COMPLIANCE COMMITTEE

CC/ERT/ARR/2009/1
19 January 2009

Report of the individual review of the greenhouse gas inventories of Italy submitted in 2007 and 2008

Note by the secretariat

The report of the individual review of the greenhouse gas inventories of Italy submitted in 2007 and 2008 was published on 16 January 2009. 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/2008/ITA, 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 greenhouse gas inventories of Italy submitted in 2007 and 2008*

* In the symbol for this document, 2008 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the centralized review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Italy, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. In accordance with the conclusions of the twenty-seventh session of the Subsidiary Body for Implementation the focus of the review is on the most recent 2008 submission[1]. The review took place from 1 to 6 September 2008 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. Inga Konstantinaviciute (Lithuania); energy – Mr. Michael Strogies (Germany) and Mr. Hristo Vassilev (Bulgaria); industrial processes – Mr. Masato Yano (Japan) and Ms. Valentina Idrissova (Kazakhstan); agriculture – Mr. Paul Duffy (Ireland) and Ms. Batima Punsalmaa (Mongolia); land use, land-use change and forestry (LULUCF) – Mr. Emil Cienciala (Czech Republic) and Richard Volz (Switzerland); and waste – Mr. Sabin Guendehou (Benin) and Ms. Tatiana Tugui (Moldova). Mr. Gugele and Ms. Tugui were the lead reviewers. The review was coordinated by Ms. Ruta Bubniene (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 Italy, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Inventory submission and other sources of information

3. The 2008 annual inventory was submitted on 16 April 2008; it contains a complete set of common reporting format (CRF) tables for the period 1990–2006 and a national inventory report (NIR). This is in line with decision 15/CMP.1. The Party indicated that the 2008 submission is also its voluntary submission under the Kyoto Protocol.[2] In its 2007 submission, Italy included a complete set of CRF tables for the period 1990–2005 and an NIR. The CRF tables were submitted on 13 April 2007 and the NIR and revised CRF tables were submitted on 2 August 2007. Where needed the expert review team (ERT) also used additional information, including that provided during the review. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

4. In 2006 (as reported in the 2008 annual inventory submission), the main GHG in Italy was carbon dioxide (CO_2), accounting for 85.9 per cent of total GHG emissions[3] expressed in CO2 eq, followed by methane (CH_4) (6.7 per cent), and nitrous oxide (N_2O) (6.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6) collectively accounted for 1.2 per cent of the overall GHG emissions in the country. The energy sector accounted for 83.4 per cent of the total GHG emissions, followed by industrial processes (6.5 per cent), agriculture (6.5 per cent), waste (3.3 per cent), and solvents (0.4 per cent). Total GHG emissions amounted to 567,922.20 Gg CO_2 eq and increased by 9.9 per cent between the base year[4] and 2006. Emissions mainly increased in road transportation, public electricity and heat production, petroleum refining, and households and services. In 2005 (as contained in

[1] FCCC/SBI/2007/34, paragraph 104.
[2] Parties may start reporting information under Article 7, paragraph 1, of the Kyoto Protocol from the year following the submission of the initial report, on a voluntary basis (decision 15/CMP.1).
[3] 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.
[4] Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

the 2007 inventory submission), total GHG emissions amounted to 579,547.66 Gg CO_2 eq. The shares of gases and sectors in 2006 (as reported in the 2008 annual inventory submission) were similar to those of 2005 (as reported in the 2007 inventory submission). The main changes are declining shares of N_2O and in industrial processes sector in 2008 because of reduction measures in adipic acid production.

5. Tables 1 and 2 show GHG emissions by gas and by sector, respectively.

D. Key categories

6. Italy has reported tier 1 and tier 2 key category analyses, both level and trend assessment, as part of its 2008 submission. The same key categories were identified in the 2007 and 2008 submissions. The Party did not identify key categories using a qualitative approach. Italy has included the LULUCF sector in its key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF).

7. The key category analysis performed by the Party and by the secretariat[5] produced similar results. The categorization used by the Party differs from that used by the secretariat. Some of these differences are due to the fact that Italy applies a tier 2 key category analysis. The following key categories were identified by the secretariat but not by the Party: manure management – CH_4, lime production – CO_2, civil aviation - CO_2, and nitric acid production – N_2O. The following key categories were identified by the Party but not the secretariat: stationary combustion – N_2O, wastewater handling – CH_4, wastewater handling - N_2O, animal production – N_2O, and land converted to cropland – CO_2. The secretariat identified emissions from stationary combustion – other fuels (CO_2) as a key category; however, the Party includes this under stationary combustion – liquid fuels. Italy includes N_2O from the other – mobile category (1A5b) and therefore identified stationary combustion – N_2O as a key category. The secretariat does not include this type of emission in the stationary combustion category.

8. The Party does not provide detailed information on the level of key category analysis for the base year and the ERT recommends that Italy provide this information in its next annual submission. In addition, the ERT recommends that the Party report CO_2 emissions from stationary combustion – other fuels separately from CO_2 emissions from stationary combustion – liquid fuels.

9. The same key categories were identified in the 2007 and 2008 submissions. The ERT noted that the NIR does not provide a clear description of if and how the key category analysis is used to prioritize the improvement of the inventory. Therefore, the ERT recommends that Italy provide this information in its next annual submission.

E. Main findings

10. The inventory is in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance, and the IPCC good practice guidance for LULUCF. The 2008 annual inventory submission is of a high quality and the Party addressed many issues raised during the review of the 2006 submission. The ERT made several recommendations to further improve the quality of the inventory. Transparency

[5] 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. 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.

