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METHODOLOGICAL ISSUES

GREENHOUSE GAS INVENTORIES

Methodological issues relating to the preparation of national greenhouse gas inventories

Note by the secretariat

Summary

An initial analysis of the greenhouse gas information submitted by all Parties to the Convention was undertaken with the aim of providing information on methodological issues that would assist the work of the Intergovernmental Panel on Climate Change (IPCC) on the revision of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (1996 IPCC Guidelines). The analysis shows that the 1996 IPCC Guidelines have enabled Parties to provide inventory data for most source categories. It also shows that existing methodologies should be improved, new methodologies should be developed for some sectors and activities, coverage of activities in some sectors should be expanded and the emission factors in the 1996 IPCC Guidelines and/or the IPCC Emission Factor Database should be updated. Such improvements would ensure that all Parties will be able to provide more complete, accurate and reliable estimates of greenhouse gas emissions and removals in the future.

CONTENTS

I. INTRODUCTION

A. Mandate

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its seventeenth session, invited the Intergovernmental Panel on Climate Change (IPCC) to revise the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (1996 IPCC Guidelines) taking into consideration the relevant work under the Convention and the Kyoto Protocol, and to aim to complete the work by early 2006.[1]

2. The SBSTA requested the secretariat to provide information on the methodologies and data used by Parties to estimate greenhouse gas (GHG) emissions and removals by sinks, taking into account the results of the trial period of annual inventory reviews (decision 6/CP.5), to support, inter alia, the work of the IPCC referred to above, with the aim of preparing a report for consideration at its nineteenth session.[2]

B. Scope of the note

3. This note reports on an initial analysis of methodological issues relating to the preparation of GHG inventories by all Parties to the Convention. The emphasis in the analysis was on identifying areas for further improvement of the 1996 IPCC Guidelines (for example, lack of methodologies or emission factors for activities currently being reported by Parties) and on highlighting some of the most commonly encountered problems associated with the application of the 1996 IPCC Guidelines. This note is not intended to provide detailed information on methodologies and emission factors used by Parties in preparing their national GHG inventories.

4. The results of the analysis are presented in accordance with the IPCC source category structure. Most issues presented here are common to all Parties. However, issues relating to the application of the guidelines by Parties not included in Annex I to the Convention (non-Annex I Parties), as a result of their specific national circumstances, are listed in separate sections for each IPCC sector. A summary of information on methods and emission factors used by Parties included in Annex I to the Convention (Annex I Parties) for estimating GHG emissions from selected sources is contained in the annex.

5. The note draws on the technical review process of GHG inventories of Annex I Parties, the work of the Subsidiary Body for Implementation (SBI) and the work of the Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention (CGE). In particular, the sources of information are:

(a) For Annex I Parties:

(i) GHG inventories submitted in 2003;

(ii) Synthesis and assessment reports for GHG inventories submitted in 2000, 2001, 2002 and 2003;[3]

(iii) Individual review reports of GHG inventories submitted in 2000, 2001 and 2002;[4]

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[1] FCCC/SBSTA/2002/13, paragraph 14 (f).

[2] FCCC/SBSTA/2002/13, paragraph 14 (g).

[3] http://unfccc.int/program/mis/ghg/s_a2000.html, http://unfccc.int/program/mis/ghg/s_a2001.html, http://unfccc.int/program/mis/ghg/s_a2002.html, http://unfccc.int/program/mis/ghg/s_a2003.html

[4] http://unfccc.int/program/mis/ghg/indrev2000.html, http://unfccc.int/program/mis/ghg/indrev2001.html, http://unfccc.int/program/mis/ghg/indrev2002.html

(b) For non-Annex I Parties:

(i) Compilation and synthesis reports of initial national communications from non Annex I Parties;[5]

(ii) Reports from workshops, including regional ones, of the CGE.[6]

6. The note contains suggestions relating to methodologies, activity data, emission factors and other parameters, which the IPCC may wish to consider, based on the experiences of Parties and on the assessments carried out by expert review teams for Annex I Parties' GHG inventories and by the CGE for non-Annex I Parties' national communications.

7. The secretariat will continue to cooperate with the IPCC during the revision of the 1996 IPCC Guidelines and will provide more detailed information on methodologies and emission factors used by Parties in preparing their national GHG inventories, based on the available submissions from Parties. This information could serve as input to the planned IPCC sectoral meetings that will take place during the revision process.

C. Possible action by the SBSTA

8. The SBSTA is invited to consider the information contained in this note and forward it to the IPCC for its consideration.

II. BACKGROUND

A. Revised 1996 IPCC Guidelines

9. The 1996 IPCC Guidelines were developed on the basis of the *1995 IPCC Guidelines for National Greenhouse Gas Inventories* (1995 IPCC Guidelines). The improvements introduced in the 1996 IPCC Guidelines were based on the synthesis and assessment of relevant new data, the revision of existing methodologies and, in certain areas, the development and assessment of additional methodologies.

10. The 1996 IPCC Guidelines contain a range of methods, including methods which are appropriate to national circumstances; the methods have different levels of detail, and so may be used by a wide range of inventory compilers. The default methods and assumptions are readily applicable using data that should be available and easily applicable to all countries in the world. More detailed methods are also discussed and national experts are encouraged to use them whenever this is possible and likely to produce more accurate national estimates. The 1996 IPCC Guidelines also allow the use of entirely different methodologies if national experts believe that these better reflect their national situation.

11. Although the flexibility in the choice of methods, emission factors and assumptions has led to the widespread acceptance and application of the 1996 IPCC Guidelines, particular methodological choices could lead to considerable differences in a Party's aggregated emissions. In addition, the 1996 IPCC Guidelines were developed to focus on the preparation of annual national estimates; they did not provide explicit guidance on trend assessment and time series, and they provide only limited guidance on uncertainties determination, quality control and verification procedures and recalculations.

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[5] FCCC/SBI/1999/11, FCCC/SBI/2000/15, FCCC/SBI/2001/14 and Add.1, FCCC/SBI/2002/8, FCCC/SBI/2002/16 and FCCC/SBI/2003/13.

