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REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF ITALY SUBMITTED IN THE YEAR 2001[1]

(Desk review)

I. OVERVIEW

A. Introduction

1. The Conference of the Parties (COP), at its fifth session, by its decision 6/CP.5, requested the secretariat to conduct, during the trial period, individual reviews of greenhouse gas (GHG) inventories for a limited number of Parties included in Annex I to the Convention (Annex I Parties), according to the UNFCCC guidelines for the technical review of GHG inventories from Annex I Parties, hereinafter referred to as the review guidelines.[2] The secretariat was requested to coordinate the technical reviews and to use different approaches to individual reviews, including desk reviews, centralized reviews and in-country reviews.

2. The review of Italy's 2001 inventory submission took place from 8 October to 27 October 2001. The desk review was carried out by a team of nominated experts from the roster of experts, working in their own countries. Experts participating in the review were Mr. Klaus Radunsky (Generalist, Austria), Mr. Michael McGettigan (Energy, Ireland), Mr. John Sarafidis (Energy, Greece), Mr. Mauro Meirelles de Oliveira Santos (Industrial processes, Brazil), Mr. Alexander Nakhutin (Industrial processes, Russian Federation), Mr. Ayite-Lo Ajavon (Agriculture, Togo), Mr. Pascal Boeckx (Agriculture, Belgium), Mr. Tomás Hernández-Tejeda (Land-use change and forestry (LUCF), Mexico), Mr. James Barton (LUCF, New Zealand), Ms. Sirintornthep Towprayoon (Waste, Thailand) and Mr. Heinrich Widmer (Waste, Switzerland). The review was coordinated by Ms. Rocio Lichte (UNFCCC secretariat). Mr. Klaus Radunsky and Mr. Ayite-Lo Ajavon were lead authors of this report.

3. In accordance with 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.

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[1] In the symbol for this document, 2001 refers to the year in which the inventory was submitted, and not to the year of publication. The number (1) indicates that for Italy this is a desk review report.

[2] For the UNFCCC review guidelines and decision 6/CP.5, see document FCCC/CP/1999/7, pages 109 to 114 and 121 to 122, respectively.

B. Inventory submission and other sources of information

4. The expert review team (ERT) reviewed the 2001 inventory submission of Italy, which consists of common reporting format (CRF) tables for the years 1998 and 1999 submitted on 17 April 2001. No national inventory report (NIR) was provided and the review therefore refers to the second national communication (NC2) as the most up-to-date source documenting the inventory process in Italy.

5. For this review, the ERT also used the 2001 status report, the draft synthesis and assessment (S&A) report of the 2001 inventory submission, the final S&A report of the 2000 inventory submissions (FCCC/WEB/SAI/2000) and the preliminary key source analysis prepared by the UNFCCC secretariat.[3] A response to the preliminary findings raised in the draft S&A report 2001 was not provided by Italy.

6. Additional information was made available to the ERT setting out the numerical differences between emission estimates provided in 2000 and recalculated values provided in 2001. This information shows the effects of recalculations in detail for 1998 by sector and gas, and in trend tables for each year from 1990 to 1998.

7. Other sources of information used during the review include the preliminary guidance for experts participating in the individual review of GHG inventories, the UNFCCC reporting guidelines[4] and the review guidelines (FCCC/CP/1999/7).

8. During the review the Party was not contacted to request additional information.

C. Emission profile, trends, key sources

9. Italy has the typical emission profile of an Annex I Party. The most important GHG is carbon dioxide (CO_2), which in 1999 accounted for 84% of total emissions,[5] followed by methane (CH_4), 8%, and nitrous oxide (N_2O), 7%. By source, energy accounted for 82% of total emissions, agriculture 8%, industrial processes 6% and waste 3%.

10. Tables 1 and 2 provide data on emission trends, by gas and by sector. Emissions of CO_2, excluding land-use change and forestry (LUCF), grew by 4% between 1990 and 1999, driven mainly by the growth of emissions from transport. N_2O emissions were in 1999 at almost the same level as in 1990 with little change in the sectors either. CH_4 emissions also showed almost the same level in 1999 as in 1990, with CH_4 emissions from energy decreasing and those from waste increasing. Hydrofluorocarbons (HFCs) experienced significant growth after 1990, with emissions in 1999 being eight times those of 1990, whereas perfluorocarbon (PFC) emissions

[3] The UNFCCC secretariat had identified, for each individual Party, those source categories that are *key sources* in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. Key sources according to the tier 1 trend assessment were also identified for those Parties that provided a full CRF for the year 1990. The key sources presented in this report are based on the secretariat's preliminary key source assessment. These might differ from the key sources identified by the Party itself.

[4] 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 (FCCC/CP/1999/7), are referred to in this report as the UNFCCC reporting guidelines.

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

decreased by 17%. Sulphur hexafluoride (SF_6) emissions almost doubled in the same period. Total GHG emissions (excluding CO_2 from LUCF) increased by 4% between 1990 and 1999.

Table 1. GHG emissions by gas, 1990-1999 (Gg CO_2 equivalent)

GHGs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)									
Net CO_2 emissions/removals	417,529	420,029	418,633	407,750	401,834	426,597	420,551	425,151	438,904	440,433
CO_2 emissions (without LUCF)[(a)]	437,749	436,521	435,491	423,526	417,291	442,457	437,405	440,169	454,200	456,533
CH_4	40,205	40,520	38,833	38,595	39,771	40,211	40,401	41,223	41,233	41,255
N_2O	39,718	41,130	40,452	40,543	39,485	40,878	40,414	41,612	38,946	39,895
HFCs	351	355	358	355	623	918	760	1,096	1,332	2,885
PFCs	237	231	205	203	212	255	161	166	186	171
SF_6	198	229	249	271	292	321	327	350	420	385
Total (with net CO_2 emissions/removals)	498,240	502,497	498,733	487,719	482,220	509,183	502,615	509,602	521,024	525,028
Total (without CO_2 from LUCF)[(a)]	518,460	518,989	515,590	503,496	497,676	525,042	519,469	524,620	536,319	541,127

[(a)] In the CRF, the information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report CO_2 emissions and removals from LUCF.