Table 1. Greenhouse gas emissions by gas, 1990–2006

Greenhouse gas emissions	Gg CO_2 eq								Change base year–2006 (%)
	Base year[a]	1990	1995	2000	2003	2004	2005	2006	
CO_2	434 783.22	434 783.22	445 845.18	464 276.38	487 837.01	491 054.86	491 833.79	488 039.37	12.2
CH_4	41 614.15	41 614.15	44 117.92	44 290.82	41 085.99	39 928.39	39 593.60	38 158.17	–8.3
N_2O	38 009.27	38 009.27	38 730.67	40 881.94	40 402.59	41 699.51	40 428.83	35 120.18	–7.6
HFCs	351.00	351.00	671.29	1 985.67	3 795.82	4 515.13	5 267.21	5 932.24	1 590.1
PFCs	1 807.65	1 807.65	490.80	345.85	497.63	350.00	361.23	282.41	–84.4
SF_6	332.92	332.92	601.45	493.43	464.69	491.57	460.17	389.84	17.1

[a] Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

Table 2. Greenhouse gas emissions by sector, 1990–2006

Sectors	Gg CO_2 eq								Change base year–2006 (%)
	Base year[a]	1990	1995	2000	2003	2004	2005	2006	
Energy	419 445.58	419 445.58	432 672.36	453 425.24	475 372.74	477 884.14	478 016.50	473 681.03	12.9
Industrial processes	36 544.50	36 544.50	34 589.69	34 964.85	38 161.66	40 640.77	41 119.03	36 782.64	0.7
Solvent and other product use	2 394.46	2 394.46	2 179.77	2 284.53	2 166.67	2 144.21	2 139.42	2 148.17	–10.3
Agriculture	40 578.05	40 578.05	40 349.95	39 940.25	38 099.66	37 895.36	37 238.87	36 642.13	–9.7
LULUCF	NA	–79 131.85	–103 532.44	–97 029.80	–126 319.77	–112 581.71	–113 464.53	–112 209.00	NA
Waste	17 935.63	17 935.63	20 665.57	21 659.22	20 283.00	19 475.00	19 431.02	18 668.23	4.1
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	NA	437 766.36	426 924.90	455 244.29	447 763.96	465 457.76	464 480.32	455 713.20	NA
Total (without LULUCF)	516 898.22	516 898.22	530 457.33	552 274.09	574 083.73	578 039.47	577 944.84	567 922.20	9.9

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 do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

could be improved by providing explanations of trends of emissions from certain categories and/or certain implied emission factors (IEFs) (for example in energy and industrial processes) and by providing additional information on country-specific methods, emission factors (EFs), and parameters used to calculate emissions (for example in energy, agriculture, and waste). The fuel split between national and international transportation should be updated.

F. Cross-cutting issues

1. Completeness

11. The inventory covers all source and sink categories for the period 1990–2006 and is complete in terms of geographic coverage. Italy has provided all CRF tables; table 7 was provided, however, it was incomplete due to problems with the CRF Reporter software, which is explained in the documentation box. Notation keys are used in all of the tables except in CRF table summary 3 for EFs and methods of CO_2 emissions from cropland. Italy has provided the LULUCF reporting tables for 1990–2006 as required by decision 14/CP.11. The ERT recommends that Italy cooperate with the CRF Reporter helpdesk in order to find solutions to any unresolved issues so that it is able to include a complete table 7 in its next annual submission. The ERT commends the efforts made by Italy to provide CRF table 8(b) in the 2008 submission; this table was not provided in the 2007 submission.

2. Transparency

12. The ERT noted with appreciation the efforts made by Italy to improve transparency. However, the ERT recommends that transparency be improved in the sector chapters that explain trends of emissions and/or IEFs for certain categories (for example in energy, industrial processes) and that Italy provide additional information on the country-specific methods, EFs, and parameters used to calculate emissions (for example energy, agriculture, waste). The ERT recommends that Italy improve the use of notation keys, for example by using not estimated ("NE") instead of not applicable ("NA") for N_2O from fugitive emissions from solid fuels if these emissions are actually occurring.

3. Recalculations and time-series consistency

13. The ERT noted that recalculations reported by the Party for the time series 1990–2005 have been undertaken to take into account the change of EFs. The major changes include CO_2 emissions from energy industries and other sectors mainly as a result of revised EFs for natural gas, coal, and fuel oil. The rationale for these recalculations is provided in the NIR and the CRF. The recalculations resulted in an increase by 0.01 per cent for the base year and a decrease by 0.28 per cent for 2005 of the total GHG emissions.

4. Uncertainties

14. An IPCC tier 1 uncertainty analysis has been performed, the results of which are presented at both the summary level and the individual source category level. In addition, an IPCC tier 2 uncertainty analysis has been applied to some categories and the results of tier 1 and tier 2 uncertainty analyses were compared. The results of the tier 2 analysis are not included in the NIR, but it is stated that the results of the two approaches are very similar. The ERT encourages the Party to provide a brief comparison of the two approaches and a short discussion of any differences in its next annual submission.

15. According to the results of the tier 1 uncertainty analysis, uncertainty estimates including LULUCF have slightly increased between the 2007 and 2008 submissions but no explanation for this is provided in the NIR. The ERT recommends that Italy include a short description of the differences between the 2007 and 2008 uncertainty analyses in its next annual submission.