[6] FCCC/SBI/2000/INF.4, FCCC/SBI/2000/INF.9, FCCC/SBI/2000/INF.10, FCCC/SBI/2001/INF.1, FCCC/SBI/2002/INF.10 and FCCC/SBI/2002/INF.3.

12. Recognizing these limitations, the SBSTA encouraged the IPCC to give high priority to completing its work on uncertainty and to prepare a report on good practices in inventory management.[7]

B. IPCC good practice guidance

13. In response to the above-mentioned request by the SBSTA, the IPCC developed the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC good practice guidance) as a reference that complements, and is consistent with, the 1996 IPCC Guidelines. It provides information to assist countries in producing inventories that are neither over- nor underestimates, so far as can be judged, and in which uncertainties are reduced as far as practicable. It provides advice on for example:

(a) Choice of estimation methods suited to national circumstances and choice of most suitable emission factors and other parameters;

(b) Prioritizing key source categories, quality assurance and quality control procedures, estimating uncertainties;

(c) When to recalculate previously prepared estimates to ensure consistent estimation of trends.

14. The IPCC is currently developing a methodology report entitled *Good Practice Guidance for Land Use, Land-Use Change and Forestry (LULUCF)* in response to a request by the COP.[8] The report will provide guidance relevant to the Convention and the Kyoto Protocol, while paying attention to the need to ensure consistency with the 1996 IPCC Guidelines. The IPCC is expected to consider and accept the report at its twenty-first session, which will be held from 3 to 7 November in Vienna, Austria. Final versions of the reports are expected to be available for consideration by the SBSTA at its nineteenth session.

C. Use of the 1996 IPCC Guidelines and of the IPCC good practice guidance

1. Annex I Parties

15. The Conference of the Parties (COP), by its decisions 3/CP.5 and 18/CP.8, adopted 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" (UNFCCC reporting guidelines). According to these guidelines, Annex I Parties are requested to use the 1996 IPCC Guidelines to estimate and report on anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol.[9]

16. The SBSTA, at its twelfth session, endorsed the IPCC good practice guidance as an elaboration of the 1996 IPCC Guidelines and recommended its use in the preparation of GHG inventories. It also concluded that the IPCC good practice guidance should be applied by Annex I Parties to the extent possible for inventories due in 2001 and 2002, and should be used for inventories due in 2003 and beyond. Annex I Parties with economies in transition may phase in the IPCC good practice guidance two years later than other Annex I Parties.[10] According to the new UNFCCC reporting guidelines (decision 18/CP.8), Annex I Parties are requested to use the IPCC good practice guidance in order to improve transparency, consistency, comparability, completeness and accuracy of their GHG inventories.

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[7] FCCC/SBSTA/1998/6, paragraph 40 (e).
[8] Decision 11/CP.7, paragraph 3 (b).
[9] For the full texts of the UNFCCC reporting guidelines see documents FCCC/CP/1999/7 and FCCC/CP/2002/8.
[10] FCCC/SBSTA/2000/5, paragraph 40 (b)–(c).

2. Non-Annex I Parties

17. The original guidelines for the preparation of initial communications by non-Annex I Parties, adopted by the COP by its decision 10/CP.2,[11] specified that non-Annex I Parties should use the 1995 IPCC Guidelines or the simplified default methodologies adopted by the IPCC, as appropriate and to the extent possible, in the fulfilment of their commitments under the Convention.[12]

18. The SBSTA, at its fourth session, encouraged non-Annex I Parties to apply the 1996 IPCC Guidelines, as appropriate and to the extend possible, in communicating their national GHG inventories.[13] At its twelfth session, it encouraged non-Annex I Parties to apply the IPCC good practice guidance, as appropriate and to the extent possible, in the preparation of their GHG inventories.[14]

19. The COP revised the guidelines for the national communications by non-Annex I Parties by its decision 17/CP.8. The new guidelines specify that non-Annex I Parties should use the 1996 IPCC Guidelines for estimating and reporting their national GHG inventories and encourage non-Annex I Parties to use the IPCC good practice guidance, taking into account the need to improve transparency, consistency, comparability, completeness and accuracy in inventories. They also encourage them, to the extent possible, to undertake any key source analysis as indicated in the IPCC good practice guidance.

D. Assessment of information submitted by Parties

20. The guidelines for the technical review of GHG inventories from Annex I Parties[15] were adopted by the COP (decisions 6/CP.5 and 19/CP.8), which also established a trial period to assess the use of these guidelines covering the GHG inventory submissions due in 2000, 2001 and 2002 (decisions 6/CP.5 and 34/CP.7). During the period 2000–2002, 53 annual national GHG inventories from Annex I Parties were reviewed.

21. The CGE was established by the COP pursuant to the provisions of decision 8/CP.5 and its mandate was further extended by decision 3/CP.8. The primary objectives of the CGE is to assist non-Annex I Parties to continue to improve the process of preparation of their national communications. The CGE was mandated, inter alia, to examine national communications, in particular GHG inventories submitted by non-Annex I Parties, with a view to arriving at recommendations on ways to overcome difficulties in the use of the IPCC methodologies and the UNFCCC guidelines relating to inventories contained in the annex to decision 10/CP.2, and on possible innovations, and produce reports thereon. During the period 2000–2002, six workshops were organized, during which the CGE assessed more than 50 initial national communications from non-Annex I Parties.

E. Reporting by Parties

22. Annex I Parties are requested to submit national inventory data on emissions by sources and removals by sinks by 15 April of each year (decisions 9/CP.2 and 3/CP.5). In accordance with Article 12, paragraph 5, of the Convention, each non-Annex I Party shall make its initial communication, including a national GHG inventory, within three years of the entry into force of the Convention for that Party, or of the availability of financial resources in accordance with Article 4, paragraph 3, of the Convention. Parties that are least developed countries (LDCs) may make their initial national communication at their discretion.

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11 Decision 10/CP.2 was adopted before the dissemination of the 1996 IPCC Guidelines.
12 For the full text of these guidelines see document FCCC/CP/1996/15/Add.1.
13 FCCC/SBSTA/1996/20, paragraph 30 (b).
14 FCCC/SBSTA/2000/5, paragraph 40 (d).
15 For the full text of these guidelines see document FCCC/CP/1999/7.

