, the difference was 0.58 per cent. A more detailed description of the reasons for the differences and the fluctuations in those differences for different years should be provided in one of Croatia's future NIRs.

52.		During the review, compared to the IPCC methodology, an allocation error for the use of natural gas in the chemical industry was discovered in the reference approach. This should be corrected in the next submission.

53.		The ERT noted significant differences between the reference and the sectoral approaches by fuel type for both energy consumption and CO_2 emissions, partly because stock changes include losses and statistical differences, especially for the base year (table 1.A.5 of the CRF). During the review, the Party explained that these deviations could be attributed to transfers in transformation processes. The ERT noted that such explanations could be included in the NIR.

54.		The ERT found discrepancies in the reference approach estimate related to errors in data entry and to the exclusion of emissions from use of fuels (natural gas in the chemical industry) in the Energy sector. These errors do not affect the national estimate of total emissions, which is based on the sectoral approach. Statistical differences in the national energy balance, which are sometimes significant, might also influence comparison between the reference approach and the sectoral approach. Finally, it is worth noting that in the Croatian inventory the reference approach provided lower estimates than the sectoral approach, while the reverse situation is found for most Parties.

<u>International bunker fuels</u>

55.		International bunker fuels and associated emissions are reported in the CRF tables, but this source is not addressed comprehensively in the NIR. This sector should be better described and documented in future in accordance with the UNFCCC reporting guidelines. In particular, the basic assumptions used for filling in the gaps in the energy consumption figures in the early 1990s should be reported in the NIR.

56.		During the review, the Party explained that calculations are based on fuel deliveries for international aviation and that this value is compared with the total fuel consumption of jet kerosene and with the transport performance of domestic aviation according to the national energy balance. The ERT recommends the inclusion in future inventory submissions of information on the methodology used to estimate emissions from international aviation. The NIR should also in future provide a description of the rationale for the split between domestic and international emissions.

Feedstocks and non-energy use of fuels

57.   The information provided in this area is limited to aggregate data on non-energy use of fuels reported in the national energy balance. Taking into account these limitations, for all years the available data are used in accordance with the IPCC guidelines: the IPCC fractions of carbon stored are applied, and estimates are appropriately subtracted in the reference approach.

58.   The estimates for feedstocks reported in reference approach table 1.A.(d) of the CRF are the values reported by the Ministry of the Economy to IEA/Eurostat, and no detailed information is provided in the NIR about how these values are compiled. Further analysis should be conducted on the non-energy use of fuels and information should be provided by the relevant organization as to how the data on non-energy use reported to IEA/Eurostat are compiled. A detailed description of the underlying trends (e.g., the use of naphtha was phased out in 1995, and reporting of lubricants starts in 1999) would facilitate the comparison of the reference and sectoral approaches.

C. **Key sources**

Fuel combustion: oil, coal, gas, biomass – CO_2

59.   Croatia uses country-specific NCVs for most fuels, which are based on information from the national energy balance and plant-specific information.

Manufacturing industries and construction: oil, coal, gas – CO_2

60.   The trend in fuel consumption fluctuates and is not explained. The ERT encourages Croatia to provide a more detailed discussion of the trend in its next NIR. This could be done in connection with the attempt which the Party has announced to differentiate the fuel consumption for this source category between the different branches of industry; at present only a total is given for the years before 2001.

Road transport – CO_2 and N_2O

61.   Croatia uses the tier 1 approach for CO_2 and, for the remaining compounds, uses the COPERT III model to estimate emissions from road transport. The use of COPERT (tier 3) is consistent with the recommendations of the IPCC good practice guidance for N_2O as a key source in Road Transportation. It should be applied throughout for estimating CO_2 from this source category, not only to verify the results.

Fugitive emissions: oil and natural gas – CH_4

62.   According to the UNFCCC secretariat's key source analysis, CH_4 fugitive emissions from oil and gas operations are a key source, contributing 4.6 per cent to Croatia's overall emissions for the year 2002. As it is a key source, the methodology for estimating the emissions should be changed to a tier 2 approach if possible. The ERT believes that all necessary input data are available in the responsible institution, the INA.

Oil and natural gas operations – CO_2

63.   Croatia reports CO_2 emissions from natural gas scrubbing under the source category Other. The nationally produced gas has a high content of CO_2 which, after treatment, is directly released to the atmosphere. There is no IPCC methodology for this source; the estimates are based on mass balance approaches performed by the operator of the gas production and gas distribution networks. The ERT recommends that in future reports these emissions be included in the appropriate subcategory, 1.B.2.b(ii) Emissions from the Production of Gas, Gas Gathering Systems and Gas Separation Plants, instead of in Other.

D. **Non-key sources**

Oil and natural gas navigation operations – CO$_2$

64.   The value for these emissions given for 1991 in the NIR and CRF is twice the value for 1990 and 1992. This should be corrected if it is a mistake; otherwise the underlying reasons for it should be explained.

Bunker emissions: liquid fuels – CO$_2$

65.   In 2002 emissions from international aviation and marine bunkers were respectively 51.4 per cent and 32.5 per cent lower than in 1990, related to national circumstances. The reasons for these decreases should be described.

