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Agenda item 9(b)
Methodological issues under the Convention
Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention

Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention

Draft conclusions proposed by the Chair

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA) welcomed the report[1] on the fourth workshop of the work programme on revising 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", held in Bonn, Germany, from 8 to 10 November 2011, which was organized by the secretariat following a request made by the SBSTA at its thirty-fourth session.[2]

2. The SBSTA acknowledged with appreciation that the Intergovernmental Panel on Climate Change (IPCC) had responded to the invitation made by the SBSTA at its thirty-third session to develop supplementary methodological guidance on wetlands and it invited the IPCC to report back to the SBSTA no later than at its thirty-ninth session.

3. The SBSTA has advanced its work on the revision of 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", but was not able to conclude its work on issues included in paragraphs 13, 20, 22–27, 28–30, 32–33, 37(b) and 37(f) of the draft guidelines contained in the annex to the draft decision contained in the annex, relating to the use of tier 3 methods in the land use, land-use change and forestry sector for addressing disturbance events, national inventory arrangements, new gases (nitrogen trifluoride (NF_3), hydrofluorethers (HFEs) perfluoropolyethers (PFPEs), indirect CO_2, a new notation key "considered insignificant", supplementary information on the minimization of adverse impacts in annex 5 to the outline and general structure of the national inventory report and the reporting of emissions from urea application (table 3.G-H and related sectoral and summary tables of the common reporting format). The SBSTA

[1] FCCC/SBSTA/2011/INF.12.
[2] FCCC/SBSTA/2011/2, paragraph 78.

agreed to invite the Conference of the Parties at its seventeenth session to provide further guidance in order to resolve these outstanding issues.

4. The SBSTA also agreed to forward a draft decision on the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories" for consideration and adoption by the Conference of the Parties at its seventeenth session. The draft decision is contained in the annex.

Annex

Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention

Draft decision -/CP.17

The Conference of the Parties,

Recalling the relevant provisions of the Convention, in particular Article 4, Article 10, paragraph 2, and Article 12,

Further recalling decision 3/CP.1 on the preparation and submission of national communications from Parties included in Annex I to the Convention, decision 4/CP.1 on methodological issues, decision 9/CP.2 on communications from Parties included in Annex I to the Convention: guidelines, schedule and process for consideration, decision 11/CP.4 on national communications from Parties included in Annex I to the Convention, and decisions 3/CP.5, 18/CP.8 and 14/CP.11 on guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories,

Reaffirming that anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol should be reported in a transparent, consistent, comparable, complete and accurate way,

Noting that 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", adopted by decisions 3/CP.5, 18/CP.8 and 14/CP.11 need to be revised in order to implement the use of the Intergovernmental Panel on Climate Change *2006 IPCC Guidelines for National Greenhouse Gas Inventories*,

Having considered the relevant recommendations of the Subsidiary Body for Scientific and Technological Advice,

1. [*Adopts* the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories" (hereinafter referred to as the UNFCCC Annex I inventory reporting guidelines) contained in annex I to this decision and the new common reporting format tables contained in annex II to this decision for trial use, in accordance with paragraph 3 of this decision;]

2. *Decides* that, from 2015 until a further decision by the Conference of the Parties, the global warming potentials used by Parties to calculate the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks of greenhouse gases shall be those listed in the column entitled "Global warming potential for given time horizon" in table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon, as included in annex III to this decision;

3. *Invites* Parties included in Annex I to the Convention (Annex I Parties), in addition to the inventory submitted in line with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" adopted by decision 14/CP.11, to use the UNFCCC Annex I inventory reporting guidelines voluntarily during a trial period from October 2012 to May 2013 and to submit their views on the experience of using these revised guidelines and the upgraded CRF Reporter to the secretariat by 3 May 2013;

4. *Further invites* the Subsidiary Body for Scientific and Technological Advice, at its thirty-eighth session, to start considering the information submitted by Annex I Parties on their experiences in using the UNFCCC Annex I inventory reporting guidelines and the upgraded or new CRF Reporter software, and any supplementary methodological guidance on wetlands developed by the Intergovernmental Panel on Climate Change with a view to adopting a final decision on these revised guidelines and common reporting format tables at the latest at the nineteenth session of the Conference of the Parties;

5. *Requests* the secretariat to enable the use of the UNFCCC Annex I inventory reporting guidelines for the trial period by the provision of an upgraded or new version of the CRF Reporter software, supporting the use of the revised UNFCCC Annex I inventory reporting guidelines, to be provided to Annex I Parties by 1 October 2012, with a view to fully implementing the regular use of the revised UNFCCC Annex I inventory reporting guidelines for Parties' greenhouse gas inventory submissions in 2015, subject to a final decision on these revised guidelines by the Conference of the Parties at its nineteenth session;

6. *Invites* Annex I Parties in a position to do so to provide financial resources for the upgrade and development of CRF Reporter in order to enable the trial and mandatory use of the revised UNFCCC Annex I inventory reporting guidelines by Annex I Parties;

7. *Takes note* of the estimated budgetary implications of upgrading and developing the CRF Reporter software;

8. *Requests* that the actions of the secretariat called for in this decision be undertaken subject to the availability of resources.

Annex I

[English only]

Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories

Contents

I. Introduction

A. Mandate

1. The Conference of Parties (COP), by its decision xx/CP.17, 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 greenhouse gas inventories and tables of the common reporting format (CRF) to implement the use of the 2006 IPCC Guidelines.

B. Scope of the note

2. This document contains the complete updated UNFCCC Annex I reporting guidelines on annual GHG inventories for all inventory sectors. The UNFCCC Annex I reporting guidelines on annual GHG inventories have been updated to reflect the implementation of the use of the 2006 IPCC Guidelines.

II. Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories

A. Objectives

1. The Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories (hereinafter referred to as the UNFCCC Annex I inventory reporting guidelines) cover the estimation and reporting of anthropogenic[3] GHG emissions and removals in both annual GHG inventories and inventories included in national communications, as specified by decision 11/CP.4 and other relevant decisions of the COP.

2. The objectives of the UNFCCC Annex I inventory reporting guidelines are:

(a) To assist Parties included in Annex I to the Convention (Annex I Parties) in meeting their commitments under Articles 4 and 12 of the Convention;

(b) To contribute to ensuring the transparency of emission reduction commitments;

(c) To facilitate the process of considering annual national inventories, including the preparation of technical analysis and synthesis documentation;

(d) To facilitate the process of verification, technical assessment and expert review of the inventory information;

(e) To assist Annex I Parties in ensuring and/or improving the quality of their annual GHG inventory submissions.

