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

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

CONTENTS

I. Overview

A. Introduction

1. This report covers the in-country review of the 2006 greenhouse gas (GHG) inventory submission of Italy, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 4 to 9 June 2007 in Rome, Italy, and was conducted by the following team of nominated experts from the roster of experts: generalist – Mr. Ignacio Sánchez García (Spain); energy – Mr. Hugh Saddler (Australia); industrial processes – Ms. Sina Wartmann (Germany); agriculture – Ms. Janka Szemesová (Slovakia); land use, land-use change and forestry (LULUCF) – Mr. Nijavalli Ravindranath (India); waste – Ms. Irina Yesserkepova (Kazakhstan). Mr. Ignacio Sánchez García and Mr. Nijavalli Ravindranath were the lead reviewers. The review was coordinated by Mr. Javier Hanna Figueroa (UNFCCC secretariat).

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

B. Inventory submission and other sources of information

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

4. After the in-country review, following the recommendations of the ERT, Italy submitted a complete set of revised CRF tables for the years 1990–2004.

C. Emission profiles and trends

5. In 2004, the most important GHG in Italy was carbon dioxide (CO_2), contributing 84.7 per cent to total[1] national GHG emissions expressed in CO_2 eq.,[2] followed by nitrous oxide (N_2O), 7.2 per cent, and methane (CH_4), 6.9 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) taken together contributed 1.2 per cent of the overall GHG emissions in the country. The energy sector accounted for 82.5 per cent of total GHG emissions, followed by industrial processes (7.3 per cent), agriculture (6.5 per cent), waste (3.4 per cent) and solvent and other product use (0.4 per cent). Total GHG emissions amounted to 578,114.60 Gg CO_2 eq. and increased by 11.9 per cent from 1990 to 2004. Emissions increased in all sectors, except solvent and other product use, and agriculture. The LULUCF sector was a sink in all years.

6. Tables 1 and 2 show the greenhouse gas emissions by gas and by sector, respectively.

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

[2] In this report, the values for total and sectoral emissions for the complete time series, and in particular in 1990 and in 2004, reflect the revised estimates submitted by Italy in the course of the review. These estimates differ from Italy's GHG inventory submitted in 2006.

Table 1. Greenhouse gas emissions by gas, 1990–2004

GHG emissions	Gg CO_2 eq.								Change
	Base year Convention[a]	1990[a]	1995[a]	2000[a]	2001[a]	2002[a]	2003[a]	2004[a]	BY–2004 (%)
CO_2 (with LULUCF)	354 868.22	354 868.22	342 397.29	365 804.74	359 102.85	356 788.65	375 050.26	383 998.02	8.2
CO_2 (without LULUCF)	434 781.95	434 781.95	445 714.27	463 598.01	469 319.73	471 157.71	486 462.78	489 918.23	12.7
CH_4	41 711.64	41 711.64	44 096.90	44 375.63	43 330.01	41 727.50	41 100.09	39 920.59	–4.3
N_2O	38 057.86	38 057.86	38 823.32	41 103.75	41 233.47	40 716.26	40 141.70	42 380.20	11.4
HFCs	351.00	351.00	671.29	2 005.50	2 761.41	3 568.02	4 589.89	5 699.29	1 523.7
PFCs	1 807.65	1 807.65	490.80	345.85	452.37	413.58	484.46	406.62	–77.5
SF_6	332.92	332.92	601.45	493.43	795.34	738.35	485.63	602.38	80.9

Note: BY = Base year; LULUCF = Land use, land-use change and forestry.
[a] Italy submitted revised estimates for the complete time series in the course of the initial review on 19 July 2007. These estimates differ from Italy's GHG inventory submitted in 2006.

Table 2. Greenhouse gas emissions by sector, 1990–2004

Sectors	Gg CO_2 eq.								Change
	Base year Convention[a]	1990[a]	1995[a]	2000[a]	2001[a]	2002[a]	2003[a]	2004[a]	BY–2004 (%)
Energy	419 460.89	419 460.89	432 512.65	452 756.73	457 455.40	459 423.14	473 960.10	476 706.63	13.6
Industrial processes	36 544.50	36 544.50	34 589.69	34 979.32	37 206.40	37 460.46	38 955.40	41 982.44	14.9
Solvent and other product use	2 394.46	2 394.46	2 181.88	2 297.40	2 220.68	2 229.58	2 178.66	2 124.31	–11.3
Agriculture	40 577.10	40 577.10	40 349.18	39 928.53	39 421.27	38 221.72	37 840.53	37 838.56	–6.7
LULUCF	–79 721.59	–79 721.59	–103 206.42	–97 476.45	–110 156.09	–114 334.99	–111 340.95	–105 107.49	31.8
Waste	17 873.93	17 873.93	20 654.10	21 643.36	21 527.79	20 952.45	20 258.28	19 462.66	8.9
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	437 129.30	437 129.30	427 081.06	454 128.89	447 675.45	443 952.36	461 852.03	473 007.12	8.2
Total (without LULUCF)	516 850.89	516 850.89	530 287.49	551 605.34	557 831.53	558 287.35	573 192.98	578 114.60	11.9

Note: BY = Base year; LULUCF = Land use, land-use change and forestry; NA = Not applicable.
[a] Italy submitted revised estimates for the complete time series in the course of the initial review on 19 July 2007. These estimates differ from Italy's GHG inventory submitted in 2006.

D. Key categories

7. Italy has reported key category tier 1 and tier 2 analyses, both level and trend assessment, as part of its 2006 inventory submission. The analyses were performed both with and without the LULUCF sector. During the review, Italy explained that a qualitative approach does not result in additional key categories in the case of Italy. The results of the key category analysis are a driving factor for the preparation of the inventory, particularly in the prioritization of resources and methodological complexity.

8. The key category analyses for 2004 performed by Italy and the secretariat[3] produced similar results. However, CO_2 emissions from stationary combustion – other fuels, and N_2O emissions from land converted to cropland are identified by the secretariat, but not by Italy, as a consequence of a different level of disaggregation of categories. Furthermore, Italy's tier 2 analysis resulted in a few additional categories that were not identified as key categories by the secretariat, such as land converted to settlements – CO_2, animal production – N_2O and wastewater handling – CH_4.

9. Italy has not provided a key category analysis for 1990, either in the CRF tables or in the NIR. The secretariat's analysis identified 24 key categories in 1990, among them limestone and dolomite use – CO_2 and nitric acid production – N_2O. The analyses performed by Italy and the secretariat both conclude that these two categories were no longer key in 2004. The ERT recommends that Italy also include in its next inventory submission a key category analysis for 1990.