16. It is not clear from the NIR whether or not Italy uses its uncertainty analysis to prioritize further improvements and whether or not plant data are used to verify uncertainties in the activity data (AD) (as recommended by the previous ERT). In response to the request, Italy informed the ERT that uncertainty analysis is used to prioritize improvements, in particular for categories where high uncertainty of AD and parameters is observed (agriculture, LULUCF, fluorinated gases in industrial processes), and that it has started to improve its collection of background AD from the relevant plants. The ERT recommends that Italy provide this information in its next annual submission.

5. Verification and quality assurance/quality control approaches

17. Italy has created and implemented a quality assurance/quality control (QA/QC) system in accordance with the IPCC good practice guidance and provided information on this system in line 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). It has developed a QA/QC manual with procedures that are applied on an annual basis and a QA/QC plan with additional activities that are also applied on an annual basis. Italy states in the NIR that in addition to routine general checks, source-specific QC procedures are applied on a case-by-case basis, focusing on key categories and on categories where significant methodological and data revision have taken place or where new sources have been identified.

18. In response to the ERT request to elaborate on the aforementioned quality checks, Italy reported that these checks include comparisons of AD for the time series from different national and international data sources, in particular for energy, industrial processes, and agriculture. The ERT recommends that Italy include information on source-specific QA/QC procedures in the energy sector in separate paragraphs (which has already been completed for other sectors). The ERT noted that arrangements for an independent review of the inventory are still under consideration and encourages the Party again to make these arrangements. In addition, the ERT reiterates the recommendation made during the previous review that Italy explain more effectively the activities carried out by the National Statistical System (Sistan) panels responsible for the quality of AD provided by external institutions in its next annual submission.

6. Follow-up to previous reviews

19. The ERT acknowledges the improvements made by Italy since the last review. The process of further developing legal, institutional, and procedural arrangements under the national system to ensure the sustainability of the existing capacities and competence of technical staff has been continued. The Agency for Environmental Protection and Technical Services (APAT) has been formally designated the single national entity with overall responsibility for the national inventory and the process for the official approval of the inventory has been formalized.

20. The ERT noted that the following resources allocated to the technical and administrative operation of the national registry have been increased: a national registry for carbon sinks has been created in order to ensure the future reporting of supplementary information related to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol; all CRF tables including those relating to key category analysis (with minor shortcomings which could be further improved) and explanatory information on recalculations (tables 8(a) and 8(b)) have been provided; a key category analysis was provided for 1990; potential PFC emissions have been reported; and per capita protein consumption has been revised in the waste sector.

21. Although some progress has been made in the areas referred to below, the ERT recommends further improvements, specifically: including the substantiation of decisions based on expert judgements in the NIR; improving the transparency of the GHG inventory by including in the NIR more information on methodologies and the underlying assumptions made when estimating emissions; and on the rationale behind recalculations; and improving the collection of input data in some sectors such as LULUCF.

G. Areas for further improvement

1. Identified by the Party

22. The 2008 NIR identifies several areas for improvement and specifies the following actions:

(a) Organize a basic independent review of the inventory before it is submitted;

(b) Collect and assess supplementary information related to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol;

(c) Improve the reporting of the energy sector by improving the allocation of fuel used by domestic and international aviation and marine sectors;

(d) Create a single database for QA/QC purposes, including data collected under the European Union (EU) directive on large combustion plants (directive 2001/80/EC), the European Pollutant Emission Register (EPER), and the EU emissions trading scheme;

(e) Elaborate on the best available technologies used in agriculture practices;

(f) Improve the availability of information on waste composition and other waste parameters following the entering into force of the EU directive on the landfill of waste (99/31/EC);

(g) Compare local inventories with the national inventory.

2. Identified by the expert review team

23. The ERT identifies several cross-cutting issues for improvement and specifies the following actions:

(a) Describe sector-specific QA/QC procedures in more detail and in separate paragraphs for the energy sector;

(b) Improve the explanations of trends of emissions and/or IEFs at the category level (in energy, industrial processes);

(c) Provide additional information on country-specific methods, EFs, and parameters used to calculate emissions (in energy, agriculture, waste).

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

II. Energy

A. Sector overview

25. The energy sector is the main sector in the GHG inventory of Italy. In 2006, the energy sector accounted for 473,681 Gg CO_2 eq, or 83.4 per cent, of total GHG emissions. Emissions from the sector increased by 12.9 per cent between the base year and 2006. The key drivers for the overall rise in emissions are the transport and energy industries. Compared with the previous year, a reduction of emissions from the energy sector by approximately one per cent occurred, mainly due to emission reductions in the category other sectors. Within the sector, 33.7 per cent of the emissions were from energy industries, followed by 28.1 per cent from transport, 18.7 per cent from other sectors and 17.7 per cent from manufacturing industries and construction. Fugitive emissions from oil and natural gas accounted for 1.6 per cent and emissions from the category other accounted for 0.2 per cent. The remaining 0.01 per cent was fugitive emissions from solid fuels.

26. The energy inventory of Italy is of high quality, generally transparent, complete with respect to all major categories, and generally in line with the UNFCCC reporting guidelines. During the last years many projects were implemented, which have improved the transparency, completeness, consistency, comparability, and accuracy of the inventory. Most improvements recommended by the previous ERT have been implemented.

27. Recalculations have been made by implementing national improvement procedures and following the recommendations made during the previous review. For example, the EFs for N_2O and CH_4 in the stationary combustion sector have been updated and N_2O emissions from venting and flaring have been reported. The NIR indicates that the use of liquid fuels in transport has been amended to take into account the fraction of carbon (C) oxidized, but no explanation has been provided. The ERT encourages Italy to summarize the effects of these recalculations for the entire sub-sector in its next annual submission.