B. Principles and definitions

3. The annual GHG inventory should be transparent, consistent, comparable, complete and accurate.

4. In the context of these UNFCCC Annex I inventory reporting guidelines on annual GHG inventories:

(a) *Transparency* means that the data sources, assumptions and methodologies used for an inventory should be clearly explained, in order to facilitate the replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of the information. The use of the common reporting format (CRF) tables and the preparation of a structured national inventory report (NIR) contribute to the transparency of the information and facilitate national and international reviews;

(b) *Consistency* means that an annual GHG inventory should be internally consistent for all reported years in all its elements across sectors, categories and gases. An inventory is consistent if the same methodologies are used for the base and all subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks. Under certain circumstances referred to in paragraphs 16 to 18 below, an inventory using different methodologies for different years can be considered to be consistent if it has

[3] Any reference to GHG emissions and removals in the guidelines shall be understood as anthropogenic GHG emissions and removals.

been recalculated in a transparent manner, in accordance with the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines);

(c) *Comparability* means that estimates of emissions and removals reported by Annex I Parties in their inventories should be comparable among Annex I Parties. For that purpose, Annex I Parties should use the methodologies and formats agreed by the COP for making estimations and reporting their inventories. The allocation of different source/sink categories should follow the CRF tables provided in annex II to this document, at the level of the summary and sectoral tables;

(d) *Completeness* means that an annual GHG inventory covers at least all sources and sinks, as well as all gases, for which methodologies are provided in the 2006 IPCC Guidelines or for which supplementary methodologies have been agreed by the COP. Completeness also means the full geographical coverage of the sources and sinks of an Annex I Party;[4]

(e) *Accuracy* means that emission and removal estimates should be accurate in the sense that they are systematically neither over nor under true emissions or removals, as far as can be judged, and that uncertainties are reduced as far as practicable. Appropriate methodologies should be used, in accordance with the 2006 IPCC Guidelines, to promote accuracy in inventories.

5. In the context of these reporting guidelines, the definitions of common terms used in GHG inventory preparation are those provided in the 2006 IPCC Guidelines.

C. Context

6. The UNFCCC Annex I inventory reporting guidelines on annual GHG inventories also cover the establishment and maintenance of a national inventory arrangements for the purpose of the continued preparation of timely, complete, consistent, comparable, accurate and transparent annual GHG inventories.

7. An annual GHG inventory submission shall consist of an NIR and the CRF tables, as set out in annexes I and II to this document. The annual submission also comprises information provided by an Annex I Party in addition to its submitted NIR and CRF tables.

D. Base year

8. 1990 should be the base year for the estimation and reporting of inventories. According to the provisions of Article 4, paragraph 6, of the Convention and decisions 9/CP.2, 11/CP.4 and 7/CP.12, the following Annex I Parties that are undergoing the process of transition to a market economy are allowed to use a base year or a period of years other than 1990, or a level of emissions as established by a decision of the COP, as follows:

Bulgaria:	1988
Croatia:	1990[5]
Hungary:	the average of the years 1985 to 1987
Poland:	1988
Romania:	1989

[4] According to the instrument of ratification, acceptance, approval or accession to the Convention of each Annex I Party.

[5] In accordance with decision 7/CP.12.

Slovenia: 1986

E. Methods

Methodology

9. Annex I Parties shall use the methodologies provided in the 2006 IPCC Guidelines, unless stated otherwise in the UNFCCC Annex I inventory reporting guidelines on annual GHG inventories, and any supplementary methodologies agreed by the COP, and other relevant COP decisions to estimate anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol.

10. Annex I Parties may use different methods (tiers) contained in the 2006 IPCC Guidelines, prioritizing these methods in accordance with the 2006 IPCC Guidelines. Annex I Parties may also use national methodologies which they consider better able to reflect their national situation, provided that these methodologies are compatible with the 2006 IPCC Guidelines and are well documented and scientifically based.

11. For categories[6] that are determined to be key categories, in accordance with the 2006 IPCC Guidelines, and estimated in accordance with the provisions in paragraph 14 below, Annex I Parties should make every effort to use a recommended method, in accordance with the corresponding decision trees in the 2006 IPCC Guidelines. Annex I Parties should also make every effort to develop and/or select emission factors (EFs), and collect and select activity data (AD), in accordance with the IPCC good practice. Where national circumstances prohibit the use of a recommended method, then the Annex I Party shall explain in its annual GHG inventory submission the reason(s) as to why it was unable to implement a recommended method in accordance with the decision trees in the 2006 IPCC Guidelines.

12. The 2006 IPCC Guidelines provide default methodologies which include default EFs and in some cases default AD for the categories to be reported. As the assumptions implicit in these default data, factors and methods may not be appropriate for specific national circumstances, Annex I Parties should use their own national EFs and AD, where available, provided that they are developed in a manner consistent with the 2006 IPCC Guidelines and are considered to be more accurate than the defaults. If Annex I Parties lack country-specific information, they could also use EFs or other parameters provided in the IPCC Emission Factor Database, where available, provided that they can demonstrate that those parameters are appropriate in the specific national circumstances and are more accurate than the default data provided in the 2006 IPCC Guidelines. Annex I Parties shall transparently explain in their annual GHG inventory submissions what data and/or parameters have been used.

13. [[In cases where national circumstances indicate that disturbance events, including wildfires, potentially represent a significant source of both emissions and removals, and where these net emissions are largely beyond the control of the Party, Parties may apply the good practice contained in chapter 3.2.1 of the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Parties shall transparently document the reasons for the use of this approach in the NIR.][Parties are encouraged to refine estimates of anthropogenic emissions and removals in the LULUCF sector through the application of tier 3 methods, provided that they are developed in a manner consistent with the 2006 IPCC Guidelines, and information for transparency is provided in accordance with paragraph 50(a).]]

[6] The term “categories” refers to both source and sink categories as set out in the 2006 IPCC Guidelines. The term “key categories” refers to the key categories as addressed in the 2006 IPCC Guidelines.

Key category identification

14. Annex I Parties shall identify their key categories for the base year and the latest reported inventory year, using approach 1, level and trend assessment, including and excluding LULUCF. Parties are encouraged to also use approach 2 and to add additional key categories to the result of approach 1.