23. To the date of publication of this note, 36 Annex I Parties had submitted their annual GHG inventories for 2003[16] and 106 non-Annex I Parties had submitted their initial national communication.

III. ENERGY

A. General

24. The activities under the Energy sector (fuel combustion – including both stationary and mobile combustion – and fugitive emissions) account for a large proportion of total GHG emissions for all Parties. Some of the most important sources from this sector are stationary combustion (CO_2 emissions), mobile combustion (CO_2 and N_2O emissions), and extraction, processing and distribution of fuels (CH_4 emissions).

25. The 1996 IPCC Guidelines contain instructions on how to estimate emissions from the Energy sector by using:

(a) A top-down method (reference approach) as well as bottom-up methods (sectoral tiered methodologies) for CO_2 emissions;

(b) A set of default and technology/fuel-based emissions factors, which can be used with corresponding methodologies to estimate CH_4 and N_2O emissions.

B. Fuel combustion

26. All Annex I Parties and the majority of non-Annex I Parties use both the reference approach and a sectoral approach to estimate CO_2 emissions. Most Parties compared between the two approaches and reported on the observed differences. This comparison has proved to be a useful self-verification procedure, which improves the transparency of the inventories by giving an indication of the level of uncertainty of the data used. However, there is limited guidance in the 1996 IPCC Guidelines on how the **differences between the reference and sectoral approaches** (both for emissions and fuel consumption) should be assessed, including cross-checking with fuel quantities included elsewhere in the inventory. This is particularly relevant to the treatment of feedstocks and non-energy use of fuels for which emissions could be included under the Industrial Processes sector, for example. It is suggested that further elaboration of this part of the 1996 IPCC Guidelines is considered during the revision process.

27. The set of default and detailed emission factors for the calculation of CO_2, CH_4 and N_2O included in the 1996 IPCC Guidelines was based on the best available estimates at the time of publication. Some Annex I and non-Annex I Parties have reported, in the context of their GHG inventory submissions, that they are using country-specific emission factors to estimate these emissions. It is suggested that the **emission factors in the 1996 IPCC Guidelines should be updated** taking into account information from Parties and any relevant research work in this area.

28. The 1996 IPCC Guidelines do not include a broad range of **emission factors relating to biomass** used in households and industries, or ethanol used in the transport subsector. The growing importance of emissions from these activities for some Annex I and non-Annex I Parties would merit the consideration of new information during the revision process. In addition, regarding **emissions from ethanol**, there is a possibility of double counting if ethanol is used as an additive to gasoline for road transport. This issue should be further explored during the revision of the 1996 IPCC Guidelines.

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[16] For the latest analysis of the status of GHG inventory submissions, see document FCCC/SBSTA/2003/14.

C. Fugitive emissions from fuels

1. Solid fuels

29. To estimate CH_4 emissions from production and post-mining activities for solid fuels, some Parties have used national activity data, and others have used activity data published by international organizations (for example, the International Energy Agency). At the international level, the published statistics do not usually provide information regarding the method of mining (i.e., surface/strip or underground) or depth of mines, although these data are usually collected and sometimes available on special request. In the absence of any information on the type of mining, a conservative first approximation is to assume that all lignite coal is surface mined and all bituminous and anthracite coal is produced from underground mines. If such an assumption is made, it could lead to overstating of emissions, because substantial amounts of bituminous coal and lesser amounts of anthracite coal are also produced from surface mining operations. To ensure that emissions from this subsector are estimated accurately, it is suggested that the new IPCC Guidelines provide **advice on how to handle international statistical information**.

30. Under this subsector, some Annex I Parties have reported emissions from closed or abandoned mines and peat production, for which the 1996 IPCC Guidelines do not include any methodologies or guidance. Although only limited information is currently available on closed or abandoned mines in the GHG inventory submissions, there are indications that emissions from these mines (even if they are flooded or mechanically sealed) may not be as negligible as previously thought. This section of the 1996 IPCC Guidelines needs further elaboration to include **methodologies for closed or abandoned mines**, taking into account the results of the on-going research work in this area, and to clarify how these emissions should be accounted for (under mining activities or under other) to **avoid double counting**.

31. As for peat production, one Annex I Party has included in its GHG inventory submission CO_2 and CH_4 emission estimates arising from the surface emissions and emissions from stockpiles and ditches together with relevant emission factors. Some other Annex I Parties have reported emissions from peat production under the Land-use Change and Forestry sector. Because this activity may be relevant for other Annex I and non-Annex I Parties, **national information and other relevant data** that may be available should be taken into consideration during the revision process. Furthermore, advice should also be provided on how these emissions should be accounted for (under fugitive emissions or land-use change and forestry) to **avoid double counting**.

2. Oil and natural gas

32. To estimated emissions from oil and natural gas systems, the 1996 IPCC Guidelines provide emission factors that refer to the energy content of the fuels and are expressed in kg/PJ. Although some Parties use activity data that are available in the energy units proposed by the IPCC (PJ), other Parties make use of, and report, activity data expressed in m^3, kt or bbl for oil and m^3 or ft^3 for gas. To enable the comparison of activity data among Parties it is desirable to convert the reported data from the original units to a common one (e.g. PJ). However, for such a conversion it is necessary to take into account information on some properties of the fuels (for example, temperature, specific pressure) which is not always readily available. It is suggested that this issue is considered during the revision process with the aim of providing **guidance on how such conversions should be performed.**

33. In addition to CH_4 emissions, there is also information on N_2O emissions from these systems, particularly from venting and flaring. Although the 1996 IPCC Guidelines do not provide a methodology or emission factors for estimating such emissions, the IPCC good practice guidance provides emission factors for some oil and natural gas activities. Because of the importance of this gas (in terms of its high

global warming potential (GWP)) it is suggested that **relevant methodologies for N_2O emissions and improvement of emission factors** be considered during the revision process.