E. Main findings

10. Italy's inventory conforms to 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 *Revised 1996* Intergovernmental Panel on Climate Change (IPCC) *Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). While the inventory is in general of high quality and in a continuous process of improvement, there are areas where further improvements are needed. They refer mainly to better documentation of decision making and the collection of activity data (AD) in some specific areas, such as the LULUCF sector.

F. Cross-cutting topics

1. Completeness

11. Italy's inventory covers all gases, sectors and main categories for the whole time series 1990–2004 and for the entire territory of the country. Only potential emissions of PFCs from consumption of halocarbons and SF_6 are not reported. The ERT recommends that Italy present them in the next submission. Emissions and removals from wetlands and other land categories were not estimated, based on the assumption that these are not occurring ("NO"). The ERT recommends that Italy validate the assumption and report on this in its next submission.

[3] The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) for the base year or base year period and the latest inventory year. Key categories according to the tier 1 trend assessment were also identified. 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.

12. The information included in the NIR and CRF tables is generally complete. However, CRF table 7 (Summary overview for key categories) and CRF table 8(b), with explanatory information on recalculations, were not filled in. Italy explained that this problem was related to the use of different reporting tools in previous submissions. In addition, table 9(a) submitted by Italy does not contain all the necessary explanations. The ERT recommends that Italy provide the above-mentioned tables in its next inventory submission. Table 1.5 in the NIR includes summary tables on completeness. However, this table follows the old category list for the land-use change and forestry (LUCF) sector and is not consistent with the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF).

2. Transparency

13. The ERT appreciates the efforts made by Italy to ensure the transparency of the NIR and the information in the CRF tables. They provide much of the information necessary to enable the ERT to assess the inventory and to understand the methodologies and data behind the estimates. Nevertheless, in some cases the descriptions of the methods in the NIR are not sufficient to explain the rationale for choosing particular data, methods and other inventory parameters, for example, the methodology to determine feedstock use and energy flows in the petrochemical industry, the percentage of aerobic/anaerobic wastewater treatment, or uncertainties for emission factors (EFs) and AD. The ERT encourages Italy to make further efforts to fully explain in the NIR the methodologies and underlying assumptions and justify the expert judgement used in the elaboration of the emission estimates. In addition, the ERT noted that more intensive use of CRF documentation boxes would improve transparency.

3. Recalculations and time-series consistency

14. The ERT noted that in the 2006 submission recalculations for the time series 1990–2003 had been undertaken in a number of categories of all the GHG inventory sectors. The recalculations are consistently made for the entire time series. The major changes, with regard to the recalculation impact in total GHG emissions, are found in categories 5.C grassland and 6.C waste incineration. As a result of all recalculations, total GHG emissions, excluding LULUCF, increased by 1.6 per cent and 1.0 per cent in 1990 and 2003, respectively. When LULUCF is included, decreases of 2.4 per cent and 4.8 per cent in 1990 and 2003, respectively, are observed. The quantitative effects of the recalculations are shown in CRF table 8(a), but there is very little documentation to support this either in the CRF table 8(b) or in the NIR. Most of the changes were explained in the course of the review, and the ERT is fairly confident that they are appropriate, but providing more complete explanations for these changes, both in CRF table 8(b) and in future NIRs, would increase transparency. The ERT recommends that Italy provide more information on the rationale for recalculations and provide more precise information on the changes made and parameters affected when recalculations take place.

4. Uncertainties

15. Italy has provided an uncertainty analysis for each category and for the inventory in total, following the IPCC good practice guidance. Italy applied a tier 1 uncertainty analysis both including and excluding the LULUCF sector. In addition, a tier 2 approach, corresponding to the application of the Monte Carlo analysis, has been applied to specific categories of the inventory. The uncertainty levels for AD are based on IPCC default values, empirical data and expert judgement. For most sectors, the uncertainty of the EFs is derived from empirical data. Expert judgement is used to decide on the final value, taking into account all available information. The resulting overall uncertainly level of the inventory is comparatively low, at 3.3 per cent without LULUCF and 8.3 per cent with LULUCF. However, the uncertainty for the LULUCF sector is high, having a combined uncertainty of above 50 per cent for both the total emissions and the trend, showing the need for improvements in this sector.

16. The ERT recommends that Italy further use its uncertainty analysis to prioritize improvements to the inventory. The ERT noted that the growing amount of data available at plant level could be used to develop more sound AD uncertainties or to support the values used so far.

5. Verification and quality assurance/quality control approaches

17. Italy has elaborated and implemented a quality assurance/quality control (QA/QC) system in accordance with the IPCC good practice guidance. It has developed a QA/QC manual with procedures that are applied every year for all sectors and a QA/QC plan with additional annual activities. Most QA/QC activities are carried out by Agency for the Protection of the Environment and Technical services (APAT) staff. The QC procedures included in the manual are comprehensive, including both tier 1 and tier 2 procedures. However, only tier 1 procedures are applied at present. The ERT recommends that Italy apply source-specific QC procedures for its next submission.

18. In addition, specific panels on quality have been established for all the main economic sectors in the context of the National Statistical System (Sistan). These panels verify the quality of the AD used to estimate emissions of several inventory categories. The ERT also recommends that Italy better explain in its next NIR the activities of Sistan's panels on quality, given their role in ensuring the quality of AD provided by external institutions.

19. Although no full independent review of the inventory was applied before submission of the inventory, Italy carries out several QA activities in different contexts: presenting the inventory to the technical committee on emissions; involving national expert panels (road transportation, land use, land-use change and forestry and energy production) in inventory preparation and applying voluntary European Community reviews. The ERT encourages Italy to make arrangements for an independent review of the inventory.

6. Follow-up to previous reviews

20. Italy was the subject of an in-country review in 2005. Following the recommendations of the ERT, estimates of several categories were revised and recalculated. In particular, complete carbon and energy balances have been elaborated for the category iron and steel and recalculations were made for manure management, rice cultivation and solid waste disposal.

21. The key category analysis has been completed, including the LULUCF categories, in accordance with the IPCC good practice guidance. The description of country-specific methods and the assumptions underlying the choice of inventory parameters have improved to some extent, although further efforts are needed in this respect.

G. Areas for further improvement

1. Identified by the Party

22. The NIR identifies several areas for improvement of the GHG inventories, the main priority being the completion of a national system for inventory preparation. For several categories, updated AD, EFs or other inventory parameters are expected, for example, data for cereal crop residue burned, and for settlements, grassland fires and waste composition. An independent review of the inventory is under consideration.

2. Identified by the ERT

23. The ERT identified the following cross-cutting issues for improvement. Italy should:

(a) Provide all the CRF tables, include those relating to key category analysis and explanatory information on recalculations;

(b) Provide the key category analysis for the base year;

(c) Improve transparency on decisions based on expert judgement, explanations of methodologies and underlying assumptions in the elaboration of emission estimates, and the rationale behind recalculations in the next NIR;

(d) Implement source-specific QA/QC procedures.