28. The ERT noted that the transparency of the NIR could be improved by providing more information on the following: the allocation of emissions from waste incineration in the energy sector, and the use of landfill gas, and the use of oxidation factors for the fraction of C oxidized during combustion (this is currently only briefly mentioned in the NIR).

29. The ERT noted that source-specific QA/QC activities are applied during the emission estimation process. However, no explanation of these activities is provided in the NIR. The ERT encourages Italy to provide a more detailed description of the efforts taken to ensure the quality of the energy sector inventory.

B. Reference and sectoral approaches

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

30. CO_2 emissions from fuel combustion have been calculated using both the reference approach and the sectoral approach for all years. The differences between estimates of CO_2 emissions using the reference and sectoral approaches are very small for the whole time series. The difference is less than 2 per cent (the median value over all years is 1.9 per cent) except for 1999. A short explanation for the considerable difference of 3.7 per cent in 1999 (single event) would improve the transparency of reporting.

31. The reference approach performed by Italy uses a mixture of IPCC default values and a few country-specific values for the carbon EFs. The reason for this should be explained in more detail, specifically for the other oil category where the difference is greater.

2. International bunker fuels

32. The national energy balance for Italy includes only aggregated fuel consumption data for transport activities. Therefore, model results for the split into domestic and international transport are used. The model for estimating emissions from international bunker fuels uses the available statistical information and research results for the fuel split in 1999. The split of fuel used by domestic transport and international bunkers are applied for the entire time series and lead to a possible underestimation of emissions from international navigation and air transport. The ERT reiterates its recommendation made during the previous review that Italy include new results for the fuel split under current conditions. This may reduce the discrepancy between International Energy Agency data and CRF data.

3. Feedstocks and non-energy use of fuels

33. Italy collects all data to perform a detailed mass balance of C in the petrochemical sector, providing good-quality results for this part of the inventory. The ERT noted that Italy reports in table 1.A(d) data for the amount of C stored and recommends that it further elaborate the explanation of the methods to estimate the amount of C stored in its next annual submission.

C. Key categories

1. Road transportation: liquid fuels – CO_2

34. The ERT noted the efforts of Italy to identify country-specific EFs for gasoline and liquefied petroleum gas, which are higher than the IPCC default values. The ERT also noted that slightly modified default EFs are used for the period 1990–2000 and the country specific EFs have been applied since the year 2000. In response to the ERT request made during the review, Italy indicated its intention to use COPERT IV (Computer Program to calculate Emissions from Road Transport) data in its next annual submission, which should explain this inconsistency.

2. Civil aviation: liquid fuels – CO_2

35. The ERT noted that Italy uses available statistical data for the total energy consumption of the relevant fuels to estimate CO_2 emissions from civil aviation. Emissions from national aviation are calculated based on modelling results of domestic and international flight movements and fuel consumption. The model input data represent conditions in 1999 and these constant parameters are applied for the entire time series. Most recent trends in civil aviation, such as technical improvements and changes in flight movements due to increased international competition, are not taken into account. Therefore this approach may lead to a potential overestimation for recent years. The ERT encourages Italy to consider results from recent available national research in the model assumptions and to revise the data accordingly to improve the accuracy of the inventory.

D. Non-key categories

Other sectors: other fuels – CO_2

36. The ERT noted that Italy reports CO_2 emissions from waste incineration under this category, which is in line with the IPCC good practice guidance. A mass balance method used to determine the amount of waste incinerated is described in the NIR, but no information is provided on waste composition or the method applied to convert the waste amount into an energy content, which is included in the CRF tables. The ERT encourages Italy to improve the transparency of its reporting by providing a more detailed description of the methods and procedures applied to estimate CO_2 emissions from waste incineration.

III. Industrial processes and solvent and other product use

A. Sector overview

37. In 2006, the industrial processes sector accounted for 36,782.64 Gg CO_2 eq, or 6.5 per cent of total GHG emissions, and the solvent and other product use sector accounted for 2,148.17 Gg CO_2 eq, or 0.4 per cent of total GHG emissions. Emissions from the industrial processes sector increased by 0.7 per cent between 1990 and 2006 and the solvent and other product use sector emissions decreased by 10.3 per cent. Emissions from the industrial processes sector increased from the mid-1990s to 2005 and decreased rapidly in 2006. The key driver for the trend of emissions in the industrial processes sector is N_2O from the chemical industry. Within the industrial processes sector, 65.4 per cent of GHG emissions were from mineral products, followed by 17.3 per cent from the consumption of halocarbons and SF_6, 10.8 per cent from the chemical industry, and 6.5 per cent from metal production. All categories are reported in the industrial processes and the solvent and other product use sectors. Estimation approaches, data availability, and relevant documentation are in general transparently presented in the NIR. In some cases additional explanatory information could be included in the NIR to improve the transparency of the reporting of information on peculiarities in IEF trends, such as changes caused by plant closures or process changes (for example in the case of nitric acid or the production of hydrochlorofluorocarbon-22 (HCFC-22)).

38. Emissions from industrial processes and the solvent and other product use sectors were recalculated to update AD and address an error that had occurred in estimating. For example, non-methane volatile organic compounds emissions from degreasing and dry-cleaning increased by 13.9 per cent in 2005. The ERT noted that Italy identified the cause of this error and corrected it as a consequence of the implementation of QA/QC procedures.

