COMPLIANCE COMMITTEE **CC/ERT/ARR/2010/15**
9 March 2010

Report of the individual review of the annual submission of Croatia submitted in 2009

Note by the secretariat

The report of the individual review of the annual submission of Croatia submitted in 2009 was published on 1 March 2010. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2009/HRV, contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.

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Report of the individual review of the annual submission of Croatia submitted in 2009*

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

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1), a draft version of this report was communicated to the Government of Croatia, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Emission profiles and trends

3. In 2007, the main greenhouse gas (GHG) in Croatia was carbon dioxide (CO_2), accounting for 76.8 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by nitrous oxide (N_2O) (11.0 per cent) and methane (CH_4) (10.8 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.5 per cent of the overall GHG emissions in the country. The energy sector accounted for 73.5 per cent of the total GHG emissions, followed by industrial processes (12.6 per cent), agriculture (10.5 per cent), waste (2.7 per cent) and solvent and other product use (0.7 per cent). Total GHG emissions amounted to 32,384.95 Gg CO_2 eq and increased by 3.2 per cent between the base year[2] and 2007. The trends of the different gases and sectors are reasonable and are similar to those of other Parties with similar national circumstances.

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

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

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

Table 1. Total greenhouse gas emissions by gas, 1990–2007[a]

Greenhouse gas	Gg CO_2 eq							Change base year–2007 (%)
	Base year[b]	1990	1995	2000	2005	2006	2007	
CO_2	23 104.69	23 104.69	16 929.73	19 954.88	23 424.18	23 528.31	24 864.67	7.6
CH_4	3 418.85	3 418.85	2 852.89	2 658.46	3 124.14	3 337.86	3 481.48	1.8
N_2O	3 902.59	3 902.59	3 062.86	3 306.82	3 519.96	3 455.95	3 557.01	–8.9
HFCs	NO	NO	7.80	23.16	349.18	430.68	465.10	NA
PFCs	936.56	936.56	NO	NO	NA, NO	NA, NO	NA, NO	NA
SF_6	11.01	11.01	11.61	12.15	15.73	16.43	16.69	51.6

Abbreviations: NA = not applicable, NO = not occurring.
[a] Total greenhouse gas emissions includes emissions from Annex A sources only (exclude emissions/removals from the land use, land-use change and forestry sector).
[b] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

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

Sector	Gg CO_2 eq							Change base year–2007 (%)
	Base year[a]	1990	1995	2000	2005	2006	2007	
Energy	22 148.96	22 148.96	16 391.15	18 822.03	22 288.54	22 416.24	23 802.55	7.5
Industrial processes	4 193.73	4 193.73	2 572.90	3 223.74	3 681.80	3 863.56	4 072.62	–2.9
Solvent and other product use	130.95	130.95	123.79	115.19	203.38	231.29	232.52	77.6
Agriculture	4 321.40	4 321.40	3 044.74	3 150.75	3 464.13	3 418.15	3 409.66	–21.1
LULUCF	NA	–4 184.92	–9 154.24	–5 280.69	–7 726.37	–7 490.29	–6 302.63	NA
Waste	578.67	578.67	732.31	643.76	795.35	839.98	867.60	49.9
Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**NA**	**27 188.79**	**13 710.64**	**20 674.78**	**22 706.83**	**23 278.93**	**26 082.32**	**NA**
Total (without LULUCF)	**31 373.71**	**31 373.71**	**22 864.88**	**25 955.47**	**30 433.20**	**30 769.22**	**32 384.95**	**3.2**

Abbreviations: LULUCF = land use, land-use change and forestry, NA = not applicable.
[a] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

C. Annual submission and other sources of information

5. The 2009 annual inventory was submitted on 26 May 2009 containing a complete set of common reporting format (CRF) tables for the period 1990–2007. The national inventory report (NIR) was submitted on 27 May 2009. Croatia did not submit information required under Article 7, paragraph 1, of the Kyoto Protocol, on a voluntary basis. The standard electronic format (SEF) tables were not submitted because the national registry has not yet started live operations. The Party indicated that the 2009 submission is also its voluntary submission under the Kyoto Protocol. The annual submission was not submitted in accordance with decision 15/CMP.1 because information required under Article 7, paragraph 1, of the Kyoto Protocol was not provided. The expert review team (ERT) encourages Croatia to provide the annual submission on 15 April.

6. Croatia submitted revised emission estimates for N_2O from 6A2 human sewage for the years 2004–2007 on 26 October in response to questions raised by the ERT during the course of the review.

7. Where necessary, the ERT also used the previous year's submission during the review. During the review, Croatia provided the ERT with additional information. The documents concerned are not part of the annual submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in annex I to this report.

Completeness of the inventory

8. The 2009 inventory submission is complete in terms of years, geographical coverage and sectors. The ERT commends Croatia for having reported – in response to recommendations made in previous review reports – actual SF_6 emissions from electrical equipment for the entire time series, CH_4 emissions from industrial wastewater, and N_2O emissions from anaesthesia. However, estimates for some source and sink categories are still not reported in the CRF tables or the NIR. In the LULUCF sector, estimates are provided only for the category forest land remaining forest land. In addition, some categories in the energy (CH_4 from oil exploration; CH_4 from natural gas exploration), industrial processes (HFCs from aerosols/metered dose inhalers; HFCs from solvents) and waste sectors (CO_2 from managed waste disposal on land; CO_2, CH_4 and N_2O from 6Cb other (non-biogenic)) are reported as not estimated ("NE"). Croatia reported potential emissions of HFCs for most of the subcategories under category 2F consumption of halocarbons and SF_6 for the years 1990–2007, but did not report actual emissions. The Party has not estimated potential or actual HFC emissions for the category aerosols/metered dose inhalers. The ERT recommends that Croatia, in its next annual inventory submission, provide estimates for the missing categories for which 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), the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) and the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) provide estimation methodologies.

D. Main findings

9. The 2009 inventory submission is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The 2009 inventory submission shows significant improvement since the previous submission with regard to major issues such as completeness and shows that the Party is using more higher-tier methods. However, the ERT identified a need to use higher tier methods for the key categories fugitive CH_4 emissions from oil and natural gas and CO_2 from forest land remaining forest land.

10. Croatia did not submit on a voluntary basis supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol. The ERT recommends that, in its next annual submission, Croatia provide all mandatory information required under Article 7, paragraph 1, of the Kyoto Protocol, in accordance with Part I of the annex to decision 15/CMP.1.

11. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1. However, the ERT identified problems regarding the Party's ability to respond in a timely manner to issues raised during the different stages of the review process. The national registry has not yet started live operations mainly due to the additional time needed to establish the assigned amount of Croatia in accordance with Article 3, paragraphs 7 and 8, of the Kyoto Protocol (see para. 82 below).

12. In the course of the review, the ERT formulated a number of recommendations relating to the following:

(a) Timeliness of the submission and responses to questions raised by the ERT during the different stages of the review (see para. 24 below);

(b) Completeness, in particular for industrial processes (HFCs from aerosols/metered dose inhalers; HFCs from solvents) and LULUCF (all categories except forest land remaining forest land) (see chapters III and V below);

(c) Transparency, in particular with regard to a more complete and detailed description of the chapter on the LULUCF sector with regard to methods, underlying assumptions, activity data (AD), quality control procedures and uncertainty estimates in the LULUCF sector (see chapter V below);

(d) Exploring the possibility of structuring its reporting, in its next annual submission, following the annotated outline of the NIR, and the guidance contained therein, that can be found on the UNFCCC website.[3]

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

1. Overview

13. The ERT concluded that the national system continued to perform its required functions although problems were observed regarding the Party's ability to respond in a timely manner to issues raised during different stages of the review process (see para. 24 below).