E. **Areas for further improvement**

Identified by the Party

66.   Croatia described and presented the following areas for improvement in the Energy sector:

  (a)   The improvement of the estimation of emissions for Road Transportation by extended use of the COPERT model;

  (b)   The disaggregation of fuel consumption for some subcategories in the CRF format, especially for the detailed estimates for the subcategories of 1.A.2 for the years before 2001;

  (c)   The extension of data collection in the Cadastre database by plant-specific questionnaires to more sectors;

  (d)   The identification of details for non-energy use of fuels in order to avoid double counting, and analysis of the relationship to the national energy balance;

  (e)   Explanation of outliers in the time series for implied emission factors (IEFs), consumption data and characteristics in order to identify errors or problems.

67.   The ERT suggests that a time schedule be set out for these planned improvements as part of the QA/QC plan.

Identified by the ERT

68.   The ERT encourages the Party to:

  (a)   Change from tier 1 to tier 2 estimation methodologies as result of the key source analysis where possible;

  (b)   Provide more explanations for country-specific NCVs;

  (c)   Describe in more detail the methods used for estimating GHG emissions from this sector;

  (d)   Provide a more detailed discussion of trend, including any fluctuations, in order to improve the transparency of the inventory;

  (e)   Use more source category-specific QA/QC procedures;

  (f)   Improve the completeness and transparency of the CRFs by filling in the tables with appropriate notation keys;

  (g)   Compare the national data with the available international figures;

(h)   Follow more strictly the structure of the NIR as given in the UNFCCC reporting guidelines.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

69.   In the year 2002, the Industrial Processes sector accounted for 9.7 per cent of the overall GHG emissions of Croatia. In the base year (1990) it was responsible for 12.3 per cent of the overall GHG emissions of the Party. In absolute terms, GHG emissions declined from 3,892 Gg CO_2 equivalent in 1990 to 2,717 Gg CO_2 equivalent in 2002 (–30.2 per cent) due to declines in many areas: some production (iron and steel, aluminium, ferroalloys) stopped completely. In 2002, Industrial Processes accounted for 9.1 per cent of total CO_2 emissions, 0.2 per cent of CH_4 emissions, 23.3 per cent of N_2O emissions, and 100 per cent of fluorinated gases (F-gases) emissions (in 1990, the figures were 8.8 per cent for CO_2, 0.4 per cent for CH_4, 23.9 per cent for N_2O and 100 per cent for F-gases). Within the sector, the share of the different gases in 2002 was 72.3 per cent for CO_2, 0.2 per cent for CH_4, 25.7 per cent for N_2O and 1.8 per cent for F-gases (in 1990 the figures were 51.7 per cent for CO_2, 0.4 per cent for CH_4, 23.8 per cent for N_2O and 24.1 per cent for F-gases).

Completeness

70.   The CRF includes estimates of emissions of CO_2, CH_4, N_2O, HFCs and PFCs, as well as of ozone and aerosol precursor gases, and most sources of emissions from the Industrial Processes sector. This is as recommended by the IPCC Guidelines. SF_6 from consumption in products (particularly switchgear) and CO_2 and N_2O from solvent and other product use are not included. Transparency would be increased by more systematic use of notation keys in the CRF, and the information required to allow reconstruction of the emissions estimates is often missing from the sectoral background data tables of the CRF. An NIR has been submitted and does include information on key sources, methods, data sources, uncertainty estimates and verification activities for the Industrial Processes sector. No information is available in general on the QA/QC procedures implemented for the Industrial Processes sector. The ERT recommends the Party also to provide estimates for the above-mentioned emissions sources where these occur, to use notation keys systematically (in particular, to indicate the distinction between "NE", "NO" and "IE"), to make more use of the documentation boxes, to fill in all cells in the CRF, and to include information on QA/QC (including planned activities) in the NIR. The ERT noted during the review that the necessary information was often already available.

Transparency

71.   The NIR explains the choices of methodology clearly but does not itself allow a full understanding of the inventory, since information on AD and EFs is often insufficient. However, the additional information provided to the ERT during the in-country visit did establish transparency. The transparency of the submission could be increased by filling in all cells in the sectoral background data tables of the CRF, and providing short explanations about the processes in the documentation boxes of the CRF, with reference to more detailed information in the relevant sections of the NIR. Worksheets could also be provided as supplementary material.

Recalculations and time-series consistency

72.   No recalculations have been done for the Industrial Processes sector since the previous inventory. As a result of a recommendation of the in-depth review of Croatia's First National Communication, the Party has corrected the double counting of CO_2 emissions from primary iron and steel production (occurring only in 1990 and 1991). The NIR provides the explanation.

73.   There are gaps in the time series of Ferroalloys Production provided by the statistical institutions for 1999 and possibly 2002. The ERT recommends that the Party fill these gaps by using direct surveys and comparison with time series of other related data (i.e., energy consumption); if that is not possible,

the ERT recommends the Party to use methodologies for providing the missing data as described in chapter 7 of the IPCC good practice guidance.

74.   As regards non-methane volatile organic compound (NMVOC) emissions from pulp and paper production (available only for 1990), the ERT recommends that the Party complete the time series (by obtaining more information on the technologies).