39. In estimating emissions, a large number of country-specific data were used. The ERT noted that some verification data such as PFC emissions from aluminium production were provided to demonstrate the data accuracy and conservativeness of estimated emissions. However, the ERT recommends that Italy provide more verification data (e.g. CO_2 from ammonia production) in its next annual submission.

B. Key categories

1. Ammonia production – CO_2

40. AD taken from international statistical yearbooks are checked against the data in the national EPER registry. An EF equaling 1.175 t CO_2/t ammonia production has been calculated on the basis of information reported by the production plants for 2002 and 2003 in the framework of the national EPER registry and has been applied to the years 1990–2001. Since no modifications were made to the production plants during the period 1990–2002, the 2002–2003 values were assumed to be representative. The EFs for 2002–2006 obtained from plant data are reported to EPER every year. Natural gas is used as feedstock in the ammonia production plants and the amount of fuel used is reconciled with the figures reported in the energy sector. The ERT recommends that Italy verify emission data published in the national EPER registry to demonstrate data accuracy.

2. Nitric acid production – N_2O

41. The inter-annual changes of IEFs are significant. Italy explained that the changes were dependent on the production levels of the different plants. In response to the ERT request, Italy provided additional information during the review, including confidential information, and acknowledged that the methodologies and data used were adequate and in line with the IPCC good practice guidance.

3. Adipic acid production – N_2O

42. N_2O emissions decreased by 69 per cent during the period 1990–2006 because abatement technology had been installed. However, information on the technology's features, which is necessary to assess EF values, has not been provided in the NIR. In response to the ERT request made during the review, Italy explained that the efficiency and the number of hours that the abatement technology was in operation were included in the estimations. The ERT recommends that Italy demonstrate the accuracy of the EF values by providing the aforementioned information in its next annual submission.

4. Iron and steel production – CO_2

43. The IEF for CO_2 from iron and steel production decreased significantly during the period 1990–2006. In response to the ERT request made during the review, Italy explained that this is due to the use of lime in iron and steel production and provided a description of this use. The ERT acknowledged that data used in its estimations were supplied from many data sources and recommends that Italy explain in detail its data collection, data verification, and QA/QC procedures in its next annual submission.

5. Aluminium production – PFCs

44. Emissions for this category were estimated using IPCC tier 1 methodologies for 1990–1999 and tier 2 methodologies for 2000–2006. The ERT noted that in order to follow the IPCC good practice guidance, it is necessary to maintain consistency of the methodology used throughout the time series. However, as mentioned in the previous review report, splicing techniques as recommended in the IPCC

good practice guidance were not found to be useful in this case. The ERT notes that this approach is not consistent, but it is transparent, accurate, and conservative.

C. Non-key categories

Production of halocarbons and SF_6 – HFCs

45. The ERT noted that since 1996 hydrofluorocarbon-23 (HFC-23) emissions from HCFC-22 manufacture have been assumed to be zero because a thermal afterburner was installed and untreated leakage of HFC-23 was collected and sent to the thermal afterburner. However, a description of this operational situation was not provided in the NIR. In response to the ERT request, Italy provided additional information during the review, which explained that the thermal afterburner is fully operational. The ERT recommends that Italy explain this in its next annual submission.

IV. Agriculture

A. Sector overview

46. In 2006, the agriculture sector in Italy accounted for 36,642.13 Gg CO_2 eq, or 6.5 per cent of total GHG emissions. Emissions from the sector decreased by 9.7 per cent between 1990 and 2006. The key driver for the fall in emissions is a decrease in the numbers of dairy cattle by 31.1 per cent and of non-dairy cattle by 15.9 per cent.

47. In 2006, N_2O emissions accounted for 58.7 per cent and CH_4 emissions accounted for 41.3 per cent of sectoral emissions. Within the agriculture sector, the largest contribution of emissions came from agricultural soils, which accounted for 48.8 per cent of emissions, followed by 29.0 per cent from enteric fermentation, 18.1 per cent from manure management, and 4.0 per cent from rice cultivation. The remaining emissions, less than 0.1 per cent, are from the field burning of agricultural residues.

B. Key categories

1. Enteric fermentation – CH_4

48. Italy uses a tier 2 methodology and livestock population data from the Italian National Institute of Statistics to estimate CH_4 emissions from enteric fermentation for all major livestock categories (dairy cattle, non-dairy cattle, and buffalo), together with country-specific EFs. A tier 1 approach with the IPCC default EFs was used to estimate CH_4 emissions from all other animal species. The ERT recommends improving the transparency of the NIR by elaborating on the parameters and IPCC good practice guidance equations used to obtain the country-specific EFs in the tier 2 methods for dairy cattle, non-dairy cattle, and buffalo in its next annual submission.

2. Manure management – CH_4

49. Italy estimates CH_4 emissions from manure management using a tier 2 method and country-specific EFs for dairy and non-dairy cattle, buffalo, and swine, which account for 87.3 per cent of emissions from this key category. A tier 1 method with IPCC default EFs was used for all other livestock categories. The ERT recognizes that the IEFs for dairy cattle, non-dairy cattle, and swine are decreasing over time owing to the increasing amounts of biogas recovered from manure management systems used for these livestock categories. The ERT noted that the percentage of manure allocations and methane conversion factors documented in CRF table 4.B (a)s2 are incorrect and recommends that Italy improve the quality checking procedures before its next annual submission.

3. Manure management – N_2O

50. Italy estimates N_2O emissions from manure management using the IPCC good practice guidance method and country-specific annual nitrogen (N) excretion rates based on data obtained from a regional N balance. The ERT noted that Italy applies the same N excretion rate (116 kg/hd/year) for dairy cattle

for all years and encourages the Party to consider developing a N excretion rate for dairy cattle that reflects changes in the dairy herd over the time series for future inventory submissions. During the review, Italy stated that it was working with agricultural experts to explore the possibility of developing this time series.