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

II. Energy

A. Sector overview

25. In 2004 the energy sector, including fugitive emissions, contributed 476,706.63 Gg CO_2 eq., or 82.3 per cent of total national emissions. Since 1990, GHG emissions from the sector have increased by 13.6 per cent. The increase between 2003 and 2004 is 0.6 per cent. Fuel combustion accounts for most of the energy sector emissions. In 2004 emissions from fuel combustion amounted to 468,868.75 Gg CO_2 eq., an increase of 60,144.78 Gg or 14.7 per cent since 1990. Fugitive emissions were 7,837.88 Gg in 2004, a decrease of 2,899.04 Gg or 27 per cent since 1990.

26. Trends in fuel combustion over the period 1990–2004 indicate an overall increase by 19.9 per cent for energy industries, 27.6 per cent for transport and 10.4 per cent for other sectors. Only emissions from manufacturing industries and construction decreased (by 3.9 per cent) over the inventory period. Energy industries and transport, taken together, contributed 46.2 per cent and 50.9 per cent of total emissions in 1990 and 2004, respectively, and accounted for 91 per cent of the increase in total emissions since 1990. The time series of emissions in the sector is consistent and the trends are closely related to the observed external factors affecting activity levels, including the severity of winter weather, levels of economic activity, and changes in particular industries with intensive emissions.

27. The estimates and reporting of the energy sector are of high quality and are transparent, complete, comparable and consistent, with major categories reported in all years with all respective gases. In particular, consistent AD values, covering production, imports and exports of coal, crude oil, petroleum products, and natural gas are collected and used by the Ministry of Economic Development to compile the national energy balance (BEN), and Italy combines these with national emission CO_2 EFs based on test data for all fossil fuels, except coal, used by the iron and steel industry. Consequently, the estimates for total energy combustion CO_2 emissions have a high accuracy. Italy uses default uncertainty ranges in the uncertainty analysis for these sources, which may in fact overestimate the real level of uncertainty. Italy also has very detailed data on fuel consumption and EFs for electricity generation.

28. Recalculations made since the 2005 submission have affected the emission estimates in many categories. As in the other sectors, the transparency of the inventory will benefit from including more information on the NIR and table 8(a) on the rationale and the changes made. Thus, the ERT identified a lack of transparency regarding the recalculations of CO_2 emissions from liquid fuels from the category chemicals (1.A.2.c) between the 2005 and 2006 submissions.

29. Transparency could be increased by including in the NIR some description of methodologies used in particular areas where the data and methodology are in fact very good. Examples include feedstock use and energy flows in the petrochemical industry (see paragraph 33), the comprehensive data and model used to calculate emissions from off-road mobile equipment, and the comprehensive data and systematic reconciliation with the waste sector of emissions from waste incinerators with energy recovery.

30. QA/QC procedures are in general very comprehensive, with calculations and estimates for the more complex parts of the inventory being cross-checked against alternative data sources and methodologies wherever available. However, procedures could be improved by more complete documentation of the reasons for some decisions regarding EFs, especially where expert judgement is involved.

B. Reference and sectoral approaches

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

31. The reconciliation between estimates of CO_2 emissions using the two approaches is consistently very close. The estimates under reference approach are consistently less than those under the sectoral approach, but the difference is less than 2 per cent in most of the years of the time series. It is 0.93 per cent in 2004. Comparison with international statistics shows that the figures are close, with fuel consumption reported in the CRF being consistently higher than the International Energy Agency (IEA) data.

2. International bunker fuels

32. Italy does not collect the data which would be needed to separate fuels used for domestic and international aviation and shipping at the points where the fuel is supplied to aircraft and ships. Italy uses models, based on comprehensive origin and destination data for both aviation and shipping in 1999, to estimate fuel used by international flights and sea voyages in all years. The ERT considers that this is satisfactory for the base year. However, Italy considers, and the ERT agrees, that this approach may overestimate the share of domestic aviation in recent years. This issue is currently being comprehensively addressed by a new study, which it is hoped will lead to the construction of a model using data available annually, so that in future the fuel allocation between domestic and international aviation can be recalculated each year. The ERT recommends that efforts be made to have the new data available for the 2008 submission. The ERT agrees with Italy that re-examining the split between domestic and international for shipping is a lower priority because, unlike aviation, there have not been great changes in the relative number of sea voyages on different routes over recent years.

3. Feedstocks and non-energy use of fuels

33. Italy collects comprehensive data on complex energy flows in the petrochemical sector and between petrochemical industries and oil refineries, together with complete data on quantities of all major petrochemical products. This allows a complete mass balance of carbon in the petrochemical sector to be constructed, which should provide a high degree of accuracy for this part of the inventory. Transparency would be improved by including a brief description of this methodology in the NIR.

C. Key categories

1. Stationary combustion: solid fuels – CO_2

34. The estimate of CO_2 emissions from the iron and steel industry has in principle been greatly improved by the use of a new methodology which constructs a full carbon mass balance for integrated steelworks, reconciling energy flows with the BEN. The steelworks include coke ovens (category manufacture of solid fuels and other energy industries, 1.A.1.c), blast furnaces and other steel-making plant (category iron and steel, 1.A.2.a) and electricity generating plants, typically fuelled by blast furnaces and/or coke oven gas (category public electricity and heat production, 1.A.1.a). The new methodology has resulted in recalculation of emissions from solid fuel combustion in these three source categories and the allocation of emissions between the source categories, which has in principle greatly improved inventory quality. This resulted in a decrease in estimated emissions in 2003, compared with the 2005 submission, of 2,425.07 Gg.

35. The time series of AD and implied emission factors (IEFs) for this source now show a high degree of consistency. However, the time series of changes resulting from the recalculation is not consistent for all years; there is a large increase in 1990 and subsequent years up to 1994, but for most years from 1995 onward there are large decreases. When the ERT examined the AD and emissions reported for the same categories in the previous (2005) submission, it noted large discontinuities in the time series. It was therefore concluded that the apparent discontinuity of changes is caused by one or more discontinuities in the methodology used in the previous submission. Nevertheless, the ERT noted that transparency would be increased by providing a more complete explanation of the changes in all years in the next NIR. The ERT assesses the increase in estimated base year emissions between the 2005 and 2006 submissions to be justified.