Uncertainties

75.   Quantitative uncertainty estimates prepared using the tier 1 approach according to the IPCC good practice guidance are presented in the NIR (annex 3). In addition qualitative uncertainty estimates are provided in table 7 of the CRF. The values reported for uncertainty estimates in the Industrial Processes sector are reasonable, but some of the EF uncertainties reported in annex 3 are reported as not estimated in the chapter on Industrial Processes of the NIR. Better use of the methodological options recommended by the IPCC good practice guidance could be helpful in assessing the uncertainty associated with the EFs. The ERT encourages the Party to report the same figures for uncertainties associated with the EFs in the different sections of the NIR. The ERT also encourages Croatia to use uncertainty assessments in the analysis of key sources according to the tier 2 approach of the IPCC good practice guidance if possible.

Verification and quality assurance/quality control approaches

76.   The NIR provides a description of the general verification procedures used in the preparation of the GHG inventory. Some information concerning plant-specific production data is already checked against statistical information. The ERT recommends the Party to perform this check more widely where production data are available both from surveys at plant level and from statistical information, and to make use of other sources of information, such as the register of point sources and the national energy balance, as well.

B. Key sources

Cement production – CO_2

77. CO_2 emissions are estimated using the tier 2 method, in accordance with the IPCC good practice guidance, based on clinker production data collected through a voluntary survey of cement manufacturers, and cross-checked with production data published in statistical reports, default EF and cement kiln dust (CKD) correction factor.

78.   The clinker production data used for the estimation are in line with cement production figures provided by United Nations statistics, according to available information on the clinker fraction in cement. The ERT recommends the Party to update the clinker fraction in cement regularly on the basis of a characterization of the national production and to collect data on the CKD correction factor from manufacturers.

Ammonia production – CO_2

79.   To estimate CO_2 emissions from ammonia production, Croatia has used natural gas consumption data and a country-specific composition of natural gas. This is in line with the general recommendation in the IPCC good practice guidance concerning key sources. The overall fluctuating trend in CO_2 emissions in the context of relatively stable fertilizer production is due to annual variations in the carbon content of natural gas.

Nitric acid production – N_2O

80. N_2O emissions from nitric acid production are estimated on the basis of plant-level production data and a default EF. Specific information on abatement devices, which is requested by the IPCC good practice guidance, has not been included either in the CRF or in the NIR, since there are no abatement

systems in operation in existing production plants. Plans to consider N_2O emissions under the emissions tax should provide an incentive for the installation of abatement devices.

C. **Non-key sources**

Limestone and dolomite use – CO_2

81. CO_2 emissions from limestone and dolomite use have been estimated using consumption data referring to the production of glass, refractory and ceramics. These figures were reported monthly from 1990 to 1995, and thereafter collected through a voluntary survey. The monthly data collected do not include blast furnace processes where limestone is used as flux in the iron ore reduction process (during the years 1990–1992). The relevant consumption figures could be either provided by plant operators or calculated on the basis of the amount of iron produced. The ERT recommends that CO_2 emissions from limestone use be checked for any possible missing sources.

Iron and steel production – CO_2

82.   To estimate CO_2 emissions from primary iron and steel production, the IPCC good practice guidance recommends the use of the amount of reducing agent as AD. This figure, which in the case of Croatia refers to the consumption of coke in blast furnace processes in 1990 and 1991, is available from production statistics, together with the consumption of electrodes. (Primary iron and steel production was discontinued in 1992.) In the current inventory, emissions from iron and steel are reported in the Energy sector in the NIR, and in the Industrial Processes sector in the CRF. The ERT recommends the use of the tier 2 method provided in the IPCC good practice guidance. By using the tier 2 method Croatia will be able to report energy-related emissions and process emissions from the iron and steel industry separately. If this is not possible, and the energy-related and process emissions are reported together, the CRF and the NIR should clearly state in which sector they are included.

Consumption of HFCs, PFCs and SF_6 – HFCs, PFCs and SF_6

83.   The only figure included in the present inventory refers to potential emissions of HFCs from refrigeration and air conditioning equipment, estimated on the basis of import/export data collected by the MEPPPC and the customs authorities from users of HFCs. Emissions from consumption of halocarbons and SF_6 are only reported for the years 1995–2002. The ERT encourages the Party to provide estimates of emissions for the years 1990–1994 as well. The ERT is aware of the difficulty of obtaining the relevant AD for these estimates.

84.   The ERT recommends the Party to provide estimates at least for the following sources:

(a)   Actual HFC emissions from domestic refrigeration and air conditioning equipment, which could be estimated on the basis of imports/exports and national production of these devices;

(b) SF_6 emissions from electric equipment: data concerning the amount of SF_6 refilled every year to high-voltage switchgears can be provided by the national electricity producers, and the national producers of switchgears should be able to provide an estimation of SF_6 from low-voltage (closed-circuit) switchgears.

85.   The ERT also encourages the Party to collect information on consumption of HFCs and PFCs for foam blowing, fire extinguishers, semiconductor manufacturing and metered dose inhalers through surveys. Where these activities do not exist or use different substances which are not greenhouse gases, the notation key "NO" should be used in the sectoral background data tables and "NE" should be used where information is not available. Emissions estimated on the basis of the potential approach should be used to cross-check actual emissions estimated on the basis of consumption data. The ERT suggests that the MEPPPC provide adequate support to data collection concerning F-gases, since this information is often considered sensitive and even confidential by users of these substances.