Table 2. GHG emissions by sector, 1990-1999 (Gg CO_2 equivalent)

SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)									
1. Energy	426,464	425,619	423,951	415,676	409,737	434,784	430,303	432,807	443,583	446,301
2. Industrial processes	32,369	32,432	32,140	28,040	27,148	29,122	28,265	28,892	29,944	31,776
3. Solvent and other product use	1,663	1,669	1,577	1,511	1,459	1,425	1,379	1,364	1,307	1,295
4. Agriculture	43,206	44,243	43,722	43,663	43,524	43,647	43,073	44,404	44,042	44,338
5. LUCF (net emissions)	-20,041	-16,456	-16,802	-15,655	-15,395	-15,822	-16,834	-14,959	-15,215	-16,040
6. Waste	13,142	13,570	12,602	12,848	14,234	14,505	14,757	15,480	15,567	15,561
7. Other	1,435	1,417	1,541	1,634	1,511	1,520	1,669	1,612	1,794	1,794

11. Italy did not perform a key source assessment. According to the preliminary key source level assessment undertaken by the secretariat, the key sources shown in table 3 below have been identified for Italy. In the absence of a CRF for 1990, an identification of key sources according to the trend assessment could not be performed.

Table 3. Key sources Italy, 1999: Level assessment (UNFCCC secretariat)[(a)]

Key source	Gas	Level assessment %	Cumulative total %
Stationary combustion – oil	CO_2	23.9	24
Stationary combustion – gas	CO_2	23.3	47
Mobile combustion – road vehicles	CO_2	20.4	68
Stationary combustion – coal	CO_2	8.5	76
Cement production	CO_2	3.4	79
Enteric fermentation in domestic livestock	CH_4	2.5	82
Direct emissions from agricultural soils	N_2O	1.8	84
Solid waste disposal sites	CH_4	1.7	85
Indirect N_2O from nitrogen used in agriculture	N_2O	1.4	87
Stationary combustion – other fuels	CO_2	1.3	88
Mobile combustion – waterborne navigation	CO_2	1.3	90
Fugitive emissions: oil & gas operations	CH_4	1.1	91
Adipic acid production	N_2O	1.1	92
Manure management	N_2O	0.7	92
Manure management	CH_4	0.7	93
Mobile combustion – road vehicles	N_2O	0.5	94
ODS substitutes	all HFCs and PFCs	0.5	94
Wastewater handling	CH_4	0.5	95

[(a)] See footnote 3 of this report.

D. General assessment of the inventory

1. Completeness and transparency of reporting

Completeness

12. Italy submitted inventory data for the years 1998 and 1999 by 17 April 2001, using the CRF of the UNFCCC reporting guidelines. The ERT identified minor omissions in the national inventory relating to potential emissions of PFCs. With these exceptions the inventory covers all major sources and sinks, as well as all direct and indirect gases, included in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, hereinafter referred to as the IPCC Guidelines.

13. The ERT noted that no data for the years 1990 to 1997 have been provided using the CRF.

Transparency

14. The transparency of the inventory, as defined by the UNFCCC reporting guidelines, cannot be fully assessed in this review because essential support material is not available. This missing information includes a NIR and completed CRF tables covering methods and emission factors (Summary 3), recalculations (table 8(a) and (b)), uncertainties (table 7 Overview) and completeness (table 9) as well as a complete time series of inventories from 1990.

15. The ERT strongly recommends that Italy provide more comprehensive information in the future by filling in the tables mentioned above. The NC2 provides a good basis for developing a first NIR for Italy which is the key missing item related to reporting requirements under the

UNFCCC guidelines. Without a NIR it is very difficult to determine the transparency of the CRF.

2. Cross-cutting issues

Institutional arrangements

16. Institutional arrangements were not addressed by the desk review.

Record keeping

17. No assessment of record keeping was made during this desk review.

Verification and quality assurance/quality control (QA/QC) approaches

18. No information is available to determine whether the inventory data was subject to any self-verification or independent review procedures for any sector. Due to this lack of supporting documentation, verification and QA/QC activities were not addressed in the individual sectoral sections of this report.

Recalculations

19. No information is provided in the CRF in relation to recalculations; recalculation tables 8(a) and (b) were not provided. However, comparison of the CRF data for the inventory year 1998 of the 2001 submission with data provided in 2000 for that year, reveals that revisions have been conducted across all gases and sectors. Such revisions have been made for all years from 1990 to 1998, as shown when comparing data reported in the trend tables (table 10) in these two submissions.

20. The full chronology of recalculations was, however, unclear from the existing information. The quantitative information provided in the 2001 inventory submission for years 1990 to 1998 was inconsistent with previously submitted data and no further information is provided in the CRF in relation to recalculations in general. The S&A report for 2000 showed that the recalculation for the base year (1990) in the 2000 inventory submission as compared to the data submitted in 1999 resulted in a reduction of 2.9 % in the total CO_2 equivalent emissions excluding LUCF. The difference for that same value submitted in 2001 as compared to 2000, was less than 0.01 %.

Uncertainties

21. The ERT noted that no uncertainty estimates or any information in relation to uncertainty estimation has been provided for any sector of the inventory.

3. Areas for further improvement

Planned or ongoing work by the Party

22. No information was provided with respect to any plans by Italy to introduce improvements. As planned improvements could not be identified from the information available for this review for any sector, no reference is made to this matter in the respective sectoral sections of this report.

Issues identified by the ERT

23. The ERT found that the inventory from Italy needs some further improvement in addition to the improvements relating to transparency already indicated in paragraphs 14 and 15 above.