2. Stationary combustion: solid, liquid, gaseous fuels – N_2O

36. This category accounted for 0.6 per cent of total emissions in 2004. In the course of the in-country review, it was noted that the IEFs for N_2O from all stationary combustion emission sources were generally much higher than the IPCC default values (0.1 kg/TJ for gaseous fuels, 0.6 kg/TJ for liquid fuels and 1.4 kg/TJ for solid fuels). The ERT recommended that the choice of EF values should be reviewed and revised, if necessary, or that full documentation be provided to support the chosen higher values. After the in-country review, in response to these comments Italy reviewed all the EFs for N_2O (including other fuels and biomass) and provided revised estimates for N_2O emissions from stationary combustion for the entire time series using EFs from a variety of reference sources, mainly default values from the IPCC good practice guidance and the EMEP/CORINAIR Guidebook. Full documentation was provided with regard to the sources used and the reasons for the choice of sources and values. The ERT considers that Italy's estimates of N_2O emissions from stationary combustion are now consistent with best practices, and notes that the effect of the revision was to reduce the estimates of N_2O emission estimates by 10.51 Gg (3,257.46 Gg CO_2 eq.) in 2004, with the revised estimate of N_2O being 12.51 Gg .

3. Oil and natural gas – CO_2, CH_4

37. Italy uses a combination of default and country-specific EFs and tier 1 and tier 2 methodologies for estimating fugitive emissions from oil and natural gas. More complete data on fugitive emissions from flaring at oil refineries were provided by the operating companies, based on the environmental reports of oil refining companies, in time for the 2006 GHG inventory submission. Therefore, Italy recalculated estimates for the time series 1990–2004, as described in the addendum to the NIR, dated April 2007. During the review, Italy informed the ERT that companies have provided additional, more detailed data that could be used for the 2007 submission. The ERT recommends that Italy assess the quality of these data and recalculate the time series if this would be in accordance with the IPCC good practice guidance.

D. Non-key categories

1. Stationary combustion: biomass – CH_4

38. During the in-country review the ERT noted that the IEF for CH_4 from biomass combustion in the categories energy industries (1.A.1) and manufacturing industries and construction (1.A.2) was very high (320 kg/TJ), and appeared to be the value appropriate for fuelwood used in residential appliances (stoves) rather than large boilers. The ERT recommended that emissions from these categories be revised for the base year and all other years using the corrected EF (30 kg/TJ). After the in-country review, Italy provided revised estimates for these categories, which used the IPCC default EF value (30 kg/TJ). This had the effect of reducing estimated CH_4 emissions by 15.26 Gg (320.56 Gg CO_2 eq.) in 2004 when biomass consumption for electricity generation was considerably higher than in 1990. The revised estimate of CH_4 emissions is 2.21 Gg.

2. Oil and natural gas – N_2O

39. During the review the ERT noted that N_2O emissions from flaring are reported as not estimated ("NE"), and for the sake of the completeness of the inventory, and given the availability of AD, the ERT recommended including an estimate using the IPCC default EF. After the in-country review, Italy included these estimates following the recommendation of the ERT. The impact of this new estimate on the overall emissions of the country was an increase of N_2O emissions by 0.0043 Gg (1.31 Gg CO_2 eq.) in 2004.

III. Industrial processes and solvent and other product use

A. Sector overview

40. In 2004 the industrial processes sector accounted for 7.3 per cent of total national emissions and solvent and other product use for 0.4 per cent. Industrial processes emissions decreased up to the mid-1990s and have been increasing ever since. A total increase in emissions of 14.9 per cent occurred between 1990 and 2004. Total national emissions have been increasing at a similar rate. The main drivers of the development of emissions in the industrial processes sector are CO_2 emissions from mineral products, chemical industry and metal production as well as N_2O from the chemical industry. While N_2O from chemical industry and CO_2 from mineral products rose only slightly until the mid-1990s, CO_2 from chemical industry and metal production significantly decreased. While CO_2 from chemical industries showed some increase from 1996 onwards, with a total decrease of 39 per cent between 1990 and 2004, CO_2 from metal production continued the strong downward trend achieving a total reduction of 60 per cent between 1990 and 2004. It must be noted that part of this production is due to changes in the use of process materials (more lime instead of carbonates is used), leading to an emission decrease in metal production, but an increase in the category dolomite and lime use. From the late 1990s onwards CO_2 from mineral products (1990–2004 development: +12 per cent) and N_2O from chemical industry (1990–2004 development: +26 per cent) also increased considerably. These developments explain the emission trend for the industrial processes sector.

41. Emissions of the major categories of the solvent and other product use sector (CO_2 from paint application, CO_2 from degreasing and dry cleaning, CO_2 from other – glue and adhesives, and CO_2 from other – domestic use of solvent) have been steadily decreasing through the whole time series (11.3 per cent). The emission trends are well documented in the NIR for these sectors.

42. The inventory for the industrial processes sector is complete. All categories are reported in the base year, except for the potential emissions of PFCs. Italy informed the ERT during the in-country review that these emissions will be included in its next submission.

43. Plant-specific data are used insofar as they are available; otherwise statistical data and default factors are used. Estimation approaches, data availability, recalculations and documentation are in general very transparently presented in the NIR. In some cases, to add transparency, additional explanatory information could be included in the NIR regarding the rationale for recalculations or information on peculiarities in the IEF trends, such as changes due to plant closures or process changes, for example in the case of nitric acid or aluminium production.

44. The estimation methods are broadly in line with the IPCC good practice guidance. The ERT welcomes the work of Italy's inventory team to develop country-specific EFs and to use plant-specific data in the sector. The estimates in the sector in the 2006 inventory submission have improved due to the recalculations using tier 2 approaches for a number of key categories, as plant-specific data from the European Pollutant Emission Register (EPER) database and also partly from the European Union emissions trading scheme (EU ETS) became available and direct contacts to operators have been established. This is the case for lime production, ammonia production and adipic acid production. The recalculations (e.g. for lime production, limestone and dolomite use and ammonia production) were

consistently introduced for the whole time series. The ERT recommends that additional contacts with plants be established, that the existing ones be formalized, and that all the EU ETS data relevant for the inventory be used for its compilation.

45. QA/QC is carried out through validation of national statistics data by cross-checking with the EPER data and, where available with previous relevant emission data. In the ERT's view some internal documentation (e.g. Excel worksheets) regarding the estimation approaches or data references (e.g. in the case of aluminium production) could be improved. The ERT recommends that the data sources and parameters used for the calculation of emissions should always be documented by the author in such a way that they allow the estimates to be reproduced without explanation of the Excel worksheets. For the uncertainties calculation, IPCC default values are mainly used. The ERT recommends that Italy derive specific uncertainty values from plant-specific data for Italy's next submission.

B. Key categories

1. Cement production – CO_2

46. Italy uses a tier 2 approach for estimating CO_2 emissions from cement production. The AD are clinker production, taken from the National Statistical System. An average EF is used (540 kg CO_2/t clinker) for the entire time series, which is based on industry information and has also been applied in the EU ETS allocation plan for Italy. The EF is based on the average calcium oxide (CaO) content in the clinker and taking into account the contribution of carbonates and additives. The approach is consistently applied for the complete time series.