Solvent and other product use

86.   Croatia only reports NMVOC emissions from solvent and other product use. Notation keys are not used for CO_2 and N_2O emissions. In table 3 of the sectoral report Croatia has included an additional table providing information on the AD and EFs used to estimate NMVOC emissions.

87.   The ERT recommends the Party also to include in the CRF N_2O emissions from medical uses, and any other possible source of N_2O emissions within this sector. Information on medical uses of N_2O could be provided by the national health institutions. The ERT also recommends the Party to use notation keys in tables 3 and 3.A-D to fill in the empty cells.

88.   In accordance with the UNFCCC reporting guidelines, Parties should include in their NIRs information as to whether oxidation of NMVOC, CH_4 and CO is included in the inventory or not. The ERT encourages the Party also to estimate and report, together with NMVOC emissions from solvent and other product use, the associated CO_2 emissions due to oxidation in the atmosphere. The ERT acknowledges that no methodology for estimating CO_2 emissions from solvents is provided either in the IPCC Guidelines or in the IPCC good practice guidance; however, submissions by countries with similar national circumstances and national surveys on the composition of solvent blends could be used to provide this estimate.

D. **Areas for further improvement**

Identified by the Party

89.   The Party plans to implement general QA/QC procedures in future, according to the IPCC good practice guidance. A QA/QC plan is in the process of being established. A draft already exists, in the Croatian language. The use of technology- and plant-specific EFs, where available, was also mentioned during the in-country review as a way to minimize uncertainty.

Identified by the ERT

90.   As a small country with a small number of plants and good-quality production statistics, Croatia has often adopted higher-tier methodologies for Industrial Processes, based on plant-level information. The ERT recommends that the Party consider wider use of source-specific verification procedures, through systematic cross-checking of plant-specific information with production statistics, and that it also use other sources of information, such as the register of point sources and the national energy balance.

IV. AGRICULTURE

A. **Sector overview**

91.   In the year 2002, the Agriculture sector accounted for 2,921 Gg CO_2 equivalent or approximately 10.4 per cent of total national GHG emissions in Croatia, having fallen some 32.4 per cent since 1990. CH_4 contributed 30.3 per cent of the total emissions from the sector and N_2O the remaining 69.7 per cent. Agricultural Soils, Enteric Fermentation and Manure Management were the major source categories, contributing 62.2 per cent, 24.9 per cent and 12.9 per cent, respectively, to the total emissions for the sector. Field burning of crop residues was a minor contributor and emissions from this source are estimated only in 1990. Between 1990 and 2002, direct and indirect N_2O emissions from agricultural soils declined by 27.3 and 16.0 per cent. Emissions from enteric fermentation and manure management decreased by 45.9 and 38.3 per cent, respectively, because of a decrease in livestock population. The key source analysis conducted by Croatia identified enteric fermentation, manure management (N_2O), direct N_2O emissions from agricultural soils and indirect N_2O emissions from agricultural soils as key sources, and this agrees with the secretariat's analysis.

Completeness

92.   The CRF includes estimates of all gases and sources of emissions from the Agriculture sector, as recommended by the IPCC Guidelines. Croatia has completed most of the relevant tables for the Agriculture sector for the period 1990–2002 (4.A, 4.B(a), 4.B(b), 4.D); however, table 4.F (sectoral background table on field burning of agricultural residues) has been completed for 1990 only. There is no rice production and there are no savannas in Croatia, so the corresponding categories are reported as "NO". Some cells in the CRF tables have not been filled in. The ERT recommends systematic use of notation keys in order to improve the transparency of the inventory.

Transparency

93.   Croatia's NIR provides basic useful information such as methodology, references to support the EFs used, and AD by subcategory at the same disaggregating level of the CRF. This information was very helpful for the review of Croatia's inventory. The ERT noted that transparency could be further improved by using the NIR to provide information on the reasons for choice of methodologies, summary tables of EFs and AD, and relevant underlying assumptions. The methods used in all subcategories are tier 1 with default EFs, apart from the country-specific value of the coefficient that specifies the fraction of total nitrogen (N) excretion emitted as nitrogen oxide (NO_X) or ammonia (NH_3) ($Frac_{GASM}$).

Recalculations and time-series consistency

94.   All AD are from the Food and Agriculture Organization of the United Nations (FAO) database with the exception of 1990, for which data are taken from a three-year average of the *Croatian Statistical Report*; however, the trend of the AD seems to be consistent because the decrease is gradual. There are some discontinuities in individual source categories, as described below, and systematic use of notation keys and documentation boxes would help to explain the circumstances.

95.   There were no recalculations in the Agriculture sector for the inventory under review.

Uncertainties

96.   Quantitative uncertainty estimates based on expert judgement are provided and results are reasonable. The ERT heard that these are being used as an input to help decide priorities for inventory development. The ERT noted Croatia's extensive knowledge of its agricultural activities, including a very detailed soil map, which has not been considered in the inventory development, and analysis of amounts of fertilizer applied in relation to crop production, and believes that this knowledge could be of great help not only for uncertainty estimation but also in future inventory development.