24. The ERT encourages Italy to fully implement the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (hereinafter referred to as the IPCC good practice guidance), which Annex I Parties should apply as far as possible for their inventory submissions of the year 2001.[6]

25. *Verification*: The ERT encourages Italy to consider implementing and reporting a formal system of verification for the whole national inventory, consistent with the IPCC Guidelines and good practice guidance. This will help to overcome some existing inconsistencies and gaps in the current inventory. A re-evaluation of the proportions adopted for carbon stored in the non-energy use of fuels is needed as part of the verification of CO_2 emissions from combustion sources by means of the reference approach.

26. *Methodologies*: Italy is encouraged to provide details about the methodologies chosen, and the rationale for the choice, and should consider developing, where appropriate, tier 2 approaches for key source categories.

27. *Calculation sheets*: Italy may wish to provide calculation sheets in order to disclose in a transparent manner the actual calculations and how these calculations are linked with the data reported in the CRF.

28. *Emission factors*: Italy may wish to consider a review of some emission factors, particularly those obtained from the joint EMEP/CORINAIR Atmospheric Emission Inventory Guidebook, to reflect recent research or technological developments as well as national circumstances.

29. *Reporting*: Italy is strongly encouraged to submit a NIR consistent with the UNFCCC reporting guidelines as well as the full time series of emissions data using the CRF from the year 1990 onwards.

30. *Completeness:* Italy may wish to consider in its future inventories some sources missing in the current inventory. These sources include potential emissions of HFCs, PFCs and SF_6.

31. *Uncertainty*: Italy should attempt to quantify uncertainties according to the IPCC good practice guidance for the key source categories.

32. *Notation keys*: Italy is encouraged to make use of the notation keys according to the UNFCCC reporting guidelines.

4. Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

33. The 1998 and 1999 CRF tables are broadly consistent with the IPCC and UNFCCC guidelines, although a number of important tables are not complete. A NIR and a complete CRF time series is needed to comply fully with the UNFCCC reporting guidelines. The good practice

[6] According to the conclusions of the Subsidiary Body for Scientific and Technological Advice (SBSTA) at its twelfth session, the IPCC good practice guidance should be applied by Annex I Parties as far as possible for inventories due in 2001 and 2002 and should be used for inventories due in 2003 and beyond.

guidance appears not yet to be fully implemented, although some elements of the good practice guidance may already apply, according to information provided in the NC2.

5. Conclusion

34. The ERT considers that Italy has provided only partly adequate information to the COP on its GHG inventory and GHG emission trends.

35. In its response to the draft of this review report, Italy noted with regard to the overview section of this report (paragraphs 1 to 34) that in its next inventory submission (submission 2002) Italy would supply more detailed information on methodologies, emission factors and activity data by using notation keys, documentation boxes and CRF tables. Italy plans also to supply the full CRF time series by 2002. Italy also informed the ERT that a NIR, which would include all the detailed information concerning recalculation of time series, would be provided after September 2002.

36. Italy also noted in its response that 1990-1997 data had already been supplied in previous submissions[7] and that these were useful for understanding the sectoral breakdown of emissions. (Recalculations considerably affected the estimates in only a few cases.). The respective methodologies are explained in detail in the NC2.

37. Italy also informed the ERT that the IPCC good practice guidance has already been used for the calculation of emission estimates, comparing default values with national data wherever possible.

II. ENERGY

A. Sector overview

38. Emissions of GHG (without CO_2 from LUCF) in Italy have increased from 1990 to 1999 by approximately 4%, from 518.46 Mt in 1990 to 541.13 Mt in 1999. This trend is determined largely by CO_2 emissions in the energy sector, which accounted for 94% of all CO_2 emissions in the country in 1999 and for 80% of total GHG emissions.

39. Approximately 90% of all CO_2 emissions and 76% of total GHG emissions emanated from four key source categories in this sector (stationary combustion using coal, oil and gas, and energy use in road transport; see table 3). The combustion of liquid fuels accounted for 54% of total CO_2 emissions from combustion sources in Italy. This is the highest contribution of liquid fuels in all Annex I Parties except Iceland.

1. Completeness

40. The energy sector of the Italian inventory appears to be fully covered with respect to IPCC source categories, and there is substantial subsectoral detail. All gases relevant to the sector are reported in the CRF. All fugitive emissions are adequately covered in tables 1.B.1 and 1.B.2. The required reporting is performed in relation to aviation and marine bunkers. The

[7] The previous year's inventory submission (submission 2000) included CRF tables for the year 1998. Trend tables, covering the entire time series from 1990 onwards, were provided in both the 2000 and 2001 inventory submissions.

review noted that there is a detailed breakdown for individual industries in subcategory 1.A.2. Manufacturing industries and construction.

2. Transparency

41. Transparency of the inventory, including the energy sector, is referred to in paragraphs 14 and 15 of this report.

3. Methodologies, activity data and emission factors

42. No information is available in the CRF on the methodologies, activity data or emission factors that have been used to compile the emissions in the energy sector. However, the NC2 indicates that the CORINAIR approach is the basic methodology used in the Italian inventories. This essentially amounts to a combination of tier 1 (area source emissions), tier 2 (aviation emissions) and tier 3 methods (CORINAIR point source emissions and road traffic) in respect of the energy sector. According to Italy's response to the draft version of this report, emission factors for energy are a combination of IPCC default emission factors and national emission factors for some sources not covered by IPCC methodologies (coal-derived gases from steel works) or calculated according to national circumstances based on the availability of the average carbon content of fuels used in a certain year as steam coal (other bit. coal), natural gas, LPG and fuel oil. Italy also explained that CRF tables for energy have been filled in manually with data derived from numerous independent sources, and that it has not used the software provided by the European Environment Agency (EEA) to generate these tables from the CORINAIR database.