34. Some Annex I and non-Annex I Parties have indicated that there is a need to revise and/or expand the emission factors and provide additional guidance for estimating CO_2 and CH_4 emissions from flaring and from the extraction and processing of oil and natural gas to take into consideration specific conditions (for example, CO_2 emissions from the decarbonization of natural gas). Because some Annex I Parties have reported that they are using country-specific emission factors for estimating emissions from this subsector, it is suggested that these **national data should be considered** during the revision process.

D. Other energy-related activities

35. Two more areas where the 1996 IPCC Guidelines may need to be expanded relate to estimating **emissions from geothermal energy and fugitive CH_4 emissions from hydroelectric dams**. Some Annex I Parties have provided estimates for CO_2 and CH_4 emissions from the use and production of geothermal energy, and the issue of hydroelectric dams has been raised by some non-Annex I Parties. It is suggested that the available information from Parties and the results of research work in these two areas should be taken into consideration during the revision process. Furthermore advice should also be provided on how these emissions should be accounted for to avoid double counting.

36. Another area where methodological work may be undertaken is the estimation of **emissions from domestic and international aviation and maritime transport**.[17] Further information on these activities may become available following the consideration of relevant methodological issues by the International Civil Aviation Organization and the International Maritime Organization pursuant to the conclusions of the SBSTA at its eighteenth session.[18] It is suggested that any information as a result of this consideration should be taken into account during the revision process.

E. Issues relating to the application of the 1996 IPCC Guidelines by non-Annex I Parties

37. A number of non-Annex I Parties reported that the level of disaggregation of national energy balances is often not consistent with the classification in the 1996 IPCC Guidelines and, as a result, some non-Annex I Parties use only the reference approach to estimate CO_2 emissions from fuel combustion.

38. Activity data are often lacking for biomass combustion, an activity that is responsible for an important share of the energy demand and of the total GHG emissions for some non-Annex I Parties. Collection of these data is particularly difficult because of the widespread use of biomass in the Energy sector and the lack of a consistent and reliable statistical/survey system, particularly in case of households being both producers of biomass and users of the energy from its combustion. Similar problems have also been reported for the consumption of kerosene used in households, for which obtaining reliable and accurate activity data is hindered by its widespread use and the lack of appropriate statistical surveys.

39. Some non-Annex I Parties have also reported that there are problems associated with the reliability of data disaggregation for other types of fuel (for example, diesel) which, although they are commonly used in the transport subsector, can also be used in other subsectors (for example in households for heating purposes and electricity generation from small production units).

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[17] Methodological issues relating to these activities have been reported in document FCCC/SBSTA/2003/INF.3.
[18] FCCC/SBSTA/2003/10, paragraph 29 (b) and (c).

IV. INDUSTRIAL PROCESSES

A. General

40. Activities under this sector, which are often important sources of emissions for both Annex I and non-Annex I Parties, include cement and lime production (CO_2 emissions), nitric acid production (N_2O emissions), iron and steel industry (CO_2 emissions), aluminium production (CO_2, CF_4 and C_2F_6 emissions) and use of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) as substitutes for ozone depleting substances.

41. In addition to the activities included in the 1996 IPCC Guidelines, some Parties have reported emissions from particular industrial activities that are covered neither in the 1996 IPCC Guidelines nor in the IPCC good practice guidance. A list of these activities and the associated GHGs is given in table 1.

42. It is suggested that, during the revision process, the IPCC considers the **inclusion of emission factors and any relevant methodological information** for all activities listed in table 1.

Table 1. Additional activities reported by Annex I Parties under Industrial Processes

Activity	Gas	Activity	Gas
Mineral products		***Metal production***	
Fletton brick production	CO_2, CH_4	Copper production	CO_2
Glass production	CO_2	Magnesium, nickel, anodes production	CO_2
Leca production	CO_2	Silicium production	CO_2
$MgCO_3$ sinter plants	CO_2	Rolling mills	CH_4
Mineral wool production	CO_2		
		Consumption of halocarbons and SF_6	
Chemical industry		Heat pumps	HFCs
Carbon dioxide consumption	CO_2	Detergents	PFCs
Glyoxylic acid production	CO_2	Open and closed applications	PFCs
Hydrogen production	CO_2	Ski wax manufacturing	PFCs
Monomer production	CO_2	Running/jogging shoes	SF_6
Plastic production	CO_2	Thermopanes	SF_6
Propelene production	CO_2	Tracer in leak detection and research purposes	SF_6
Titanium dioxide production	CO_2	Windows (insulated glass, soundproof)	SF_6
Methanol production	CH_4		
Caprolactam production	N_2O	***Hard foam***	
		Closed pores	HFCs
Iron and steel		Polyethylene foam	HFCs
Blast furnace gas flaring	CO_2, CH_4, N_2O	Spray foam	HFCs
Blast furnace - mass balance	CO_2, CH_4, N_2O	Urethane foam	HFCs
Iron cast	CO_2, CH_4		
Steel cast	CO_2		

Note: The activities listed in this table are only those associated with emissions of GHGs.

B. Emissions of CO_2, CH_4 and N_2O

43. For calculating CO_2, CH_4 and N_2O emissions, no major problems with the application of the 1996 IPCC Guidelines have been identified or reported. Some issues that may be of relevance for the revision of the 1996 IPCC Guidelines are listed below:

(a) Some Parties have reported industrial process emissions from certain activities together with emissions arising from fuel combustion, primarily because the reported emissions are the result of

direct measurements, which do not distinguish between process and energy-related components. This is an area of **potential double-counting** which may merit further consideration;

(b) Some Parties have reported **CO_2 emissions from asphalt roofing and road paving with asphalt** although the 1996 IPCC Guidelines do not contain any methodology for these activities. Again this is an area of **potential double-counting** and may merit further consideration;

(c) For some activities, there is an inconsistency in the **definitions of tiered methodologies** included in the IPCC Guidelines and in the IPCC good practice guidance (see, for example, cement production);

(d) Some Parties have reported using **country-specific emission factors** for a number of activities under the Industrial Processes sector.