2. Lime production – CO_2

47. CO_2 emissions from lime production have been estimated on the basis of production AD supplied by the National Statistical System. Plant-specific EFs have been received from the EU ETS allocation plan for Italy. Emissions have been recalculated for the whole time series based on the additional production data from smaller plants, which only became available under the EU ETS.

3. Ammonia production – CO_2

48. AD taken from international statistical yearbooks are checked against the data in the national EPER registry. An EF equalling 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 applied to the years 1990–2001. As no modifications to the production plants occurred over the period 1990–2002, the 2002–2003 values were assumed to be representative. The EFs for 2002–2004 resulted from plant data annually reported to EPER. 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 also verify the emission data published in the EPER registry based on the amounts of natural gas used as production input in ammonia plants.

4. Adipic acid production – N_2O

49. While the production in other chemical industries in Italy decreased during the period 1990–2004, it increased by 58.1 per cent for adipic acid production. AD as well as emission data were provided by the plant operators. The resulting emission factor of 0.30 kg N_2O/kg adipic acid, equalling the IPCC default EF, was used for 1990–2003. Abatement technology was implemented at the end of 2004.

5. Iron and steel production – CO_2

50. In the category iron and steel production the IPCC default method is applied and country-specific EF values (0.15 t CO_2/t pig iron production and 0.053 t CO_2/t steel production in 1990 changed to 0.053 t

CO_2/t pig iron production and 0.022 t CO_2/t steel production in 2004). Data on carbonates used in sinter plants were received directly from the plant operators mainly within the framework of the EU ETS allocation plan for Italy. The average EF for steel production in electric arc furnaces (0.035 t CO_2/t steel production) has been calculated based on industry data applied to equation 3.6B of the IPCC good practice guidance and including pig iron and steel scraps and graphite electrodes used in the furnace.

6. Aluminium production – PFCs

51. PFC emissions from aluminium production have been estimated using both IPCC tier 1 (1990–1999) and tier 2 methodologies (2000–2004). For the tier 1 methodology, default EFs for tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6) were used, while for tier 2 information was provided by the national primary aluminium producer, with reference to documentation by the International Aluminium Institute and the IPCC good practice guidance.

52. A recalculation of the 1990–1999 data with the tier 2 methodology has been considered, but is not possible due to several plant closures and updates in the 1990s. At the same time, further application of the tier 1 methodology was found to underestimate 2000–2004 emissions. Thus, a split time series is used. This approach is not consistent, but it is transparent, accurate and conservative.

7. Consumption of halocarbons and SF_6 – HFCs

53. For all subcategories (refrigeration and air conditioning, foam blowing, fire extinguishers, aerosols/metered dose inhalers) IPCC tier 2a has been used for the estimations. Data were supplied by the relevant industrial associations.

54. Regarding refrigeration and air conditioning, a model for the calculation of annual emissions from HFCs in the equipment is used. This model projects annual emissions at a steady rate without consideration of equipment lifetimes and without considering imports and exports. The ERT recommends that for its next submission Italy introduce standard lifetimes for all types of equipment into the model and use assumptions about the level of gas reclaiming, based on existing legislation and its implementation. In addition, the ERT recommends that Italy consider the imports and exports of fluorinated gases in the equipment in order to improve the accuracy of the estimates.

8. Solvent and other product use – CO_2 and N_2O

55. CO_2 emissions from solvent and other product use, N_2O emissions from anaesthesia and N_2O from aerosol cans are identified as key categories only in the key category analysis of Italy (tier 2 level and trend). CO_2 emissions from solvents have been calculated by using a bottom-up approach based on national and EMEP/CORINAIR non-methane volatile organic compounds (NMVOC) EFs for the various applications and AD taken from the EPER registry (e.g. solvent use in paint application, dry cleaning, textile finishing, and tanning industries), trade associations and national statistics. N_2O emissions from the use of N_2O for anaesthesia and N_2O from aerosol cans have decreased by 23 per cent since 1998, due to increased use of halogen gas instead of N_2O. Emissions are calculated based on AD from national statistics in the case of N_2O for anaesthesia (number of surgical beds), and production data supplied by the Italian Association of Aerosol Producers in the case of aerosol cans. An assumption of 100 per cent emission of N_2O is used.

IV. Agriculture

A. Sector overview

56. In 2004 Italy's GHG emissions from the agriculture sector are estimated to be 37,838.56 Gg CO_2 eq. When compared to those of 1990, they had decreased by 6.75 per cent, mainly due to reductions in the cattle populations and reductions in emissions from agricultural soils. The share of emissions from

the agriculture sector in total national emissions also decreased, from 7.9 per cent in 1990 to 6.5 per cent in 2004.

57. In 2004, CH_4 emissions from the agriculture sector contributed 38.6 per cent of total CH_4 emissions. The reduction from 1990 was 9.8 per cent. Emissions of N_2O from the sector contributed 50.0 per cent of total national N_2O emissions, with a total reduction of 4.5 per cent from 1990. In 2004 aggregated emissions in CO_2 eq. from enteric fermentation accounted for 28.6 per cent, manure management for 18.1 per cent, and agricultural soils for 49.2 per cent of total sectoral emissions. The remaining 4.9 per cent of emissions were from rice cultivation and field burning of agricultural residues.

58. The CRF for 2004 includes estimates of all gases and sources of emissions from the agriculture sector, as recommended by the Revised 1996 IPCC Guidelines and IPCC good practice guidance. The NIR states that the application of sewage sludge to agricultural soils is reported under the waste sector.

59. In the case of the category manure management – dairy cattle, Italy does not use dynamic country-specific EFs across the time series, but a constant EF based on country-specific parameters. The ERT encourages Italy to make further efforts to develop dynamic country-specific EFs across the time series for dairy cattle and to take into account available statistical information in line with the IPCC good practice guidance.

60. The NIR and its addendum are transparent; however, the reporting of the agriculture sector could be further improved by including a time series of livestock population, statistical data on crops and information on fertilizers applied to soils in an appendix to the report. Further information in the NIR explaining the trend fluctuations and justifying the country-specific parameters used would further enhance the overall transparency of the reporting within the sector.

61. As a follow-up to the previous (2005) review, in the original 2006 submission, Italy carried out recalculations of the estimates of CH_4 from enteric fermentation (a 1.1 per cent increase), CH_4 and N_2O from manure management (decreases of 14.9 and 3.9 per cent, respectively), CH_4 from rice cultivation (a 6.4 per cent decrease), N_2O from agricultural soils (a 1.1 per cent decrease) and CH_4 and N_2O from field burning (increases of 1.3 and 1.6 per cent, respectively) for 2003. The reasons for the recalculations are provided in the NIR and its addendum. However, the ERT recommends that further attention be given to the documentation of recalculations carried out in the sector, including further details on methodological changes and justification of these changes, in both the NIR and CRF table 8(b).