4. Recalculations

43. Recalculations have been conducted for Italian inventories for each year from 1990 to 1998, but details of the changes cannot be assessed without the full CRF series. The changes at IPCC source category level over this period are to be seen when comparing the trend tables (table 10 of the CRF) as provided in the 2000 and 2001 inventory submissions. For the 1998 inventory the differences are detailed in full CRF, as a full CRF was available in both the 2000 and 2001 submissions. (No further information is provided in the CRF regarding recalculations in general, and the full chronology of recalculations is unclear from the existing information). The biggest changes affecting the energy sector relate to combustion CO_2 and N_2O emissions from subsector 1.A.5, fugitive CO_2 in subsector 1.B.2 and N_2O emissions from subsector 1.A.1 Energy industries. In its response to the draft of this report, Italy explained that these recalculations have occurred due to improvements in data quality (the availability of detailed estimates from industry and revision of the emission factor used).

5. Uncertainties

44. No information is provided in relation to estimates of uncertainty. The NC2 states that the general revision of inventories to account for the Revised 1996 IPCC Guidelines and more complete application of national data in the various methodologies now available has increased the reliability of the emissions estimates. No quantitative estimate of uncertainty is given but the ERT notes that CO_2 emissions from energy use are assigned a "high" quality rating in the NC2.

6. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines

45. The NC2 gives a substantial amount of information describing the various procedures, data sources and methodologies being used in Italy to compile inventories in close conformity with the IPCC Guidelines. The CORINAIR approach is the basis for all emission inventories. The ERT is of the opinion that substantial improvements have been made in adapting this methodology to compile GHG emissions according to national circumstances, since the NC1 and its subsequent in-depth review. Furthermore, the NC2 provides a good basis for developing a first NIR for Italy, which is the key missing item relating to reporting requirements under the UNFCCC reporting guidelines. The 1998 and 1999 CRF tables are broadly consistent with the IPCC Guidelines and UNFCCC guidelines although a number of important tables (methods and emission factors, recalculations and completeness) are not completed. Indicators are not used in the CRF tables for the energy sector.

B. Reference and sectoral approach

1. Comparison between reference and sectoral approach

46. Emissions of CO_2 according to the sectoral approach and the reference approach (table 1.A(b)) are included in sufficient detail in the CRF for 1998 and 1999. The CO_2 emission factors used in the reference approach are drawn directly from the default values of the IPCC Guidelines, although there are some small differences (other kerosene, LPG, other bit. coal, sub-bit. coal and natural gas) reflecting national circumstances (see also paragraph 42). Italy confirmed in its response to the draft of this report that for "other kerosene" the IPCC default value has been used.

47. All calculations are based on net calorific values (NCV), but since input values are presented in Mtoe no further assessment (default values, national values and so on) is possible. The value used for the conversion of Mtoe to TJ (41,840 TJ/Mtoe) is slightly different from the one proposed by the International Energy Agency (IEA) (41,870 TJ/Mtoe approximately). In its response to the draft of this report, Italy noted that the use of Mtoe derives from its national energy balance and that a slightly different conversion factor has been used in converting Mtoe to TJ energy.

48. The deviation between the estimated emissions under the two methods is –1.84% for 1998 and 2.99% for 1999. However, no explanation is provided for the observed difference in 1999. The methodology followed for the non-energy uses of fuels (see the following section) and the difference in the consumption of liquid fuels according to the two approaches (13.6%) could explain this deviation. The Italian NC2 states that emissions from military activities (aviation and stationary) appear in subsector 1.A.5 of the CRF.

49. In response to paragraph 48 above, Italy explained that the difference of 13.6% in liquid sources energy content derives from the following reasons:

- LPG used in transport and civil sectors and natural gas used in transport are added to the "other" line in table 1.A(c) from the CRF software;[8]

[8] According the structure of the CRF, all fuels which in table 1.A(a) are entered by Parties under "other fuels" under the respective sub-sources, are also aggregated to the total "other fuels" which is used in the comparison between the two approaches. The provisions for reporting "other fuels" from transport in the CRF will be improved as part of the revision of the UNFCCC reporting guidelines, following the conclusions of the SBSTA at its sixteenth session.

- The energy value of the non-energy uses of fuels is not subtracted by the CRF software.[9]

Italy pointed out that the difference between the reference and the sectoral approach is not due to the methodology followed for the non-energy use of fuels.

2. Treatment of feedstocks and non-energy use of fuels

50. Table 1.A(d) on feedstocks and non-energy use of fuels is fully completed for 1998 and 1999. For all fuel types in the table, the full carbon content is taken to be stored when the fuels are used for non-energy purposes. In all cases, this level of non-release of carbon differs substantially from the default proportions for carbon storage given in the IPCC Guidelines. The high level of carbon assumed to be stored in this way obviously has implications for the comparison above between the results of the sectoral approach and the reference approach for CO_2 emissions.

51. Regarding the observation in paragraph 50 above, Italy explained in its response to the draft version of this report that the fraction of carbon stored derives from statistical data describing the "net petrochemical input" (as reported in the notes to table 1.A(d)) whereas in the IPCC Guidelines reference is made to the "gross or total petrochemical input", and that this explains why the proportion is different.

3. International bunker fuels

52. The emissions from international bunker fuels are fully covered and they are reported in accordance with the UNFCCC reporting guidelines. The amount of jet kerosene used in international aviation reported by IEA for 1999 is 34.6% higher than that reported in the CRF. The differences are even larger for international marine transport fuels. For residual oil, the IEA amount is 77.7% greater than in the CRF. Gas oil is not used in marine bunkers according to the CRF but the IEA gives 34,404 TJ for this item. Italy explained in its response to the draft of this report that the 1999 data for marine and aviation bunker fuels derive from a recent study based upon UNFCCC methodologies, whereas the IEA data derive from "proxy" estimates (based on estimates for internal flights consumption and coastal navigation consumption for freight). The above-mentioned recent study has estimated the fuel used for domestic and international flights and in the coastal navigation, and has involved an evaluation of all journeys, the actual carriers used and the routes followed.