C. Emissions of HFCs, PFCs and SF_6

44. The 1996 IPCC Guidelines include methodologies for the estimation of both potential and actual emissions of HFCs, PFCs and SF_6. The calculation of actual emissions from the use of these gases still remains a challenge for a number of Annex I and non-Annex I Parties.[19]

45. The major difficulties identified concern the availability of activity data in a suitable format to enable the calculation of actual emissions. In a number of countries the activity data are either incomplete (in terms of years covered) or available only in an aggregated format. In addition, some Parties have reported problems with the accessibility of the necessary statistical information because of the confidential nature of certain data sets.

V. SOLVENT AND OTHER PRODUCT USE

46. Solvent and other product use contribute to the release of N_2O and non-methane volatile organic compounds (NMVOC) emissions. The 1996 IPCC Guidelines do not include methodologies for estimating these emissions, but they refer to other methodologies that have been developed, for example, the guidelines developed by EMEP/CORINAIR[20] or the United States Environmental Protection Agency's Compilation of Air Pollutants Emissions Factors.

47. Some Annex I Parties have reported N_2O emissions estimates from this sector and CO_2 emissions resulting from the atmospheric oxidation of NMVOC, which usually account for a rather small percentage of their total national estimates. These N_2O emissions come from aerosol cans; anesthesia, propellant use, medical and industrial uses, spray cans, cosmetic institutions and hair styling.

48. It is suggested that future revisions take into account **the latest available information on N_2O emission factors** and that further consideration be given to the possible development of a **methodology for estimating CO_2 emissions from the oxidation of NMVOC,** with guidance on how to **avoid double-counting**. In addition, it should be re-emphasized that, for the sake of completeness, emissions from this sector should be estimated and reported.

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[19] Although HFC, PFC and SF_6 emissions do not seem to be considerable for many non-Annex I Parties, they could be important for those Parties with a relatively high level of industrialization.

[20] EMEP: Cooperative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe. CORINAIR: a project to gather and organize information on emissions into the air relevant to acid deposition in the context of the work programme CORINE (CO-oRdination d'INformation Environnementale).

VI. AGRICULTURE

A. General

49. The Agriculture sector is the second most important source of GHG emissions for most Parties. Some of the key sources from this sector include enteric fermentation (CH_4 emissions), manure management (CH_4 and N_2O emissions), rice cultivation (CH_4 emissions),[21] direct N_2O emissions from agricultural soils, and indirect N_2O emissions from nitrogen use in agriculture.

B. Emissions of CH_4

50. Most problems identified with the application of the IPCC methodologies for estimating CH_4 emissions from enteric fermentation, manure management and rice cultivation are associated with the use of default emission factors and climatic conditions included in the 1996 IPCC Guidelines, which do not appropriately reflect local conditions. It is suggested that the **existing emission factors in the 1996 IPCC Guidelines should be updated**, taking into account any new information provided by Parties and relevant research in this area.

51. In addition, some Parties have highlighted the lack of emission factors for certain animal types, including alpacas, ostriches, deer, reindeers, rabbits and emus. To facilitate estimation of emissions from these animals, it is suggested to **incorporate any available information on relevant emission factors** for them, which can be used with the existing methodologies.

52. The 1996 IPCC Guidelines recognize that some **CH_4 may be released from agricultural soils**. However, no methodology is included for these emissions. These emissions should be assessed and additional guidance and methodologies should be provided, if appropriate.

C. Emissions of CO_2 and N_2O

53. **Emissions of CO_2 from agricultural soils** can be estimated and reported either under the Agriculture sector or the LUCF sector. However, in the 1996 IPCC Guidelines the methodologies for estimating CO_2 emissions are included under the LUCF sector. This has confused some Parties, which have claimed that the IPCC does not contain methodologies for the agricultural soils subsector. In addition, it has also created difficulties in comparing national totals without LUCF across Parties, because for those Parties choosing to report CO_2 fluxes from agricultural soils under agriculture this estimate is included in the national total. Furthermore, this is also an area of potential double counting. It is suggested that this issue should be addressed during the revision process to ensure clarity in the new guidelines taking into account any guidance on this matter that may be provided in the good practice guidance for LULUCF.

54. Some Parties have indicated that the IPCC methodologies are not directly applicable due to the lack of emission factors and the non-correspondence of national data with the IPCC classification for rice fields and other agricultural soils. It is suggested that the **soil type classification** and the **default emission factors** in the 1996 IPCC Guidelines relating to the estimation of CO_2 and N_2O emissions from agricultural soils are revised taking into account any new information from Parties and relevant research in this area.

D. Issues relating to the application of the 1996 IPCC Guidelines by non-Annex I Parties

55. Many non-Annex I Parties have reported difficulties in obtaining activity data for the Agriculture sector. For some of them the data are not available or accessible because the data collection system is

[21] Primarily for non-Annex I Parties.

insufficient or does not exist, whereas for others the data are sparse and/or only available for certain rural areas.

VII. LAND-USE CHANGE AND FORESTRY

A. General

56. Almost all Parties report emissions and removals from activities under the LUCF sector. The majority provide estimates from category 5.A (Changes in Forest and Other Woody Biomass Stocks), whereas the coverage of emissions and removals estimates from categories 5.B–5.D (Forest and Grassland Conversion, Abandonment of Managed Lands, CO_2 Emissions and Removals by Soils) is sparse and generally not well documented. It is anticipated that the use of the IPCC good practice guidance on LULUCF (currently in its final stage of completion) and the development of new reporting tables for Annex I Parties will improve the quality of estimates and the transparency of reporting.

57. The IPCC methodologies are deemed not appropriate for use by many Parties primarily because in many cases the local/national classification of forests or national inventory practices are different from, and do not correlate with, the IPCC classification and inventory system. In some cases, the 1996 IPCC Guidelines are not clear enough to allow consistent reporting of estimates from some activities, for example, emissions or sequestration in managed natural forests. Problems were also identified in the use of default values for carbon density, growth rates of biomass and emission rates of soil carbon, as well as in distinguishing between fractions of biomass burnt on-site, burnt off-site or left to decay. As a consequence, some Parties have resorted to using national methodologies, which are not always consistent or compatible with the IPCC methodologies and, in many cases, are not well documented. In turn this has resulted in incomplete or non-transparent reporting that has impaired the synthesis and comparison of the reported data.