14. The institutional arrangements for the preparation of the inventory are described in the NIR. The Ministry of Environmental Protection, Physical Planning and Construction (MEPPPC) has overall responsibility for the national inventory, as it is responsible for the functioning of the national system and the approval of the inventory and submission of the inventory to the UNFCCC secretariat. However, other agencies and organizations are also involved in the preparation of the inventory. The Croatian Environmental Agency (CEA) has overall responsibility for organizing the collection of AD, developing and implementing the quality assurance/quality control (QA/QC) plan, archiving all of the information used in the preparation of the GHG inventory, selecting the institution that prepares the inventory and reporting on changes to the national system. The consultancy company Ekonerg has a three-year contract with the CEA to prepare the GHG inventory, prepare the NIR and CRF tables and report on registry units. Other organizations and ministries provide data and support the inventory preparation process.

[3] <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/reporting_requirements/application/pdf/annotated_nir_outline.pdf>.

The CEA also oversees the administration of the national registry and facilitation of the inventory reviews.

15. Information on changes in the national system and changes in the national registry that have taken place since the previous annual submission is not reported in the NIR. During the centralized review, Croatia informed the ERT that there have not been any changes in the national system since the previous submission except the establishment of an independent expert group to support the MEPPPC in inventory approval and improvement processes. The ERT recommends that Croatia provide information on changes in the national system and the registry in its next annual submission, as necessary.

2. Inventory planning

16. The previous ERT acknowledged that Croatia had comprehensive legal and institutional arrangements. However, it encouraged Croatia to strengthen the functional aspects of the national system by: (1) focusing its attention on methodological issues because priority is given to AD collection; (2) enhancing collaboration with expert and research organizations and initiating research and studies to support the inventory preparation process, especially in the agriculture and LULUCF sectors, in order to enhance the consideration of national circumstances; (3) strengthening the implementation of QA/QC procedures; and (4) providing additional support for the sectoral experts when compiling the inventory (such as providing support on cross-cutting issues, ensuring availability of backup staff and increasing the interaction of experts across sectors). In addition, the previous ERT encouraged Croatia to consider whether additional resources are required to ensure the timely submission of the inventory. As it was not evident how these issues have been dealt with from the information provided in the NIR or the responses received from the Party during the centralized review, the ERT recommends that the Party implement/solve the issues mentioned above and to report on the implementation in its next annual submission.

17. The improvement plan in the NIR identifies several areas for improvement, building largely on recommendations made in previous review reports. The ERT commends Croatia for its improvement plan and reiterates the recommendation made in the previous review report that Croatia provide a more detailed plan and add a time schedule for the planned improvements in its next annual inventory submission.

3. Inventory preparation

Key categories

18. Croatia reported a key category tier 1 analysis, both level and trend assessments, as part of its 2009 submission and included the LULUCF sector in its analysis. As Croatia performed the level assessment only for the year 2007 and not for 1990, the key category analysis is not fully in accordance 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). The key category analysis performed by the Party and that performed by the secretariat[4] produced different results mainly owing to an error in the Party's trend key category analysis. In tables A1-4 and A1-5 of the Croatian NIR, categories should be ranked according to percentage contribution to the trend and not according to last year's estimate. In addition, the Party

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

does not fully take into account the guidance from the IPCC (e.g. equation 5.4.3 in the IPCC good practice guidance for LULUCF) in cases where emissions are zero for the current year (as was pointed out in previous review reports). The key category analysis conducted by the secretariat identifies PFCs from aluminium production and N_2O from road transportation as key categories in 2007, whereas the Party does not identify these categories as key categories. Furthermore, the ERT noted some inconsistencies in the reported key categories between CRF table 7 and table A1-6 in the NIR. The ERT recommends that the Party complete CRF table 7 for the year 1990 and that it prepare and report its key category analysis fully in accordance with the IPCC good practice guidance, the IPCC good practice guidance for LULUCF and the UNFCCC reporting guidelines. In addition, as it is not evident in the NIR, the ERT also recommends that the Party explain in its next NIR if and how the results of the key category analysis (along with the uncertainty analysis) are used as a basis for prioritizing future improvements in the inventory. The ERT encourages the Party to identify key categories for activities under Article 3, paragraph 3, and Article 3, paragraph 4, of the Kyoto Protocol for its next submission.

Uncertainties

19. Croatia has provided an uncertainty assessment for each category and for the inventory in total, following the tier 1 approach of the IPCC good practice guidance. National circumstances and improvements made in the inventory are not always reflected in the uncertainty estimates. Although some uncertainty estimates have been revised, the link to improved methods and emission factors (EFs) is not evident in the NIR. The ERT recommends that Croatia improve and update the uncertainty estimates in its next annual inventory submission, especially when changes are made in the inventory or when country-specific methods or EFs are used (e.g. nitric acid production). The ERT noted that, compared to other Parties, the uncertainty estimates for CH_4 emissions from oil and natural gas are relatively high, whereas the uncertainty estimates for N_2O emissions from agricultural soils are rather low. In addition, the ERT noted that uncertainties for the LULUCF sector have only a minor effect on the overall level of uncertainty but a rather significant effect on the trend uncertainty. During the centralized review, the Party indicated that it intends to further analyse uncertainty estimates in its next annual inventory submission. The ERT encourages the Party to include a short discussion of the results of this analysis in its next annual inventory submission and to revise the uncertainty estimates, if needed. The ERT also recommends that the Party explain in its next NIR if and how the results of the uncertainty analysis (along with the key category analysis) are used as a basis for prioritizing future improvements in the inventory.

Recalculations and time-series consistency

20. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. During the 2008 review of the initial report, Croatia revised its estimates for several categories for the period 1990–2006 following recommendations made by the ERT; these revised estimates were included in the resubmission of Croatia's 2008 inventory in 2009. In addition, recalculations were performed during the preparation of the 2009 inventory submission in early 2009 based on the revised estimates for 2008. The ERT noted that the recalculations reported by Croatia for the time series 1990–2006 have been undertaken mainly in order to take into account changes and improvements in AD (in the waste and industrial processes sectors) and the correction of errors (for fugitive emissions and agriculture). The overall impact of the recalculations is an increase in total GHG emission estimates in 1990 (by 0.09 per cent) and an increase in 2006 (by 0.65 per cent). The rationale for these recalculations is provided in the NIR and in CRF table 8(b). The ERT acknowledges that Croatia experienced difficulties in ensuring time-series consistency in the early 1990s and encourages the Party to continue its efforts to improve time-series consistency in the inventory. The ERT found that the time series in the waste sector was derived from extrapolation on the basis of only two years. The ERT recommends that the Party improve time-series consistency in the waste sector.

Verification and quality assurance/quality control approaches

21. Croatia has elaborated a QA/QC plan in accordance with the IPCC good practice guidance including general QC procedures (tier 1) as well as source/sink category-specific procedures (tier 2) for key categories. Before submitting the NIR to the UNFCCC secretariat an audit was carried out by the designated QA/QC manager by checking the actual implementation of the QC procedures. The previous ERT recommended that Croatia continue to update annually the QA/QC plan, set specific quality objectives for each sector and cross-cutting issues, improve the documentation and recording of implemented QC measures (e.g. in the calculation sheets) and include consistency checks across sectors and categories as well as between the CRF tables and the NIR. In addition, the previous ERT encouraged Croatia to implement the QA and verification measures included in the QA/QC plan in its next annual inventory submission and to develop these further, based on the experience gained. As it is not clear from the NIR and the responses received during the review how the Party plans to address these issues, the ERT recommends that the Party implement the recommendations above and report on this in its next annual inventory submission.