C. Key sources

1. Stationary combustion: oil, gas and coal – CO_2

53. Key source analysis shows that stationary combustion sources using oil, gas and coal in Italy account for 66% of total CO_2 emissions in 1999 and for 56% of total aggregate GHG emissions in CO_2 equivalent (see table 3). Oil accounts for 28.3% of CO_2 emissions and for 23.9% of total aggregate GHGs in 1999.

[9] The reference approach in the CRF follows the reference approach of the IPCC Guidelines, which is intended to be used mainly for comparing CO_2 emissions according to the two approaches. As part of the revision of the UNFCCC reporting guidelines following the conclusions of the SBSTA at its sixteenth session, the CRF will provide provisions for reporting apparent consumption data from the reference approach, corrected for the amounts of fuels used as feedstocks and for non-energy use. This will facilitate the comparison of consumption figures resulting from the two approaches.

54. The CORINAIR methodology is used to estimate emissions from these key sources using official energy data. This incorporates tier 1 methods for area-source emissions and tier 3 methods for CORINAIR point sources. The emission factors are a combination of country-specific values and CORINAIR or IPCC default values. A high proportion of these emissions emanate from subcategories 1.A.1(a) Public electricity and heat, 1.A.1(b) Petroleum refining and 1.A.2 Manufacturing industries, and they would therefore be largely subject to level 3 inventory methods for CORINAIR point sources. Accordingly, the emissions of CO_2 would be well quantified, with a high degree of reliability. This is, to some extent, reflected in the very minor changes that have occurred in the recalculated CO_2 emissions in this main combustion source category, as is shown when the data provided in the two submissions 2000 and 2001 are compared.

55. The IEF for CO_2 in respect of oils across all stationary source categories are typical of IPCC default values and there is good consistency between 1998 and 1999 as well as with the values for other reporting Parties.

56. An apparently anomalous IEF of 235.6 t/TJ appears for CO_2 from solid fuels in subcategory 1.A.1(c) Manufacture of solid fuels and other energy industries for both 1998 and 1999.

57. The IEFs of 63.76 t/TJ and 61.65 t/TJ for CO_2 in 1.A.2(a) Iron and steel in 1998 and 1999, respectively are substantially lower than the IEFs for solid fuels in other source categories. The values are inconsistent with the CO_2 emission factors listed under the reference approach. The corresponding CH_4 IEFs also appear to be significantly out of line with those for solid fuels in other subcategories.

58. The IEF for CH_4 in respect of gaseous fuels in 1.A.1(b) Petroleum refining decreased from 61.5 kg/TJ in 1998 to 2.2 kg/TJ in 1999.

59. Other fuels in 1.A.4 Other sectors refers to LPG, according to the information provided in the documentation box. However, a note in 1.A.4(a) Commercial/institutional mentions that other fuels refer to LPG, municipal solid waste (MSW) and recovered biogas. Moreover, no explanation is provided regarding other fuels in the rest of the sectors (with the exception of navigation/gasoline and road transportation/LPG).

60. Recalculations for the years 1990-1998 generally resulted in large reductions in N_2O emissions in subsectors 1.A.1 and 1.A.2.

2. Fuel consumption by road traffic

61. Total GHG emissions from transport increased by 20% from 104,274 kt in 1990 to 125,186 kt in 1999. The increase is driven by CO_2 emissions, which account for approximately 91% of the total in this sector. Road transport accounted for 24% of total CO_2 emissions in Italy in 1999 and for 21% of aggregate GHGs.

62. The CORINAIR methodology as applied to road transport is a tier 3 methodology for all gases. The CO_2 emissions factors for gasoline, diesel and LPG used in road transport are similar to IPCC default values and the values of other Parties and they are consistent between 1998 and 1999.

D. Non-key sources

63. The ERT noted the relatively high CH_4 IEFs of 47.69 kg/TJ in 1998 and 48.84 kg/TJ in 1999 for gasoline combustion. These values are much higher than IEFs for CH_4 for liquid fuels in general throughout the CRF for both years, and more than two times higher than the default emission factors proposed in the IPCC Guidelines (20 kg/TJ).

64. The ERT identified a low IEF for CO_2 in 1998 (36.85 t/TJ) and 1999 (38.4 t/TJ) for the combustion of other fuels in subsector 1.A.4(a) Commercial/institutional. These values cannot be reconciled with the information available in the CRF on the CO_2 emission factors for individual fuels. If other fuels refer to LPG (as noted in the documentation box) then the IEF for CO_2 is significantly lower than the one estimated with the information available in table 1.A(b) Reference approach (65 t/TJ). This combustion source also shows the highest IEFs for CH_4 among all stationary sources using solid, liquid and gaseous fuels.

65. Recalculations for the years 1990-1998 resulted in very large decreases for both CO_2 and N_2O emissions in source category 1.A.5.

66. The recalculations indicate large decreases for fugitive emissions of CO_2 for all years 1990-1997 in subsector 1.B.2.

67. There is reasonably good agreement (less than 8% difference) between CRF activity data and IEA data for international marine transport and navigation in 1999. Activity data for jet kerosene reported by IEA for 1.A.3(a) Civil aviation is 165.9% higher than CRF data. In the case of international aviation, where the amount is much larger, the difference is only 2.6%.

E. Areas for further improvement

Issues identified by the ERT

68. In addition to the recommendations made for the inventory as a whole (see overview), a re-evaluation of carbon storage relating to the non-energy use of fuels is encouraged in applying the reference approach for estimating CO_2 emissions.

69. A small number of apparently anomalous IEFs identified by this review and the S&A report should be investigated.

70. Based on the detailed information provided in the NC2, important elements of the good practice guidance may already apply to the energy sector.