58. For changes in forest and other woody biomass stocks, some Parties have adapted the IPCC methodologies to reflect their national circumstances. Some examples of different methodological elements used by Parties include: the use of either total biomass or only above-ground biomass; inclusion or exclusion of wood products; estimation of other woody biomass (e.g. for urban trees); use of yield tables or direct on-site measurements; use of different biomass expansion factors and other local conversion factors or IPCC default factors; use of different definitions for what is a productive forest; use of different minimum measurable tree diameter; use of different methods to estimate the annual net increment in biomass stocks; use of different sources of activity data to report forest harvesting; and inclusion of emissions from prescribed forest fires.

59. Furthermore, some Parties have reported difficulties in differentiating between anthropogenic and non-anthropogenic emissions and removals and in providing disaggregated estimates from managed forests, plantations, and productive or protected natural forests. Other difficulties are associated with the estimation of emissions and removals from some tree species which are found in either uniform or mixed forest areas and in different geographical/climatic zones within the country, due to the lack of detailed spatial information (e.g. growth rates, management practices, species composition and abundance). To overcome this difficulty, some Parties applied the information for a selected taxonomic group of trees to forest ecosystems whose morphological and structural characteristics were similar to this selected group.

60. Under subcategory 5E (Other), information for a variety of activities has been reported, including accumulation of biomass due to change in crop type biomass (new arable crops, new woodlands, new urban areas and new permanent grass area), peat extraction (drainage of upland deep peat and drainage of lowland wetlands)[22] and carbon storage in discarded yard trimmings in landfills.

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[22] See also chapter III (Fugitive emissions – solid fuels) of this note.

B. Issues relating to the application of the 1996 IPCC Guidelines by non-Annex I Parties

61. In many non-Annex I Parties, activity data in the LUCF sector are lacking or are not accessible. Most Parties highlighted the relatively high degree of uncertainty associated with activity data in this sector, which are difficult to obtain and, in a number of cases, inconsistent for performing time-series calculations. In some cases, large differences were reported between internationally available activity data and national activity data for forestry activities.

VIII. WASTE

A. General

62. The activity that is most often identified as a key source under the Waste sector is solid waste disposal sites (CH_4 emissions). Other sources include waste-water handling (CH_4 and N_2O emissions) and waste incineration (CO_2 emissions).

63. The methodologies that Parties use for this sector range from default activity data and emission factors to use of country-specific methods including models. Some Parties have reported difficulties in obtaining reliable activity data for estimating emissions from the Waste sector, resulting in the use of the default activity data included in the 1996 IPCC Guidelines. However, it has been reported that the default values for some of Parties do not take into consideration the specific conditions of waste management in these Parties. The following are some of the areas that merit further consideration during the revision process:

(a) The default activity data provided by the 1996 IPCC Guidelines should be updated to ensure that they better reflect prevailing waste management practices;

(b) The existing emission factors and other parameters should be updated taking into consideration information from Parties and any relevant research in this area;

(c) The development, if feasible, of methodologies and emission factors for estimating emissions form sludge spreading and composting.

B. Issues relating to the application of the 1996 IPCC Guidelines by non-Annex I Parties

64. The specific circumstances of waste disposal in some non-Annex I Parties are not appropriately reflected in the methods for estimating waste emissions in the 1996 IPCC Guidelines. For example, estimating CH_4 emissions from common solid waste practices involving burning and/or the use of open dump, using the IPCC methodologies, does not appropriately reflect the level of these emissions due to the lack of anaerobic conditions typical of landfills considered in the 1996 IPCC Guidelines. It is suggested that the IPCC methodologies for this sector should be revised to enable the estimation of emissions from use of open dumps and open burning of waste.

IX. OTHER GENERAL MATTERS

65. The following matters are of general character and are applicable to almost all sectors of the 1996 IPCC Guidelines:

(a) The unavailability of certain data sets for some areas of the inventory is often quoted as one the primary areas of concern for many Parties. Although it is not likely that this issue can be resolved in the context of the revision of the 1996 IPCC Guidelines, it is suggested that the IPCC considers this matter and explores the possibility of providing alternative methods or additional guidance and recommendations to assist Parties in the compilation of such data. The IPCC could also consider whether statistical methods or other similar tools are available to assist inventory teams or agencies in

determining whether the activity data are representative for the source categories included in their national GHG inventories;

(b) Some recent developments and practices (for example recovery, recycling and destruction of HFCs, PFCs and SF_6, and recovery of CH_4 from landfills or mines) appear to have a rather large potential for GHG emission reductions. Due the importance of these gases (in terms of their high GWP and long lifetime in the atmosphere, particularly for HFCs, PFCs and SF_6), it is suggested that the latest available information on the **emission reduction technologies or practices** to be taken into consideration during the revision process.

Annex

Information on methods and emission factors used by Annex I Parties for selected sources

The information in the following tables is based on the 2002 and 2003 GHG inventory submissions from Annex I Parties. The sources presented in this annex were selected based on the key source analysis for the 2003 GHG inventory submissions that was carried out by the secretariat (for more details see FCCC/WEB/SAI/2003). The Parties whose abbreviated names appear in parentheses in the following tables have reported using more than one method and/or more than one type of emission factor to estimate emissions from the particular source category.

List of Parties considered in this annex and their ISO three-letter country codes

Party	Country code	Party	Country code
Australia	AUS	Latvia	LVA
Austria	AUT	Luxemburg	LUX
Bulgaria	BGR	Monaco	MCO
Canada	CAN	Netherlands	NLD
Czech Republic	CZE	New Zealand	NZL
Denmark	DNK	Norway	NOR
Finland	FIN	Poland	POL
France	FRA	Portugal	PRT
Germany	DEU	Romania	ROM
Greece	GRC	Slovakia	SVK
Hungary	HUN	Spain	ESP
Iceland	ISL	Sweden	SWE
Ireland	IRL	Switzerland	CHE
Italy	ITA	United Kingdom of Great Britain and Northern Ireland	GBR
Japan	JPN	United States of America	USA