Uncertainties

15. Annex I Parties shall quantitatively estimate the uncertainty of the data used for all source and sink categories using at least approach 1, as provided in the 2006 IPCC Guidelines, and report uncertainties for at least the base year and the latest inventory year and the trend uncertainty between these two years. Annex I Parties are encouraged to use approach 2 or a hybrid of approaches 1 and 2 provided in the 2006 IPCC Guidelines, in order to address technical limitations of approach 1. The uncertainty of the data used for all source and sink categories should also be qualitatively discussed in a transparent manner in the NIR, in particular for categories that were identified as key categories.

Recalculations and time-series consistency

16. The inventory for a time series, including the base year and all subsequent years for which the inventory has been reported, should be estimated using the same methodologies, and the underlying AD and EFs should be obtained and used in a consistent manner, ensuring that changes in emission trends are not introduced as a result of changes in estimation methods or assumptions over the time series of estimates.

17. Recalculations should ensure the consistency of the time series and shall be carried out to improve accuracy and/or completeness. Where the methodology or manner in which underlying AD and EFs are gathered has changed, Annex I Parties should recalculate their inventories for the base year and subsequent years of the times series. Annex I Parties should evaluate the need for recalculations relative to the reasons provided in the 2006 IPCC Guidelines, in particular for key categories. Recalculations should be performed in accordance with 2006 IPCC Guidelines and the general principles set down in these reporting guidelines.

18. In some cases it may not be possible to use the same methods and consistent data sets for all years, owing to a possible lack of AD, EFs or other parameters directly used in the calculation of emission estimates for some historical years, including the base year. In such cases, emissions or removals may need to be recalculated using alternative methods not generally covered by paragraph 9 above. In these instances, Annex I Parties should use one of the techniques provided in the 2006 IPCC Guidelines to estimate the missing values. Annex I Parties should document and report the methodologies used for the entire time series.

Quality assurance/quality control

19. Each Annex I Party shall elaborate an inventory quality assurance/quality control (QA/QC) plan and implement general inventory QC procedures in accordance with its QA/QC plan following the 2006 IPCC Guidelines. In addition, Annex I Parties should apply category-specific QC procedures for key categories and for those individual categories in which significant methodological changes and/or data revisions have occurred, in accordance with the 2006 IPCC Guidelines. In addition, Annex I Parties should implement QA procedures by conducting a basic expert peer review of their inventories in accordance with the 2006 IPCC Guidelines.

F. National inventory arrangements

20. Each Annex I Party [shall][should] implement and maintain national inventory arrangements for the estimation of anthropogenic GHG emissions by sources and removals by sinks. The national inventory arrangements include all institutional, legal and procedural arrangements made within an Annex I Party for estimating anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol, and for reporting and archiving inventory information.

21. National inventory arrangements should be designed and operated:

(a) To ensure the transparency, consistency, comparability, completeness and accuracy of inventories, as defined in paragraphs 3 and 7 above;

(b) To ensure the quality of inventories through the planning, preparation and management of inventory activities. Inventory activities include collecting AD, selecting methods and EFs appropriately, estimating anthropogenic GHG emissions by sources and removals by sinks, implementing uncertainty assessment and QA/QC activities, and carrying out procedures for the verification of the inventory data at the national level, as described in these reporting guidelines.

22. [In the implementation of its national inventory arrangements, each Annex I Party shall perform the following general functions:

(a) Establish and maintain the institutional, legal and procedural arrangements necessary to perform the functions defined in paragraphs 23 to 27 below, as appropriate, between the government agencies and other entities responsible for the performance of all functions defined in these reporting guidelines;

(b) Ensure sufficient capacity for the timely performance of the functions defined in these reporting guidelines, including data collection for estimating anthropogenic GHG emissions by sources and removals by sinks and arrangements for the technical competence of the staff involved in the inventory development process;

(c) Designate a single national entity with overall responsibility for the national inventory;

(d) Prepare national annual GHG inventories in a timely manner in accordance with these reporting guidelines and relevant decisions of the COP, and provide the information necessary to meet the reporting requirements defined in these reporting guidelines and in relevant decisions of the COP;

(e) Undertake specific functions relating to inventory planning, preparation and management.

Inventory planning

23. As part of its inventory planning, each Annex I Party shall:

(a) Define and allocate specific responsibilities in the inventory development process, including those relating to choosing methods, data collection, particularly AD and EFs from statistical services and other entities, processing and archiving, and QA/QC. Such definition shall specify the roles of, and the cooperation between, government agencies and other entities involved in the preparation of the inventory, as well as the institutional, legal and procedural arrangements made to prepare the inventory;

(b) Elaborate an inventory QA/QC plan as indicated in paragraph 19 above;

(c) Establish processes for the official consideration and approval of the inventory, including any recalculations, prior to its submission, and for responding to any issues raised in the inventory review process.

24. As part of its inventory planning, each Annex I Party should consider ways to improve the quality of AD, EFs, methods and other relevant technical elements of the inventory. Information obtained from the implementation of the QA/QC programme, the inventory review process and other verification activities should be considered in the development and/or revision of the QA/QC plan and the quality objectives.

Inventory preparation

25. As part of its inventory preparation, each Annex I Party shall:

(a) Prepare estimates in accordance with the requirements defined in these reporting guidelines;

(b) Collect sufficient AD, process information and EFs as are necessary to support the methods selected for estimating anthropogenic GHG emissions by sources and removals by sinks;

(c) Make quantitative estimates of uncertainty for each category and for the inventory as a whole, as indicated in paragraph 16 above;

(d) Ensure that any recalculations are prepared in accordance with paragraphs 16–18 above;

(e) Compile the NIR and the CRF tables in accordance with these reporting guidelines;

(f) Implement general inventory QC procedures in accordance with its QA/QC plan, following the 2006 IPCC Guidelines.

26. As part of its inventory preparation, each Annex I Party should:

(a) Apply category-specific QC procedures for key categories and for those individual categories in which significant methodological and/or data revisions have occurred, in accordance with the 2006 IPCC Guidelines;

(b) Provide for a basic review of the inventory by personnel that have not been involved in the inventory development process, preferably an independent third party, before the submission of the inventory, in accordance with the planned QA procedures referred to in paragraph 19 above;

(c) Provide for a more extensive review of the inventory for key categories, as well as for categories where significant changes to methods or data have been made, in accordance with the 2006 IPCC Guidelines;

(d) On the basis of the reviews described in paragraph 3(b) and (c) above and periodic internal evaluations of the inventory preparation process, re-evaluate the inventory planning process, in order to meet the established quality objectives referred to in paragraph 24 above.