Transparency

22. The NIR is structured in accordance with the outline recommended in the UNFCCC reporting guidelines and provides most of the information necessary to review the inventory. The ERT commends the Party for having improved the transparency of the information provided in the NIR, such as providing more detailed descriptions for the agriculture sector and providing more trend explanations. However, the level of detail in the NIR still varies by sector. The section on LULUCF in particular is short and does not provide sufficient information for the full assessment of underlying assumptions and the rationale for choices of data, methods and other inventory parameters. Also, the transparency of the section on the industrial processes sector could be improved, for example by providing more information on limestone and dolomite use. In addition, trend explanations of emissions and background data in the agricultural sector should be improved. In a few cases, errors or inconsistent use of notation keys have been identified (in the waste and energy sectors). Inconsistencies between the NIR and the CRF tables were identified, such as between CRF table 3 and the NIR (in table Summary 3 Croatia reports using a Tier 1 method and default EF ('T1, D'), while in the NIR 'a higher tier method based on reducing agents' is reported for CO_2 from ferroalloys production). The ERT recommends that Croatia work to improve these issues for its next annual inventory submission. Sector-specific recommendations are given in more detail in the sector chapters of this report.

4. Inventory management

23. Croatia has a centralized archiving system at the CEA. In addition, Ekonerg archives relevant inventory information. According to the NIR, the system includes AD on the calculation of emission estimates, EFs and documents used for inventory planning, preparation and QA/QC.

24. The ERT noted that the Party did not respond in a timely manner to requests made during previous stages of the review and to questions raised by the ERT during the review, as required by paragraph 16 (c) of the annex to decision 19/CMP.1. These difficulties in responding in a timely manner suggest that there are problems in the functioning of the national system. The ERT strongly recommends that the Party adapt the national system in order to ensure that for its future submissions the Party is able to respond in a timely manner to requests during different stages of the review in order to clarify information contained in the inventory, as required by paragraph 16 (c) of the annex to decision 19/CMP.1.

F. Follow-up to previous reviews

25. Following the recommendations provided in the previous review report, Croatia has implemented the following improvements:

(a) Use of higher tier methods for the industrial processes sector (nitric acid and ferroalloys production);

(b) Provision of estimates of actual SF_6 emissions from electrical equipment (for the entire time series), CH_4 emissions from industrial wastewater, and N_2O emissions from anaesthesia;

(c) Improved transparency in the chapter on agriculture relating to clear and detailed information on AD (e.g. tables with time-series information on livestock populations, mineral fertilizer use and types of crops cultivated) and explanations of the trends and annual fluctuations in the data;

(d) Provision of more complete justifications for recalculations.

26. The ERT noted that the following recommendations were not fully implemented:

(a) Provision of emission estimates for actual emissions from consumption of halocarbons and SF_6 (actual SF_6 from electrical equipment was provided but actual HFC emissions from all subcategories are still missing) and emission and/or removal estimates for most of the mandatory categories of the LULUCF sector, except for the category forest land remaining forest land;

(b) Improvement of the description of the LULUCF sector related to methods, underlying assumptions, AD, QC procedures and uncertainty estimates in the chapter on LULUCF.

G. Areas for further improvement

1. Identified by the Party

27. The 2009 NIR includes an improvement plan that builds largely on recommendations made in previous review reports. Short-term and long-term goals for improving the inventory are presented by sector and general and institutional issues are addressed in the NIR. The principal aim of the plan is to improve data collection, use higher tier methods when necessary data are available and use county-specific EFs in the energy, industrial processes, agriculture and waste sectors. In the LULUCF sector, the aim is to develop a land-use database with higher quality data and to develop biomass-expansion factors that are country-specific.

2. Identified by the expert review team

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

(a) The provision of estimates for missing categories, in particular for the energy (CH_4 from oil exploration; CH_4 from natural gas exploration), industrial processes (HFCs from aerosols/metered dose inhalers; HFCs from solvents), LULUCF (all categories except forest land remaining forest land) and waste sectors (CO_2 from managed waste disposal on land; CO_2, CH_4 and N_2O from 6Cb other (non-biogenic));

(b) The provision of a more complete and detailed description of the chapter on the LULUCF sector with regard to methods, underlying assumptions, AD, QC procedures and uncertainty estimates;

(c) The use of higher tier methods for the key categories fugitive CH_4 emissions from oil and natural gas and CO_2 from forest land remaining forest land;

(d) The improvement of inventory planning and management in order to allow the inventory and supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol to be submitted by 15 April each year and to ensure timely responses from the Party during all stages of the review;

(e) A description in the NIR of how recommendations from previous review reports have been implemented and/or addressed;

(f) The submission of all mandatory elements required under Article 7, paragraph 1, of the Kyoto Protocol.

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

II. Energy

A. Sector overview

30. In 2007, the energy sector was the main sector in the GHG inventory of Croatia, accounting for 73.5 per cent of total GHG emissions. Sectoral emissions decreased by 31.2 per cent between 1990 and 1994, but after 1994 there was a slow and steady increase. This was followed by a slight decrease in emissions in 2000 and a second increase of 27.0 per cent between 2001 and 2007, which resulted in an overall increase in emissions of 7.5 per cent between 1990 and 2007. The largest category in this sector is energy industries accounting for 32.2 per cent of emissions in 2007, followed by transport (27.6 per cent), manufacturing industries (16.4 per cent) and other sectors (14.3 per cent). Fugitive emissions from oil and natural gas accounted for the remaining 9.6 per cent of energy-related GHG emissions in 2007.

31. The reporting of the energy sector is transparent. The methodologies are well documented in the NIR with sufficient background information to make it possible to replicate the inventory. The Party explains emission trends for the categories in the energy sector by referring to important drivers, for example the large contribution of hydropower stations and the closure of coal mines. In a few cases drivers are used to calculate emissions (e.g. for emissions from domestic aviation) (see para. 40 below). A quantitative uncertainty assessment has been performed for all categories in the energy sector. The inventory is complete except for two minor sources which are reported as not estimated: fugitive CH_4 from oil exploration and fugitive CH_4 from natural gas exploration.

32. During the 2008 review of the initial report Croatia revised its estimates for several categories for the period 1990–2006 following recommendations made by the ERT; these revised estimates were included in the resubmission of Croatia's 2008 inventory in 2009. In addition, recalculations were performed during the preparation of the 2009 inventory submission in early 2009 based on the revised estimates for 2008. However, for the energy sector these recalculations are very small (+0.09 Gg CO_2 eq for CH_4 from 1B2a due to the correction of an error in the AD of oil refined).

33. The main objectives of the GHG inventory improvement plan provided in the NIR of the 2009 submission with regard to the energy sector are: (i) to reduce data gaps, (ii) to improve data collection, (iii) to reduce uncertainties in AD and EFs, and (iv) to carry out activities aimed at improving methodologies, EFs, documentation and description of the inventory system. Short-term and long-term goals for GHG inventory improvement have been developed. Short-term goals to be completed within one year (i.e. for the 2010 submission) include using higher tier methods for key categories in the energy

sector. Priority will be given to key categories with a high level of uncertainty. However, Croatia faces significant constraints with regard to availability of AD, particularly for the early 1990s. Long-term goals (that take more than one year to complete) include the extensive use of plant-specific data collected in the newly established Register of Environmental Pollution "ROO" of the MEPPPC and the use of more category-specific QA/QC procedures.