III. INDUSTRIAL PROCESSES

A. Sector overview

71. In 1999, industrial processes account for 5.9% of total GHG emissions, in terms of CO_2 equivalent. In 1990, the share of this sector was slightly higher, 6.2%. In 1999 the most important GHG is CO_2, with 67.8% of the sector emissions, followed by N_2O, with 21.0%. In 1990, these figures were 76.4% and 20.8%, respectively. The increase in fluorinated gases since 1994 has been responsible for these changes in the relative contributions.

72. In 1999, 85.5% of CO_2 emissions originate from the cement industry, which is identified as a key source (see table 3).

73. HFCs have experienced significant growth since 1990 with emissions in 1999 being eight times the 1990 emissions, whereas PFC emissions decreased by 17%. SF_6 emissions almost doubled in the same period.

74. HFC, PFC and SF_6 emissions account for 0.16% of the country's total emissions (without CO_2 from LUCF) in 1990 and for 0.66% in 1999. During the 1990 - 1999 period, the contribution of HFCs to total emissions of fluorinated GHGs increases from 44.6% to 83.8%, the contribution of PFCs decreases from 30.2% to 5.0%, and the contribution of SF_6 drops from 25.2% to 11.2%.

1. Completeness

75. Emissions from all major sources of the industrial production sector are covered by the inventory although potential emissions of PFCs remain non-estimated.

76. The CRF table 9 (Completeness) was not filled in.

77. No data for the years 1990 to 1997 have been provided using the CRF.

2. Consistency

78. The 1998 and 1999 inventory submission (CRF) is broadly consistent with the IPCC and UNFCCC guidelines in regard to the industrial processes sector.

3. Recalculations

79. Recalculated 1998 emissions in 23 source categories of the industrial processes sector were submitted by Italy. The ERT came to the conclusion that the purpose of recalculations was to fill gaps in the inventory, to improve previous estimates and to correct allocation of emissions.

80. The renewed activities data were provided by the Party to explain recalculations without any other comments.

81. The recalculated 1998 emissions of SF_6 appear not to be consistent with the 1999 SF_6 emissions figure provided by the Party. According to Italy's comments on the draft version of this report, this was due to a change in 1999 in the method used for the estimation of SF_6 emissions from electrical equipment (see subsection 6. Methodology below). Italy also informed the ERT that in its 2002 submission, Italy would provide a complete data series for the years 1995-2000 based on the tier 3c method, as well as a complete data series for the years 1990-2000 based on the tier 2a method, for comparison purposes.

4. Transparency

82. Use of indicator keys in the CRF tables appears to be limited to the 1998 tables only. Transparency of the inventory, including the industrial processes sector, is referred to in paragraphs 14 and 15 of this report.

5. Comparability

83. Comparability of reported emission estimates is high enough. However, general comparability in the industrial processes sector is limited by a lack of support information.

6. Methodology

84. No information on methodologies used for estimating emissions in the industrial processes sector is included in Italy's inventory submission.

85. Actual emissions of HFCs, PFCs and SF_6 were estimated using the tier 2 approach of the IPCC Guidelines. According to the Party's comments on the draft version of this report, the IPCC good practice guidance tier 3c method was introduced in 1999 to replace the tier 2a method (used until 1998) for estimation of SF_6 emissions from electrical equipment.

7. Emission factors and activity data

86. Some discrepancies regarding emission factors are discussed under key source categories, as noted below.

87. The industrial activity data are only partially submitted in the CRF.

8. Good practices

88. The good practice guidance appears not yet to be fully implemented, although some of its elements have already been applied (see subsection 6. Methodology above).

B. Specific findings

89. Metal production: CO_2 IEF for steel production (0.0388t/t) is the second lowest among the reporting countries (IPCC default is 1.5 – 1.6 t/t). IEFs for pig iron, sinter and coke are not calculated even though activity data are provided in the CRF tables (no entries were made for the corresponding emission estimates). Italy explained in its response to the draft version of this report that CO_2 emissions from this source category have been included in the fuel combustion sector.

90. Production and consumption of HFCs, PFCs and SF_6: potential emissions of HFCs and SF_6 are included in CRF table 2(II) but not reflected in tables 2(I) and Summary 1.A.

C. Key sources

1. 2.A.1 Cement production – CO_2 (3.4% level assessment)

91. The CO_2 IEF (0.5t/t) is similar to that of the IPCC default.

2. 2.B.3 Adipic acid production – N_2O (1.1% level assessment)

92. The N_2O IEF (0.3t/t) in 1999 is high as compared to other countries. The IPCC default factors range from 0.02 to 0.07 t/t or even less. Italy explained in its response to the draft version of this report that both the emission estimate and the emission factor have been obtained from the single Italian producer of adipic acid.

3. 2.F Consumption of Halocarbons and SF_6 – HFCs, PFCs (0.5% level assessment) and SF_6

93. Actual SF_6 emissions increased by 3.5% from 1998 to 1999.

94. The SF_6 potential to actual (P/A) emission ratio of 8.98 was the second highest among reporting Parties, although in 1999 it was less than in 1998 (30.85). Italy explained in its response to the draft version of this report that data were supplied by the main producer.

95. Actual HFC emissions increased by 143.8% from 1998 to 1999. According to Italy's comments on the draft version of this report, the increase was due to the use of HFCs in metered inhalers, which started in 1999.

96. The HFCs P/A ratio of 1.38 is one of the lowest amongst the Parties.

97. Actual PFC emissions increased by 43.3 % from 1998 to 1999.

98. PFC potential emissions were not reported, and hence the P/A ratio could not be determined.

D. Areas for further improvement

Issues identified by the ERT

99. Italy may wish to consider in its future inventories potential emissions of PFCs, missing in the current inventory.

100. Italy may wish to consider a review of some emission factors to reflect recent research or technological developments as well as national circumstances.

101. Italy is encouraged to use notation keys in the CRF tables according to the UNFCCC reporting guidelines.

102. Italy is strongly encouraged to submit a NIR consistent with the UNFCCC reporting guidelines, including information, on methodologies used and other support information, as well as the full time series of emissions data in the industrial processes sector using the CRF from the year 1990 onwards.