62. The ERT welcomes the efforts Italy has made in improving estimates from the agriculture sector, in particular the work undertaken within the framework of the MeditAIRaneo[4] project. The ERT encourages further implementation of the QA/QC plan in the sector, further steps to improve uncertainty analyses for the agriculture sector, and documentation of the verification process from peer review. The ERT was impressed by Italy's excellent electronic and paper archives of AD and other source references for the agriculture sector.

B. Key categories

1. Enteric fermentation – CH_4

63. Italy uses a tier 2 methodology for estimating CH_4 emissions from enteric fermentation for significant livestock categories – dairy cattle, non-dairy cattle and buffalo – together with country-specific EFs for the whole time series. Emissions from all other livestock categories are estimated using a tier 1 methodology. The ERT recommends that Italy consider using a higher-tier methodology for the estimation of emissions from the category sheep, which is significant (it accounted

[4] Project supported by APAT to produce reliable GHG inventories in Mediterranean countries, through the exchange of information.

for 12.6 per cent of total CH_4 emissions from enteric fermentation in 2004). For this category of the emission estimates, Italy uses AD as reported in the various publications of the Italian National Statistics Institute (ISTAT). In the case of different AD sources, data are further reconstructed by APAT. The ERT advises that Italy clearly specify in its next NIR the data sources, the criteria for their choice, the way the AD are collected and the influence of the AD trend on emissions.

2. Manure management – CH_4

64. Italy uses a tier 2 methodology for cattle, buffalo and swine along with country-specific and default EFs in estimating CH_4 emissions from manure management. For the estimation of slurry and solid manure management a new methodological approach was developed by Italy that provided updated time series for slurry and manure production, conversion factors and EFs for cattle and buffalo.

65. The ERT welcomes the improvement of transparency in the NIR and the increasing accuracy of the EFs for cattle, buffalo and swine. The ERT recommends that Italy apply the same information for animal populations split across all categories in the agriculture sector in its next submission, since currently different levels of aggregation for cattle are applied in enteric fermentation and manure management.

3. Manure management – N_2O

66. Italy has estimated N_2O emissions from manure management using equation 4.18 of the IPCC good practice guidance, and has applied country-specific nitrogen (N) excretion rates per livestock category and country-specific fractions of wastes deposited to each manure management system. N_2O emissions are estimated using the IPCC default EFs for each animal waste management system (AWMS). Italy uses a country-specific N excretion rate for swine calculated as an average value of country-specific N excretion rates for subcategories (sows and other swine). The ERT considers the information provided to be appropriate but recommends that Italy improve the transparency of its reporting by providing the necessary background information and data for the time series in its next NIR. The ERT also recommends that Italy reconsider the use of notation keys in CRF table 4.B(b). For example, for other AWMS (chicken-dung drying system) for poultry for the period 1990–1994, "not applicable" ("NA") should be replaced with the appropriate notation key.

4. Direct soil emissions – N_2O

67. The IPCC default tier 1a methodology and default EFs have been used to estimate direct N_2O emissions from agricultural soils. Italy has compiled estimates of emissions from synthetic fertilizers, animal manure applied to soils, N-fixing crops, crop residues and the cultivation of histosols. The ERT encourages Italy to develop country-specific EFs according to the available country-specific data on N sources.

5. Pasture, range and paddock manure – N_2O

68. Italy uses a country-specific value for fraction of livestock N excretion and deposition onto soil during grazing ($Frac_{GRAZ}$) of 19 per cent. N excreted in pasture, range and paddocks as a percentage of total N excretion, as calculated from the data in table 4.B(b), equals 19 per cent, in accordance with the $Frac_{GRAZ}$ value. The percentage of N excreted during grazing varies between animal categories from 5 per cent for dairy cattle to 90 per cent for sheep and goats. The ERT welcomes the consistency of Italy's reporting approach.

69. Italy uses an IPCC default value of 0.02 kg N_2O-N/kg N for estimating N_2O emissions from pasture, range and paddock manure. The ERT noted a fluctuation in the trend for animal manure applied to soils between 2000 and 2001 (a 3.4 per cent inter-annual change). This affects the emissions trend of N_2O and the time series values fluctuate. The ERT recommends that Italy highlight the factors affecting the trend, the circumstances of collection of the AD and the criteria for choosing the AD.

6. Indirect soil emissions – N_2O

70. Italy estimates emissions of N_2O from atmospheric deposition and from leaching and run-off using the IPCC default methodology and EFs for this key category. Italy has developed a country-specific fraction of N input to soils that is lost through leaching and run-off ($Frac_{LEACH}$) of 0.3 kg N_2O -N/kg N, which is comparable to the IPCC default value, and uses a country-specific fraction of livestock N excretion that volatilizes as ammonia (NH_3) and nitrogen oxide (NO_X) ($Frac_{GASM}$) (0.29 in 2004) and a country-specific fraction of synthetic fertilizer N applied to soils that volatilizes as NH_3 and NO_X ($Frac_{GASF}$) (0.094 in 2004) in estimating indirect emissions of N_2O from soils. The ERT welcomes the efforts made by Italy to develop country-specific parameters and recommends that Italy improve the documentation on how the country-specific parameters were developed in its next NIR, and provide more details in the NIR for the trend fluctuations in important emission sources (e.g. the inter-annual fluctuation in leaching and run-off emissions between 1996 and 1997).

C. Non-key categories

1. Rice cultivation – CH_4

71. Following the recommendation of the 2005 review report, Italy has improved and developed country-specific methodology and national EFs for rice cultivation. Even though the country-specific EFs are lower than the IPCC default EFs, Italy justified the methodological choice and other aspects of recalculations made in the NIR. The change of the methodology is not reflected in the uncertainty analysis and the ERT recommends that Italy update the uncertainty values for country-specific EFs and AD (e.g. irrigated area), reflecting the revised methodology, in its next NIR.

2. Field burning of agricultural residues – CH_4 and N_2O

72. Italy estimates emissions of CH_4 and N_2O for this category assuming that 10 per cent of the cereal residues (50 per cent for rice) are burned on-site.

73. The ERT welcomes Italy's efforts to estimate emissions from this category, considering that the activity is illegal in the country and that data are difficult to collect. The ERT recommends that Italy estimate emissions only from regions where this activity takes place as farming practice for its next submission.