B. Reference and sectoral approaches

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

34. Emissions of CO_2 from fuel combustion have been estimated using the reference approach and the sectoral approach. For the year 2007, there is a difference of 5.87 per cent in the CO_2 emission estimates between the two approaches. When only solid and liquid fuels are compared, these differences are much smaller. Croatia stated in the NIR that the differences are due to the large amount of natural gas used for non-energy purposes and natural gas losses from pipelines. As the total fugitive emissions from natural gas reported in CRF table 1.B.2 (74.82 Gg CH_4) accounts for less than 1.0 per cent of total gas consumption, these emissions contribute only to a minor extent to the difference between the reference and sectoral approaches for natural gas consumption. The difference in CO_2 emissions from gaseous fuels (22.1 per cent) originates mainly from the non-energy use of natural gas for ammonia production.

2. International bunker fuels

35. Emissions from international bunker fuels are reported separately from those associated with domestic operations. International marine bunkers data are included in the national energy balance for the period 1994–2007 and are reported separately. For the period 1990–1994, the allocation of data to international marine bunkers is based on expert judgement. Croatia implemented a country-specific approach for separating the consumption of domestic and international jet kerosene on the basis of the number of passengers and flights in domestic and international aviation. This approach is well explained in the NIR and is in line with the IPCC good practice guidance. However, the ERT noted that the quantity of jet kerosene for international bunkers differs between CRF table 1.A(b) and CRF table 1.C by 2.3 per cent. During the centralized review, Croatia explained that in CRF table 1.C the wrong net calorific value was used to calculate consumption of jet kerosene for 2007 (44.96 TJ/Gg was used instead of 43.96 TJ/Gg) and that the error will be corrected in the next annual submission. The ERT recommends that Croatia correct this error in its next annual inventory submission.

3. Feedstocks and non-energy use of fuels

36. The apparent consumption in the reference approach reported by Croatia is higher than that reported to the International Energy Agency (IEA) for all years, with differences of up to 9 per cent, but with only a 1.8 per cent difference for 2007. The IEA data for Croatia are available only from 1992. The reason for these differences is not explained in the NIR so the ERT recommends that Croatia provide an explanation in its next annual inventory submission. In CRF table 1.A(d), carbon stored in non-energy use of natural gas is reported as not occurring ("NO"). The ERT recommends that Croatia reconsider and correct if necessary its reporting of carbon stored and CO_2 emissions from non-energy use of fuel and feedstocks in its next annual inventory submission.

4. Country-specific issues

37. 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 previous ERT encouraged Croatia to include all relevant background information, including the

natural gas composition before and after scrubbing, in its next annual inventory submission, in order to improve transparency. As this information was not included in the current NIR, the ERT repeats the encouragement of the previous review team.

C. Key categories

1. Stationary combustion: liquid, solid, gaseous fuels – CO_2

38. Croatia uses a detailed bottom-up approach based on plant-specific data to estimate CO_2 emissions from public electricity and heat production for the period 1990–2007. The ERT noted that this approach is different from the approach used for estimating the emissions for the rest of the key category. The ERT recommends that Croatia provide information on how the Party reconciles the two approaches (ensuring that neither double counting nor omissions occur) and explain variations in the trend for electricity production and fuel consumption.

39. As indicated in previous review reports, the CO_2 implied emission factors (IEFs) for solid fuels for the category public electricity and heat production (89.47–92.71 t/TJ) for 1990–2007 are below the IPCC default range (94.60–106.70 t/TJ) for all years. This seems to be partly related to country-specific circumstances because the Party imports bituminous coal (92.7 t/TJ and 94.1 t/TJ) for electricity production. However, this does not explain the very low IEFs at the beginning of the 1990s. Therefore, the ERT recommends that Croatia provide in its next inventory submission information on the low IEFs for solid fuels.

2. Civil aviation: liquid fuels – CO_2

40. Fuel consumption and CO_2 emissions decreased by 32.6 per cent between 1990 and 2003, and increased by 51.0 per cent between 2003 and 2007. During the review of the 2008 submission, the ERT recommended that Croatia estimate emissions from domestic aviation using drivers such as ratio of domestic and international passengers, taking into account average distance travelled for passengers on domestic and international routes. The Party followed this recommendation and split total jet kerosene consumption in the energy balance in domestic and international aviation according to the average distance travelled per passenger on domestic and international routes. The ERT commends Croatia for this improvement in its inventory reporting.

3. Road transportation: liquid fuels – CO_2 and N_2O

41. The time series for road transportation has been recalculated based on the COPERT III model for the years 1990–2007. This model represents a tier 2/3 method and is used to estimate emissions of CO_2, CH_4 and N_2O. According to the COPERT III fleet classification, all vehicles are grouped into classes and subclasses based on type of vehicle, volume of the engine and weight of the cargo. The GHG emissions were calculated based on the following two assumptions: (i) motor fuel purchased abroad and consumed in Croatia is equal to fuel purchased in Croatia and consumed abroad; and (ii) fuel consumption, calculated using the COPERT model, should be equal to relevant data from the national energy balance with a difference of less than 1.0 per cent. As the latest version of the COPERT model (COPERT IV) includes significantly revised N_2O EFs, the ERT recommends that Croatia use the COPERT IV model in its next annual inventory submission.

4. Oil and natural gas – CH_4

42. The tier 1 method with default EFs as provided in the Revised 1996 IPCC Guidelines has been used to estimate the fugitive emissions of CH_4 from oil and natural gas. This category has been identified as a key category, contributing 5.0 per cent to total GHG emissions in 2007, and the ERT noted that in the previous review report it was recommended that Croatia use higher tier methods in its future annual

inventory submissions. This recommendation has yet not been implemented; however, the Party explains in the NIR the main steps required to compile the data and input for the use of a tier 3 method in the future. The ERT reiterates the recommendation from previous review reports that Croatia use higher tier methods for this category. In addition, the ERT also noted that CH_4 emissions from oil exploration and CH_4 emissions from natural gas exploration are reported as "NE". The ERT recommends that Croatia provide emission estimates for these categories in its next annual inventory submission, if possible, or provide detailed explanations in its next NIR as to why it was not feasible to provide such estimates.

III. Industrial processes and solvent and other product use

A. Sector overview

43. In 2007, emissions from the industrial processes sector amounted to 4,072.62 Gg CO_2 eq, or 12.6 per cent of total GHG emissions. Emissions from the solvent and other product use sector amounted to 232.52 Gg CO_2 eq, or 0.7 per cent of total GHG emissions. Since 1990, emissions have decreased by 2.9 per cent in the industrial processes sector and increased by 77.6 per cent in the solvent and other product use sector. The key driver for the fall in emissions in the industrial processes sector was the closure of aluminium, ferroalloy and pig iron production facilities that has been taking place since 1990. As a result, emissions from metal production have decreased by 99.97 per cent since 1990. This decrease in emissions was partially offset by an increase in emissions from mineral products (cement production (48.0 per cent) and lime production (58.0 per cent)). Within the industrial processes sector, 46.6 per cent of the emissions were from mineral products, followed by the chemical industry (41.6 per cent), consumption of halocarbons and SF_6 (11.8 per cent) and metal production (0.01 per cent).

44. Croatia has implemented a number of recommendations made in previous review reports regarding key categories, which has lead to an increase in the completeness and transparency of the inventory. With respect to completeness, for the solvent and other product use sector, Croatia now includes N_2O emissions from anaesthesia. Croatia has also applied a plant-specific EF for nitric acid production, and used a higher tier method and recalculated the time series for ferroalloys. Although the Party still does not estimate actual emissions of HFCs for consumption of halocarbons and SF_6, some improvements have also been made in this category, specifically reporting of actual emissions of SF_6 from electrical equipment.