Verification and quality assurance/quality control approaches

97.   The NIR contains no formal description of QA/QC procedures, although it became clear to the ERT during the review that important elements of QA/QC are operational, including the system of data record sheets. The ERT encourages Croatia to develop a formal QA/QC system as described in the IPCC good practice guidance.

B. Key sources

Direct N_2O emissions from agricultural soils – N_2O

98.   The tier 1a method with default EFs is used except for the parameter describing the fraction of total N excretion emitted as NO_X or NH_3 ($Frac_{GASM}$), which is country-specific. This method is in line with the decision tree of the IPCC good practice guidance, as Croatia does not have the relevant data needed to apply the tier 1b methodology. If possible, more country-specific values (e.g., EFs, $Frac_{GASF}$) should be used where these describe national circumstances more accurately.

99.   The NIR provides summary explanations of the AD, and the CRF has some transcription inaccuracies: for example, with regard to N-fixing Crops and Crop Residue in 2001 and 2002, AD are

reported but not emissions. Regarding Cultivation of Histosols, emissions in 2002 are missing because AD were unavailable. In such cases the ERT encourages the Party to either extrapolate or use one of the other techniques to estimate the missing year, as indicated in chapter 7 of the IPCC good practice guidance, until the AD can be provided. The ERT considers that it would be useful for the NIR to provide information about the AD (e.g., the definition and rationale for the choice of AD) and underlying reasons for the observed trend in estimated emissions. The ERT also recommends as a QA/QC procedure cross-checking for consistency between synthetic fertilizer consumption and area of crop cultivated multiplied by N demand intensity.

100.   The fraction of crop residue that is removed from the field as crop ($Frac_R$) fluctuates (in 1990 it was 0.25, in 1991 and 1996 it was 0.55, and in the other years it was 0.45). The reasons for this are not apparent but seem to be calculation errors. The ERT recommends Croatia to check its AD, and to establish regular QA/QC procedures in order to avoid possible calculations errors and explain the fluctuations in the NIR. Croatia is also encouraged to provide explanations of the basis for the estimation of $Frac_{GASM}$ by experts, to update EF_2[6] for Cultivation of Histosols and to check for consistency with other subcategories – for instance, between Manure Management and Animal Wastes Applied to Soils – because the same parameters are used in these source categories.

Indirect N_2O emissions from agricultural soils – N_2O

101.   The tier 1a method with default EFs is used. The method used is in line with the decision tree of the IPCC good practice guidance, as Croatia does not have the relevant data needed to apply the tier 1b methodology. N_2O produced from the discharge of human sewage N into rivers or estuaries is not included. The ERT recommends that the Party check the assumptions on which this exclusion is based.

Enteric fermentation – CH_4

102.   The tier 1 method with default EF is used for all types of livestock. According to the IPCC good practice, if data are available or can be collected without excessive cost, the tier 2 method should be applied to dairy cattle, which are a key source. The ERT also recommends Croatia to provide related data, such as annual milk production per head and weight, as additional information in the CRF and to check the resolution of the statistics for young cattle.

103.   The reason for the choice of EFs should be indicated in the NIR. The ERT noted the following:

(a)   For Poultry, 0 (zero) is the figure given for 1990–1996 and 2002, and the notation key "NO" is used for 1997–2001, whereas "NE" would be correct;

(b)   Emissions from goats and asses are reported only in 1996 and 1997, although emissions should have occurred for the other years as well.

104.   According to the CRF the EF for Swine changed between 1990-1995 (for which it is entered as 1.5 kg CH_4/head/year) and 1996-2002 (for which it is 1.0 kg CH_4/head/year). The ERT understands that this is a transcription error, and that the value 1.0 kg CH_4/head/year (the value for developing countries) is in fact used throughout the time series.

Manure management – N_2O

105.   The tier 1 method with default EFs is used. The ERT noted that, for dairy cattle, Enhanced Livestock Population Characterization would be preferable, in accordance with the decision tree of the IPCC good practice guidance. If possible a survey should be conducted every few years to determine the relative shares of different types of animal waste management system (AWMS) being used. QA/QC should entail consistency checks on the parameters used in the estimation of emissions from waste

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[6] EF_2 was updated in the IPCC good practice guidance and is indicated in table 4.17 of the IPCC good practice guidance.

management with those used elsewhere in the inventory, for example, the volatile solids (VS) daily excretion.

106.   The trend in estimated emissions from this source fluctuates. Between 1990 and 1995 the emissions decrease. They increase in 1996, and then between 1996 and 2001 are quite stable before decreasing by 42.1 per cent between 2001 and 2002. The 2002 value of N_2O emissions (0.7 Gg) is 42.1 per cent lower than the 1990 value. The ERT believes that this is because the shares of different AWMS for non-dairy cattle have not been applied consistently over time, and that systematic application of QA/QC would deal with this without difficulty. The ERT encourages Croatia to look into this and to provide the explanations in the next NIR.

107.   Transparency would be significantly improved if the NIR contained summary data on key parameters, including the share of each AWMS used and the EF corresponding to each AWMS.

C. Non-key sources

Manure management – CH_4

108.   The EFs for management of swine and horse manure fluctuate but the reasons for this are not indicated. This seems to be caused by simple mistakes.