V. Land use, land-use change and forestry

A. Sector overview

74. The LULUCF sector has been a net sink during all the years from 1990 to 2004. In 2004, it was a sink of 105,107.49 Gg, CO_2 eq., offsetting 18.2 per cent of Italy's total GHG emissions, and removals by the sector were 31.8 per cent higher than in 1990. CO_2 dominates the emissions/removals from the sector. CO_2 emissions and removals are reported for forest land, cropland and settlements. Emissions from wetlands and other land are reported as "NO" over the entire time series, while emissions from grasslands are reported only for some years, and the notation key "NO" is used for the rest of the years. A combination of tier 1 and tier 2 methods are adopted for the inventory estimation for all land categories, except for the category forest land (5.A), where the growth model was applied to forest inventory data. Italy needs to be complimented for successfully and fully adopting the IPCC good practice guidance for LULUCF. QA/QC procedures have been adopted and implemented for the 2004 inventory for the LULUCF sector as whole, although the source-specific QA/QC plan adopted is described only for the category forest land in the NIR.

75. Forest land is the dominant category, accounting for 88.1 per cent of net removals by the sector during 2004. Italy has developed a land-use change matrix describing the changes in land area covering categories based on national land-use statistics. However, the annual transitions between land categories

are derived based on assumptions. It is assumed that new forest areas and settlement areas have come from cropland or grassland. Given the importance of these changes in land categories, the ERT suggests that Italy validate these assumptions in its next NIR, based on forest inventory and periodic remote sensing data.

76. In terms of completeness and transparency, all the CRF tables for LULUCF have been reported, using notation keys cells where emissions are not provided. The NIR provides information for all land categories, all subcategories and all carbon pools and adequately describes the methods and procedures applied. It focuses on the 2004 inventory processes and explains the models used.

77. An uncertainty analysis was carried out for the LULUCF sector. The uncertainty for the dominant forest land category is estimated to be 86.3 per cent for the five carbon pools. The overall uncertainty of the sector is reported to be 56 per cent. The sector affects the overall uncertainty of the total GHG inventory, being 3.3 per cent in 2004 without LULUCF and 8.3 per cent with LULUCF. The ERT encourages Italy to reduce the uncertainty in the sector.

B. Key categories

1. Forest land remaining forest land – CO_2

78. Forest land remaining forest land dominates the Italian land area, accounting for 10,726.94 kha in 1990 and 12,650.42 kha in 2004. The land area estimate is based on the assumption of linear trend changes between the 1985 and 2002 forest inventories. The ERT considers it necessary to seek remote sensing data to estimate annual changes in forest area. The annual carbon stock increment for 2004 is estimated based on a model which uses the growing stock values derived for 1985. The ERT suggests that Italy validate the growing stock estimates based on sample measurements for at least the dominant forest types, such as protective forests, oak, spruce and coppice in broadleaf forests, until the estimates from new forest inventory become available, which may lead to recalculations of the growing stock and carbon increment estimates. The carbon stock change increase in living biomass for some categories such as sweet chestnut (5.91 t C or 12 t biomass/ha/yr over the time series) and Mediterranean pine stands (4.64 t C or 10 t biomass/ha/yr over the time series) seem to be high and may have to be checked with values in the scientific literature, even though they are within the IPCC default values. These values are important since estimates for below-ground biomass, dead organic matter and soil carbon are derived as a function of above-ground biomass. The uncertainty for soil carbon is estimated to be high at 150 per cent. The ERT encourages Italy to generate data from field studies for different forest types to reduce uncertainty for its next submission.

2. Land converted to forest land – CO_2

79. The net carbon stock change in soils for grassland converted to forest land is reported to increase at 32.91 t C/ha/year in 2004, which is an extremely high value. The ERT recommends that this value be checked. In addition, the ERT recommends that Italy for its next submission validate the assumption of conversion of grassland to forest land by using remote sensing data.

3. Land converted to cropland – CO_2

80. A sudden rise in land converted to cropland is reported for 2004. Grassland is assumed to be converted to cropland. Soil carbon (C) is estimated to decrease at 5.78 t C/ha during the year of conversion (this accounts for 13 per cent of total C stock in grasslands). The ERT considers that this value needs to be validated in Italy's next NIR. All soil carbon is assumed to be lost in the first year of conversion, according to the NIR.

C. Non-key categories

1. Grassland – CO_2

81. Grassland accounted for about 5.9 Mha or 20 per cent of the geographic area of Italy in 2004, but this area is not accounted for in the inventory. Italy has reported only the area of grassland remaining grassland, while land conversion to grassland is reported as "NO". The IPCC good practice guidance for LULUCF recommends reporting of CO_2 emissions and removals from soil carbon even when there is no land-use change. The ERT recommends that Italy reconsider its reporting, gather AD on management practices adopted for grasslands and include relevant estimates in its future inventory. During the in-country review, the ERT was informed of Italy's plans to obtain these data.

2. Wetlands – CO_2

82. Italy reports 57.14 kha of wetlands remaining wetlands for the entire time series. Land conversion to wetlands is reported as "NO". Italy reports lack of data on flooded land, for which loss of carbon stock is required to be reported. The ERT encourages Italy to collect data on flooded lands for its next submission. During the in-country review, Italy informed the ERT that it plans to obtain these data.

3. Settlements – CO_2

83. Italy reports only a small area of land converted to settlements (8.26 kha) in 2004 and further reports a net carbon stock change in soils per area of 42.28 t C/ha for grassland converted to settlements. This EF value seems to be large: such high emissions are unlikely unless the land is dug up and the soil is subjected to heavy disturbance. The ERT recommends that Italy check the EF used for its next submission. The ERT further recommends that Italy specify in its next NIR if the carbon stock change in farms, parks and gardens is reported within this category.

4. Biomass burning – CH_4 and N_2O

84. The IPCC default method and EFs are used for estimating emissions from forest land remaining forest land. Only CH_4 and N_2O emissions from wildfires in forests are reported under biomass burning, since CO_2 emissions are considered under forest land remaining forest land. The forest area subjected to biomass burning was comparatively small in 2004 (18,874.38 ha). For the rest of the land categories biomass burning is reported as "NO". The ERT encourages Italy to recheck the assumption made for grassland and to collect AD on grassland subjected to biomass burning, if applicable, in its next submission.

5. Land converted to cropland – N_2O

85. N_2O emissions from land-use conversions resulting from the conversion of grassland to cropland are reported in CRF table 5.A. The secretariat identified this category in 2004 as a key in the trend analysis. The area undergoing a transition from grassland to cropland is estimated to be 351,823 ha in 2004. Emissions of N_2O from mineral soils resulting from the land-use conversion are reported to be 2.50 Gg for the year 2004. The ERT suggests that Italy use a locally-derived C/N ratio rather than a default value for its estimates in its next submission.