ENERGY

Table A.1 Stationary combustion – CO_2 emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Plant-specific**	***Total***
Methods	**T1**	CZE, (FIN), HUN, ISL, LVA, MCO, (NZL), (JPN), ROM, SVK		(AUS), (IRL), (ITA), (NZL), USA	(IRL)	***14***
	T2		(PRT)	(AUS), CAN, (FIN), (ITA), (NLD), NOR, POL, GBR	(FIN), (NLD)	***9***
	T3	(BGR)		(BGR)		***1***
	CORINAIR		(GRC), LUX, (PRT), (ESP)	AUT, DNK, FRA, (GRC), CHE		***8***
	Country-specific			DEU, SWE, (JPN)	(ESP)	***4***
	Total	***11***	***4***	***20***	***4***	

Table A.2 Stationary combustion – CH_4 emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Plants-specific**	***Total***
Methods	**T1**	(FIN), ISL, (ITA), LVA, MCO, NZL, ROM, SVK, (USA)	IRL	(AUS), HUN, (USA)		***12***
	T2	CZE, (ITA), (NOR), (GBR)	(PRT), (GBR)	(AUS), CAN, (FIN), (JPN), (NLD), POL, (GBR)	(FIN), (NLD)	***11***
	T3	(BGR)		(BGR)		***1***
	CORINAIR		(DNK), GRC, LUX, (PRT), ESP	AUT, (DNK), FRA, CHE		***8***
	Country-specific			DEU, (JPN), (NOR), SWE		***4***
	Total	***13***	***7***	***17***	***2***	

Table A.3 Stationary combustion – N_2O emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Plant-specific**	***Total***
Methods	**T1**	ISL, (ITA), LVA, MCO, (NLD), NZL, ROM, SVK, (USA)	IRL	(AUS), (FIN), HUN, (USA)	(FIN), (NLD)	***13***
	T2	(CZE), (NOR), (GBR)	(PRT), (GBR)	(AUS), CAN, (FIN), (ITA), (JPN), (NOR), POL, (GBR)	(CZE), (FIN)	***10***
	T3	(BGR)		(BGR)		***1***
	CORINAIR	CHE	DNK, GRC, LUX, (PRT), ESP	AUT, FRA		***8***
	Country-specific			DEU, (JPN), SWE		***3***
	Total	***14***	***7***	***15***	***3***	

Table A.4 Road transportation – CO_2 emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Model**	***Total***
Methods	**T1**	CZE, HUN, ISL, LVA, MCO, NZL, ROM		IRL		***8***
	T2			AUS, BGR, ITA, NLD, POL, GBR, USA		***7***
	T3					
	CORINAIR[a]		FRA, GRC, LUX, PRT, ESP			***5***
	Country-specific			CAN, DEU, JPN, SWE, CHE		***5***
	Model			AUT, DNK, FIN, NOR	SVK	***5***
	Total	***7***	***5***	***17***	***1***	

[a] The CORINAIR methodology recommends the use of the COPERT model for the estimation of emissions from road transport.

Table A.5 Road transportation – N_2O emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Model**	***Total***
Methods	**T1**	ISL, LVA, MCO, NZL, ROM	IRL	HUN		***7***
	T2	CZE, (USA)		AUS, POL, (USA)		***4***
	T3	(GBR)	ITA	NDL		***3***
	CORINAIR[a]		DNK, FRA, GRC, LUX, PRT, ESP			***6***
	Country-specific			CAN, DEU, SWE, CHE		***4***
	Model		(NOR)	AUT, (NOR)	DNK, FIN, SVK, (USA)	***6***
	Total	***8***	***9***	***11***	***4***	

[a] The CORINAIR methodology recommends the use of the COPERT model for the estimation of emissions from road transport.

Table A.6 Fugitive emissions – solid fuels – CH_4 emissions

		Emission factors			
		Default	**CORINAIR**	**Country-specific**	***Total***
Methods	**T1**	BGR, DNK, GRC, (ITA), (NZL), NOR, ROM		HUN, (NZL), SVK, ESP	***10***
	T2		(PRT)	AUS, JPN, GBR, (USA)	***5***
	T3			CZE, (USA)	***2***
	CORINAIR		(PRT)	AUT, FRA, (ITA)	***4***
	Country-specific			CAN, FIN, DEU, POL, SWE	***5***
	Total	***7***	***1***	***17***	

Table A.7 Fugitive emissions – oil and natural gas – CH_4 emissions

		Emission factors					
		Default	**CORINAIR**	**Country-specific**	**Plant-specific**	**Model**	***Total***
Methods	**T1**	BGR, (CZE), JPN, (NZL), ROM, (SVK)		(HUN), IRL, (NLD), (NZL), (SVK)		(HUN)	***9***
	T2		(PRT)	AUS			***2***
	T3			(CZE), GBR			***2***
	CORINAIR		DNK, GRC, LUX, (PRT), (ESP)	AUT, FRA, (ITA), CHE			***9***
	Country-specific			CAN, DEU, (ITA), (NLD), NOR, POL, SWE	FIN, LVA, (ESP)		***10***
	Model					USA	***1***
	Total	***6***	***5***	***17***	***3***	***2***	

INDUSTRIAL PROCESSES

Table A.8 Mineral products – CO_2 emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Plant-specific**	***Total***
Methods	**T1**	BGR, CZE, (FIN), ISL, IRL, ITA, (JPN), (LVA), (PRT), ROM, SVK, (ESP), (USA)		CAN, NZL, NOR, POL	(FIN)	***17***
	T2	GBR, (ESP)		AUS, HUN, (NLD)	(NLD)	***5***
	CORINAIR	(LVA)	GRC, LUX, (PRT), (ESP)	(AUT), FRA, CHE		***8***
	Country-specific			(AUT), DNK, DEU, (JPN), (NLD), SWE, (ESP), (USA)	(NLD)	***8***
	Total	***14***	***4***	***16***	***3***	

Table A.9 Chemical industry – N_2O emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Plant-specific**	***Total***
Methods	**T1**	AUS, BGR, HUN, (ITA), (PRT), ROM		IRL, (ITA), (JPN), SVK, (USA)	FIN, (JPN), (USA)	***11***
	T2			CAN	CZE, NLD	***3***
	CORINAIR		GRC, LUX, (PRT), (ESP)	(FRA), (ESP), SWE, CHE	AUT, (FRA)	***8***
	Country-specific			DEU, ISL, POL, GBR	NOR	***5***
	Total	***6***	***4***	***14***	***8***	