103. The ERT encourages Italy to implement fully the good practice guidance in regard to the industrial processes sector.

IV. AGRICULTURE

A. Sector overview

104. Italy has provided the following information required by the COP:

(a) A set of CRF tables

(b) Disaggregated estimates of all GHGs and sources not controlled by the Montreal Protocol using methods broadly consistent with the IPCC Guidelines

(c) Some information relating to emission factors and activity data

(d) A status report with inventory data for the 1998 and 1999 period, covering the main sectors and the following gases: direct GHGs: CH_4 and N_2O.

105. Italy has not provided a NIR.

106. No information is available as to whether the inventory data were subject to any self-verification or independent review procedures.

107. There is no information on verification or QA/QC activities for the agriculture sector.

108. Part II of the status report on provision of information relating to recalculations has not been completed.

Trends

109. The submission by Italy shows a decrease of agricultural CH_4 emissions from 913 to 903 Gg and an increase of N_2O emissions from 77.6 to 81.9 Gg over the 1990-1999 period.

B. Key sources

110. The reporting of emissions estimates for this source category conforms to the UNFCCC reporting guidelines. In general, the values in this source category are high compared to IPCC default values.

1. 4.A Enteric fermentation – CH_4

111. Emission estimates for cattle (dairy and non-dairy), sheep, goat, horses, mules and asses, swine and rabbits are reported.

112. CH_4 IEFs for dairy and non-dairy cattle are high compared to IPCC default values. Italy explained in its response to the draft of this report that the emission factors reflect national circumstances in terms of age class distribution of animals and average daily feed intake.

2. 4.B Manure management – CH_4 and N_2O

113. Emission estimates for cattle (dairy and non-dairy), sheep, goat, horses, mules and asses, swine, poultry and rabbits are reported.

114. CH_4 IEFs for sheep conformed to those of the IPCC default values for cool regions. Italy explained in its response to the draft version of the report that the average monthly provincial temperatures are lower than 15ºC, which is representative of a "cool region" according to the IPCC Guidelines.

115. N_2O IEFs for animal waste management systems (AWMS) for liquid systems and dry lot are high compared to IPCC default values. In its response to the draft of this report, Italy explained this as being a result of incorrect activity data input. However, corrected data have not been provided.

116. N excretion rates for dairy cattle are high compared to the IPCC default values. Italy explained in its response to the draft of this report that emission factors reflect national circumstances and are calculated on the basis of recent (2000-2001) European literature. However, no further details or references to literature used have been provided.

Methodology, activity data and emission factors

117. Very little information is available regarding the methodologies used to estimate the different emissions. Information on activity data and emission factors used to estimate emissions from enteric fermentation and manure management are missing. In its response to the draft of

this report, Italy referred to its NC2 (paragraph 4.4), where a detailed description of these methodologies is available.

Completeness

118. Estimates or explanations using notation keys are missing, for example for prescribed burning of savannas.

Uncertainty

119. Uncertainties are not quantified according to the IPCC good practice guidance for the key source categories.

3. 4.D Agricultural soils – N_2O

120. The N_2O IEF value is the same for synthetic fertilizer, animal wastes applied to soils, N-fixing crops and crop residues.

121. The N_2O IEF value is very high for atmospheric deposition and N-leaching and run-off compared to IPCC default values.

122. In response to the observations in paragraphs 120 and 121 above, Italy explained this as being a result of incorrect activity data input. However, corrected data have not been provided.

C. Non-key source

1. 4.D Agricultural soils – N_2O

123. N_2O IEFs for pasture range and paddock are very high.

124. Field burning of agricultural residues: CH_4 and N_2O activity data for wheat and maize are very low.

125. In response to the observations in paragraphs 123 and 124 above, Italy explained this as being a result of incorrect activity data input. However, corrected data have not been provided.

Methodology, activity data and emission factors

126. Information on methodologies is not provided. Information on activity data and emission factors used to estimate emissions from enteric fermentation and manure management is missing. In its response to the draft of this report, Italy referred to its NC2 (paragraph 4.4), where a detailed description of the methodologies used is available.

Recalculations

127. No information is provided in the CRF in relation to recalculations.

Completeness

128. Italy provided emission estimates only for 1998 and 1999 in the CRF.

Uncertainty

129. Uncertainties were not quantified according to the IPCC good practice guidance for the key source categories.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

130. The LUCF sector constitutes a net sink which, in absolute terms, is equivalent to 3.5% of Italy's total 1999 gross CO_2 emissions. Changes in forest and other woody biomass stocks, forest and grassland conversion, abandonment of managed lands, CO_2 emissions and removals from soil, and other, constitute in 1999 a reported sink for CO_2 of 16,099 Gg.

1. Completeness

131. CRF inventory data for the LUCF sector for 1998 and 1999 are provided in sectoral background tables 5.A, 5.B, 5.C and 5.D and, in summary form, in table 5.

132. Estimates of emissions from non-CO_2 gases for forest and grassland conversion are reported in table 5 but do not appear in table 5.B.

2. Transparency

133. As no NIR was provided it was not possible to determine the methodology used to obtain the estimates: hence the LUCF estimates for Italy can not be regarded as transparent for review purposes.

3. Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

134. Since no additional documentation was provided, it has not been possible to assess consistency with the IPCC Guidelines of the methodology used by Italy for the LUCF sector. Italy has provided estimates within CRF tables 5 and 5.A – 5.D.

135. In its response to the draft of this report, and with regard to the observations made in paragraphs 133 and 134 above and paragraphs 136 to 144 below noting the lack of methodological description and activity data due to lack of a NIR or other type of additional documentation, Italy referred to its NC2 (paragraph 4.5, pages 80-82) where a detailed description of the methodologies is available. The ERT acknowledges that Italy did provide information in its NC2. The current desk review was, however, undertaken without reference to this information.