Field burning of agricultural residues – CH_4, N_2O

109.   Emissions are reported only for 1990. Although the contribution to the national total is very small (less than 0.02 per cent), they should be reported in other years as well for the sake of time-series consistency.

D. Areas for further improvement

Identified by the Party

110.   The Party recognizes the need to formalize QA/QC procedures and increase the amount of information provided in the NIR as far as reasonably possible, in order to improve transparency.

Identified by the ERT

111.   The ERT recommends a review of the applicability of higher-tier methods for key sources, subject to the availability of data. The IPCC good practice guidance (p. 7.14) recommends that reasons be given where higher-tier methods are not applied for key sources due to national circumstances. The reasons for not using a higher-tier method should be clearly stated in the NIR.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

112.   The CRF and the NIR only provide estimates for IPCC category 5.A (Changes in Forests and Other Woody Biomass Stocks). In the period 1990–2002, the LUCF sector in Croatia was a net sink, with an uptake of 6,505 Gg CO_2 in 1990 and 9,000 Gg CO_2 in 2002, an increase of 38.4 per cent over the period. The LUCF CO_2 sink amounted to 20.6 per cent and 32.2 per cent of total GHG emissions in 1990 and 2002, respectively. There are two large increases in the LUCF net CO_2 sink in estimated annual uptake, of 24 per cent between 1995 and 1996, and of 11.5 per cent between 2001 and 2002. The NIR states that the main influence on CO_2 removals is the annual commercial harvest rate, which has declined from an estimated 6,405 Gg CO_2 in 1990 to 5,707 Gg CO_2 in 2002 – a decrease of some 10.9 per cent.

Completeness

113.   CRF table 5.A is provided for the entire period 1990–2002, with CO_2 uptake from commercial forest growth and CO_2 release from commercial harvest reported, but not the IEFs. Tables 5.B (Forest and Grassland Conversion), 5.C (Abandonment of Managed Lands) and 5.D (CO_2 Emissions and

Removals from Soils) are reported as 0.00 (zero), although the NIR states that sufficient data are not available to estimate the corresponding categories, so the correct notation key would be "NE". The ERT contacted the Ministry of Agriculture and Forestry, the Forest Research Institute and the Croatian Forests Company, which indicated that most of the information required to complete the missing tables could be made available. The ERT encourages coordination between the relevant authorities in order for all the relevant CRF tables to be completed.

Transparency

114.   The NIR contains background information, information on data availability and bibliographic references, but transparency would be improved by providing summary descriptions of the methodologies used, including information on the key EFs and other parameters, and AD.

Recalculations and time-series consistency

115.   The ERT recommends that the time series between 1990 and 2002 be reviewed for possible recalculation following consideration of the evidence on wood densities, and in order to remove any inconsistencies associated with annual biomass growth rates applied between 1990 and 1995, and between 1996 and 2002.

Uncertainties

116.   In the NIR, uncertainties for LUCF are estimated globally at 20 per cent of the input data and 30 per cent of the conversion and expansion factors, with a total of about 50–60 per cent. The uncertainty could probably be reduced following the review of wood density and growth rates identified above.

Verification and quality assurance/quality control approaches

117.   Source-specific verification and QA/QC are not reported, but should be considered as part of the general review of QA/QC discussed in section C, Cross-cutting issues, in chapter 1 (the Overview section) of this review report.

B. **Sink and source categories**

Changes in forest and other woody biomass stocks

118.   The NIR indicates that the main sources of data on the area of forest land and annual increment are the Forest Management Area Plan of Croatia for the periods 1986–1995 and 1996–2005, both elaborated by the Croatian Forests Company. According to the NIR, the commercial harvest is estimated as the planned annual cut for the period 1990–1995. The Croatian Forests Company provided the data on actual harvest in the period 1996–2001, and the data on actual harvest for 2002 came from the Ministry of Agriculture and Forestry. According to the Ministry of Agriculture and Forestry, the Forest Research Institute and the Croatian Forests Company, a national forest inventory already exists in Croatia and will be updated in 2005. Possible differences between these institutional historical data sources could produce differences in the determination of country-specific EFs, and the historical data should therefore be checked and any inconsistencies taken into account using the methods set out in chapter 7 of the IPCC good practice guidance.

119.   Carbon content in wood and biomass expansion factors are taken from the IPCC default values. Wood density for deciduous and evergreen forests, average annual growth rate and harvested wood density are the assessments of the Croatian expert team, although these values are not provided in the NIR. The present values of wood density used to calculate the whole carbon uptake in commercial forests are 0.35 t/m^3 for evergreen species and 0.45 t/m^3 for deciduous species as country-specific factors. These are below the IPCC default factors (0.45 t/m^3 and 0.65 t/m^3, respectively). The ERT and the national forest authorities agree that there is a need to assess the country-specific factors.

120.   It would be useful for transparency to include more detailed information in the NIR on the average forest annual growth rate in dry matter between the periods 1990–1995 and 1996–2002. The increase in annual growth for evergreen forests (from 3.15 t dm/ha/yr in the period 1990–1995 to 4.07 t dm/ha/yr in 1996–2002) and the increase in annual growth for deciduous forests (from 1.92 t dm/ha/yr in 1990–1995 to 2.45 t dm/ha/yr in 1996–2002) should be explained and documented in the NIR.