Table A.10 Metal production – CO_2 emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Plant-specific**	***Total***
Methods	**T1**	BGR, CZE, HUN, ISL, (ITA), LVA, (NOR), (PRT), ROM, (USA)		(CAN), NZL, (POL), (USA)		***13***
	T2			AUS, (CAN), GBR		***3***
	CORINAIR		GRC, (ITA), LUX, (PRT), ESP	(AUT), FRA, (ITA), CHE	(AUT)	***8***
	Country-specific			DEU, (NLD), (POL), SWE	(NLD), (NOR)	***5***
	Total	***10***	***5***	***13***	***3***	

Table A.11 Consumption of halocarbons and SF_6 – HFC emissions

		Emission factors					
		Default	**CORINAIR**	**Country-specific**	**Plant-specific**	**Model**	***Total***
Methods	**T1a**	BGR, (FIN), ISL, MCO, (POL), PRT, (SVK), (ESP)		HUN, (ITA), (SVK)			***10***
	T1b	(FIN), (POL)					***2***
	T2	CAN, (FIN), NZL, (POL), (SWE), (GBR)		FRA, DEU, (ITA), (NLD), NOR, (SWE), (GBR), (USA)		CHE	***13***
	CORINAIR		LUX				***1***
	Country - specific			AUT, JPN	(ESP)		***3***
	Model			DNK, (NLD)		(USA)	***3***
	Total	***12***	***1***	***13***	***1***	***2***	

Table A.12 Consumption of halocarbons and SF_6 – PFC emissions

		Emission factors				
		Default	**Country-specific**	**Plant-specific**	**Model**	***Total***
Methods	**T1a**	MCO, (POL), (SVK), (ESP)	HUN, ITA, (SVK)			***6***
	T2	CAN, (NLD), NZL, (POL), (GBR)	FRA, DEU, SWE, (GBR), (USA)		CHE	***10***
	T3	(NLD)				***1***
	Country-specific		AUT, JPN	(ESP)		***3***
	Model		DNK		(USA)	***2***
	Total	***8***	***11***	***1***	***2***	

AGRICULTURE

Table A.13 Enteric fermentation – CH_4 emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Model**	***Total***
Methods	**T1**	(AUT), BGR, CAN, (FIN), (DEU), GRC, HUN, ISL, (IRL), (ITA), LVA, (NLD), NOR, PRT, ROM, (SVK), (ESP), (SWE), (USA)		(DNK), (IRL)		***20***
	T2	JPN, (GBR)		(AUT), CZE, (DNK), (FIN), (ITA), (NLD), NZL, POL, (SVK), (GBR), (USA)		***12***
	CORINAIR		(DEU), LUX	FRA		***3***
	Country-specific			(ESP), (SWE), CHE		***3***
	Model				(USA)	***1***
	Total	***21***	***2***	***17***	***1***	

Table A.14 Manure management – CH_4 emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Model**	***Total***
Methods	**T1**	(AUT), (BGR), CAN, (DEU), GRC, HUN, ISL, (IRL), (ITA), (JPN), LVA, (SVK), (ESP), (SWE), (USA)		(IRL), (SVK)		***15***
	T2	(FIN), (NOR), (PRT), (GBR)		(AUT), (BGR), CZE, DNK, (FIN), FRA, (ITA), NLD, NZL, (NOR), POL, (PRT), ROM, (ESP), (SWE), (GBR), (USA)		***17***
	CORINAIR		(DEU), LUX			***2***
	Country-specific			(JPN), CHE		***2***
	Model				(USA)	***1***
	Total	***19***	***2***	***21***	***1***	

Table A.15 Agricultural soils – N_2O emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Model**	***Total***
Methods	**T1**	AUT, BGR, CAN, CZE, (FIN), GRC, ISL, (IRL), (ITA), LVA, (NZL), (NOR), PRT, ROM, (ESP), GBR[a], USA[a]		(FIN), HUN, (IRL), (ITA), (NLD[a]), (NZL), (NOR), (SWE)		***20***
	T2			(FRA), POL		***2***
	CORINAIR		LUX, (SVK)	(SWE)		***3***
	Country-specific	(SVK)		AUS, (DNK), DEU, JPN, (NLD), (SVK), (ESP), CHE		***8***
	Model				(DNK)	***1***
	Total	***18***	***2***	***17***	***1***	

[a] Additional information was provided on the use of tier 1a and tier 1b.

LAND USE CHANGE AND FORESTRY

A.16 Changes in forest and other woody biomass stocks – CO_2 emissions/removals

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Model**	***Total***
Methods	**T1**	HUN, (ITA), (JPN), (LVA), POL, PRT, ROM, (SVK)		AUT, (CAN), IRL, (JPN), (LVA), NLD, SWE		***13***
	CORINAIR		LUX			***1***
	Country-specific	(NOR)		AUS, BGR, (CAN), CZE, (DNK), FIN, FRA, DEU, ISL, (ITA), (NZL), (NOR), (SVK), ESP, CHE, USA		***16***
	Model				(DNK), (NZL), GBR	***3***
	Total	***9***	***1***	***22***	***3***	

WASTE

A.17 Solid waste disposal on land – CH_4 emissions

		Emission factors				
		Default	**CORINAIR**	**Country-specific**	**Model**	***Total***
Methods	**T1**	(BGR), GRC, (ITA), LVA, (POL), ROM, SVK		(BGR), (CZE), DEU, (POL)		***9***
	T2	(FIN), (IRL), (SWE)		(FIN), (IRL), (ITA), NZL, PRT, ESP, (SWE)	AUS	***8***
	T3			(CZE)		***1***
	CORINAIR		LUX			***1***
	Country-specific	(HUN)		AUT, CAN, FRA, (HUN), ISL, (JPN), (NLD), CHE		***8***
	Model			(JPN), (NLD), NOR, GBR	DNK, USA	***6***
	Total	***11***	***1***	***21***	***3***	

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