45. The previous ERT found that although QA/QC activities for the industrial processes sector were generally appropriate, the activities were poorly documented in the NIR. Furthermore, the previous ERT concluded that QC procedures should be extended to include plausibility checks of the data. At that time, Croatia indicated that it intended to make improvements to QA/QC activities for the industrial processes sector by finalizing and implementing the QA/QC plan as part of its next annual inventory submission. However, the present ERT was unable to identify any further elaboration of QA/QC activities in the 2009 submission. The QA/QC plan was not included in the submission, so it was not possible to identify whether specific activities outlined in the plan have been implemented to improve the quality of the inventory for the industrial processes sector. The ERT reiterates the recommendation of the previous ERT to document transparently QA/QC activities for this sector in the NIR of Croatia's next annual inventory submission.

B. Key categories

1. Ammonia production – CO_2

46. Croatia estimates emissions for this key category based on the amount of natural gas consumed. The ERT commends Croatia for implementing the recommendation made by the previous ERT and for recalculating the EF (55.62 t CO_2/TJ) for natural gas to ensure that the same EF is used to estimate

natural gas used as fuel and natural gas used as feedstock. Croatia includes combustion and process-related emissions from ammonia production in the industrial processes sector. However, considering that Croatia is able to separately calculate CO_2 emissions from natural gas used as a feedstock and natural gas used for combustion, the ERT encourages Croatia to report all combustion-related emissions under the energy sector, consistent with the Revised 1996 IPCC Guidelines. This separation of industrial process emissions from combustion-related emissions will enhance the comparability of emission estimates with other Parties.

2. Consumption of halocarbons and SF_6 – HFCs

47. The reporting of fluorinated gases is not complete. For HFCs, only potential emissions are reported, with the exception of emissions from aerosols/metered dose inhalers and solvents, which are reported as "NE". For SF_6, only actual emissions are reported. Emissions of PFCs are reported as "NO". Croatia has attempted to develop estimates of actual emissions of HFCs by distributing questionnaires to facilities identified as possible sources of these gases. This process did not provide sufficient data to develop actual emission estimates. Although sufficient data were not gathered in this effort, the ERT welcomes these efforts and Croatia's intent to strengthen efforts to collect the necessary data for this category in the future. Following the recommendations made in the previous review report, the ERT strongly recommends that Croatia make the necessary efforts to collect the relevant data and to estimate actual emissions of HFCs in its next annual inventory submission.

48. Croatia does not produce HFCs (or PFCs), and estimates potential emissions through the use of import and export data. The ERT welcomes the improvements implemented by Croatia in response to the previous review report, specifically the cluster analysis used to estimate potential HFC emissions from refrigeration and air conditioning for the period 1990–1995 and the estimation of potential emissions of fluoroform (HFC-32) for the period 1990–1999.

49. The ERT commends Croatia for including actual emissions of SF_6 from electrical equipment. The ERT recommends that Croatia complete CRF table 2(II).F for SF_6 emissions from electrical equipment based on the information provided by the relevant domestic companies. The ERT also encourages Croatia to make the necessary efforts for estimating potential emissions from this category in its next annual inventory submission.

C. Non-key categories

1. Limestone and dolomite use – CO_2

50. The NIR states that limestone was only used in 1990–1991 for pig iron production. However, AD are reported for limestone use for 1992 onwards and emission estimates for this category are included in the national totals. In response to a question raised by the ERT during the centralized review, Croatia indicated that limestone was used by one glass manufacturer. The ERT asked for further information from the Party to determine whether reporting of emissions from dolomite consumption was complete. The Party informed the ERT that according to the Regulation on the Monitoring of Greenhouse Gas Emissions in the Republic of Croatia (Official Gazette 1/2007) each industrial facility that is a source of GHGs should report the required AD in order to obtain more accurate emission estimates. Croatia hopes to use this information to provide more detailed data in the 2010 annual submission. The ERT welcomes Croatia's proposal to increase the completeness and transparency of the documentation of emission estimates from this category and encourages Croatia to implement these improvements in its next annual inventory submission.

2. Ferroalloys production – CO_2

51. The ERT welcomes the implementation of a higher tier method for estimating CO_2 emissions from ferroalloys production based on the quantity of reducing agents consumed. In the last inventory submission, Croatia estimated CO_2 emissions by applying material-specific EFs to the quantity of ferroalloys produced. In response to a recommendation of the previous ERT, Croatia calculated CO_2 emissions based on the quantity of reducing agent consumed. Emissions were recalculated for the years 1990–2003, when ferroalloy production ceased. The ERT encourages Croatia to review the trend for 2001–2003 for ferroalloys, as the IEFs were identified as outliers, ranging from 0.1 to 35.3 t/t. They are outside the IPCC default range (1.3 to 6.5 t/t) and among the lowest and highest of reporting Parties (ranging from 0.002 to 35.3 t/t).

3. Iron and steel production – CO_2

52. Croatia currently includes CO_2 emissions from pig iron production in the energy sector because coke oven coke is included in the energy balance. Croatia does not include CO_2 emissions from pig iron production in industrial processes in order to avoid double counting. The ERT encourages Croatia to report, if possible, these emissions in industrial processes. Alternatively, the ERT recommends that the Party provide detailed explanations, in its next national inventory report, as to why it was not possible.

IV. Agriculture

A. Sector overview

53. In 2007, emissions from the agriculture sector amounted to 3,409.66 Gg CO_2 eq, or 10.5 per cent of total GHG emissions. Since 1990, emissions have decreased by 21.1 per cent. The key driver for the fall in emissions is the reduction in the cattle population since 1991. In 2007, 65.5 per cent of the emissions came from agricultural soils (N_2O), followed by 23.1 per cent from enteric fermentation (CH_4) and 11.4 per cent from manure management (CH_4 and N_2O). Field burning of agricultural residues, rice cultivation and prescribed burning of savannas are reported as "NO".

54. The ERT commends Croatia for providing in the NIR of its 2009 submission detailed information on the crops included in estimates of direct soil emissions from crop residues and nitrogen (N)-fixing crops. To further improve transparency of the inventory, the ERT recommends that Croatia include in its next annual inventory submission clear and detailed information on AD (e.g. tables with time-series information on livestock populations, mineral fertilizer use and types of crops cultivated) and explanations of the trends and annual fluctuations in the data.

55. The ERT noted that the characterization of dairy and non-dairy cattle is not in line with the IPCC good practice guidance because all mature cows are reported as dairy cattle. The ERT noted that this may affect the estimate of the emissions from enteric fermentation and manure management. During the centralized review, Croatia informed the ERT that the necessary data are not available for such a characterization of cattle; however, the ERT recommends that the Party address the relevant institutions on this issue. The ERT recommends that Croatia investigate and correct if necessary this characterization of cattle and the consistency between the livestock categories and the EFs used and that it provide further information on this in its next annual inventory submission.

56. Croatia's estimate of AD uncertainty for livestock (30 per cent) is among the highest of reporting Parties. The high uncertainty may reflect the poor quality of statistical data available for the war years (1991–1995), but it is unclear why the current AD uncertainty estimate is also 30 per cent. With regard to agricultural soils, the uncertainty for the EF (40 per cent) is lower than that reported by other Parties although Croatia uses the same IPCC default factor (0.0125 kg N_2O-N/kg N). The ERT encourages

Croatia to investigate these issues and to provide information on these two points in its next annual inventory submission.