Inventory management

27. As part of its inventory management, each Annex I Party shall:

(a) Archive all relevant inventory information for the reported time series, including all disaggregated EFs and AD, documentation on how these factors and data have been generated and aggregated for the preparation of the inventory, internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements;

(b) Provide review teams with access to all archived information used by the Party to prepare the inventory through the single national entity, in accordance with relevant decisions of the COP;

(c) Respond, in a timely manner, to requests for clarifying inventory information resulting from the different stages of the process of review of the inventory information and information on the national inventory arrangements.]

G. Reporting

1. General guidance

Estimates of emissions and removals

28. Article 12, paragraph 1(a), of the Convention requires that each Party shall communicate to the COP, through the secretariat, inter alia, a national inventory of anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol. As a minimum requirement, inventories shall contain information on the following GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) [and] [nitrogen trifluoride (NF_3)] [,] [hydrofluorethers (HFEs)][and] [perfluoropolyethers (PFPEs)]]. Annex I Parties should report anthropogenic emissions and removals of any other GHGs[whose [100-year global warming potential (GWP) values have been identified by the IPCC][and adopted by the COP].

29. In addition, Annex I Parties should provide information on the following precursor gases: carbon monoxide (CO), nitrogen oxides (NO_X) and non-methane volatile organic compounds (NMVOCs), as well as sulphur oxides (SO_X). [Annex I Parties [should][may] report indirect CO_2 from the atmospheric oxidation of CH_4, CO and NMVOCs [as a memo item]. Annex I Parties should [also] report as a memo item indirect N_2O emissions from other than the agriculture and LULUCF sources. These estimates of [indirect CO_2 and] indirect N_2O should not be included in national totals but be reported separately.]

30. GHG emissions and removals should be presented on a gas-by-gas basis in units of mass, with emissions by sources listed separately from removals by sinks, except in cases where it may be technically impossible to separate information on sources and sinks in the area of LULUCF. For HFCs[,] [and] PFCs, [and HFEs,] emissions should be reported for each relevant chemical in the category on a disaggregated basis, except in cases where paragraph 36 below applies.

31. Annex I Parties should report aggregate emissions and removals of GHGs, expressed in CO_2 eq, using the global warming potentials values as agreed by decision XX/CP.17 or any subsequent decision by the COP on global warming potentials.

32. Annex I Parties shall report actual emissions of HFCs, PFCs[,] [and] SF_6, [NF_3,] [HFEs] [and] [PFPEs] providing disaggregated data by chemical (e.g. HFC-134a) and category in units of mass and in CO_2 eq, except in cases where paragraph 36 below applies. Annex I Parties should report emission estimates or notation keys in line with paragraph 37 below and trends for these gases for 1990 onward, in accordance with the provisions of these reporting guidelines.

33. Annex I Parties [are strongly encouraged to][should] also report emissions and removals of additional GHGs, [such as [HFEs] [and] [PFPEs], and other gases][identified by the IPCC] [for which 100-year GWP values are available from the IPCC] but have not yet been adopted by the COP. These emissions and removals should be reported separately from national totals. [The GWP value and reference should be indicated.]

34. In accordance with the 2006 IPCC Guidelines, international aviation and marine bunker fuel emissions should not be included in national totals but should be reported separately. Annex I Parties should make every effort to both apply and report according to the method contained in the 2006 IPCC Guidelines for separating domestic and

international emissions. Annex I Parties should also report emissions from international aviation and marine bunker fuels as two separate entries in their inventories.

35. Annex I Parties should clearly indicate how feedstocks and non-energy use of fuels have been accounted for in the inventory, under the energy or industrial processes sector, in accordance with the 2006 IPCC Guidelines.

36. Emissions and removals should be reported at the most disaggregated level of each source/sink category, taking into account that a minimum level of aggregation may be required to protect confidential business and military information.

Completeness

37. Where methodological or data gaps in inventories exist, information on these gaps should be presented in a transparent manner. Annex I Parties should clearly indicate the sources and sinks which are not considered in their inventories but which are included in the 2006 IPCC Guidelines, and explain the reasons for such exclusion. Similarly, Annex I Parties should indicate the parts of their geographical area, if any, not covered by their inventory and explain the reasons for their exclusion. In addition, Annex I Parties should use the notation keys presented below to fill in the blanks in all the CRF tables.[7] This approach facilitates the assessment of the completeness of an inventory. The notation keys are as follows:

(a) "NO" (not occurring) for categories or processes, including recovery, under a particular source or sink category that do not occur within an Annex I Party;

(b) "NE" (not estimated) for AD and/or emissions by sources and removals by sinks of GHGs which have not been estimated but for which a corresponding activity may occur within a Party.[8] Where "NE" is used in an inventory to report emissions or removals of CO_2, N_2O, CH_4, HFCs, PFCs, SF_6 [,][or NF_3] [,HFEs] [and] [PFPEs], the Annex I Party should indicate in both the NIR and the CRF completeness table why such emissions or removals have not been estimated;[9]

(c) "NA" (not applicable) for activities under a given source/sink category that do occur within the Party but do not result in emissions or removals of a specific gas. If the cells for categories in the CRF tables for which "NA" is applicable are shaded, they do not need to be filled in;

(d) "IE" (included elsewhere) for emissions by sources and removals by sinks of GHGs estimated but included elsewhere in the inventory instead of under the expected source/sink category. Where "IE" is used in an inventory, the Annex I Party should indicate, in the CRF completeness table, where in the inventory the emissions or removals for the displaced source/sink category have been included, and the Annex I Party should explain such a deviation from the inclusion under the expected category, especially if it is due to confidentiality;

(e) "C" (confidential) for emissions by sources and removals by sinks of GHGs of which the reporting could lead to the disclosure of confidential information, given the provisions of paragraph 36 above[.][;]

(f) ["CI" (considered insignificant) for emissions that would result in an estimate below 0.05 per cent of the national total GHG emissions,[10] but not exceed 500 kt, for

[7] If notation keys are used in the NIR, they should be consistent with those reported in the CRF tables.