4. Direct soils emissions – N_2O

51. Italy uses the IPCC default tier 1a methodology and EFs to estimate direct N_2O emissions from agricultural soils. The ERT noted that Italy estimates emissions for all sub-categories and considers the methodology used for this key category to be complete and transparent. The ERT noted an error in calculating synthetic N fertilizers (F_{SN}) for the year 2006. The value for N input from application of synthetic fertilizers in CRF table 4.D.s1 is reported as 712,691.4 t of N/year, but the value of N in fertilizers (N_{FERT}) is 781,824 t and the fraction of synthetic fertilizer N applied to soils that volatilizes as ammonia and nitrogen oxides ($Frac_{GASF}$) is 0.0918, thus the correct F_{SN} should be 710,021 t of N. The ERT recommends that Italy correct this value in its next annual submission and that it ensure that proper QC procedures are implemented to avoid errors of this nature in the future.

5. Indirect soil emissons – N_2O

52. Italy estimates emissions of N_2O from atmospheric deposition and from leaching and run-off using IPCC default methodology and EFs for this key category. Italy uses country-specific values for a fraction of synthetic fertilizer N that volatilizes as ammonia and nitrogen oxides ($Frac_{GASF}$ = 0.092) and a fraction of livestock N excretion that volatilizes as ammonia and nitrogen oxides ($Frac_{GASM}$ =0.290) to estimate the amount of N volatilized from synthetic fertilizers and manures deposited onto soils. The ERT noted that the amount of N from atmospheric deposition (321,191 t) is reported incorrectly in CRF table 4.Ds1. Based on a total N excretion of 833,940 (CRF table 4.B (b)) and total synthetic fertilizers of 781,824 t, the amount of N should be 313,741 t. The ERT recommends that Italy correct this error in its next annual submission and encourages Italy to develop a country-specific value for fraction of N input to soils that is lost through leaching and run-off ($Frac_{LEACH}$) as emissions from this category are the largest contributor to total N_2O emissions from agricultural soils (33.0 per cent).

C. Non-key categories

Pasture, range and paddock manure – N_2O

53. The ERT noted that the amount of N reported in CRF table 4.Ds1 for 2006 (155,766.3 t) does not correspond with the amount of N in CRF table 4.B.(b) (159,675.4 t), but is in fact the same value as reported in 2005. This also means the incorrect IEF is reported (0.0205 kg N_2O-N/kg N) instead of the correct value (0.02 kg N_2O-N/kg N). The ERT recommends that Italy correct this value in its next annual submission and recommends that Italy ensure that the proper QC procedures are implemented to avoid errors of this nature in future.

54. The ERT encourages Italy to provide a full N balance for manure management and agricultural soils for the entire time series in its next annual submission, which would help reduce N input errors in the CRF tables and improve the overall transparency of reporting.

V. Land use, land-use change and forestry

A. Sector overview

55. In 2006, the LULUCF sector accounted for 112,209 Gg CO_2 eq removals, which increased by 41.8 per cent between 1990 and 2006. The key driver for the rise in removals is the increase in removals from forest land remaining forest land. Within the sector, 71.2 per cent of removals were from forest land remaining forest land, followed by 17.5 per cent from cropland remaining cropland and 14.4 per cent from land converted to forest land. Land converted to settlements resulted in emissions (1,280.3 Gg CO_2) that accounted for 1.1 per cent of net removals. For grassland and wetlands the notation key not

occurring ("NO") is reported. In other years removals in the grassland category were reported due to the conversion of cropland to grassland.

56. In the NIR Italy provided an updated land-use change matrix that describes the changes in land area, including recalculated tables for all years since 1990. However, the annual transitions between land categories are still based on assumptions made by experts. Italy informed the ERT of its plans to improve land-use data statistics and investigations to obtain more detailed data on land-use management activities. The ERT recognized with appreciation the efforts made by the Italian experts and encourages Italy to report on the outcomes of these efforts in its next annual submission.

57. The ERT noted that the uncertainty analysis for the LULUCF sector for the dominant forest land category is estimated to be 85.9 per cent for all five C pools (above-ground, below-ground, dead mass, litter, and soil). This has remained almost constant since 1990. The ERT recommends that Italy prioritize its efforts in this sector in order to improve its uncertainty analysis.

B. Key categories

1. Forest land remaining forest land – CO_2

58. The annual C stock increment is estimated using a model application that uses data from the national forest inventories of 1985 and 2002. More than 50 per cent of the increase in C stock is allocated to the C stock of dead organic matter and soils. Italy applies a relation between C stock in above-ground biomass and the C stock in litter and soils. This leads to high increases in the C stocks in litter and soils. During the review, Italy provided additional arguments for applying this method. The ERT welcomed Italy's plans to provide improved estimates of soil and dead wood pools in the framework of the national registry and the national forest inventory and the ERT encourages Italy to include this information in its next annual submission.

2. Land converted to forest land – CO_2

59. The area of forest land increased by 20 per cent (1,881 kilo hectares (kha)) between 1990–2006. The only category reported is grassland converted to forest land. The main increase is attributed to the increase of the C stock in the soil, the total effect of which is reported in the year of conversion. The ERT welcomed Italy's planned soil survey, which was seen as an improved data source for estimating C sequestration in the soil pool.