VI. Waste

A. Sector overview

86. In 2004, the waste sector emissions amounted to 19,462.66 Gg CO_2 eq. and contributed 3.4 per cent of total national GHG emissions. Emissions from this sector in 2004 were 8.9 per cent above the 1990 level. The trend is entirely defined by CH_4 emission changes from solid waste disposal on land, which increased also by 8.9 per cent between 1990 and 2004 and contributed 74.4 per cent to the

total emissions of the waste sector both in 1990 and in 2004. The trend is explained in the NIR. The methodology used by Italy is in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The inventory covers all gases and all categories. CH_4 emissions from compost production are also included under the subcategory other (6.D). All calculations are described in the NIR; however, more explanations and methodological information could be included along with referencing the sources of information and providing more methodological information. In addition, Italy can consider wider use of the documentation boxes in the CRF to improve transparency in its reporting. Recalculations were carried out for the sector following the recommendations of the previous (2005) review, with the main impact being on CH_4 from solid waste disposal on land. Some revisions for N_2O emissions from wastewater handling were made in the course of this review.

B. Key categories

1. Solid waste disposal on land – CH_4

87. As a result of the previous reviews, Italy changed tier 1 methodology with a tier 2 method (first order decay model) for the inventory of CH_4 emissions from solid waste disposal on land in line with the Revised 1996 IPCC Guidelines and IPCC good practice guidance. The recalculation was made for the entire time series. The AD on municipal solid waste (MSW) generation were obtained from the national waste cadastre. The EFs are based on the national data on waste composition taking into account the speed of the degrading process for different types of MSW: rapid (food and sludge), moderate (waste from gardens and parks) and slow (paper, textile, leather, wood and straw). Besides other changes, new information on sludge amounts disposed on landfills was included and the CH_4 density value was corrected. The ERT considers the changes as an improvement. However, it recommends that Italy clearly document the recalculations and methodological choices made in the NIR of its future submissions.

2. Wastewater handling – CH_4

88. Emissions from wastewater handling increased by 17.5 per cent between 1990 and 2004, mainly due to an increase in the amount of wastewater treated anaerobically. The estimates cover handling of industrial, domestic and commercial wastewater and sludge. Italy used the IPCC tier 1 methodology and default EFs as national values were not available. The percentages of aerobic and anaerobic wastewater treatment are based on expert judgement and have not changed since the base year. National data were used in the calculations of degradable carbon values for industrial plants. The ERT recommends that Italy give more methodological explanations on these values and their changes between years. The uncertainty of the estimates is still considered to be high (104 per cent). Given the importance of the category, the ERT recommends that Italy make further efforts to reduce the uncertainty of the estimates.

3. Wastewater handling – N_2O

89. N_2O emissions from wastewater handling were identified as a key category only in Italy's tier 2 trend assessment and were not identified as a key category according to the secretariat's analysis. For estimating N_2O emissions from human sewage Italy uses a constant value of protein consumption for all years (1990–2004), which was obtained from the National Research Centre on Nutrition (1997) and accounted for 60 g protein/capita/day, which amounts to half of the Food and Agriculture Organization of the United Nations (FAO) values reported for Italy (i.e. 111–113 g protein/capita/day). The ERT recommended that Italy revise the estimates of N_2O emissions from human sewage based on updated protein consumption from the FAO data or fully documented national information. After the in-country review, following the ERT's recommendations, Italy revised the emissions for this category and presented new estimates of N_2O emissions from human sewage for the base year and the complete time series, which resulted in an increase in emissions of N_2O for the entire time series (by 2.90 Gg or 898.28 Gg CO_2 eq. in 2004), with the revised estimate of N_2O being 6.12 Gg in 2004. Italy used the protein consumption value as in the FAO statistics for Italy.

C. Non-key categories

Waste incineration – CO_2

90. CO_2 emissions from waste incineration with energy recovery are reported in the energy sector under the category commercial/institutional (1.A.4a). The ERT encourages Italy to further investigate the correctness of its reporting of these emissions under 1.A.4a or under public electricity and heat production (1.A.1a) and to provide more information on this in its next NIR. CO_2 emissions from the incineration of non-biogenic waste (without energy recovery) are reported in table 6.C. However, the level of aggregation of the reporting at the level of table 6.C hides the types of waste considered in the estimate (namely municipal waste, industrial waste and waste oil, hospital waste and sewage sludge) and aggregates the EFs used. The ERT recommends that Italy report the waste flows separately in the CRF tables in its next submission to help improve the transparency of the reporting for this category.

VII. Conclusions and recommendations

A. Conclusions

91. Italy has provided its GHG inventory data for the years 1990–2004, and has included all the tables required with data on all relevant gases and categories. Italy's inventory conforms to the UNFCCC reporting guidelines, the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

92. The ERT noted the continuous improvement of Italy's GHG inventory. Recommendations from previous reviews have been followed, for example, revising and recalculating estimates of several categories in the 2006 submission.

93. However, during the in-country review the ERT identified a few categories where methods or EFs used were not fully in accordance with the IPCC good practice guidance and this might lead to overestimation of emissions in 1990 or underestimation of emissions in the most recent years (e.g. 2004). In particular, the ERT raised concerns related to the estimates of CH_4 and N_2O emissions from stationary combustion and N_2O emissions from flaring and wastewater handling. The ERT recommended that Italy revise its estimates for these categories.

94. The ERT noted that after the in-country review Italy provided timely and thorough replies to all the questions raised during the in-country review. In this respect, Italy followed the ERT's recommendations, and provided revised estimates for these categories for the complete time series and in line with the IPCC good practice guidance.

B. Recommendations

95. While the inventory is generally of high quality, there are areas where further improvement is needed. The key recommendations that the ERT believes should be considered in the course of future reviews are that Italy should:

(a) Improve documentation in the NIR of decisions based on expert judgement;

(b) Improve the transparency of the GHG inventory by including in the NIR more information on methodologies used and underlying assumptions made in the elaboration of emission estimates and on the rationale behind recalculations;

(c) Provide all the CRF tables, including those relating to key category analysis and explanatory information on recalculations (tables 8(a) and 8(b));

(d) Provide the key category analysis for the base year (1990);

(e) Implement source-specific QA/QC procedures;

(f) Improve its collection of input data in some specific areas, for example LULUCF.

96. In relation to institutional arrangements, the ERT recommends that Italy strengthen its arrangements to ensure the sustainability of existing capacities and the competence of technical staff.

Annex

Documents and information used during the review

A. Reference documents

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

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B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Riccardo de Lauretis (APAT) and the members of the inventory team in APAT, including additional material on the methodology and

assumptions used. Excel working files and access to the reference databases were also provided when needed to the ERT for all sectors.

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APAT. 2007. *National Greenhouse Gas Inventory System in Italy*. July.

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Energy sector

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