121.   The report on the in-depth review of the first National Communication of Croatia states that a large afforestation plan was initiated under a World Bank loan. The ERT recommends that as far as possible growth of biomass attributable to afforestation be taken into account in future inventories.

122.   The ERT recommends that an estimate be made of traditional fuel wood consumption in Croatia for inclusion in the NIR and in CRF table 5.A, using available AD.

Forest and grassland conversion

123.   The NIR states that forest conversion does not occur in Croatia because of legal restrictions. Occurrence of forest fires is considered negligible in the inventory, but the Croatian Forests Company does have detailed data on occurrences of fire. If fires are associated with land-use change, then CO_2 and non-CO_2 GHGs should be estimated. Even where fires are not associated with forest and grassland conversion, they may be relevant to estimating carbon stock changes in IPCC category 5.A (Changes in Forest and Other Woody Biomass Stocks). The ERT recommends that the changes consequent on forest fires (including carbon stock changes and non-CO_2 emissions) be estimated on the basis of the available data.

Abandonment of managed lands

124.   During the in-country review Croatia informed the ERT that 166,000 hectares of arable land have been abandoned because of the presence of landmines and could be under bushes and forest re-covering. The ERT recommends that the available information on this be reviewed for possible inclusion in table 5.C of the CRF, with information on the associated methodological background to be provided in the NIR.

CO_2 emissions and removals from soils

125.   The ERT learned during the review that detailed data are available on soils and cultivation in Croatia. This should make it possible to include estimates of emissions and removals related to the cultivation of mineral and organic soils and the liming of agricultural soils in the GHG inventory.

C. Areas for further improvement

Identified by the Party

126.   A recalculation of the time series from 1990 to 2002 is scheduled to take place in 2005 for the source category Changes in Forest and Other Woody Biomass Stocks.

Identified by the ERT

127.   The ERT recommends Croatia to include the other source categories in the LUCF sector, including the specific improvements detailed above.

VI. WASTE

A. Sector overview

128.   In the year 2002, the Waste sector contributed 4.4 per cent of Croatia's total GHG emissions. CH_4 represented 4.1 per cent and nitrous oxide 0.3 per cent of the emissions from the sector. In 1990 the Waste sector accounted for 3.0 per cent of total emissions, CH_4 representing 2.5 per cent and N_2O

0.4 per cent of emissions from the sector. Emissions from waste increased by 32.3 per cent between 1990 and 2002, or in absolute terms from 933 to 1,234 Gg CO_2 equivalent. CH_4 emissions in 2002 were 54.5 Gg CO_2 equivalent and N_2O emissions were 0.29 Gg CO_2 equivalent. Solid Waste Disposal on Land is a key source and the NIR states that waste management in general has been identified by Croatia as an environmental priority.

Completeness

129.   The CRF includes estimates of most gases and sources of emissions from the Waste sector, as recommended by the IPCC Guidelines. Estimates of emissions other than those from N_2O from human sewage are not provided for waste-water handling and there are no estimates of emissions from waste incineration. The NIR states that this is due to lack to data in the case of waste incineration. In the case of waste-water handling the NIR states that treatment is either aerobic or anaerobic with flaring, so CH_4 is not emitted.

Transparency

130.   The information provided in the NIR and the CRF should allow reconstruction of the emissions estimates. In practice, reference to external documentation is often needed for complete transparency. The NIR does provide documentary references to the main sources of information on AD and EFs but, in the view of the ERT, could usefully provide rather more detail on the methodologies used and on the origin of the AD and of key parameters such as degradable organic carbon (DOC).

Recalculations and time-series consistency

131.   Waste is the only sector for which recalculations have been made in the 2002 submission. Recalculations were provided for all the emissions included in the sector for the year 2001. They are associated with new AD and increase the total for 2001 by 0.2 per cent. Recalculations are properly included in the CRF but a more thorough explanation of them should be included in the NIR. All the recalculations are associated with the acquisition of more accurate data and efforts to achieve consistency with other national and international data sources, and should improve overall time-series consistency.

B. Key sources

Solid waste disposal – CH_4

132.   Solid Waste Disposal on Land is a key source for both level and trend. Croatia uses the tier 1 approach because of lack of the AD needed for the tier 2 approach, which would otherwise be indicated by the IPCC good practice guidance because it is a key source. The ERT recognizes the difficulties of collecting the AD but encourages Croatia to estimate historical data in order to enable the tier 2 approach to be applied. The additional information table in table 6.A of the CRF should be fully completed to enhance the transparency of the inventory. The proper methane conversion factor (MCF) was used in the calculations but not recorded properly in the CRF, and there is a transcription error in the 1993 value quoted in the NIR. AD are obtained from the volumes and estimated destinations of waste calculated on the basis of weighed volumes in one facility. The DOC value was estimated to be stable for the period 1990–2002 and is based on a study which is available and referenced. Croatia has policies to increase recycling and composting, and it is probable that this will affect the DOC value for land-filled waste in future.

133.   The value for 2001 was recalculated when AD became available. The 2002 value was also obtained from extrapolation initially, and will probably also be recalculated in future. The ERT noted that coordination with the information provider might make AD available sooner in the annual cycle and that this might help avoid the need to recalculate.