3. Cropland remaining cropland – CO_2

60. Italy applies the IPCC default value to estimate the net change in the living biomass of perennial crops. No losses are reported, whereas the IPCC good practice guidance for LULUCF default coefficient indicates a harvesting cycle of 30 years. Italy explained that perennial crops such as olive trees or grapevines have long harvesting cycles of total biomass and informed the ERT of its intention to report losses caused by the pruning of these crops. The ERT recommends that Italy validate the application of the default values and include the losses in its next annual submission.

4. Land converted to settlements – CO_2

61. Italy reports that it has been continuously converting 8 kha of land to settlements. In some years grassland has been converted and in other years cropland has been converted. It is assumed that the changes in C stocks of living biomass and in soil occur in the year of conversion. The ERT welcomes Italy's efforts to improve its land-use system in such a way that it is able to say from which land-use category each unit of converted land was converted.

C. Non-key categories

Land converted to cropland – CO_2

62. Italy reports in some years conversion from grassland to cropland using the IPCC default values. The total change of C stock in the soil is reported in the year of conversion. The ERT noted that removals by the new crop are accounted for, whereas losses are reported as "NO". Italy describes in the NIR that the loss from grassland biomass is included in the gains from land converted to cropland. The ERT recommends that Italy report gains and losses separately, even if default values are used, in order to improve the transparency of its reporting.

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

63. Italy elected not to submit on a voluntary basis information required under Article 7, paragraph 1, of the Kyoto Protocol regarding activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The Party provided annex 9 to the NIR, which describes the current status of the implementation of the national registry for forest C sinks. The sampling grid will cover the entire country and will be based on remote sensing data and ground data. The experimental phase of the system started in January 2008 and it is hoped that it will be operational by 1 January 2010. The grid will be dimensioned on the basis of the first national forest inventory. At every grid point a 0.5 ha circular plot is analysed. The NIR also provides a hierarchical system for allocating a plot to one land-use category.

64. The ERT welcomed the amendment to the national registry for forest C sinks and Italy's efforts to establish a national land-use inventory. The challenge for Italy is to provide sound data for the years 2008 and 2009. The ERT noted that according to the IPCC good practice guidance for LULUCF, a grid system can meet the requirements of the Marrakesh Accords, as long as the spatial resolution is fine enough to be able to represent the minimum forest area. Otherwise, supplementary information is needed to identify areas where afforestation and deforestation occurs. The ERT also noted that it is good practice to document afforestations and reforestations by describing decisions taken to plant new trees or allow forest regeneration to take place by other means. Remote sensing data may not be sufficient to confirm that such a decision was taken. The ERT encourages Italy to provide the aforementioned additional information if it chooses to submit information on activities under Article 3, paragraphs 3 and 4, of the Kyoto protocol on a voluntary basis.

VII. Waste

A. Sector overview

65. In 2006, the waste sector accounted for 18,668.23 Gg CO_2 eq, or 3.3 per cent of total GHG emissions. Emissions from the waste sector increased by 4.1 per cent between 1990 and 2006. The key driver for the rise in emissions is CH_4 emissions from solid waste disposal on land. In 2006, 73.1 per cent of emissions within the sector were from solid waste disposal on land, followed by 23.5 per cent from wastewater handling, and 3.4 per cent from waste incineration. The remaining 0.02 per cent was from composting.

66. The ERT noted that the information reported does not make it possible to identify whether or not category-specific QA/QC procedures, as required by the IPCC good practice guidance for key categories, have been fully implemented (e.g. how QA/QC has been applied to uncertainty estimates). The ERT recommends that Italy document in more detail the category-specific procedures applied and provide a description of general QA/QC procedures implemented in its next annual submission.

67. Minor recalculations have been reported as a result of the correction of some errors. The ERT noted that the major improvements reported by Italy are linked to data collection as a result of the implementation of the provisions of the EU directive on the landfill of waste (directive 99/31/EC).

B. Key categories

Solid waste disposal on land – CH_4

68. Italy used the first order decay model, as required by the IPCC good practice guidance, to estimate CH_4 emissions from solid waste disposal on land. Using the model spreadsheets provided during the centralized review, the ERT noted that Italy has made a great effort to compile historical and current data and information on waste generation, waste composition, and waste management practices for the period 1950–2006. The approach taken by Italy to estimate emissions, which distinguishes between different waste categories (rapidly degradable, moderately degradable, slowly degradable) is in line with the IPCC good practice guidance. The ERT commended Italy for reconstructing historical data from 1975 onwards on waste composition and the amount of waste landfilled, incinerated, and composted (based on different data sources, national legislation, and a regression model, using the population as a driver for the model). The ERT further commended Italy for filling data gaps for the period 1950–1975 (using the exponential function as a correlative factor between the gross domestic product and waste production).

69. Italy estimated the amount of wastewater sludge sent to landfills based on the number of wastewater plants, the population connected to wastewater plants, and the assumption that 80 kg of sludge is produced per inhabitant per year. Seventy five per cent of wastewater sludge is sent to landfills. The ERT recommends that Italy explain its choice of assumption in its next annual submission.

70. In response to the ERT request, Italy provided information on which landfills have been considered as managed and which as unmanaged for the period 1950–2000, noting that all 'new' landfills were managed during the period 2000–2006. The ERT encourages Italy to include this information in its next annual submission. The ERT noted some inconsistencies between the NIR and the CRF tables. For example, in the NIR Italy reported that 50 per cent of unmanaged landfills are shallow, whereas in the CRF tables unmanaged waste disposal sites (depth > 5 m) are reported as "NO". The ERT recommends that Italy correct these inconsistencies in its next annual submission.