[8] The notation key "NE" should also be used when an activity occurs in the Party but the 2006 IPCC Guidelines do not provide methodologies to estimate the emissions/removals.

[9] Even if emissions are considered to be negligible, Parties should either report the emission estimate, if calculated, or use the notation key "NE".

[10] "National total GHG emissions" refers to the total GHG emissions without LULUCF for the latest reported inventory year.

emissions which cannot be estimated owing to the lack of AD and for emissions for which data collection would jeopardize the resources available for the improvement of the data and methods used for key categories, in line with IPCC good practice. If this notation key is used for a category, Parties should use approximated AD and default IPCC EFs to derive an approximated estimate for the respective category for one year. Where "CI" is used in an inventory, the Annex I Party shall transparently document the approximated emission estimation in the NIR, including the justification for the approximated estimate related to data availability and resource needs. The notation key "CI" shall not replace an inventory estimate for a category below the aforementioned threshold which was reported in previous inventory submissions. The Party should conduct an assessment on its use of "CI" for categories every 5 years.]

38. Annex I Parties are encouraged to estimate and report emissions and removals for source or sink categories for which estimation methods are not included in the 2006 IPCC Guidelines. If Annex I Parties estimate and report emissions and removals for country-specific sources or sinks or of gases which are not included in the 2006 IPCC Guidelines, they should explicitly describe what source/sink categories or gases these are, as well as what methodologies, EFs and AD have been used for their estimation, and provide references for these data.

Key categories

39. Annex I Parties shall estimate and report the individual and cumulative percentage contributions from key categories to their national total, with respect to both level and trend. The emissions should be expressed in terms of CO_2 eq using the methods provided in the 2006 IPCC Guidelines. As indicated in paragraph 50 below, this information should be included in the NIR using tables 4.2 and 4.3 of the 2006 IPCC Guidelines, adapted to the level of category disaggregation that the Annex I Party used for determining its key categories.[11]

Verification

40. For the purposes of verification, Annex I Parties should compare their national estimates of CO_2 emissions from fuel combustion with those estimates obtained using the IPCC reference approach, as contained in the 2006 IPCC Guidelines, and report the results of this comparison in the NIR.

41. Annex I Parties that prepare their estimates of emissions and/or removals using higher-tier (tier 3) methods and/or models shall provide in the NIR verification information consistent with the 2006 IPCC Guidelines.

Uncertainties

42. Annex I Parties shall report, in the NIR, uncertainties estimated as indicated in paragraph 16 above, as well as methods used and underlying assumptions, for the purpose of helping to prioritize efforts to improve the accuracy of national inventories in the future and to guide decisions on methodological choice. This information should be presented using table 3.3 of the 2006 IPCC Guidelines. In addition, Annex I Parties should indicate in that table those categories that have been identified as key categories in their inventory.

Recalculations

43. Recalculations of previously submitted estimates of emissions and removals as a result of changes in methodologies, changes in the manner in which EFs and AD are obtained and used, or the inclusion of new sources or sinks which have existed since the base year but were not previously reported, shall be reported for the base year and all subsequent years of the time series up to the year for which the recalculations are made.

[11] Table 4.1 of the 2006 IPCC Guidelines should be used as the basis for preparing the key category analysis but does not need to be reported in the NIR.

Further, a discussion on the impact of the recalculations on the trend in emissions should be provided in the NIR at the category, sector and national total level, as appropriate.

44. Recalculations shall be reported in the NIR, with explanatory information and justifications for recalculations. Information on the procedures used for performing the recalculations, changes in the calculation methods, EFs and AD used, and the inclusion of sources or sinks not previously covered should be reported with an indication of the relevant changes in each source or sink category where these changes have taken place.

45. Annex I Parties shall report any other changes in estimates of emissions and removals, and clearly indicate the reason for the changes compared with previously submitted inventories (e.g. error correction, statistical reason or reallocation of categories), in the NIR as indicated in paragraph 50 below and outlined in annex II to this document. Small differences (e.g. due to the rounding of estimates) should not be considered as recalculations.

Quality assurance/quality control

46. Annex I Parties shall report in the NIR on their QA/QC plan and give information on QA/QC procedures already implemented or to be implemented in the future. In addition, Annex I Parties are encouraged to report on any peer review of their inventory, apart from the UNFCCC review.

Corrections

47. Inventories shall be reported without corrections relating, for example, to climate variations or trade patterns of electricity.

2. National inventory report

48. Annex I Parties shall submit to the COP, through the secretariat, an NIR containing detailed and complete information on their inventories. The NIR should ensure transparency and contain sufficiently detailed information to enable the inventory to be reviewed. This information should cover the base year, the most recent 10 years and any previous years since the base year ending with 0 or 5 (1990, 1995, 2000, etc.).

49. Each year, an updated NIR shall be electronically submitted in its entirety to the COP, through the secretariat, in accordance with the relevant decisions of the COP.

50. The NIR shall include:

(a) Descriptions, references and sources of information for the specific methodologies, including higher-tier methods and models, assumptions, EFs and AD, as well as the rationale for their selection. For tier 3 models, additional information for improving transparency;[12]

(b) An indication of the level of complexity (IPCC tier) applied and a description of any national methodology used by the Annex I Party, as well as information on anticipated future improvements;

(c) For key categories, an explanation if the recommended methods from the appropriate decision tree in the 2006 IPCC Guidelines are not used;

(d) A description of the national key categories, as indicated in paragraph 39 above, including:

[12] Parties should, as applicable, report information on: basis and type of model, application and adaptation of the model, main equations/processes, key assumptions, domain of application, how the model parameters were estimated, description of key inputs and outputs, details of calibration and model evaluation, uncertainty and sensitivity analysis, QA/QC procedures adopted and references to peer-reviewed literature.

(i) A summary table with the key categories identified for the latest reporting year (by level and trend);

(ii) Information on the level of category disaggregation used and the rationale for its use;

(iii) Additional information relating to the methodology used for identifying key categories;

(e) Information on how and where feedstocks and non-energy use of fuels have been reported in the inventory;

(f) Assessment of completeness, including information and explanations in relation to categories not estimated or included elsewhere, and information related to the geographical scope;

(g) Information on uncertainties, as requested in paragraph 43 above;

(h) Information on any recalculations relating to previously submitted inventory data, as requested in paragraphs 43 to 45 above, including changes in methodologies, sources of information and assumptions, in particular in relation to recalculations made in response to the review process;

(i) Information on changes in response to the review process;

(j) Information on the national inventory arrangements and changes to the national inventory arrangements, including a description of the institutional arrangements for inventory preparation, as well as information on verification as requested in paragraphs 40 and 41 above and on QA/QC as requested in paragraph 46 above.