C. __Non-key sources__

Waste-water handling – human sewage – N_2O

134.   Croatia has used a stable figure for population in the period 1990–1995 based on a 1991 census. The calculation of protein intake for the period 1990–1995 was based on the average in other European countries and is 48.8 per cent higher than the average for the period 1996–2001. The 1996-2002 data are taken from FAO statistics. Croatia uses the IPCC default value as the IEF; it combines discharges to rivers and estuaries. Considering that nearly 25 per cent of the Croatian population lives close to the sea, Croatia may consider it appropriate to review the EF applied, taking account of the advice on page 4.110 in volume 3 of the IPCC Guidelines. Croatia may also wish to consider in its estimates the population influx due to the development of tourism.

135.   The value for 2001 was recalculated on the basis of availability of AD (FAOSTAT) and the 2002 value will probably also be recalculated when more accurate data are available. The ERT recommends Croatia to review protein intake for consistency and the EF for accuracy in future recalculations.

Other emissions

136.   Croatia does not report CH_4 emissions from waste-water treatment in the NIR and a zero value is shown in the CRF. The ERT learned during the review that this is because either the treatment is aerobic or (if the treatment is anaerobic) the CH_4 produced is flared. The ERT noted that disposal in rural areas may be by systems such as septic tanks which may be partly anaerobic without flaring, and that some CH_4 emission may result. It may therefore be worth reviewing the production of CH_4 from waste-water treatment (particularly in rural areas) taking into account the variety of systems used in practice.

137.   Croatia informed the ERT that no waste incineration occurs in Croatia except for incineration of clinical waste. An incinerator for hazardous waste was functioning in Zagreb between 1997 and 2002. Neither of these is currently included in the inventory. The ERT noted that they should be estimated for the sake of completeness, although they would not be expected to affect the trend significantly.

D. __Areas for further improvement__

Identified by the Party

138.   Croatia plans to improve its waste statistics and to carry out sector-specific studies related to solid waste disposal in order to use the tier 2 methodology.

Identified by the ERT

139.   AD and the calculations of EFs are available and well documented in published documents, and should be included in the NIR in order to enhance transparency and facilitate the review process. Emissions from waste-water handling and waste incineration should be included for the sake of completeness. New statistics available and sector-specific studies should be used to reconstruct historical AD in applying the tier 2 method for key sources.

ANNEX 1: MATERIALS USED DURING THE REVIEW

A. Support materials used during the review

2003 and 2004 Inventory submissions of Croatia. 2004 submission including a set of CRF tables for 1990–2002 and an NIR.
UNFCCC secretariat. "2004 Status report for Croatia" (available on the secretariat web site http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/hrv04.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 http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/2767.php
UNFCCC secretariat. Review findings for Croatia (unpublished).
Croatia'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 http://unfccc.int/resource/docs/cop5/07.pdf).
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" and "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention." FCCC/CP/2002/8 (available on the secretariat web site http://unfccc.int/resource/docs/cop8/08.pdf).
UNFCCC secretariat. Database search tool – *Locator* (unpublished).
IPCC. *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000* (available on the following web site: http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm).
IPCC/OECD/IEA. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volumes 1–3, 1997* (available 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 Mr. Željko Jurić (EKONERG), Mr. Branko Vuk (Energy Institute "Hrvoje Požar"), Ms. Snježana Fijan-Parlov (EKONERG), Professor Milan Mesić (Faculty of Agriculture of the University of Zagreb), Mr.Ivica Milković (Croatian Forest Company) and Mr. Miroslav Benko (Forest Research Institute) including additional material on the methodology and assumptions used.
Republic of Croatia, Ministry of Economy, Labour and Entrepreneurship. *"Energy in Croatia 2002 Annual Energy Report 2002",2003, ISBN 953-6474-41-7*
Republic of Croatia, Ministry of Economy Affairs. *"Energy in Croatia1990-1994 Annual Energy Report",1995, ISBN 953-96311-2-2*
EKONERG, *"Godisnje izvjesce o emisiji stetnih tvari u atmosferu iz termoelektrana HEP-a" – 2001. godina – (Annual report about emissions from large combustion plants), 2002* (unpublished)
CROSTAT, *1996. Industry 1993 – Monthly Report. Central Bureau of Statistics, Zagreb, 1996* (in Croatian).
CROSTAT, *1994. Production and sales of finished goods and consumption of raw materials in 1991. Central Bureau of Statistics, Zagreb, 1994* (in Croatian).
Additional information regarding the Position of Serbia and Montenegro in relation to "Croatia National Inventory Report: Inventory of Anthropogenic Emissions by Sources and Removals by Sinks of all Greenhouse gases not controlled by the Montreal Protocol for the period from 1990 to 2002", submitted to

UNFCCC on 15 April 2004, Letter to the secretariat from Minister Aleksander Popovic, dated 14 July, 2004, Belgrade.

Additional information regarding the Bosnia and Herzegovina position in relation to "Croatia national inventory report: inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal protocol for the period from 1990 to 2002", submitted to UNFCCC on 15 April 2004, submission from Bosnia and Herzegovina, 26 August, 2004.

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