B. Specific source and sink categories

1. 5.A Changes in forests and other woody biomass stocks

Methodology

136. No supporting details are provided on the methodology used to obtain the 1999 estimate of removals by forests and other woody biomass stocks of -25,314 Gg of CO_2 as reported in table 5.A of the CRF. The documentation box could have been used for this purpose. The same comment applies to the 1998 estimate for removals by forests and other woody biomass stocks of –33,593 Gg of CO_2 as reported in table 5.A of the CRF.

Activity data

137. From the documentation provided it is not possible to identify the source of the activity data used for the forests and other woody biomass stocks category.

Implied emission factors

138. An implied carbon uptake factor of 1.39 t C/ha is reported in table 5.A for 1998 and 1.40 t C/ha for 1999.

2. 5.B Forest and grassland conversion

Methodology

139. No supporting details are provided on the methodology used to obtain the 1999 estimate of emissions from forest and grassland conversion of 995 Gg of CO_2. Estimates are given for emissions of CH_4 (2.57 Gg), N_2O (0.02 Gg), NO_X (0.64 Gg) and CO (22.48 Gg) in table 5 but no details on how these gases were estimated are supplied. The documentation box to table 5.B could have been used for this purpose. The same comment on the use of the documentation box applies to the estimates given for these gases in the 1998 CRF.

Activity data

140. From the documentation provided it has not been possible to identify the source of the activity data used for this source category. IEFs and emissions are not reported in table 5.B.

3. 5.C Abandonment of managed lands

Methodology

141. No details are provided on the methodology to obtain the 1999 estimate of -154.36 Gg of CO_2 for removals by abandonment of managed lands. The documentation box to table 5.C could have been used for this purpose. This comment also applies to the estimate made for 1998. It was further noted that for 1998 the estimate of total annual CO_2 removals reported in table 5.C from abandonment of managed lands was 152,719 Gg CO_2. This estimate is inconsistent (by 1000 times) with the estimate of 152.72 Gg CO_2 reported in table 5.

Activity data

142. From the documentation provided it has not been possible to state the source and methods used to provide the activity data for the abandonment of managed lands. IEFs were not calculated.

4. 5.D CO_2 emissions and removals from soil

Methodology

143. No supporting details have been provided on the methodology used to obtain the 1999 estimate of emissions and removals from soil of 8,374 Gg of CO_2. The documentation box to table 5.D could have been used for this purpose. The same comment applies to the 1998 estimate of 77,015 Gg of CO_2. This estimate in table 5.D is not the same as the estimate of 8,634 Gg of CO_2 reported table 5.

Activity data

144. From the documentation provided it has not been possible to state the source and methods used for the activity data reported in table 5.D for CO_2 emissions and removals from soil.

C. Areas for further improvement

Issues identified by the ERT

145. Italy is encouraged to provide a NIR fully describing how the estimates within the LUCF sector have been prepared. This should include details of the country-specific methods used. Italy should also recheck the estimates provided for 1998 in table 5 against those appearing in tables 5.C and 5.D, as they appear to be inconsistent. In its response to the draft of the review report, Italy explained this as being a result of an incorrect activity data input. However, corrected data have not been provided.

VI. WASTE

A. Sector overview

146. The CRF contains CO_2 emissions from a non-key source (waste incineration) as well as other trace gas emissions: CO, NMVOC and SO_2. CH_4 emissions from the key source solid waste disposal on land are showing a decreasing trend.

1. Completeness

147. The estimation of CH_4 emissions was done for key sources (solid waste disposal on land) and non-key sources (wastewater handling and waste incineration). CO_2 was calculated only for waste incineration. N_2O was estimated for wastewater handling and waste incineration. No methodology is indicated in table Summary 3 of the CRF.

2. Trends

148. Total GHG emissions in CO_2 equivalent from the waste sector increased over the 1990 to 1999 period, whereas CH_4 emissions from solid waste disposal on land were found to be decreasing over that period. However, significant increases are found in waste incineration and others.

B. Key sources

1. 6.A Solid waste disposal on land – CH_4

Methodologies

149. Agreement with the draft S&A report 2001 was found regarding the high value for the fraction of methane used in the calculation (0.9), which needs explanation. The IPCC and other researchers in the field of landfill gas recommended a figure of 0.45-0.6. The value for methane generation rate constant was also high. However, considering the indicated 25-year time lag in landfill, the methane generation rate should rather be 0.04, as the indicated composition of the deposited waste does not provide any explanation for the rapid degradation. Further information, and explanations of the factors indicated in the CRF, are therefore needed. In its response to the

draft of this report, Italy noted that for the fraction of methane an incorrect data input has been made and that the correct value for the fraction of methane used in the calculation is 0.5.

Emission factor

150. The IEF was low compared to other Parties, which may be due to a low degradable organic carbon (DOC) fraction. However, this conflicts with the rapid degradation presumed above. Italy explained in its response to the draft of this report that the DOC value is based on national measurements. In the view of the Party, the IEF is low due to a low DOC fraction (11% compared to 19% IPCC default value) and a high amount of gas recovered. The first figure depends on the low DOC value for paper compared with the IPCC default value.

C. Non–key sources

1. 6.B Wastewater handling

Methodology

151. It is noted that domestic and commercial wastewater handling is 100% aerobic treatment, and therefore no emissions are taken into account. Industrial wastewater handling is 15% anaerobically treated. No estimate of N_2O is given.

Emission factor

152. The reported IEF suggests that the IPCC default value was used in the emission estimation of CH_4 from wastewater handling**.**

Activity data

153. Sufficient activity data are reported in table 6.B of the CRF.

D. Areas for further improvement

Issues identified by the ERT

154. Additional information should be provided by the Party to explain or to correct the big differences in methane generation rates compared to other countries. If these differences are not simply an error of calculation (that is, by a factor of ten) an explanation is needed concerning the landfill technology used, as well as regarding the efficiency of the reported gas recovery systems.

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