51. The NIR should follow the outline and general structure contained in annex I to this document.

3. Common reporting format tables

52. The CRF tables are designed to ensure that Annex I Parties report quantitative data in a standardized format and to facilitate comparison of inventory data and trends. Explanation of information of a qualitative character should mainly be provided in the NIR rather than in the CRF tables. Such explanatory information should be cross-referenced to the specific chapter of the NIR.

53. Annex I Parties shall submit annually to the COP, through the secretariat, the information required in the CRF tables, as contained in annex II to this document. This information shall be electronically submitted on an annual basis in its entirety to the COP, through the secretariat, in accordance with the relevant decisions of the COP. Parties should submit their CRF tables, generated by the CRF Reporter software, via the UNFCCC submission portal, with a view to facilitating the processing of the inventory information by the secretariat.

54. The CRF is a standardized format for reporting estimates of GHG emissions and removals and other relevant information. The CRF allows for the improved handling of electronic submissions and facilitates the processing of inventory information and the preparation of useful technical analysis and synthesis documentation.

55. The CRF tables shall be reported in accordance with the tables included in annex II to this document and as specified in these reporting guidelines. In completing the CRF tables, Annex I Parties should:

(a) Provide a full set of CRF tables for the base year and all years from 1990 up to the most recent inventory year;

(b) Provide completeness tables for the latest inventory year only, if the information applies to all years of the time series. If the information in those tables differs for each reported year, then either the tables or information on the specific changes must be provided for each year in the CRF tables;

(c) Use the documentation boxes provided at the foot of the sectoral report and background data tables to provide cross references to detailed explanations in the NIR, or any other information, as specified in those boxes.

56. Annex I Parties should provide the information requested in the additional information boxes. Where the information called for is inappropriate because of the methodological tier used by the Annex I Party, the corresponding cells should be completed using the notation key "NA". In such cases, the Annex I Parties should cross-reference in the documentation box the relevant chapter in the NIR where equivalent information can be found.

57. Annex I Parties should use the notation keys, as specified in paragraph 37 above, in all the CRF tables to fill in the cells where no quantitative data are directly entered. Using the notation keys in this way facilitates the assessment of the completeness of an inventory.

H. Record keeping

58. Annex I Parties should gather and archive all relevant inventory information for each year of the reported time series, including all disaggregated EFs and AD, and documentation on how those factors and data were generated, including expert judgement where appropriate, and how they have been aggregated for their reporting in the inventory. This information should allow for the reconstruction of the inventory by the expert review teams. Inventory information should be archived from the base year and should include corresponding data on the recalculations applied. The 'paper trail', which can include spreadsheets or databases used to compile inventory data, should enable estimates of emissions and removals to be traced back to the original disaggregated EFs and AD. Also, relevant supporting documentation related to QA/QC implementation, uncertainty evaluation or key category analyses should be kept on file. This information should facilitate the process of clarifying inventory data in a timely manner when the secretariat prepares annual compilations of inventories or assesses methodological issues.

I. Systematic updating of the guidelines

59. The UNFCCC Annex I inventory reporting guidelines on annual GHG inventories shall be reviewed and revised, as appropriate, in accordance with decisions of the COP on this matter.

J. Language

60. The NIR shall be submitted in one of the official languages of the United Nations. Annex I Parties are encouraged to submit an English translation of the NIR to facilitate its use by the expert review teams.

Appendix

An outline and general structure of the national inventory report

EXECUTIVE SUMMARY

ES.1. Background information on greenhouse gas (GHG) inventories and climate change (e.g. as it pertains to the national context)

ES.2. Summary of national emission and removal related trends

ES.3. Overview of source and sink category emission estimates and trends

ES.4. Other information (e.g. indirect GHGs)

Chapter 1: Introduction

1.1. Background information on GHG inventories and climate change (e.g. as it pertains to the national context, to provide information to the general public)

1.2. A description of the [national inventory system][national inventory arrangements]

1.2.1. Institutional, legal and procedural arrangements

1.2.2. Overview of inventory planning, preparation and management

1.2.3. Quality assurance, quality control and verification plan

Indicate:

- *Quality assurance/quality control (QA/QC) procedures applied*

- *QA/QC plan*

- *Verification activities*

- *Treatment of confidentiality issues*

1.2.4. Changes in the [national inventory system][national inventory arrangements] since previous annual GHG inventory submission

1.3. Inventory preparation, and data collection, processing and storage

1.4. Brief general description of methodologies (including tiers used) and data sources used

1.5. Brief description of key categories

Provide a summary table with the key categories identified for the latest reporting year (by level and trend) on the basis of table 4.4 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the 2006 IPCC Guidelines) and provide more detailed information in annex 1. Indicate whether the key category analysis differs from the one included in the common reporting format (CRF) table and, if so, give a short description of the differences.

1.6. General uncertainty evaluation, including data on the overall uncertainty for the inventory totals

1.7. General assessment of completeness

Provide, inter alia, information and explanations in relation to categories not estimated or included elsewhere, and information related to the geographical scope. [Note: "use of calendar years/fiscal years for the reporting" to be placed under time-series consistency assessment.]

Chapter 2: Trends in greenhouse gas emissions

2.1. Description and interpretation of emission trends for aggregated GHG emissions

2.2. Description and interpretation of emission trends by sector

Explain, inter alia, significant changes compared with 1990 and the previous year.