B. Key categories

1. Enteric fermentation – CH_4

57. In 2007, this category accounted for 787.92 Gg CO_2 eq, or 23.1 per cent of sectoral emissions. Emissions from this category decreased by 35.5 per cent between 1990 and 2007. Croatia uses a tier 2 method to estimate emissions from enteric fermentation from cattle. The ERT recommends that Croatia investigate the characterization of cattle (see para. 55 above) and the related milk yields which could affect the EF and the emission estimates, and correct if necessary, and that the Party provide further information in its next annual inventory submission on the subcategories included under dairy and non-dairy cattle.

58. For animals other than cattle, Croatia uses a tier 1 methodology with IPCC default EFs specific of a cool climate zone, for a developing country in Eastern Europe. The ERT encourages Croatia to provide in the NIR of its next annual inventory submission information on its national circumstances that may explain why EFs for developing countries in cool climate zones are more appropriate for Croatia than those for developed countries.

2. Agricultural soils – N_2O

59. In 2007, this category accounted for 2,231.99 Gg CO_2 eq, or 65.5 per cent of sectoral emissions. Emissions from this category decreased by 10.4 per cent between 1990 and 2007. Croatia uses a tier 1a methodology to estimate the direct and indirect emissions of N_2O and uses IPCC default parameters except for the volatilization of nitrogen oxide (NO_X) and ammonia (NH_3) for which more detailed country-specific values are used. The ERT recommends that Croatia provide in the NIR of its next annual inventory submission a time series for the different types of fertilizer used and that it correct the values for fraction of N emitted as NH_3 and NO_X presented in table 6.5-1 of the NIR which are not consistent with Croatia's reference which is EMEP/CORINAIR values (0.02 should be used instead of 0.2 for all fertilizer types except urea).

60. According to the NIR, the fraction of synthetic fertilizer N applied to soils that volatilizes as NH_3 and NO_X were obtained from documents submitted under the Convention on Long-Range Transboundary Air Pollution for each fertilizer type. These values are contained in the NIR but the $Frac_{GASF}$ value in CRF table 4.D still shows the IPCC default value of 0.1. The ERT recommends that Croatia harmonize the information contained in CRF table 4.D with the information in the NIR of its next annual inventory submission.

3. Manure management – N_2O

61. In 2007, this category accounted for 222.83 Gg CO_2 eq, or 6.5 per cent of sectoral emissions. N_2O emissions decreased by 41.2 per cent between 1990 and 2007 in line with a general decrease in the size of animal populations. Croatia uses IPCC default EFs. In CRF table 4.B(b) the sum of N excreted by animal waste management systems is not equal to the mathematical product of livestock number and excretion rates. In particular, the N excretion rate is not reported for goats (the notation key "NO" is used). The ERT recommends that Croatia review and correct this discrepancy in its next annual inventory submission.

C. Non-key categories

Manure management – CH_4

62. In 2007, this category accounted for 166.93 Gg CO_2 eq, or 4.9 per cent of sectoral emissions. Emissions from this category decreased by 26.9 per cent between 1990 and 2007. Croatia uses a tier 1 methodology with IPCC default EFs for developing countries in cool climate zones and IPCC default EFs specific of a cool climate zone, for a developing country in Eastern Europe. The ERT encourages Croatia to provide in the NIR of its next annual inventory submission information on its national circumstances which may explain why the EFs for developing countries in cool climate zones are more appropriate than those for developed countries.

63. CRF table 4.B(a)s2 has not been completed correctly; the sum of the allocation values (per cent) for each livestock category should be equal to 100, but the sum of the reported values equals 700. As the methodology for CH_4 emissions from manure management is not used in this allocation, the notation keys not applicable "NA" or "NE" may be appropriate. The ERT recommends that Croatia completely revise and correct errors in this table in its next annual inventory submission.

V. Land use, land-use change and forestry

A. Sector overview

64. In 2007, net GHG removals from the LULUCF sector amounted to 6,302.63 Gg CO_2 eq. Since 1990, net removals have increased by 50.6 per cent. The key driver for the rise in removals is forest land remaining forest land, as this is the only LULUCF category for which Croatia has estimated and reported net carbon stock changes. After the war, Croatia recovered over time, in terms of forest management practices. From 1995–2007, commercial fellings significantly increased. Furthermore, there were increases in forest area and annual increment. All of these factors drove the increase in net removals over the time series. The ERT did not find any improvements that had been made to the inventory since the previous submission.

65. CO_2 emissions and removals are reported by Croatia only for the category forest land remaining forest land. The ERT strongly recommends that Croatia enhance the completeness of its reporting of the LULUCF sector by estimating and reporting emissions and removals for land converted to forest land in its next annual inventory submission, as afforestation is occurring and data are available to the Party in its statistical yearbooks. Emissions and removals of CO_2 in cropland, grassland, wetlands, settlements and other land categories are reported as "NE" and "NO", and CO_2 and non-CO_2 emissions from wildfires are reported as "NE" under cropland, grassland and wetlands. The ERT strongly recommends that Croatia estimate and report GHG emissions and removals for all land-use categories in its next annual inventory submission. To enhance the completeness of the NIR in its next annual inventory submission, the ERT further recommends that Croatia provide information on land-use pattern, including area under different land-use categories during the inventory year and a land-use change matrix for the years since 1990 that incorporates the areas subject to change from one land-use category to another. During the centralized review, the Party informed the ERT of progress made when evaluating available land-cover data and planning for reporting land-use conversions in the future. The ERT commends Croatia for its efforts made so far in this regard and encourages the Party to strengthen its efforts for its next annual inventory submission. The ERT encourages Croatia to improve the completeness of the CRF tables by providing explanations and clarifications in the documentation boxes, as this is good practice.

66. The ERT found that there were limited descriptions of methods, AD and assumptions used. The ERT recommends that the Party provide more detailed descriptions of methods, underlying assumptions and AD. The ERT reiterates the specific recommendation included in previous review

reports that Croatia be more transparent regarding QC procedures, particularly those for AD and that the Party add a description of methods for estimating uncertainty values for the LULUCF sector. During the centralized review, Croatia provided more information on sources of AD as well as the type of uncertainty analysis applied. The ERT encourages the Party to include this additional information in its next annual inventory submission.

67. In the 2008 inventory submission, CO_2 emissions and removals from the sector were recalculated for the year 1990 owing to the availability of revised estimates of AD for forest area and the annual net carbon increment. In the previous review report it was recommended that Croatia provide the rationale and explanations for the new AD in its 2009 inventory submission, but this information has not been included. During the centralized review, Croatia explained that before submitting the 2008 inventory, the calculation of carbon stock gain was performed by using area data that included both forest vegetation and degraded forest, but the annual increment referred only to forest vegetation. The Party recognized the inconsistency of such an approach, but data on annual increment for degraded forest could not be obtained, so it was decided to use a more consistent and accurate approach for the 2008 submission, using data (forest area and annual increment) which refer only to forest vegetation. The ERT recommends that Croatia include this information in its next annual inventory submission.

B. Key categories

Forest land remaining forest land – CO_2

68. Even though forest land remaining forest land is a key category, the carbon stock changes for this category are estimated using a tier 1 method. For the estimates, country-specific data on the average annual increment in net carbon are used, but all other EFs and parameters are taken from the IPCC good practice guidance for LULUCF. The ERT recommends that Croatia adopt, in its next annual inventory submission, a higher tier method to estimate emissions from forest land remaining forest land, since it is a key category. During the centralized review, Croatia informed the ERT of the institutional steps that are already being taken to plan for data collection to allow the Party to develop country-specific EFs. The ERT commends these initial efforts. The ERT recommends that Croatia further stratify its forests according to more detailed forest types, using data that are available for Croatia, as reported by the Party to the previous ERT. During the centralized review, Croatia informed the ERT that it will address this issue, to the extent possible, in its 2010 submission.