71. The ERT noted that Italy reported country-specific data on degradable organic carbon, which is higher than the IPCC default for different waste categories. The ERT further noted that Italy reported the percentages of waste categories landfilled considering wet weight of waste for different waste categories. The ERT recommends that Italy explain how wet and dry weights have been combined in its next annual submission in order to improve the consistency of its reporting.

72. Italy uses country-specific values for the CH_4 generation rate constant (k), which is encouraged in the IPCC good practice guidance. Since these values differ from the IPCC default (for example national k value for rapidly biodegradable waste is three times higher than the IPCC default), it is good practice to document how this value has been obtained by taking into account the composition of waste disposed of in solid waste disposal sites over time and conditions at these sites. The ERT encourages Italy to explain this value in its next annual submission.

C. Non-key categories

1. Wastewater handling – CH_4

73. Italy used the IPCC methodology, and IPCC default EFs and country-specific EFs, including wastewater output per tonne of production and chemical oxygen demand (COD), to estimate CH_4 emissions from industrial wastewater handling. The ERT recommends that Italy provide references on the country-specific parameters used (for example the COD value used in the iron and steel and textile industries) in its next annual submission.

74. The ERT noted that Italy reported that 95 per cent of domestic and commercial wastewater and 85 per cent of industrial wastewater are treated in aerobic conditions (which imply lower emissions), without further explanation. Furthermore, Italy used country-specific AD (industrial production) and

some country-specific parameters, such as COD, but applied IPCC default uncertainties to estimate the uncertainty associated with these estimates. The ERT encourages Italy to explain the drivers for CH_4 emissions from wastewater handling becoming a key category and to collect information on the uncertainty of country-specific data in its next annual submission.

2. Waste incineration – CO_2, CH_4, N_2O

75. Under waste incineration, Italy reported emissions from agricultural residues that have been collected and burned. In response to the ERT request made during the review, Italy clarified that these agricultural residues are collected and are managed in different ways (disposed of in landfills, composted, combusted to produce energy). The ERT recommends that Italy explain the distribution of these agricultural residues between the management practices listed above, and estimate and report associated CH_4 and N_2O emissions accordingly using the appropriate EFs in its next annual submission.

76. In order to estimate emissions from the incineration of the other types of waste (municipal, industrial, hospital), Italy analysed its fossil C content and reported CO_2 and non-CO_2 emissions from non-biogenic waste in line with the IPCC good practice guidance. The ERT noted that although references have been provided for some of the default parameters used, the EFs estimated in some cases (e.g. industrial waste, waste oil, hospital waste) were unclear and the ERT recommends that Italy improve the transparency of its reporting with regard to the use of country-specific EFs in its next annual submission.

VIII. Other issues

1. Changes to the national system

77. Italy has reported legislative and institutional changes to its national system in the 2008 submission. A legislative decree formally made APAT the single entity for the preparation of the national GHG inventory and set up a procedure for the official approval of GHG inventory submissions. Italy informed the ERT that the national registry for C sinks was established as a part of the national system, to which a substantial budget has been allocated and a three-year plan to stabilize short-term staffing has been implemented. The ERT commends Italy for the steps taken to strengthen its national system, acknowledges that the implementation of the three-year plan should further strengthen the national system, and encourages the Party to follow its implementation closely.

2. Changes to the national registry

78. Italy has reported on changes made to its national registry in the 2008 submission. The ERT noted that the new legislative decree assigns responsibility to APAT for the development, operation, and maintenance of the national registry, and establishes the provision of financial resources for the running of the registry. The ERT also noted that Italy has increased the number of staff responsible for operating the national registry from one to six people. The ERT noted that Italy described the disaster recovery plan as requested by the previous review. In response to a request made by the ERT during the review, Italy has provided the name of the registry administrator.

3. Commitment period reserve

79. Italy has not reported its commitment period reserve in the 2008 annual submission. In response to questions raised by the ERT during the review, Italy reported that its commitment period reserve has not changed since the initial report review (2,174,650,108 t CO_2 eq.). The ERT agrees with this figure. The ERT recommends that Italy include information on its commitment period reserve in its next annual submission.

IX. Conclusions and recommendations

80. Italy submitted the complete 2008 annual inventory on time. It contains a complete set of CRF tables for the period 1990–2006 and an NIR. The inventory covers all source and sink categories for the period 1990–2006 and was complete in term of geographic coverage.

81. The inventory is in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance, and the IPCC good practice guidance for LULUCF. The Party addressed most of the issues raised during the previous review.

82. Since the previous review, Italy has strengthened its national system for inventory preparation and management. The 2008 annual inventory submission is of a high quality, which demonstrates the functionality of the national system.

83. The key recommendations identified by the ERT are that Italy:

(a) Describe sector-specific QA/QC procedures in more detail in separate paragraphs for the energy sector;

(b) Update the method for estimating the fuel use split for national and international transportation;

(c) Improve explanations of certain emissions and/or IEFs trends at the category level (in energy, industrial processes);

(d) Provide additional information on country-specific methods, EFs, and parameters used to calculate emissions (in energy, agriculture, waste).

X. Questions of implementation

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

Annex

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>.

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FCCC/IRR/2007/ITA. Report of the review of the Initial Report of Italy. Available at: <http://unfccc.int/resource/docs/2007/irr/ita.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Riccardo De Lauretis (the Agency for Environmental Protection and Technical Services), including additional material on the methodology and assumptions used.

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