Chapter 3: Energy (CRF sector 1)

3.1. Overview of sector (e.g. quantitative overview and description, including trends and methodological tiers by category)

3.2. Fuel combustion (CRF 1.A), including detailed information on: [indent following sub-lines]

3.2.1. Comparison of the sectoral approach with the reference approach

3.2.2. International bunker fuels

3.2.3. Feedstocks and non-energy use of fuels

3.2.4. Category (CRF category number)

3.2.4.1. Category description (e.g. characteristics of sources)

3.2.4.2. Methodological issues (e.g. choice of methods/activity data/emission factors, assumptions, parameters and conventions underlying the emission estimates and the rationale for their selection, information on carbon dioxide (CO_2) capture, any specific methodological issues (e.g. description of national methods and models))

3.2.4.3. Uncertainties and time-series consistency

3.2.4.4. Category-specific QA/QC and verification, if applicable

3.2.4.5. Category-specific recalculations, if applicable, including changes made in response to the review process and impact on emission trend

3.2.4.6. Category-specific planned improvements, if applicable (e.g. methodologies, activity data, emission factors, etc.), including tracking of those identified in the review process

3.3. Fugitive emissions from solid fuels and oil and natural gas (CRF 1.B)

3.3.1. Category (CRF category number)

3.3.1.1. Category description (e.g. characteristics of sources)

3.3.1.2. Methodological issues (e.g. choice of methods/activity data/emission factors, assumptions, parameters and conventions underlying the emission estimates and the rationale for their selection, any specific methodological issues (e.g. description of national methods and models))

3.3.1.3. Uncertainties and time-series consistency

3.3.1.4. Category-specific QA/QC and verification, if applicable

3.3.1.5. Category-specific recalculations, if applicable, including changes made in response to the review process and impact on emission trend

3.3.1.6. Category-specific planned improvements, if applicable (e.g. methodologies, activity data, emission factors, etc.), including tracking of those identified in the review process

3.4. CO_2 transport and storage (CRF 1.C)

3.4.1. Category (CRF category number)

3.4.1.1. Category description (e.g. characteristics of sources)

3.4.1.2. Methodological issues (e.g. choice of methods/activity data/emission factors, assumptions, parameters and conventions underlying the emission estimates and the rationale for their selection, any specific methodological issues (e.g. description of national methods and models))

3.4.1.3. Uncertainties and time-series consistency

3.4.1.4. Category-specific QA/QC and verification, if applicable

3.4.1.5. Category-specific recalculations, if applicable, including changes made in response to the review process and impact on emission trend

3.4.1.6. Category-specific planned improvements, if applicable (e.g. methodologies, activity data, emission factors, etc.), including tracking of those identified in the review process

Chapter 4: Industrial processes and product use (CRF sector 2)

4.1. Overview of sector (e.g. quantitative overview and description, including trends and methodological tiers by category)

4.2. Category (CRF category number)

4.2.1. Category description (e.g. characteristics of sources)

4.2.2. Methodological issues (e.g. choice of methods/activity data/emission factors, assumptions, parameters and conventions underlying the emission estimates and the rationale for their selection, information on CO_2 capture, any specific methodological issues (e.g. description of national methods and models))

4.2.3. Uncertainties and time-series consistency

4.2.4. Category-specific QA/QC and verification, if applicable

4.2.5. Category-specific recalculations, if applicable, including changes made in response to the review process and impact on emission trend

4.2.6. Category-specific planned improvements, if applicable (e.g. methodologies, activity data, emission factors, etc.), including tracking of those identified in the review process

Chapter 5: Agriculture (CRF sector 3)

5.1. Overview of sector (e.g. quantitative overview and description, including trends and methodological tiers by category)

5.2. Category (CRF category number)

5.2.1. Category description (e.g. characteristics of sources)

5.2.2. Methodological issues (e.g. choice of methods/activity data/emission factors, assumptions, parameters and conventions underlying the emission and removal estimates and the rationale for their selection, any specific methodological issues (e.g. description of national methods and models))

5.2.3. Uncertainties and time-series consistency

5.2.4. Category-specific QA/QC and verification, if applicable

5.2.5. Category-specific recalculations, if applicable, including changes made in response to the review process and impact on emission trend

5.2.6. Category-specific planned improvements, if applicable (e.g. methodologies, activity data, emission factors, etc.), including tracking of those identified in the review process

Chapter 6: Land use, land-use change and forestry (CRF sector 4)

6.1. Overview of sector (e.g. quantitative overview and description, including trends and methodological tiers by category, and coverage of pools)

6.2. Land-use definitions and the classification systems used and their correspondence to the land use, land-use change and forestry categories (e.g. land use and land-use change matrix)

6.3. Information on approaches used for representing land areas and on land-use databases used for the inventory preparation

6.4. Category (CRF category number)

6.4.1. Description (e.g. characteristics of category)

6.4.2. Methodological issues (e.g. choice of methods/activity data/emission factors, assumptions, parameters and conventions underlying the emission and removal estimates and the rationale for their selection, any specific methodological issues (e.g. description of national methods and models))

6.4.3. Uncertainties and time-series consistency

6.4.4. Category-specific QA/QC and verification, if applicable

6.4.5. Category-specific recalculations, if applicable, including changes made in response to the review process and impact on emission trend

6.4.6. Category-specific planned improvements, if applicable (e.g. methodologies, activity data, emission factors, etc.), including those in response to the review process

Chapter 7: Waste (CRF sector ~~5~~)

7.1. Overview of sector (e.g. quantitative overview and description, including trends and methodological tiers by category)

7.2. Category (CRF category number)

7.2.1. Category description (e.g. characteristics of sources)

7.2.2. Methodological issues (e.g. choice of methods/activity data/emission factors, assumptions, parameters and conventions underlying the emission estimates and the rationale for their selection, any specific methodological issues (e.g. description of national methods and models))

7.2.3. Uncertainties and time-series consistency

7.2.4. Category-specific QA/QC and verification, if applicable

7.2.5. Category-specific recalculations, if applicable, including changes made in response to the review process

7.2.6. Category-specific planned improvements, if applicable (e.g. methodologies, activity data, emission factors, etc.), including those in response to the review process

Chapter 8: Other (CRF sector 6) (if applicable)

Chapter 9: Indirect CO_2 and nitrous oxide emissions

9.1 Description of sources of indirect emissions in GHG inventory

9.2 Methodological issues (e.g. choice of methods/activity data/emission factors, assumptions, parameters and conventions underlying the emission estimates and the rationale for their selection, any specific methodological issues (e.g. description of national methods and models))

9.3 Uncertainties and time-series consistency

9.4 Category-specific QA/QC and verification, if applicable

9.5 Category-specific recalculations, if applicable, including changes made in response to the review process and impact on emission trend

9.6 Category-specific planned improvements, if applicable (e.g. methodologies, activity data, emission factors, etc.), including tracking of those identified in the review process