69. During previous stages of the review, it was found that the trend of net carbon stock changes in living biomass on forest land remaining forest land fluctuates over the time series. The following unusual inter-annual changes were identified: 1990–1991 (91.6 per cent), 2005–2006 (–10.0 per cent) and 2006–2007 (–8.0 per cent). During the centralized review, Croatia provided explanations for the identified inter-annual changes. The Party explained the main reasons for these fluctuations: (i) during the war (1991–1995) fellings decreased, which explains the large inter-annual variations in net carbon stock changes for LULUCF between 1990 and 1991 (beginning of the war), and (ii) drought and high temperatures led to an increase in the areas of forest fire, which explains the inter-annual variations in net carbon stock changes in the later years of the time series. The ERT considers the explanations offered by the Party to be reasonable and recommends that Croatia include these explanations in its next annual inventory submission.

70. CRF table 5.A reports changes in carbon stocks only for the living biomass carbon pool. Net carbon stock changes in dead organic matter and net carbon stock change in mineral soils and organic soils are reported as "NE". Areas with degraded forest vegetation are not included in the inventory calculations; the ERT recommends that Croatia include carbon gains and losses for these areas. The Party informed the ERT that it has initiated planning efforts to improve emission estimates for the LULUCF sector, which includes collecting data on degraded forests. The ERT commends these initial

efforts and encourages Croatia to build on them. The ERT recommends that Croatia estimate changes in all IPCC carbon pools in its next annual inventory submission.

VI. Waste

A. Sector overview

71. In 2007, emissions from the waste sector amounted to 867.60 Gg CO_2 eq, or 2.7 per cent of total GHG emissions. Since 1990, emissions have increased by 49.9 per cent. According to the NIR, the key driver for the rise in emissions is the better standard of living, leading to increased consumption and therefore more waste, even though this rise is compensated by measures undertaken to reduce and recycle waste. Within the sector, 69.5 per cent of the emissions were from solid waste disposal on land, followed by 30.5 per cent from wastewater handling (CH_4 and N_2O). The remaining 0.01 per cent was from CO_2 from the incineration of waste. CH_4 emissions account for 90.2 per cent, N_2O emissions for 9.8 per cent and CO_2 emissions for 0.01 per cent.

72. In the 2009 submission, N_2O emissions from industrial wastewater handling and sludge treatment were not estimated for the entire time series and they were reported as not occurring. The ERT recommends that Croatia make all the necessary efforts to report emission estimates for these categories in its next annual inventory submission. The ERT encourages Croatia to calculate EFs for any missing categories that lack EFs by using sources such as the IPCC emission factor database. The use of notation keys in the CRF tables is complete and consistent with the information in the NIR. Total AD from unmanaged waste disposal sites is reported as included elsewhere ("IE") although it should be aggregated from the AD of its subcategories (deep and shallow unmanaged waste disposal sites). Uncertainty estimation is established using the tier 1 method of the IPCC good practice guidance.

73. Recalculations conducted in the 2009 submission using new AD for solid waste disposal on land led to an increase of 0.47 per cent in total emissions for 2006 and remained without changes in 1990. Croatia plans to improve its waste statistics and to carry out sector-specific studies related to solid waste disposal on land in order to improve the use of the tier 2 method for this category. Croatia also plans to establish an information system for all wastewater handling systems. According to the NIR, Croatia conducted tier 1 general inventory QC procedures for selected unspecified activities and tier 2 source-specific QC procedures for solid waste disposal on land, checking EFs and AD. The ERT encourages Croatia to use tier 2 QC procedures for wastewater handling, which is a key category according to the secretariat's key category assessment.

B. Key categories

Solid waste disposal on land – CH_4

74. CH_4 emissions from solid waste disposal on land is the only key category (according to both level and trend assessment) in the waste sector identified in the 2009 inventory submission. The estimate covers managed and unmanaged (deep and shallow) solid waste disposal on land. Croatia uses the tier 2 method to estimate CH_4 emissions from solid waste disposal on land, with country-specific AD and a combination of country-specific EFs and IPCC default values. The method and variables used are described in the NIR, even when transparency might be improved with more detailed AD. The waste AD had changed due to improvements in data and revised calculations since the previous submission, leading to a recalculation in this category with no impact in 1990 and a small impact in 2006.

75. The ERT noted the use of interpolation methods. The ERT recommends that Croatia make efforts to apply a methodology to determine the quantity and composition of waste, reconstruct historical data and explain how the consistency in emission estimates is ensured in its next annual inventory submission.

76. The ERT noted the use of the notation key "IE" in Table 6A when its components are included there. The ERT recommends that Croatia check the use of notation keys for unmanaged waste disposal sites in its next annual inventory submission.

C. Non-key categories

1. Wastewater handling – CH_4 and N_2O

77. Emissions from wastewater handling are estimated using a tier 1 method and EF default values from the Revised 1996 IPCC Guidelines. In the absence of AD, values for available years (1990, 1995, 2000 and for the period 2003–2007) have been interpolated to other years in the time series. N_2O emissions from industrial wastewater are reported as "NO". According to the amount of industrial wastewater reported, the correct notation key would be "NE" because large emissions of industrial wastewater lead to non-negligible N_2O emissions. Emissions from and treatment of sludge are not explained in the NIR, even when sludge is mentioned in waste incineration. During the centralized review, the ERT encouraged Croatia to fill these data gaps, and Croatia informed the ERT that it intends to strengthen its efforts to collect the necessary information, provide information in the NIR and use correct notation keys.

78. Emissions from human sewage for 1990 and 1991 were extrapolated using data for the period 1992–1994. Emissions for the period 2004–2007 were calculated by extrapolating data for the years 2002 and 2003. The selection of just two years leads to a deviation of the trend. Therefore, the ERT recommends that Croatia calculate emissions for the years 2004–2007 using the data available for the years 2001–2003 in accordance with the IPCC good practice guidance.

2. Waste incineration – CO_2, CH_4 and N_2O

79. Croatia included CO_2 emissions from incineration of clinical waste, hazardous waste, and plastics for 2007. For other years, information included only clinical waste and has been recalculated for previous years due to energy recovery. The ERT encourages Croatia to develop EFs in order to provide estimates for emissions of CH_4 and N_2O for these activities, including emissions from incineration of sewage sludge, in its next annual inventory submission.

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

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

80. Croatia did not report on a voluntary basis information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The ERT recommends that the Party report information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in its next annual submission.

B. Information on Kyoto Protocol units

1. Standard electronic format and reports from the national registry

81. In its 2009 annual submission, Croatia has not provided information on its accounting of Kyoto Protocol units in the SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. At the time of the review, the registry had not commenced live operations due to the pending decision on the calculation of the assigned amount of Croatia in accordance with Article 3, paragraphs 7 and 8, of the

Kyoto Protocol.[5] Therefore, the standard independent assessment report and SEF comparison report for Croatia were not available.[6]

2. National registry

82. Croatia did not provide information on the national registry in its 2009 annual submission and did not provide updated information on the registry in response to questions raised by the ERT during the centralized review. However, during previous stages of the review, the Party indicated that information on the registry was submitted during the review of the initial report of Croatia.

83. The results of the technical assessment of the national registry reported in the independent assessment report submitted to the previous ERT during the review of the initial report of Croatia, identified the following minor limitations in registry readiness: no evidence was provided on a disaster recovery test plan; limited evidence was provided on a time validation plan; little evidence was provided on version change management; little evidence was provided to demonstrate that tests were conducted and documented; little evidence was provided on how Croatia deals with incidents; and little evidence was provided on how change management is performed.

84. In response to the draft review report, Croatia indicated that its national registry underwent the initialization process on 11 December 2009, after the following measures were adopted:

(a) A detailed plan for the disaster recovery plan exercise was prepared; the testing with the international transaction log (ITL) took place in the first week of September 2009;

(b) NTP (Network Time Protocol) procedure was configured and the results provided to the ITL service desk in September 2009;

(c) A change in the national registry was made, the forms were filled (impact assessment form, change request form, form for summary of change requests) and proves were provided to the ITL service desk in September 2009;

(d) Testing of the national registry was performed, evidence was collected and provided to the ITL service desk in September 2009;

(e) Incidents were recorded in the incident record sheet and provided to the ITL service desk in September 2009;

(f) A new web server (virtual machine) and firewall in the backup system were installed and finalized by 10 August 2009.

85. The Party indicated that it would report, in its next annual submission, on additional information concerning practical user guidance, the initialization process, the detailed plan for the disaster recovery plan exercise, NTP procedure, change and testing of the national registry, incident recording, installation of a new web server and firewall in the backup system as well as the other improvements. The ERT recommends that Croatia provide this information in its next inventory submission.

3. Calculation of the commitment period reserve

86. Croatia has not reported its commitment period reserve in its 2009 annual submission. In response to questions raised by the ERT during the centralized review, the Party indicated that it

[5] FCCC/IRR/2008/HRV.

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

intended to provide such information during the review process. The ERT noted that this information has not yet been completed due to the pending decision on the calculation of the commitment period reserve in accordance with paragraph 6 of the annex to decision 11/CMP.1 and of the assigned amount of Croatia in accordance with Article 3, paragraphs 7 and 8, of the Kyoto Protocol and recommends that Croatia include information on its commitment period reserve in its next annual submission.

C. Changes to the national system

87. Croatia did not report on any changes in its national system since the previous annual submission. In its response to previous stages of the review, the Party indicated that no changes in the national system were made. In addition, Croatia informed the ERT that MEPPPC has started a process of establishing an independent expert group to support the MEPPPC in the inventory approval and improvement process. The ERT concluded that Croatia's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1 and recommends that the Party provide information on any changes in the national system in its next annual submission.

D. Changes to the national registry

88. In its 2009 NIR, Croatia did not report information on changes in its national registry. However, in its response to previous stages of the review, the Party indicated that information on the registry was submitted during the review of the initial report of Croatia. Since the NIR was submitted in May 2009 and the report of the review of the initial report of Croatia was published in August 2009, all relevant information was included in the latter. The ERT recommends that the Party report in its next annual submission any changes in its national registry in accordance with section I G of the annex to decision 15/CMP.1.

VIII. Conclusions and recommendations

89. Croatia provided its annual submission on 26 May 2009 (CRF tables) and 27 May 2009 (NIR). The Party indicated that the 2009 annual submission is its voluntary submission under the Kyoto Protocol. The annual submission contains the GHG inventory. No supplementary information under Article 7, paragraph 1, of the Kyoto Protocol was provided. The main reasons for not providing this information are that the national registry has not yet started live operations due to the pending decision on the calculation of the assigned amount of Croatia in accordance with Article 3, paragraphs 7 and 8, of the Kyoto Protocol. The ERT recommends that Croatia report this information its next annual submission, including supplementary information under Article 7, paragraph 1, by 15 April 2010, as required by decision 15/CMP.1.

90. The ERT concluded that the inventory was prepared and reported generally in accordance with the UNFCCC reporting guidelines. The Party submitted a complete set of CRF tables for the years 1990–2007 and an NIR; these are both complete in terms of geographical coverage, years and sectors, as well as generally complete in terms of categories and gases. Some of the categories, particularly in the energy, industrial processes, LULUCF and waste sectors, were reported as "NE". The ERT recommends that the Party provide estimates for these categories in its next annual inventory submission in order to improve completeness, giving priority to missing categories for which the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF provide methodologies for their estimation.

91. Croatia did not report on a voluntary basis the information required under Article 7, paragraph 1, of the Kyoto Protocol.

92. The Party's inventory is generally in line with the UNFCCC reporting guidelines, the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for

LULUCF. The 2009 inventory submission shows significant improvement with regard to major issues such as completeness and increased use of higher tier methods. However, the ERT identified a need to use higher tier methods for the key categories fugitive CH_4 emissions from oil and natural gas and CO_2 from forest land remaining forest land, and to further improve completeness (in the energy, industrial processes, LULUCF and waste sectors).

93. Croatia did not report information on its accounting of Kyoto Protocol units in accordance with section I E of the annex to decision 15/CMP.1.

94. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1, although problems were observed regarding the Party's ability to respond in a timely manner to issues raised during the different stages of the review process.

95. The national registry has not yet started live operations mainly due to the pending decision on the calculation of the assigned amount of Croatia in accordance with Article 3, paragraphs 7 and 8, of the Kyoto Protocol. In response to the draft review report, the Party informed the ERT that the registry underwent the initialization process on 11 December 2009.

96. In the course of the review, the ERT formulated a number of recommendations[7] relating to the completeness and transparency of reporting and the accuracy of the estimates. The key recommendations are that Croatia:

(a) Provide estimates for missing categories, in particular for energy (CH_4 from oil exploration; CH_4 from natural gas exploration), industrial processes (HFCs from aerosols/metered dose inhalers; HFCs from solvents), LULUCF (all categories except forest land remaining forest land) and waste sectors (CO_2 from managed waste disposal on land; CO_2, CH_4 and N_2O from 6Cb other (non-biogenic));

(b) Provide a more complete and detailed description of the methods, underlying assumptions, AD, QC procedures and uncertainty estimates in the chapter on LULUCF;

(c) Use higher tier methods for the key categories fugitive CH_4 emissions from oil and natural gas and CO_2 from forest land remaining forest land;

(d) Improve inventory planning and management in order to allow the inventory and supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol to be submitted by 15 April each year and to ensure timely responses to questions received during all stages of the review;

(e) Describe in its next NIR how recommendations from previous review reports have been implemented and/or addressed;

(f) Submit all information under Article 7, paragraph 1, of the Kyoto Protocol as required by the annex to decision 15/CMP.1.

IX. Questions of implementation

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

[7] For a complete list of recommendations, the relevant chapters of this report should be consulted.

Annex I

Documents and information used during the review

A. Reference documents

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

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

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

"Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

Status report for Croatia 2009. Available at <http://unfccc.int/resource/docs/2009/asr/hrv.pdf>.

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

FCCC/ARR/2008/HRV. Report of the individual review of the greenhouse gas inventory of Croatia submitted in 2007 and 2008. Available at <http://unfccc.int/resource/docs/2009/arr/hrv.pdf>.

FCCC/IRR/2008/HRV. Report of the review of the initial report of Croatia. Available at <http://unfccc.int/resource/docs/2009/irr/hrv.pdf>.

UNFCCC. Standard independent assessment report, Parts I and II. Unpublished document.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Višnja Grgasović (Ministry of Environmental Protection, Physical Planning and Construction), including additional material on the methodologies and assumptions used.

Annex II

Acronyms and abbreviations

AD	activity data
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
ERT	expert review team
Gg	gigagram
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFC-32	fluoroform
HFCs	hydrofluorocarbons
IEA	International Energy Agency
IE	included elsewhere
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
LULUCF	land use, land-use change and forestry
N	nitrogen
NA	not applicable
NE	not estimated
NO	not occurring
N_2O	nitrous oxide
NH_3	ammonia
NIR	national inventory report
NO_X	nitrogen oxide
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
t	tonne (1,000 kilograms)
TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change

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