Chapter 10: Recalculations and improvements

10.1 Explanations and justifications for recalculations, including in response to the review process

10.2 Implications for emission levels

10.3 Implications for emission trends, including time-series consistency

10.4 Planned improvements, including in response to the review process

Annexes to the national inventory report

Annex 1: Key categories

- Description of methodology used for identifying key categories, if different from the Intergovernmental Panel on Climate Change (IPCC) tier 1 approach
- Information on the level of disaggregation
- Tables 4.2 and 4.3 of the 2006 IPCC Guidelines, including and excluding land use, land-use change and forestry

Annex 2: Assessment of uncertainty

- Description of methodology used for identifying uncertainties
- Table 3.3 of the 2006 IPCC Guidelines

Annex 3: Detailed methodological descriptions for individual source or sink categories

A.3.X (sector or category name)

Annex 4: The national energy balance for the most recent inventory year

Annex 5: Any additional information, as applicable [, such as supplementary information on the minimization of adverse impacts]

References

All references used in the national inventory report must be listed in the references.

Annex II

[English only]

Common reporting format tables

Owing to the complexity of and the importance of colour coding in the common reporting format (CRF) tables, they are not included in this document but can be downloaded from the UNFCCC website, both as an Excel file and in pdf format, at <http://unfccc.int/national_reports/annex_i_ghg_inventories/reporting_requirements/items/2759.php>.

Annex III

[English only]

Global warming potential values[a]

Greenhouse gas	*Chemical formula*	*Global warming potentials*
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298
Hydrofluorocarbons (HFCs)		
HFC-23	CHF_3	14 800
HFC-32	CH_2F_2	675
HFC-41	CH_3F	92
HFC-43-10mee	$CF_3CHFCHFCF_2CF_3$	1 640
HFC-125	C_2HF_5	3 500
HFC-134	$C_2H_2F_4$ (CHF_2CHF_2)	1 100
HFC-134a	$C_2H_2F_4$ (CH_2FCF_3)	1 430
HFC-143	$C_2H_3F_3$ (CHF_2CH_2F)	353
HFC-143a	$C_2H_3F_3$ (CF_3CH_3)	4 470
HFC-152	CH_2FCH_2F	53
HFC-152a	$C_2H_4F_2$ (CH_3CHF_2)	38
HFC-161	CH_3CH_2F	12
HFC-227ea	C_3HF_7	3 220
HFC-236cb	$CH_2FCF_2CF_3$	1 340
HFC-236ea	CHF_2CHFCF_3	1 370
HFC-236fa	$C_3H_2F_6$	9 810
HFC-245ca	$C_3H_3F_5$	693
HFC-245fa	$CHF_2CH_2CF_3$	1 030
HFC-365mfc	$CH_3CF_2CH_2CF_3$	794
Perfluorocarbons		
Perfluoromethane – PFC-14	CF_4	7 390
Perfluoroethane – PFC-116	C_2F_6	12 200
Perfluoropropane – PFC-218	C_3F_8	8 830
Perfluorobutane – PFC-3-1-10	C_4F_{10}	8 860
Perfluorocyclobutane – PFC-318	c-C_4F_8	10 300
Perfluourpentane – PFC-4-1-12	C_5F_{12}	9 160
Perfluorohexane – PFC-5-1-14	C_6F_{14}	9 300
Perfluorodecalin – PFC-9-1-18	$C_{10}F_{18}$	>7 500
Sulphur hexafluoride (SF_6)		
Sulphur hexafluoride	SF_6	22 800
[Nitrogen trifluoride (NF_3)		
Nitrogen trifluoride	NF_3	17 200]
[Fluorinated ethers		
HFE-125	CHF_2OCF_3	14 900

Greenhouse gas	*Chemical formula*	*Global warming potentials*
HFE-134	CHF_2OCHF_2	6 320
HFE-143a	CH_3OCF_3	756
HCFE-235da2	$CHF_2OCHClCF_3$	350
HFE-245cb2	$CH_3OCF_2CF_3$	708
HFE-245fa2	$CHF_2OCH_2CF_3$	659
HFE-254cb2	$CH_3OCF_2CHF_2$	359
HFE-347mcc3	$CH_3OCF_2CF_2CF_3$	575
HFE-347pcf2	$CHF_2CF_2OCH_2CF_3$	580
HFE-356pcc3	$CH_3OCF_2CF_2CHF_2$	110
HFE-449sl (HFE-7100)	$C_4F_9OCH_3$	297
HFE-569sf2 (HFE-7200)	$C_4F_9OC_2H_5$	
HFE-43-10pccc124 (H-Galden 1040x)	$CHF_2OCF_2OC_2F_4OCHF_2$	1 870
HFE-236ca12 (HG-10)	$CHF_2OCF_2OCHF_2$	2 800
HFE-338pcc13 (HG-01)	$CHF_2OCF_2CF_2OCHF_2$	1 500
	$(CF_3)_2CFOCH_3$	343
	$CF_3CF_2CH_2OH$	42
	$(CF_3)_2CHOH$	195
HFE-227ea	$CF_3CHFOCF_3$	1 540
HFE-236ea2	$CHF_2OCHFCF_3$	989
HFE-236fa	$CF_3CH_2OCF_3$	487
HFE-245fa1	$CHF_2CH_2OCF_3$	286
HFE 263fb2	$CF_3CH_2OCH_3$	11
HFE-329mcc2	$CHF_2CF_2OCF_2CF_3$	919
HFE-338mcf2	$CF_3CH_2OCF_2CF_3$	552
HFE-347mcf2	$CHF_2CH_2OCF_2CF_3$	374
HFE-356mec3	$CH_3OCF_2CHFCF_3$	101
HFE-356pcf2	$CHF_2CH_2OCF_2CHF_2$	265
HFE-356pcf3	$CHF_2OCH_2CF_2CHF_2$	502
HFE 365mcf3	$CF_3CF_2CH_2OCH_3$	11
HFE-374pc2	$CHF_2CF_2OCH_2CH_3$	557
	$-(CF_2)_4CH(OH)-$	73
	$(CF_3)_2CHOCHF_2$	380
	$(CF_3)_2CHOCH_3$	27]
[Perfluoropolyethers		
PFPMIE	$CF_3OCF(CF_3)CF_2OCF_2OCF_3$	10 300]

[a] As listed in the column entitled “Global warming potential for given time Horizon” in table 2.14 of the errata to the contribution of working group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon.