HANDBOOK FOR THE REVIEW OF NATIONAL GREENHOUSE GAS INVENTORIES

Contents

I. Introduction

1. Parties to the Paris Agreement[1] are required to regularly provide information on anthropogenic greenhouse gas (GHG) emissions by sources and removals by sinks under the enhanced transparency framework (ETF) established by Article 13. In accordance with Article 13, paragraph 7(a), and the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement, set out in the annex to decision 18/CMA.1 (MPGs)[2], each Party shall submit a national inventory report (NIR)[3] prepared using good practice methodologies accepted by the Intergovernmental Panel on Climate Change (IPCC)[4]. This information is provided through biennial transparency reports (BTR) and, where applicable, NIRs submitted as stand-alone documents, using the common reporting tables (CRT) adopted by decision 5/CMA.3[5]. Parties are expected to submit BTRs on a biennial basis[6]; however, least developed countries (LDCs) and small island developing States (SIDS) may submit the information referred to in Article 13, paragraphs 7, 8, 9 and 10, at their discretion, in accordance with paragraph 4 of the MPGs. Annex I Parties, in accordance with decision 1/CP.24[7] and consistent with their longstanding obligations under the Convention as reflected in decision 3/CP.1[8], shall submit NIRs annually, including in years in which a BTR is due.

2. The information on greenhouse gas (GHG) inventories submitted by Parties is subject to a technical expert review (TER) conducted by technical expert review teams (TERTs) in accordance with the ETF. In years in which a BTR is submitted, the TERT conducts a technical expert review of the BTR, including the NIR, in accordance with the MPGs, and documents its findings in a technical expert review report (TERR). In years in which a BTR is not due, annual inventory information submitted by Annex I Parties is subject to a simplified review, consistent with the applicable ETF procedures and timelines[9].

3. The review of GHG inventories is a complex process that requires the consideration of a wide range of information and supporting materials, including Parties' submissions, relevant decisions adopted under the Paris Agreement, and the MPGs. In conducting the review, currently TERTs must assess primarily the consistency of inventories against the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*[10] (hereinafter referred to as the 2006 IPCC Guidelines), which Parties are required to use in preparing their national inventory reports. In addition, TERTs must take into consideration that Parties are encouraged to use the *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*[11] (hereinafter referred to as the Wetlands Supplement) and that Parties may, on a voluntary basis, also apply the *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*[12] (hereinafter referred to as the 2019 Refinement to the 2006 IPCC Guidelines).

[1] Paris Agreement
[2] Decision 18/CMA.1, Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs)
[3] National inventory report (NIR) consists of the national inventory document (NID), which contains the descriptive and methodological information, together with the common reporting tables (CRT), which contain the standardized quantitative emissions and removals data. NIR may be submitted as part of a BTR or as a stand-alone document.
[4] Per Article 13, paragraph 7(a) of the Paris Agreement and paragraph 20 of the MPGs
[5] Decision 5/CMA.3, Guidance for operationalizing the modalities, procedures and guidelines for the enhanced transparency framework referred to in Article 13 of the Paris Agreement
[6] Decision 18/CMA.1 require the first BTRs to be submitted by 31 December 2024 at the latest. Subsequent BTRs are submitted biannually.
[7] Decision 1/CP.24, Preparations for the implementation of the Paris Agreement and the first session of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
[8] Decision 3/CP.1, Preparation and submission of national communications from the Parties included in Annex I to the Convention
[9] Report to Lead Reviewers on Simplified Reviews
[10] 2006 IPCC Guidelines for National Greenhouse Gas Inventories
[11] 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands
[12] 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

4. To enhance the efficiency and efficacy of reviews, the UNFCCC secretariat supports the review process through the provision of standardized tools and materials, including guidance documents and analytical tools to facilitate the assessment of trends, recalculations and time-series consistency, templates and this Review Handbook.

5. The Review Handbook covers the process for conducting technical expert reviews of GHG inventories. Its objective is to provide a concise, user-friendly tool to guide review experts, particularly new experts, through the review process (before, during and after the review week). The Review Handbook is intended solely as supporting material for experts and does not constitute any mandatory or legally binding guidance. In conducting a review, TERTs must consult the MPGs and the relevant decisions adopted under the Paris Agreement, as well as the 2006 IPCC Guidelines and, where applicable, the Wetlands Supplement and the 2019 Refinement to the 2006 IPCC Guidelines.

6. Chapter II provides an overview of the review of NIRs under the ETF, and chapter III explains the activities, timing, and deliverables of the review process. Chapters IV and V provide an overview of the most important tools and templates, respectively, used in the GHG inventory reviews. Chapter VI provides general guidance applicable to all reviewers, and chapter VII includes sector-specific guidance for the review of GHG inventories in accordance with the MPGs.

Box 1-1

How to use the Review Handbook

As elaborated below, the Review Handbook is one of many tools and materials available to the TERT before and during the review cycle. These tools and materials complement, but do not replace, the review-specific material that a TERT should consider for each Party under review (e.g. the NIR). So, where does this Review Handbook fit in among all the materials?

The Review Handbook serves primarily as a reference and orientation tool. It may be used as a refresher on the relevant decisions adopted under the Paris Agreement and the MPGs, as well as the GHG inventory review training programme. The secretariat and lead reviewers (LRs) are encouraged to promote its use well in advance of the review week, particularly chapter III, so that the expectations, deliverables and the expected time commitments before, during and after the review week are understood by the full TERT.

Approximately four to ten weeks prior to the review, when review-specific materials become available, the TERT should consult the specific tools and templates (chapters IV and V) and general and cross-cutting sections (chapter VI) to help prepare for their reviews. As the review progresses, and each TERT member focuses on the relevant sector, the TERT may consult the relevant section of chapter VII for guidance on issues to consider and possible checks to carry out.

It is always important to remember that the Review Handbook, like other tools and materials, cannot replace official UNFCCC decisions and MPGs, but rather supplements them, in particular decisions 18/CMA.1, 5/CMA.3 and 9/CMA.4, as well as decision 1/CP.24 for developed country Parties.

II. Overview of the review of national inventory reports

A. Objectives of the review

7. In accordance with Article 13 of the Paris Agreement and the MPGs adopted by decision 18/CMA.1, Parties are required to report national GHG inventory information covering the time series from 1990[13,14] to the latest reporting year, which shall be no more than two years prior to the submission of its NIR.[15] Inventory information is reported using CRTs and an NID, which may be included as part of a BTR or submitted as a stand-alone NIR, as applicable. The inventories shall be prepared using methodologies consistent with the 2006 IPCC Guidelines. Annex I Parties continue to submit annual national inventory reports, including in years in which a BTR is not due, in fulfilment of their national inventory reporting obligations under the Convention.

8. Inventory information submitted by Parties is subject to technical expert review in accordance with the ETF. The objective of the review is to ensure consistency with the MPGs while considering the flexibility accorded to the developing country Parties that need it in the light of their capacities, and to identify areas of improvement and capacity-building needs, as applicable[16]. The review supports the implementation of the Paris Agreement and contributes to the information basis for the global stocktake[17]. It must be implemented in a facilitative, non-intrusive, non-punitive manner, respecting national sovereignty and avoiding undue burden being placed on Parties[18]. The technical expert review shall pay particular attention to the respective national capabilities and circumstances of developing country Parties[19]. The review should not make political judgments or review the Party's determination to apply flexibility for a specific provision, the self-determined estimated time frames for improvements in relation to those capacity constraints, or whether it possesses the capacity to implement that specific provision without flexibility.

9. Another important objective of the review is to assist Parties in improving the quality of their GHG inventories in line with the principles of transparency, accuracy, completeness, consistency, and comparability (TACCC)[20]. TERTs may support Parties in strengthening these aspects through constructive discussions with Party experts and clear and focused recommendations and encouragements provided during the review.

10. Like the reviews under the Convention and the Kyoto Protocol, TERRs under the ETF are made publicly available. They are also considered to a separate body for compliance purposes, the Paris Agreement Implementation and Compliance Committe (PAICC)[21] The key differences between those earlier processes and the ETF review are described in chapter II.C.

[13] MPG, para. 57. Those developing country Parties that need flexibility in the light of their capacities with respect to this provision have the flexibility to instead report data covering, at a minimum, the reference year/period for its NDC under Article 4 of the Paris Agreement and, in addition, a consistent annual time series from at least 2020 onwards.
[14] Some Annex I Parties that are required to submit information under the Convention and are undergoing the process of transition to a market economy may use a base year, a period of years other than 1990, or a level of emissions for the purpose of reporting under the Convention as follows: Bulgaria: 1988; Croatia: 1990; Hungary: the average of the years 1985 to 1987; Poland; 1988 Romania: 1989; and Slovenia 1986 (decision 19/CP.19).
[15] MPG, para. 58. Those developing country Parties that need flexibility in the light of their capacities with respect to this provision have the flexibility to instead have their latest reporting year as three years prior to the submission of their NIR.
[16] MPG, paras. 4 – 6.
[17] Global Stocktake | UNFCCC
[18] MP, para. 148.
[19] MPGs, para. 147.
[20] MPG, para. 3(d). These principles are defined in the 2006 IPCC Guidelines (Volume I, Chapter 1.4)
[21] Paris Agreement Implementation and Compliance Committee (PAICC) | UNFCCC

11. The review procedures (chapter III), tools (chapter IV), templates (chapter V), training of TERT members and guidance in chapters VI and VII of this handbook all aim at facilitating TERTs in meeting the review objectives.

B. Key roles of actors in the review process

12. The GHG inventory reviews are carried out by TERTs, which consist of two lead reviewers (LRs), at least one generalist, and several sector experts. The UNFCCC secretariat invites experts to participate in specific reviews, on the condition that they have been nominated and approved by Parties or relevant intergovernmental organizations, are included in the UNFCCC roster of experts, and hold the relevant qualifications. When inviting experts to the reviews, the secretariat takes into consideration that the collective skills and competencies of the TERTs cover all sectors under review, i.e. Energy, IPPU, agriculture, LULUCF, and waste, and also cross-cutting or general matters[22]. The secretariat also selects TERT members with a view to achieving a balance between experts from developed and developing country Parties, and shall ensure geographical and gender balance among the review experts, to the extent possible. For centralized reviews of BTRs from least developed countries (LDCs) and small island developing States (SIDS), the secretariat shall strive to include technical experts from the LDCs and SIDS.

13. All experts participating in the GHG inventory reviews must sign the "Agreement for Expert Review Services for BTR Review Activities" before participating in a review. According to the agreement, each expert shall:

(a) Follow the MPGs, decision 5/CMA.3, and other relevant COP and CMA decisions as the basis for the TER;

(b) Perform the review duties in his or her personal capacity and in an objective, neutral and professional manner;

(c) Notify the secretariat of any known potential conflict of interest relating to the review activity in which the expert has been invited to participate;

(d) Work cooperatively with other TERT members;

(e) Not use the information provided by Parties under review and by the secretariat for purposes other than that specific inventory review or disclose any information acquired during the review;

(f) Protect any confidential information provided in the course of the review both during and after the term of service; and

(g) Do everything in his or her power to meet time requirements and deadlines.

14. Training courses are provided by the secretariat to facilitate the knowledge of the TERT members in relation to the ETF, the MPGs, and the 2006 IPCC Guidelines. Training courses also cover the reporting and review under Article 13 of the Paris Agreement, including the application of review procedures and tools. New review experts must pass the examinations for Course A (General and cross-cutting aspects for the technical expert review under the enhanced transparency framework under the Paris Agreement), Course B1 (General and cross-cutting issues of the GHG inventory review), and their respective sector before participating in a review (see decision 5/CMA.3, annex VII).

[22] The TERT includes also experts for other areas, such as tracking progress in implementing and achieving the NDC, and, as appropriate, climate impacts and adaptation and financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the Paris Agreement

Box 2-1
Training courses

Following the adoption of the MPGs under decision 18/CMA.1, existing reviewer training courses were updated to the reporting and review requirements under the ETF and the 2006 IPCC Guidelines. All review experts, including experienced experts and lead reviewers, are required to complete Course A and are encouraged to participate in the remaining online training courses. For the latest training offerings, please refer to the UNFCCC website[23]. The courses are self-paced and available as an interactive online version and a downloadable offline PDF document.

15. In the review, the TERT is supported by the secretariat. The roles of the key actors in the review process are summarized in Table 2-1. More detailed timelines on actions by each actor, along with the particular role each actor plays in ensuring the quality of the final report, are provided in chapter III of this handbook.

Table 2-1
Main actors in the review process

Actor	*Role*
Lead reviewer (LR)	Member of the TERT responsible for coordinating the review work. Each TERT has two LRs, one from a developed country Party and another from a developing country Party. LRs are also sector experts, generalists, or experts for other thematic areas that are not the NIR (e.g. NDC, FTC, PaMs, etc). The LR tasks are to: (a) Oversee the work of the TERT and act as co-lead reviewers, in accordance with the MPGs (b) Ensure that the TER are conducted in accordance with the MPGs (c) Ensure the quality and objectivity of the review and promote continuity, consistency across Parties and timeliness (d) Ensure that the reviewers have all the necessary information provided by the secretariat prior to the review (e) Monitor the progress of the review (f) Coordinate the submission of queries from the TERT to the Party under review and the inclusion of responses in the TERR, in collaboration with the TRO (g) Provide technical advice to TERT members, if needed (h) Ensure that the review is conducted and the TERR is prepared in accordance with the MPGs, decision 5/CMA.3, and other relevant COP and CMA decisions (i) Ensure that the TERT gives priority to issues raised in previous TERRs
Sector expert	Member of the TERT responsible for reviewing a specific sector (energy, IPPU, agriculture, LULUCF, or waste) in accordance with the MPGs and the 2006 IPCC Guidelines
Generalist	Member of the TERT responsible for the review of inventory cross-cutting elements in accordance with the MPGs and the 2006 IPCC Guidelines

[23] Training programmes for expert reviewers | UNFCCC

Actor	*Role*
Technical Review officer (TRO)	The UNFCCC secretariat officer supporting the review by the TERT. The TRO coordinates the review process, distributes relevant materials to the TERT, supports the LRs in coordinating the review work, facilitates communication between the Party and the TERT, provides technical support as needed, and assists the TERT in the compiling the TERR

Box 2-2

Key sources of guidance for the review

The **MPGs** provide the principal basis for the review. During the review process, the TERT must assess the Parties' reporting against the applicable requirements in the MPGs. For additional cross-cutting and sector-specific checks, see chapters VI and VII of this review handbook.

Decision 5/CMA.3 provides the CRTs for national GHG inventory reporting and the outlines for BTRs, NIDs and TERRs. During the review, the TERT shall assess whether the Party has reported inventory information using the agreed CRTs and, where applicable, followed the relevant reporting outlines. The TERT shall also examine the transparency, accuracy, completeness, internal consistency and comparability of reported data presented in the CRTs.

The 2006 IPCC Guidelines provides the methodological basis for the preparation and review of national GHG inventories. In the review, the TERT uses the 2006 IPCC Guidelines to assess whether the Party's methodologies, choice of emission factors (EFs) and other parameters, collection of activity data (AD) and cross-cutting inventory elements (e.g. documentation, quality assurance/quality control (QA/QC) and uncertainty analysis) are consistent with the relevant guidance. Where applicable, the TERT should also take into consideration the Wetlands Supplement, the 2019 Refinement to the 2006 IPCC Guidelines and any subsequent IPCC methodological guidance recognized or adopted through relevant COP or CMA decisions.

Other materials. Additional sources of guidance for the review include the "Code of Practice for Handling of Information Designated by Parties as Confidential during Review-related Activities under Article 13 of the Paris Agreement"[24], the training programme for GHG inventory review experts[25], and the Review Guidance. Finally, the conclusions from the annual meetings of LRs[26] provide additional guidance for the reviews. Even though not strictly mandatory, following any recommendations from the LR meetings is important to ensure the consistency of reviews across TERTs.

C. Major differences between reviews under the MPGs and the Convention and the Kyoto Protocol

16. The review process under the MPGs differs from the review processes established under the Convention and the Kyoto Protocol in several important respects, as summarized in table 2-2.

[24] Code of Practice for Handling of Information Designated by Parties as Confidential during Review-related Activities under Article 13 of the Paris Agreement

[25] Decision 18/CMA.1, paragraph 12(c), and decision 5/CMA.3.

[26] Available at: Lead Reviewers Meetings under the Enhanced Transparency Framework | UNFCCC.

Table 2-2
Major differences between reviews under the MPGs and previous review processes

Element	*Reviews under the Convention and Kyoto Protocol*	*Reviews under the MPGs*
Scope and framework	Reviews were conducted under separate arrangements for reporting and review under the Convention and, for Parties with commitments, under the Kyoto Protocol. Kyoto Protocol reviews also included Kyoto-specific accounting elements, such as assigned amounts, Kyoto units, national registries and commitment period reserve requirements.	Reviews are conducted under a single ETF applicable to all Parties. The review covers GHG inventory information and information necessary to track progress in implementing and achieving NDCs. The review of adaptation information is voluntary, while the review of information on financial, technology development and transfer and capacity-building support (FTC) provided and mobilized is mandatory for developed country Parties; other Parties that provide support may undergo a review of that information at their discretion.
Nature of findings	Under the Convention and Kyoto Protocol, expert review teams identified “issues” or “problems”, including failures to follow mandatory reporting requirements.	Under the MPGs, the TERT identifies areas for improvement and, for developing country Parties, capacity-building needs, as applicable. Findings are framed in a facilitative manner and are not classified as “issues” or “problems” for the purpose of determining compliance.
Treatment of unresolved matters	Under the Kyoto Protocol, unresolved problems could lead to procedures related to adjustments under Article 5, paragraph 2, or to a question of implementation.	Under the MPGs, there is no adjustment procedure. The TERT does not calculate substitute estimates or impose revised values. Unresolved concerns are documented in the TERR as areas of improvement (recommendations and encouragements) and, as applicable, capacity-building needs.
Compliance linkage	Under the Kyoto Protocol, questions of implementation could be forwarded to the Compliance Committee, including matters related to adjustments and accounting.	The TER itself does not raise questions of implementation and does not determine whether a Party has achieved its NDC. The PAICC is expert-based and operates in a facilitative, transparent, non-adversarial and non-punitive manner. It may consider information from final TERRs, including in relation to significant and persistent inconsistencies between the information submitted and the MPGs. The TERR also serves as an input to the facilitative multilateral consideration of progress (FMCP), through which Parties' progress in implementing and achieving their NDCs is considered.

Overview of the review of national inventory reports

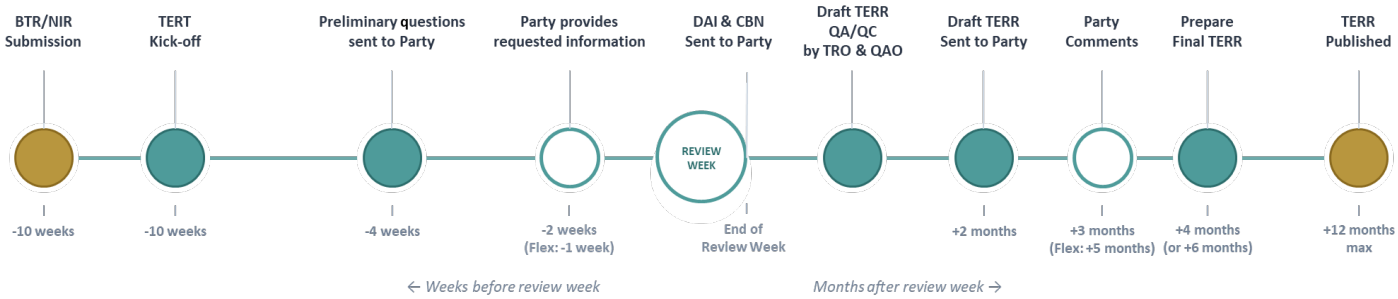
Element	*Reviews under the Convention and Kyoto Protocol*	*Reviews under the MPGs*
Review output	Review reports under the Convention and Kyoto Protocol documented findings, including identified problems, adjustments and, where applicable, questions of implementation.	TERRs under the ETF are prepared in accordance with the MPGs and decision 5/CMA.3, made publicly available, and contribute to the information basis for the facilitative multilateral consideration of progress (FMCP) and the global stocktake.
Tone and purpose	Reviews had a stronger compliance and accounting function, particularly under the Kyoto Protocol.	TER is implemented in a facilitative, non-intrusive, non-punitive manner, respectful of national sovereignty, and avoids placing undue burden on Parties. Reviews focus on transparency, clarification and continuous improvement of reporting, and on identifying capacity-building needs where applicable.

III. Activities, timing and deliverables during the review process

A. Overview of review process

17. A summary of the key deadlines and deliverables in the review process is provided in Figure 3-1 below.

Figure 3-1
Overall timing of the review process



18. The technical expert review conducted under the ETF is organized in three main phases: the preparation phase prior to the review week, the review week, and the finalization of the TERR following the review week. The duration and operational modalities of the review week are determined in accordance with the MPGs and the applicable review schedule. The main deliverables of the review are listed in Table 3-1. To promote efficiency, consistency and timeliness, the review process uses standardized templates and collaboration platform maintained by the secretariat (e.g. (see chapter IV.A). Further information on each phase of the review is provided in chapters III.B–D below.

Table 3-1
Main deliverables of the review process and the related templates

Deliverable	*Description*	Template and *chapter reference*
Thematic checklists	Thematic checklists support the TERT in assessing how the Party has fulfilled the applicable reporting provisions of the MPGs in its BTR and inventory submissions. On the basis of this assessment the TERT may identify potential issues requiring clarification, submit questions to the Party, and develop findings for inclusion in the review report.	Checklists (see section V.A)
Technical expert review report (TERR)	The TERR is the main output of the review process. It includes the TERT's assessment of the Party's inventory information and recommendations or encouragements as appropriate for further improvement. The TERR is made publicly available through the UNFCCC website.	TERR (see section V.D)
Comment response document	Following receipt of the draft TERR, the Party has one month to provide written comments. The TERT considers these comments and prepares a written response to the Party indicating whether, and if so how, the TERT intends to reflect the comment(s) in the final TERR. In its response, the TERT should include the rationale for its decision.	Comment response (see section V.C)

19. Reviews under the ETF may be conducted through different operational modalities, including desk reviews (DR), centralized reviews (CR) and in-country reviews (ICRs). In a **DR**, experts conduct the review from their duty station or home offices. In a **CR**, experts meet at a common location, typically Bonn or another venue, to review the inventory submission of one or more Parties. In an **ICR**, experts visit the Party under review to conduct the review on site.

20. Guidance on the scope and approach to the review, applicable to all modalities, is provided in chapter VI.A. The preparation phase before the review (see chapter III.B) and the finalization phase after the review week (see chapter III.D) are generally similar across modalities. The principal differences relate to logistical arrangements and the modalities of communication during the review week among TERT members and between the TERT and the Party.

21. In a centralized review under the ETF, a single TERT may review the inventories of multiple Parties during the same review session, in accordance with the schedule established by the secretariat.

Table 3-2
Characteristics of desk reviews, centralized reviews and in-country reviews

Element	*Desk review*	*Centralized review*	*In-country review*
Typical composition of the TERT[a]	One expert per sector; generally experienced experts	One expert per sector per Party; the same expert may occasionally cover the same sector for multiple Parties or cover two sectors for the same Party	One expert may cover one or more sector; generally experienced experts
Typical number of Parties reviewed	One to two	Three to four	One
Location	Remote (own duty station of home office)	Bonn or another common venue	Party under review
Communication within the TERT during the review week	E-mail, videoconferences	In person	
Communication with the Party before/during the review week	E-mail, designated electronic Q&A platform, videoconferences if needed		In person, designated electronic Q&A platform, E-mail
Main deliverables before the review week	(a) Thematic checklists (b) Preliminary questions to Party (c) Zero order draft of TERR (main report & addendum)		

Activities, timing and deliverables during the review process

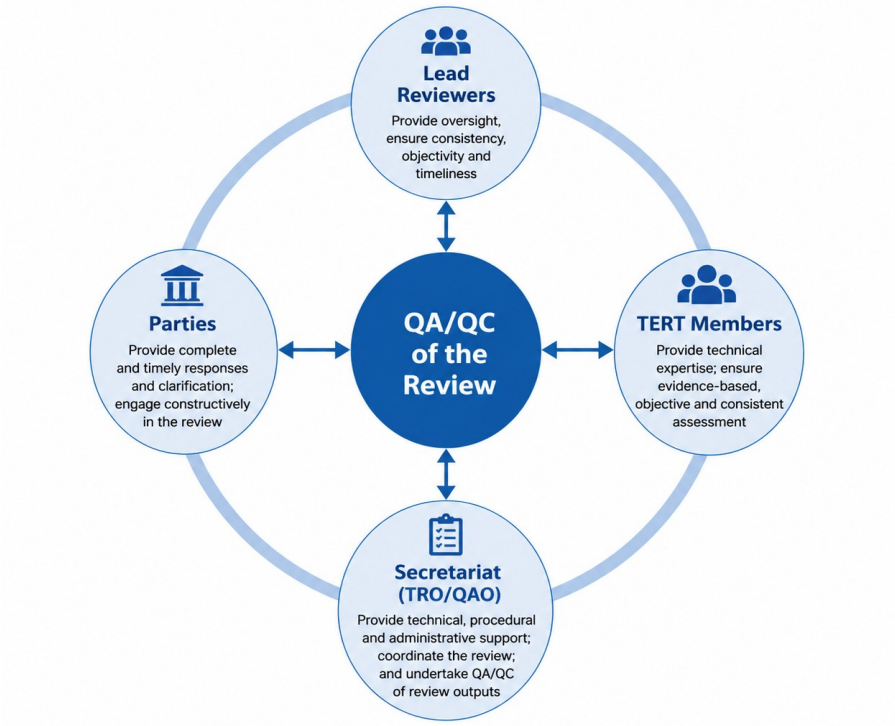
Element	*Desk review*	*Centralized review*	*In-country review*
Main deliverables at the end of the review week	(a) First-order draft of TERR (main report & addendum) (b) List of draft areas of improvement (DAI) and capacity-building needs (CBNs)		(a) First-order draft of TERR (main report & addendum) (b) Oral presentation on DAI and CBNs
Main deliverables after the review week	(a) Finalized TERR (b) Comment response document addressing the Party's comments on the draft TERR		

[a] Depends on the number of Parties reviewed.

QA/QC during the review cycle

22. All review outputs listed in table 3-1 are subject to appropriate QA/QC procedures, the nature and level of which depend on the specific deliverable. For example, the TERR is subject to multiple QA/QC steps by the secretariat, LRs and editors, whereas questions to the Party and DAI are reviewed by the LRs and the TRO before being communicated or incorporated into draft outputs. Effective QA/QC supports consistency with the MPGs and applicable review procedures and contributes to the efficiency and timeliness of the review process. Figure 3-2 illustrates the main actors involved in ensuring quality throughout the review cycle.

Figure 3-2
Main actors in ensuring quality of the review



23. **LRs** are responsible for helping to ensure that reviews are conducted in accordance with the MPGs and applicable review procedures. They promote quality, objectivity, comparability and timeliness, including thorough review of questions to the Party, DAI and draft TERR text for clarity, factual accuracy and consistency. Consistency across reviews is further supported through regular lead reviewers' meetings and consultations with the secretariat, where common review issues, approaches and procedural matters are discussed.

24. **Parties** contribute to the quality of the review process by providing complete, transparent and timely responses to review questions. In commenting on the draft TERR, Parties may also assist in identifying factual inaccuracies, inconsistencies or matters requiring clarification.

25. **TERTs** members are responsible for conducting the review in accordance with the applicable procedures and time frames. In performing their work, they contribute to quality by ensuring that questions, DAI and TERR text are clear, technically sound, evidence-based and factually accurate. Sector experts and LRs should cooperate throughout the review process, including thorough peer-review of draft outputs.

26. **Secretariat** supports consistency across TERTs by providing technical, procedural and administrative assistance. The secretariat supports LRs in the QC of questions and DAI and coordinates formal QA of the draft TERR at different stages of the review process until its publication. This includes QA/QC undertaken through both the TRO and a designated quality assurance officer (QAO). The QAO is separate from the TRO and carries out QA of the draft TERR before it is submitted to the Party. Draft TERRs are also reviewed by professional editors before submission to the Party and are proofread again prior to final publication.

B. Preparation prior to the review week

27. Effective preparation by the LRs and the TERT is essential to the success of the review week and the overall review process. Timely preparation enables the TERT to submit clarifying questions to the Party before the review week and allows the Party sufficient time to consider preliminary issues identified and to provide well-elaborated responses. This, in turn, facilitates the subsequent work of the TERT. Good preparation also helps ensure that the limited time available during the review week can be used efficiently for interaction with the Party, internal coordination among reviewers and preparation of the TERR.

28. The preparation phase begins with the allocation of responsibilities among TERT members and the establishment by the secretariat of a dedicated electronic collaboration platform for the review (see table 3-3). All relevant documents, templates and supporting materials are made available through this platform. For each Party under review, these material normally include:

(a) The BTR, including the NIR[27] (the NID and the CRTs) for the current submission, as well as relevant previous submissions;

(b) The thematic checklists;

(c) The TERR template and the addendum, pre-filled with relevant factual and procedural information;

(d) The TERR from the previous review cycle and related review documentation, as applicable; and

(e) Supporting reference materials relevant to the review, as appropriate.

29. Background resources common to the review of all Parties are also made available:

(a) Relevant decisions adopted under the Paris Agreement, including the MPGs and related CMA decisions;

(b) Relevant IPCC guidance documents, including the 2006 IPCC Guidelines and, where applicable, the 2019 Refinement;

(c) Conclusions and recommendations from LR meetings;

(d) Review tools with data for all Parties, such as the Locator; and

(e) General guidance documents such as this Review Handbook.

30. For considerations relating to resubmissions of the BTR or its components, and which version of the submission forms the basis of the review, see box 3-1.

[27] The NIR may be submitted as a stand-alone document.

Box 3-1

Resubmissions of the BTR and its components

Parties may resubmit the BTR, CRTs, or common tabular formats (CTFs) before or during the review. For practical purposes, submissions or resubmissions should not be received later than eight weeks before the review week, in order to allow the TERT sufficient time to consider them within the deadlines established by the MPGs. Any submission or resubmission received after that point should be treated as additional information provided during the review rather than as a submission subject to formal review. Where such late material is received, the TERT should acknowledge and document it in the TERR as having been received during the review process and note that it was not possible to assess it within the deadlines established by the MPGs.

Where the TERT reviewed a resubmitted version of the BTR or its components, the TERR should clearly state the date of the revised version that formed the basis of the review. Where a Party submitted a further revised version after the review was concluded, this should also be noted in the TERR, with a statement that it was not subject to review.

Resubmissions of the BTR after the review week are not established in the MPGs and are not expected in the process. Where a Party nonetheless intends to resubmit after the review week, the TERT should make clear during the review week the time and resource constraints of the post-review phase, which will preclude the TERT from assessing new information within the deadlines established by the MPGs.

31. Before the review week begins, experts are expected to examine the Party's submission (NID and CRTs) as well as the area of improvements from the previous review cycle (see chapter VI on review priorities). Particular attention should be given to previous recommendations, recalculations, transparency gaps and key categories.

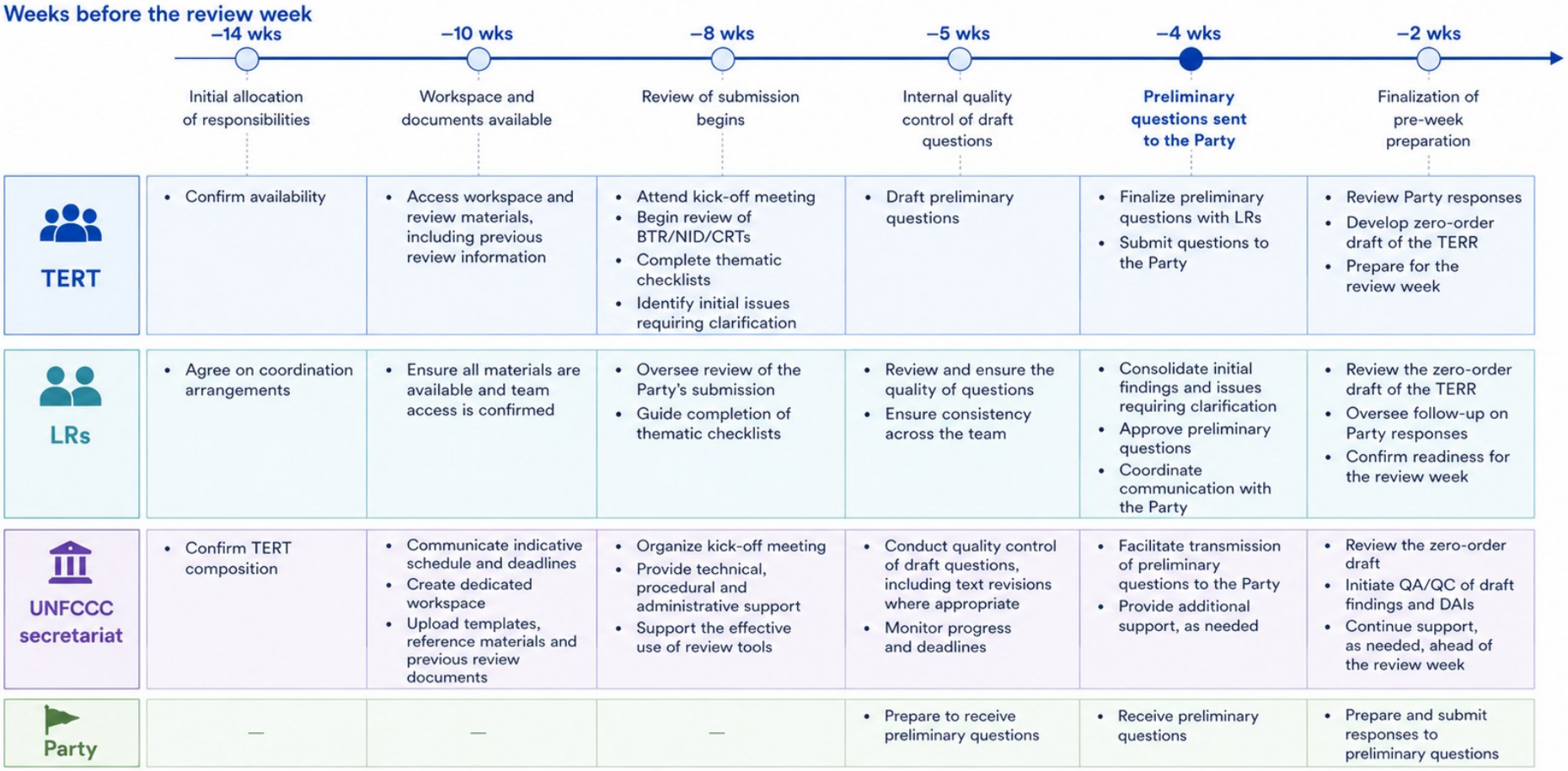
32. The main deliverables of this step are:

(a) a list of preliminary questions to be sent to the Party, normally at least 4 weeks before the review week through the designated electronic Q&A platform; and

(b) a zero-order draft of the TERR, to be developed progressively as the areas of improvements are identified.

33. The list of preliminary questions should be as comprehensive as practicable, while remaining clear, concise and precise, to provide all actors with an early understanding of the matters likely to be discussed during the review process (refer to box 3-2 for considerations in drafting questions). Preliminary questions are subject to an internal QC loop, as illustrated in figure 3-3. During this phase, TERT members are also expected to complete the thematic checklists to ensure that all required reporting elements have been examined.

Figure 3-3
Indicative timeline and responsibilities prior to the review week



Note: The timing indicated above is indicative. Adjustments may be made in accordance with the review schedule and circumstances of each review.

Box 3-2
How to draft questions to the Party

Effective communication between the TERT and the Party is essential to a successful review process. Although the questions and answers exchanged during the review week are not made public and do not constitute formal deliverables, they play an important role in supporting an efficient and well-informed review. The TERT should therefore ensure that communications are clear, concise and professional.

Before submitting a question to the Party, the TERT (through the LRs) should consider the following:

(a) Clarity and specificity: Is the question drafted in a clear and concise manner, free from ambiguity? Is it clear to which category, gas and year(s) the question refers? Is it clear where in the BTR, NID or CRTs the matter was identified? Is it clear which reporting provision is relevant, where appropriate?

(b) Tone and neutrality: Does the question maintain a polite, neutral and professional tone, seeking clarification without suggesting or prejudging the TERT's eventual findings or recommendations?

(c) Avoidance of duplication: Have all previous responses provided by the Party been reviewed to ensure that the same question is not being asked again?

(d) Follow-up questions: Where follow-up questions are necessary, are they clearly linked to the original question and to the Party's previous response(s)?

(e) Usefulness for the review: Is the question framed in a way that is likely to generate information relevant to the review and reduce the need for unnecessary further exchanges?

Examples of well-phrased and poorly phrased questions

Poorly phrased		***Well phrased***	
Question	**Why?**	**Question**	**Why?**
The emission factor (EF) for solid fuels used in households is lower than that used by other countries. Please explain why	(a) The TERT is using terminology not used in the CRTs (b) The gas and year are not specified (c) The TERT is asking the Party to explain why an EF is different from that used by other Parties. In principle, the Party is not required to know that; instead, the TERT should use the identified difference as an indication of a problem	The TERT noted that, for 1990–2014, the CO_2 IEF for solid fuels reported for category 1.A.4.b.i (residential – stationary combustion), ranging from 72.2–75.3 t CO_2/TJ, is lower than the values reported by other Parties. Which fuels are included under solid fuels for this category? Which EFs are used and what are the sources? It would also be helpful if the Party could provide fuel use by fuel type, for example for 2014	(a) Question is specific (gas, category, years) (b) The TERT is asking the Party only to explain issues related to its own submission (c) The TERT is trying to think in advance the rationale for the low EF (fuel mix or sources of EFs) and elaborates the questions on that basis

Poorly phrased		*Well phrased*	
Question	**Why?**	**Question**	**Why?**
You have not changed the method for enteric fermentation even though the need to move to tier 2 was discussed during the in-country review two years ago. When will you move to tier 2?	(a) The question is not specific, as the subcategory is not indicated (b) The TERT is not giving the Party a chance to explain (e.g. based on national circumstances) why it has not implemented the recommendation or whether it is addressing the recommendation (c) The TERT is suggesting the final recommendation	The TERT noted that in previous review report (TERR 2024, paragraph 14), the previous TERT recommended the implementation of a tier 2 method for enteric fermentation under category 3.A.1 (cattle). The present TERT noted that tier 1 is still used and did not identify information in the NID regarding plans to move to a tier 2 method. Could the Party elaborate on the current status of addressing the recommendation? Is a move to tier 2 planned and, if so, when? Please also describe any relevant constraints, such as data availability, limited expertise or resources.	(a) The question is specific to the category and references a specific TERR recommendation (b) The TERT is not suggesting the outcome but giving the Party a chance to explain the situation (c) The TERT is trying to anticipate the Party response and potential follow-up questions in order to save time
In the NID the N_2O EFs for composted waste are presented as kg N_2O/t wet waste. The TERT recommends that these values are converted to g N_2O/kg dm in line with the CRTs	(a) The question does not specify where in the NID the problematic value was found (b) There is no question (just a recommendation), so the Party may not understand that the TERT is expecting a response	In NID table 7.20, N_2O EFs for composting are provided in the unit kg N_2O/t wet waste. Dry-matter fractions are not reported. The disaggregation of waste types is different from that provided in CRT 5.B, in which the IEF is presented as g N_2O/kg dry matter. The TERT finds there is lack of transparency in NID table 7.20 on how emissions in CRT 5.B are derived using country-specific EFs. The TERT would like to receive information on: (1) the applied dry-matter contents for waste fractions included in NID table 7.20 and (2) which waste fractions in NID table 7.20 are allocated to each subcategory in CRT 5.B	(a) The question specifies where in the NID the problematic value was found (b) The question specifies why the TERT is asking for more information (replication of the calculation) (c) The question asks for additional information that would allow the TERT to replicate the calculation
Poorly phrased		*Well phrased*	

Question	Why?	Question	Why?
Why is the QA/QC plan not included in the NID as an annex?	(a) The question has a harsh tone and could sound argumentative to the Party (b) The question suggests that the Party has not met a requirement, but there is no such requirement in the MPGs (c) The response from the Party may not provide the information the TERT needs for its review	According to the MPGs, Parties shall report in the NID on their QA/QC plan and give information on QA/QC procedures already implemented or to be implemented in the future. The TERT did not find this information in the NID. Does the Party have a QA/QC plan in place? If so, could the Party please provide the plan to the TERT or a short summary of it? Which QA/QC procedures were implemented for the current submission? Please also provide examples of QA/QC activities undertaken, such as completed checklists or internal review procedures.	(a) The question refers to a reporting requirement (b) The question is posed in such a way as to generate a response which will likely allow the TERT to determine whether the Party's QA/QC procedures are in line with the MPGs
You have used the notation key "FX" for this category. Please justify why flexibility was applied here.	(a) The question implies the TERT is entitled to challenge the Party's decision to apply flexibility, which it is not (b) The question is confrontational in tone	The TERT noted that the notation key "FX" has been applied to category [X] for the years [Y–Z]. In accordance with paragraph [X] of the MPGs, the Party is requested to confirm: (1) the specific provision to which flexibility is being applied; (2) the capacity constraints that have informed this decision; and (3) whether a self-determined time frame for improvement has been identified.	(a) The question seeks transparency information that the TERT is entitled to review, without challenging the flexibility decision itself (b) The three-part structure ensures the Party provides all information required for the TERR Addendum entry

Table 3-3
Key actions of the TERT, LRs, and TRO prior to the review week

Task	*TERT members*	*LRs*	*TRO*
Division of tasks	Confirm availability, accept assigned responsibilities and inform the LRs of any constraints that may affect timely completion of preparatory work.	Agree on working arrangements and ensure that the workload is appropriately distributed among TERT members.	Inform the TERT, through an introductory e-mail or videoconference, of the Party(s) to be reviewed, the composition and responsibilities of the TERT and the overall support arrangements.
Schedule	Inform the LRs promptly of any periods of unavailability, and where necessary, agree on alternative internal deadlines that do affect overall milestones.	Review progress against the proposed schedule, provide feedback to the TRO on feasibility and flag any risks to timeline delivery	Communicate the overall schedule and key deadlines for the tasks before, during and after the review week, and support planning of preparatory activities. In the case of an ICR, support the Party and the TERT in developing and agreeing the agenda for the review week.
Review materials	Examine the Party's submission, previous review reports and supporting materials in accordance with the review priorities set out in chapter VI. Identify matters requiring clarification at an early stage.	Encourage TERT members to begin their substantive review work as early as possible and monitor overall progress	Upload review materials, templates and supporting documentation to the designated collaboration platform, and communicate any delays or updates affecting document availability.
Coordination meetings /Videoconferences	Prepare for, and participate actively in meetings, report progress, share preliminary observations and discuss any technical or procedural questions where clarification is needed or other colleagues may benefit from. These meetings are a good occasion for the TERT members to share any common findings on the submissions of the Party(s) under review	Organize meetings, circulate agendas and provide guidance on how the TERT should prepare. Initial meetings may be used to introduce team members, explain timelines, clarify roles and responsibilities, provide guidance and address initial questions. Additional meetings may be convened to discuss progress and common matters arising from the review.	
			Provide procedural, technical and logistical support during meetings, including clarification of review procedures, deliverables and use of tools.

Activities, timing and deliverables during the review process

Task	*TERT members*	*LRs*	*TRO*
Preliminary questions to the Party	Draft clear, concise and technically sound questions on matters requiring clarification, following the guidance in box 3-2 and chapter VI. Review Party responses received before the review week and prepare follow-up questions, where necessary. Ensure that all preliminary questions are submitted before the review week begins.	Conduct QC of draft questions to ensure that they are clear, factually accurate, non-confrontational and sufficiently specific (e.g. category, gas, year and relevant references where appropriate). Approve questions for transmission to the Party and guide the preparation of follow-up questions where needed.	Support the LRs in the QC process and transmit approved questions to the Party through the designated electronic questions and answers platform.
Draft TERR (see chapter V.D)	Draft relevant sections of the TERR progressively during the preparation phase, particularly where no further clarification from the Party is required. Update draft text as responses are received and issues are clarified.	Encourage early drafting of TERR and provide guidance on structure, consistency, completeness and quality of the draft text.	Ensure that pre-filled TERR templates are available and provide support to the TERT in using the templates, maintaining version control and compiling draft outputs.

C. Review week

34. The review week is the central phase of the GHG inventory review process. During this week, the TERT clarifies, refines and substantiates its findings, through direct communication with Party experts in ICRs, or through electronic communication in CRs or DRs. The review week also enables the TERT to develop a common view on the main issues and findings relating to the inventory of the Party under review.

35. In **CR**s and **DR**s, the TERT, including the LRs, continues to work intensively during the first two to three days of the review week to identify any additional questions[28], concerns and issues relating to the Party's implementation of the applicable reporting requirements. The TERT analyses the Party's responses to the preliminary questions and prepares any necessary follow-up questions. Communication with the Party is conducted through the designated electronic Q&A platform. Where necessary, supplementary exchanges may take place by e-mail, phone calls or videoconferences. In CRs, smaller technical discussions may also be organized when useful, for example, between the agriculture and LULUCF experts or between the energy and IPPU experts.

36. In an **ICR**, a similar sequence takes place, with the added advantage that the Party and the TERT are in the same room to discuss issues in greater depth. Focused discussions between Party experts and the TERT are normally held early in the week, drawing on issues identified during the preliminary question phase and on brief presentations by the Party. The TERT must be well prepared to lead these focused discussions (i.e. having done a thorough review in the time prior to the review week). Also, during an ICR, bilateral exchange between Party inventory experts and TERT members can be arranged, for example in order to go through detailed calculation files. In addition, during an ICR the TERT is in a position to carry out a thorough review of national inventory arrangements. This is also reflected in the

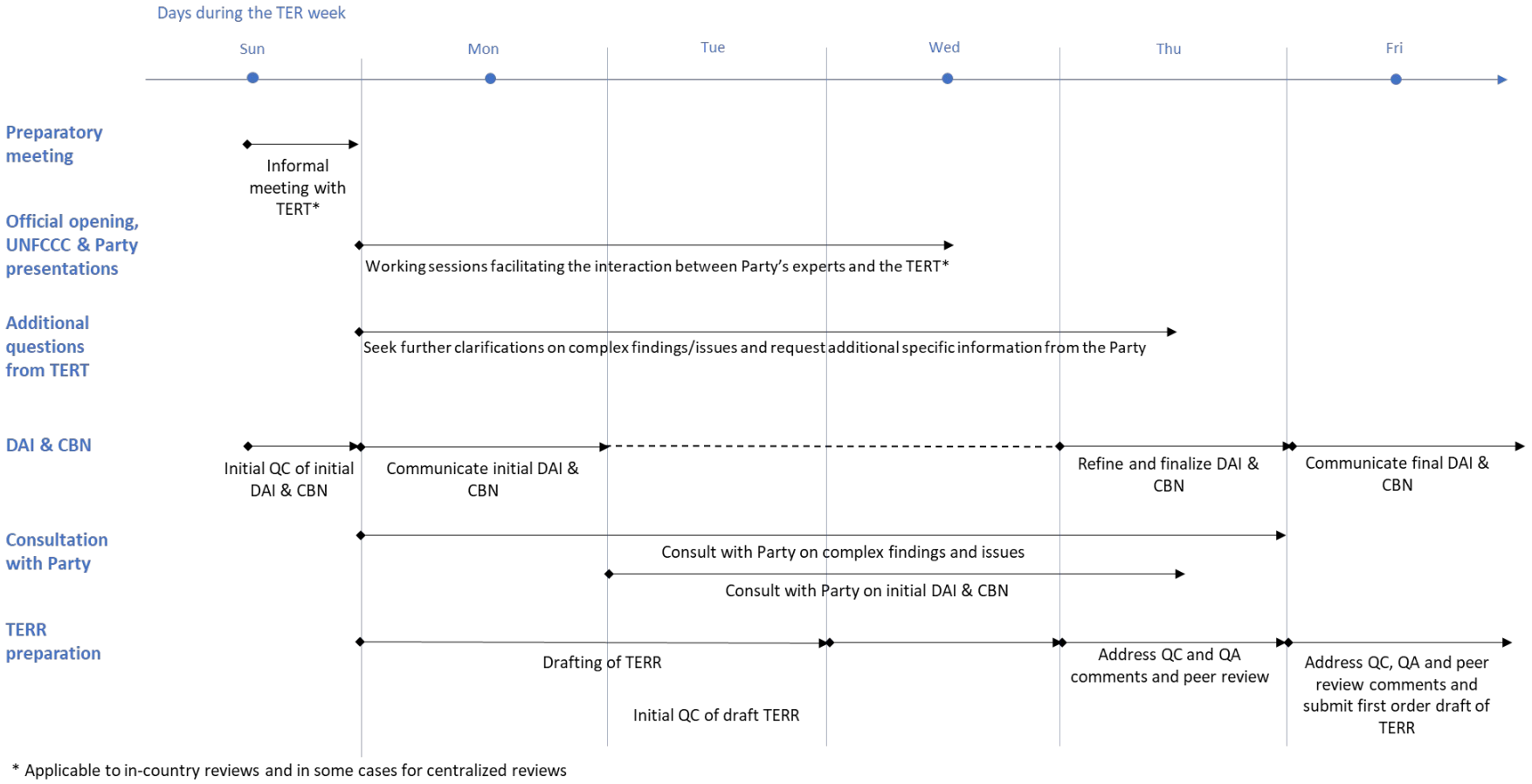
[28] All new preliminary questions must be submitted before the review week begins. During the review week, the TERT may only raise follow-up questions arising directly from the Party's responses to previously submitted preliminary questions; entirely new lines of enquiry should not be introduced during the review week unless exceptional circumstances require it and the LRs agree.

review scope (see chapter VII.B). It is essential to keep in mind that a large majority of time during an ICR is spent in discussions with the Party and in bilateral exchange with Party experts, and that there is only limited time available to review the NIR or CRTs during the review week. At the end of the week, on Friday, each TERT member gives a presentation on his or her DAIs and draft CBNs arising from the review. The key actions during the review week of the LRs and TERT with support of the TROs are explained in table 3-4.

37. In **all review approaches**, the TERT drafts the TERR (see chapter V.D), with the aim of finalizing a complete TERR draft by the end of the review week. At the end of the review week the TERT also compiles a list of DAI[29] and CBNs (chapter V.B), which is sent to the Party. See figure 3-4 for an overview of the review week schedule.

[29] The DAI document is drawn directly from the areas of improvement recorded by the TERT in the TERR Addendum tables during the review week; it is not prepared separately from scratch. TERT members should therefore ensure that all areas of improvement are fully described in the Addendum before the end of the review week.

Figure 3-4
General review week schedule



Note: The schedule above is indicative and reflects a typical in-country review. Activities may vary for centralized reviews and desk reviews. For centralized reviews and desk reviews, communication with the Party is normally conducted through the designated collaboration platform and, when necessary, via videoconferences, e-mails or phone calls.

38. Wrap-up meetings of the TERT are typically organized in all review approaches. The timing and frequency of these meetings depend on the review format and preferences of the TERT and, in the case of a DR, on the geographic locations of the TERT members. Daily wrap-up meetings are generally held in ICRs and CRs, while less frequent meetings may be sufficient for DRs. Depending on the issues under discussion, time zones differences, and the preferences of the LRs, email communications may be used in lieu of videoconferences. The wrap-ups are chaired by the LRs and are used to monitor review progress, identify significant or cross-cutting issues, and to discuss and agree on DAI. Active participation of all TERT members is essential to ensure that any concerns related to timelines, key findings or cross-sectoral issues are raised and addressed in a timely manner. At the end of the review week, LRs may also use the wrap-up meeting to reflect on the discuss what worked well and what could be improved, including any lessons learned, to inform future review activities.

Table 3-4
Key actions of the TERT, LRs and TRO during the review week

Task	*TERT members*	*LRs*	*TRO*
Prepare follow-up questions[30]	Draft follow-up questions to the Party on issues requiring further clarification, ensuring that they build on and are clearly linked to the Party's response to the preliminary question and remain directly linked to the issue under review. Follow-up questions should be raised as early as possible and, to the extent possible, before the review week.	(a) Monitor the Q&A platform for questions from the TERT (b) Conduct QC of the follow-up questions; ensure consistency and request revisions/clarifications from the TERT, where necessary, before approval and submit them to the TRO	(a) Monitor the Q&A platform for questions from the TERT (b) Review and approve follow-up questions for submission to the Party, liaising with the TERT to clarify issues where needed
Review work	(a) Continue the work started prior to the review week (see chapter VI) by making observations and identifying findings and issues (b) Cooperate across sectors, as needed. Raise any potential issues for discussion with LRs. Seek advice from the LRs and TRO as appropriate (c) To the extent time permits, experts should peer-review their colleagues' work to help enhance the accuracy and consistency of the final TERR	Lead and guide the TERT in identifying and assessing substantive findings/issues. Guide and manage the participation of new experts in the review. Facilitate teamwork, for example by identifying and organizing, as appropriate, breakout groups (e.g. between LULUCF and agriculture experts, or between energy and IPPU experts).	Assist the TERT (in particular the LRs) in conducting the review, as needed, explaining procedures and the use of tools, distributing documentation, reviewing draft texts if available, supporting the peer-review of reports among experts, providing technical support, conducting QA/QC of the review products, and managing any requests to knowledge hubs (KH)[a]

[30] In addition to follow-up questions, new questions may be raised where new issues are identified during the review week. Such questions should be limited to substantive issues or those arising from discussions with the Party, and should be kept to a minimum, as the majority of questions are expected to be raised before the review week.

Activities, timing and deliverables during the review process

Task	*TERT members*	*LRs*	*TRO*
TERT presentation (ICR only)	Present identified DAI and, if applicable, CBNs to the Party on Friday of the review week. Cover Party responses and potential recommendations	Support the TERT in its preparation of the presentation of main findings to the Party. Ensure that presentations are clear. Chair the TERT presentations to the Party	Distribute the presentation template to the TERT and provide guidance, as necessary
Draft areas of improvement (DAI) and, where applicable, capacity-building needs (CBNs) **(see also chapter V.B)**	Finalize findings in the sectoral tables of the TERR addendum for inclusion in the list of DAI and, where applicable, CBNs, keeping in mind that all DAI and CBNs identified should be included	Make a preliminary QC check of the findings in the TERR. Strive to ensure that the list includes all findings	Assist the LRs in the final compilation of the DAI and CBNs
TERR **(see also chapter V.D)**	Complete the relevant sector assessment and findings for the TERR in the collaboration platform by the end of the review week. If time allows, complete the sectoral parts earlier in the review week and provide to LRs/TRO for early QC checks	Conduct preliminary QC checks of the sectoral TERR findings in the collaboration platform during the review week	(a) Support the preparation of the TERR by providing guidance on the use of the TERR template and by conducting preliminary QC check of the available findings during the review week (b) Ensure that, at the end of the review week, drafts of all chapters are included in the TERR
Other documentation	Ensure that all documentation produced or used by the TERT, with the exception of data marked confidential by the Party, is in the collaboration platform, including questions, Party responses and any additional information used during the review		
Schedule and process for TERR completion[b]	Commit to the TERR completion schedule and process by indicating any periods of unavailability and any other concerns	Agree to the TERR completion schedule and process with the TERT, including the division of tasks between LRs, and the sequence of actions among the TERT, LRs and TRO	Assist the LRs in the preparation of the TERR completion schedule by providing the framework of deadlines and time needed for QA/QC procedures. Recognize perennially difficult time periods (e.g. the annual meetings of the COP/CMA/CMP and holidays) in trying to meet the deadlines set out in the MPGs

[a] Knowledge Hub (KH) provides technical assistance to TERTs on complex review issues. The TRO manages all requests to the KH on behalf of the TERT. Consultation with the KH is not a direct TERT-to-KH channel; TERT members should route any requests requiring specialist input through the TRO.The KH may be consulted when the TERT encounters methodological questions requiring specialist input beyond the TERT's immediate expertise.

[b] The preparation of the TERR is a complex task with many actors involved, so the timelines in the original schedule are not always met. It may be helpful for TERTs to receive a notification two to five days before the next version of the TERR is expected to be sent to them. In this manner, the time needed for actual reaction by the experts is expected to be reduced. The TRO, in coordination with the LRs, maintains a dashboard that outlines the timing of expected and actual interim milestones.

D. After the review week

39. The main task of the TERT after the review week is to finalize the TERR according to the schedule agreed at the end of the review week. The work after the review week is a follow-up of the deliverables during the review week, as illustrated in figure 3-5.

40. After the review week, finalization of the TERR is the common responsibility of the TERT members and LRs, with support from the UNFCCC secretariat. In the QA/QC process on the TERR, there are multiple rounds of review and comment on the draft TERR. These typically include: (1) LR and TRO quality control; (2) QAO quality assurance; (3) editorial formatting check; and (4) clearance by the TRO in coordination with the QAO before the draft TERR is submitted to the Party. These are elaborated on in table 3-5. Due to the tight timelines and the number of actors involved, it is necessary that all actors involved allocate enough time for the timely finalization of the TERR.

Figure 3-5
Main actions after the review week

	Weeks after the review week				Weeks after the receipt of Party comments		
	+2 wks.	+4 wks.	+8 wks.	*4 wks. (dev. countries: 12 wks.)*	+1 wk.	+2 wks.	+4 wks.
TERT	Address LR/TRO quality control comments	Prepare draft TERR	Address QAO quality assurance comments; prepare final draft TERR		Address Party comments; prepare final TERR	—	Receive notification of TERR publication
LR	Quality control of draft TERR	Review and approve revised draft	Quality assurance of draft TERR		Oversee and approve TERT responses to Party comments	—	—
UNFCCC Secretariat	Quality control of draft TERR	Format and edit	Quality assurance; clearance to send to Party; send final draft TERR to Party		Send TERT response to Party; request no objection for publication	Receive Party no objection; move TERR to proofreading	Proofreading; final formatting; clearance for publication; publication of TERR
Party	Provide any additional information requested	—	—		Review draft TERR; submit written comments (if any)	Provide no objection for publication (or further comments)	Receive notification of TERR publication

Note: The timing indicated above is indicative. All steps in the post-comment phase fall within the four-week deadline for finalizing and publishing the TERR, as set out in MPG paragraph 162(g). For developing country Parties, the comment period following receipt of the draft TERR is up to three months. The TERT shall make every effort to complete the TERR no later than 12 months from the start of the TER process. Adjustments may be made in accordance with the review schedule and the circumstances of each review.

Table 3-5
Key actions of the TERT, LRs and TRO after the review week

Action/task	*TERT members*	*LRs*	*TRO*
Finalization of the draft TERR	Complete the draft TERR by incorporating, as appropriate, comments from the Party on the DAI and taking into account any comments from LRs in a timely manner and in accordance with the schedule agreed by the TERT	Coordinate closely with the TERT to ensure timely finalization of the draft TERT. Conduct a QA check of the draft report and ask experts to revise, if necessary. Ensure comments from the Party on the DAI are reflected, as appropriate, in the final draft TERR	Coordinate closely with the TERT to ensure the timely finalization of the draft TERR. Be available for any technical or logistical support for the TERT and LRs, as needed
TRO QC of the draft report	Respond to any comments received from the TRO and revise tables of the TERR in a timely manner	Coordinate closely with the TERT to ensure the timely revision of the TERR based on comments from the TRO	Review the draft TERR, providing comments to the TERT and LRs and supporting LRs in finalizing the revised TERR. Submit the report to the UNFCCC editors (addressing comments as applicable) and for QA
QA/QC review of the draft TERR	Respond in a timely manner to requests from LRs to clarify or revise the TERR text	Respond to any substantive comments from the QA process, coordinating with the TERT as appropriate. Provide the rationale for any significant comments not accepted	Coordinate with the LRs who are addressing the comments from the QA process
Editorial proofreading	Review and respond to any editorial queries arising from the final proofreading		Submit the draft TERR for editorial proofreading and consolidate any corrections
Draft TERR sent to Party	Respond to any questions from the LR/TRO, as needed	Respond to any TRO questions prior to the submission of the draft TERR to Party, if required	(a) Coordinate with the QAO for clearance of the draft TERR, consulting LRs if necessary (b) Submit the draft TERR to the Party
Address any comments from Party	Respond to requests from LRs to revise the TERR text based on comments from the Party and provide justification (in a timely manner) for any comments not addressed in the comment response template	Finalize the TERR taking into account comments from the Party and provide justification for any comments not addressed within the agreed schedule	(a) Coordinate the finalization of the TERR, ensuring that Party comments on the draft TERR are distributed to the TERT in the comment response template (b) Send the completed template, with TERT responses, to the Party for review and any final comment

Activities, timing and deliverables during the review process

Action/task	*TERT members*	*LRs*	*TRO*
TERR publication			Coordinate the final proofreading and clearance for publication

IV. Effective use of the review tools

A. Collaboration platforms

41. The technical expert review process can be carried out in **one of two platforms**, depending on the assignment: 1) **BTR Review SharePoint Tool**; and 2) **BTR Collaboration Tool**.

1. BTR Review SharePoint Tool

42. SharePoint is a web application that serves as the main documentation hub and collaboration environment for the review. This tool provides a centralized and structured workspace hosting all materials and outputs relevant to the review, including the Party's submissions, working versions of the checklists and TERR templates, reference materials, and supplementary documents provided by the Party. Among its functions, the BTR Review SharePoint Tool includes dedicated modules for managing specific review tasks, one of which is the Questions and Answers (Q&A) module. This module provides an interactive interface through which all TERT members can raise preliminary and follow-up questions to the Party in support of their BTR review tasks, organized by thematic area. The tool is subject to ongoing development and further updates to its structure and functionality may be introduced in subsequent review cycles; the TRO will provide orientation at the start of each review cycle. Detailed guidance on the Q&A module can be found here: 

2. BTR Collaboration Tool

43. The BTR Review Collaboration Tool is a dedicated web-based platform developed by the UNFCCC Secretariat to support structured, transparent, and collaborative BTR reviews. It integrates the core functions of the review workflow within a single environment. Detailed guidance on the tool can be found here: 

44. It is important that all the TERT members work directly in the online version of draft TERR templates to ensure a single authoritative version of documents, avoid version clashes or loss of updates.

B. Locator

45. The Locator is a database query tool that allows the TERT to view the data submitted by Parties in CRTs without opening individual CRT excel files. The TERT may view emissions, AD, implied emission factors (IEFs) and other parameters (e.g. Average gross energy intake (GE), Milk yield, Typical animal mass (average), methane conversion factor (MCF)) for the selected category and gas. The Locator tool allows the TERT to compare either the entire time series for a single Party or review data reported by the Party as compared with other Parties. If a Party submitted several submissions, the tool also allows user to compare among submissions. It includes a graphic visualization which helps identify inconsistencies throughout the time series. The Locator also enables the TERT to track the use of notation keys by the Party.

46. The Locator may be found at https://data.unfccc.int/locator/, and its user guide may be found here: 

C. Comparison tool

47. The Comparison tool allows the TERT to review the recalculations for all years in the time series without opening individual CRTs. Recalculations are provided both in absolute and percentage terms and for the entire inventory and for individual categories. The tool also contains a filter to show only those categories that contained recalculations for emissions/removals during the time series greater than ±2 per cent. This filter can help TERTs conducting a DR to prioritize the categories for review.

48. The TERT can use the Comparison tool to identify differences between two submissions, including differences in numerical data and changes from notation key to number and vice versa. The Comparison tool can be used both when reviewing the recalculations since the previous year submission, and when reviewing the changes made in any resubmission by the Party in the same year.

49. The Comparison Tool may be found at https://data.unfccc.int/comparison/.

D. Statistical Outlier Detection Tool (SODT)

50. The SODT is a data query tool for identifying outlier with six criteria:

(a) Time-series fluctuation (inter-annual changes, whole time-series change, and DT^2);

(b) IPCC default range (comparing IEF and additional information with IPCC default data, if these are available for selected category and gas);

(c) Across other Parties (data itself, inter-annual changes).

51. The SODT facilitates prioritizing categories of gases to be reviewed, by sorting out categories by key category analysis (KCA) ranking or by filtering with recalculation. However, statistical comparisons may be difficult to interpret; therefore, users should use findings identified by SODT as just a starting point of consideration of issues behind the data.

52. The SODT may be found at https://data.unfccc.int/sodt/.

V. Effective use of templates

A. Checklists

53. There are twelve thematic checklists, each assigned to the corresponding sectoral TERT member. The checklists are the TERT's primary working tool for systematically assessing the consistency of the Party's BTR with the provisions of the MPGs, ensuring that all relevant reporting requirements are considered during the review. Each checklist is structured around the relevant MPG provisions and guides the TERT member through the identification of potential areas of improvement and the formulation of preliminary questions to the Party. Detailed guidance on completing the checklists is embedded in the checklist templates themselves.

54. TERT members should begin working with their assigned checklist 6 to 8 weeks before the review week, treating it as an active working document throughout the preparation and review process. A key drafting rule applies across all checklists: where multiple sub-paragraphs under a single provision are affected, only one recommendation or encouragement is included per provision, referencing all relevant sub-paragraphs. TERT members should coordinate with one another to ensure that issues identified across multiple sectors are captured once under the generalist, rather than repeated in each applicable sector. As the checklist content transfers directly into the corresponding TERR Addendum tables, accuracy and completeness at the checklist stage are essential to the quality of the final TERR. Guidance on formulating recommendations, encouragements and capacity-building needs is set out in chapter V.D.

B. Draft areas of improvement (DAI) and draft capacity-building needs (CBNs)

55. At the end of the review week, the TERT compiles and communicates to the Party the DAI and, where applicable, the draft CBNs identified in consultation with the developing country Party that needs flexibility in the light of its capacities. The DAI document sets out the preliminary recommendations (for "shall" provisions) and encouragements (for non-"shall" provisions) identified by the TERT on the basis of the review, and provides the Party with early notice of the areas of improvement that will likely form the basis of the draft TERR. The CBN document, where applicable, sets out the reporting-related capacity-building needs identified by the TERT in consultation with the Party. The Party is given two weeks to comment on the list of DAI and CBNs, and the TERT should consider, and as appropriate incorporate, the Party’s comments into the draft TERR.

56. For in-country reviews, the TERT makes a presentation to the Party on the DAI and CBNs on the final day of the review week, focusing on key findings and priority areas. The secretariat has developed a presentation template to facilitate this communication. For centralized and desk reviews, the DAI and CBN documents are communicated to the Party electronically. The TRO works closely with the TERT throughout this process to ensure the accuracy, clarity, and completeness of both documents and their full consistency with the MPGs.

57. Neither the DAI document nor the CBN document has a separately designed template in the traditional sense. The DAI is drawn directly from the draft findings recorded by the TERT in the TERR Addendum tables at the end of the review week, and its format focuses on the areas of improvement and associated recommendations or encouragements. The CBN document is similarly drawn from the CBN workspace sections of the TERR Addendum, completed by each expert in consultation with the Party, and reflects both CBNs relating to

flexibilities applied by the Party and those identified by the Party itself in relation to other reporting provisions.

58. Note that all findings included by the TERT in the draft TERR addendum at the end of the review week will be reflected in the DAI list and CBNs list. Although the DAI & CBNs documents sent to the Party will include a disclaimer noting that the findings are provisional and subject to change, it is still important that all findings are clearly described in the TERR addendum at the end of the review week, to avoid unnecessary confusion and comments from the Party.

C. Comment response document

59. The Party subject to review has one month from receipt of the draft TERR to provide written comments. Developing country Parties that need flexibility in the light of their capacities have up to three months from receipt of the draft TERR to provide comments, in accordance with paragraph 162(f) of the MPGs. The secretariat provides Parties with a standardized comment response template to facilitate the submission of comments. The template contains one table for comments on the main report and another for comments on the addendum. For each comment, the Party is asked to indicate the relevant paragraph, figure, table, or AoI ID number, provide the comment with justification for any proposed changes, and include a textual proposal where applicable.

60. Upon receipt of the Party's comments, the secretariat will distribute the comment response document to the TERT. The TERT's response column indicates whether the TERT accepts or rejects the Party's comment and why, and sets out any revised TERR language where applicable. There is no mandated time frame in the decisions by which the TERT must complete this interim deliverable. The LRs generally allow about a week, but the time may be extended depending on the nature and scope of the Party's comments.

61. The main tasks by the LRs and TERT to complete the comment response document are as follows:

(a) Consider carefully all comments provided by the Party;

(b) Provide the TERT’s response based on the template language. Possible choices range from “the TERT agreed with the comment” to “the TERT considered the comment but decided that the report already sufficiently addresses the comment” and “the TERT considered, but disagreed with the comment”;

(c) Provide a rationale for the response made by the TERT;

(d) Indicate what action the TERT will take (e.g. delete the paragraph or modify it to reflect the Party’s comment). It is particularly helpful to include a tracked changes version of the relevant paragraph so the Party can easily identify how the TERT intends to address the comment (if at all).

62. The completed comment response document will be sent to the Party for its consideration, along with a revised TERR reflecting the changes. Although the findings contained in the final report are those of the TERT, every effort will be made to reach agreement with the Party on the content of a report prior to its publication. If a disagreement remains, the Party may provide additional information in a separate chapter of the report.

D. Technical expert review report (TERR) template

63. The TERR is the most important output by the TERT and the only review product published on the UNFCCC website. The report contains the final conclusions,

recommendations and encouragements, and, for developing country Parties, the capacity-building needs identified by the TERT in consultation with the Party, regarding the Party's reporting under the ETF and its consistency with the MPGs.

64. The report is prepared using standardized templates provided by the secretariat before the review week (see chapter III.B). These templates are pre-filled with information for each Party under review. Ultimately, the TERR is the collective responsibility of the TERT, so it is critical that each TERT member reviews closely the information contained in the pre-filled template, as well as the final draft of the report prior to submission to the Party, to ensure that each member of the TERT agrees with the contents of the TERR.

65. Under the ETF, the TERR consists of two complementary components:

(a) the TERR main report; and

(b) the TERR Addendum.

66. The main report provides an overview of the Party's reporting and the key conclusions of the review. The Addendum provides the detailed technical assessment of the Party's reporting against the MPGs on a provision-by-provision basis. This two-tier structure ensures transparency, consistency and comparability across reviews, and enables the systematic identification and tracking of areas of improvement, recommendations, encouragements and, for developing country Parties, capacity-building needs across successive review cycles.

67. There are four separate TERR templates:

(a) TERR main report for Parties other than European Union Member States (EUMS);

(b) TERR addendum for Parties other than EUMS;

(c) TERR main report for EUMS; and

(d) TERR addendum for EUMS.

68. The TERR main report summarizes the overall results of the TER and includes:

(a) an introduction and overview of the scope of the review;

(b) a review of the consistency of the Party's BTR with the MPGs across all thematic areas, a consideration of the Party's implementation and achievement of its NDC, and where applicable, a consideration of the Party's FTC support provided and a voluntary review of information on climate change impacts and adaptation;

(c) a summary of areas of improvement related to "shall" provisions of the MPGs, referenced by their ID numbers [31];

(d) for developing country Parties, a summary of the main capacity-building needs identified by the TERT in consultation with the Party; and

(e) conclusions and recommendations.

69. The TERR Addendum provides the detailed findings of the TERT across the elements subject to review under the MPGs. The addendum typically includes:

(a) structured tables documenting the full list of areas of improvement identified by the TERT in the Party's reporting for each thematic area, with the corresponding recommendations and encouragements. Each area of improvement entry follows a three-paragraph structure: the first paragraph describes the issue and its inconsistency with the MPGs; the second paragraph sets out the Party's response and the TERT's consideration of it; and the third paragraph contains the recommendation or encouragement; and

[31] Encouragements are not listed in the main report and are only included in the addendum.

(b) for developing country Parties, a consolidated table of all capacity-building needs identified during the review, covering all thematic areas.

70. The TERR templates contain instructions that will assist the TERT in completing the report; these are not repeated in full here. However, it is important for the TERT to understand the use and inter-relationship of terms which are key to completing the TERR: areas of improvement, recommendations and encouragements, and capacity-building needs.

71. Under the ETF, the classification system used under the Convention and the Kyoto Protocol (i.e. issues, problems and findings) is no longer applied. Instead, all findings are framed in a facilitative manner as areas of improvement, reflecting the non-intrusive, non-punitive nature of the ETF. All areas of improvement lead to either a recommendation or an encouragement in the TERR, depending on the nature of the underlying MPG provision. For developing country Parties, areas of improvement may also give rise to capacity-building needs, which are identified in a spirit of support and assistance to help the Party strengthen its reporting over successive review cycles.

72. The TERR does not need to include all observations identified during the review. Only key and significant findings should be documented. These are findings that relate to a Party's consistency with the MPGs, have implications for the TACCC principles, or are relevant for tracking progress over time. Minor findings such as editorial inconsistencies, presentational issues in the NID with no bearing on the accuracy or completeness of the inventory, or minor drafting problems that do not affect the substance of the estimates should not be included in the TERR. Such findings may be communicated informally to the Party through the designated electronic questions and answers platform, where appropriate.

73. **Areas of improvement**: The TERT documents its findings as areas of improvement where it identifies an inconsistency between the Party's reporting and a provision of the MPGs. All areas of improvement lead to either a recommendation or an encouragement in the TERR, depending on the nature of the underlying provision. Areas of improvement identified during the current review will be tracked in subsequent review cycles in order to assess the Party’s progress in addressing them.

74. **Recommendations**: A recommendation is issued where the area of improvement relates to a "shall" provision of the MPGs. All recommendations are addressed to the Party for its next submission, unless otherwise specified in the TERR.

75. **Encouragements**: An encouragement is issued where the area of improvement relates to a "should" or "may" provision of the MPGs. A "should" requirement is not mandatory but, where an inconsistency is identified, leads to an encouragement. A "may" provision is also not mandatory and may, but will not always, lead to an encouragement.

76. When formulating recommendations and encouragements, the TERT should carefully consider any qualifiers included in the relevant MPG provisions.

(a) Where provisions are qualified by expressions such as “to the extent possible”, the TERT should assess whether the Party has provided sufficient information or justification for not reporting the requested information. If neither information nor justification is provided, a recommendation or encouragement should be formulated, as appropriate.

(b) Where provisions are qualified by expressions such as “as appropriate”, the TERT should apply expert judgement in assessing the applicability of the provision to the Party’s national circumstances and may seek clarification during the review. Lack of reporting on a given element in such cases does not necessarily lead to a recommendation by the TERT.

77. Recommendations and encouragements should be formulated clearly, specifically and in a facilitative manner, using the wording of the relevant MPG provision as much as possible. The TERR and its Addendum are the written record of the areas of improvement identified by the TERT, and clarity is essential to ensure that the Party, future TERTs and the public understand what is required and why. Vague formulations such as "the reporting is not transparent" without further elaboration do not provide the Party with sufficient direction and should be avoided.

78. The TERT should bear in mind that the objective of each recommendation or encouragement is to help the Party improve its inventory over successive review cycles. Recommendations and encouragements should therefore be practical, specific and proportionate to the significance of the area of improvement identified. Where a Party has already indicated plans to address an issue, the TERT should acknowledge this in the TERR while still issuing the recommendation or encouragement if the issue has not yet been fully resolved.

79. **Capacity-building needs (CBNs)**: CBNs reflect the capacity constraints that underlie the areas of improvement identified by the TERT, and must be based on those areas of improvement. Their identification is a mandatory function of the TERT for developing country Parties, carried out in consultation with the Party during the review week. CBNs should be formulated specifically, identifying the concrete capacity constraint and the type of support that would be most beneficial, rather than reiterating the description of the area of improvement. The full list of CBNs is documented in the TERR Addendum, while the TERR main report only includes a summary of the high-priority CBNs. The relevant sections in the TERR templates are deleted for developed country Parties, for whom the CBN identification process does not apply.

VI. General approach to the review of the inventory submission: CRT and the BTR or NID

A. Overview of the review of the CRT and the BTR or NID

80. The primary elements of a Party's inventory submission, the CRTs and the BTR or NID (where the NID has been submitted as a stand-alone document), are the main focus of the review.

81. The information provided by the Party in the CRTs includes all estimates of emissions and removals for the entire time series, AD and other related data, including calculated IEFs. The results of the key category analysis, where reported by the Party, are also included. The CRTs are an integral part of the inventory submission and should be consulted, together with the BTR or NID, throughout the entire review process.

82. Annex V to decision 5/CMA.3 contains an outline for the NID. Parties are encouraged to prepare their NID in accordance with this outline, though it is not a mandatory requirement. The NID must nonetheless include all information required under the relevant provisions of the MPGs.

83. The BTR or NID is the main source of information describing the institutional arrangements in the country and the procedures undertaken to develop the national GHG inventory, the methodologies used, available AD, EFs and the rationale for these choices. Information on the implementation of an uncertainty analysis and QA/QC procedures and information on any recalculations related to previously submitted data are also included. A separate chapter should be included that identifies changes from previous years regarding methodologies used, sources of information and assumptions, as well as responses to the review process and planned improvements.

84. Parties are allowed to submit their BTR or NID in any of the six official languages of the United Nations (Arabic, Chinese, English, French, Russian and Spanish). Ideally, all TERT members would be fluent in the language of the Party’s submission, but practically this is not always the case. However, lack of knowledge of the language of the BTR or NID does not reduce the responsibility of the TERT to fully review the submission. In order to facilitate the review, Parties may provide unofficial translations of their submission. Experts can also use automatic translation tools available online and ask the Party clarifying questions where needed. In cases where the exact wording of the BTR or NID is of importance, experts may consult those members of the TERT who are fluent in the language of the submission.

85. In the review, a major task of the TERT is to assess whether the Party’s submission is consistent with the MPGs. Particular attention is to be paid to the “shall” requirements, while the TERT should also review whether the Party has addressed the “should” and “may” elements of the MPGs. In all review approaches (desk, centralized, in-country), focus should be given to the observations which have an impact on the level and/or trend of the GHG emissions or removals. Even in the case of issues related to transparency (i.e. the NID does not clearly describe how emissions were estimated), the TERT should specifically determine if the lack of transparency in the inventory gives rise to concerns about the accuracy of the inventory estimates reported.

Special note: Review of regional economic integration organizations

86. The general guidelines above are applicable to all Parties. TERTs responsible for reviewing the submission of the European Union (EU) (a regional economic integration organization) face additional complexities. The review of the EU submission is unique in that it is the direct sum of emissions and removals from the national inventories compiled by the

EU member States[32] and that individual member States are also subject to individual inventory reviews. The focus of the EU review should be on ensuring that the EU submission accurately reflects the summation of the emissions and removals of its member States and that information is transparently reported in the BTR or NID of the EU, particularly for key categories identified at the level of the EU. When drafting the TERR, the TERT should be cognizant that the Party under review is the EU, not an individual member State. Recommendations directed at specific member States are beyond the scope of the EU TERR. It is good practice for the secretariat to conduct the review of the EU submission after the submissions from individual EU member States have been reviewed.

Box 6-1:
Scope of and approach to the review of the EU GHG inventory

(i) At the start of the review, the LRs should request the TERT to focus the review on the transparency of the information reported in the BTR or NID of the EU and provide guidance thereon, particularly for key categories identified at the EU level, followed by categories for which recalculations have been performed and categories that are the subject of recommendations in the previous review report, as well as progress in the implementation of planned improvements. The TERT should assess whether the EU GHG inventory is compiled in accordance with the MPGs.

(ii) The LRs should ensure that recommendations in the review report are addressed to the EU, because the inventories of the member States fall outside the scope of the EU review.

(iii) The TERT may also consider information on the efforts undertaken at the EU level to address the main issues pertaining to the member States as reflected in previous EU review reports.

87. During CRs and ICRs, the TERT should, to the extent possible, make a thorough review of all categories in the inventory. If time does not allow for a thorough review of all categories, priority should be given to key categories, categories where recalculations have been carried out, and categories for which recommendations or encouragements were included in the previous TERR. In its review of non-key categories, the TERT should focus on the most important ones or those which have not been reviewed in recent years. Such categories can be identified based on previous TERRs.

88. During desk reviews, it is important to remember that the scope of the review is more targeted. The TERT should conduct a thorough review of categories for which recalculations have been carried out, areas of improvement identified in previous TERRs, and any findings from the simplified review, where applicable. If time allows, the TERT should carry out other review tasks (those which are carried out in CRs and ICRs), giving priority to key categories.

89. The TERT's tasks that are common to all sector experts (and the generalist) are elaborated in chapters VI.B–G together with possible actions by the TERT. The tasks which are under the main responsibility of the generalist are included in chapter VII.B and the sector-specific tasks in chapters VII.C–G. The tables and figures listing TERT actions are not intended as checklists where the team must complete all the tasks but rather as guidance for the reviewers.

[32] The EU's BTR submission aggregates the inventories of its current 27 member States. The composition of the EU joint submission has changed over time due to EU enlargement and, more recently, the departure of the United Kingdom. Under the Convention, the joint submission comprised 15 member States in the first commitment period of the Kyoto Protocol and 27 member States plus Iceland and the United Kingdom in the second commitment period. Reviewers should exercise caution when comparing current BTR submissions with previous submissions and when considering the continued relevance of recommendations made in review reports under the Convention or the Kyoto Protocol.

90. A core element of the technical expert review is the clarification of findings with the Party. Communication is an essential element of all potential TERT actions that are presented in the tables and figures throughout chapters VI and VII, even where clarification is not explicitly mentioned. Further information on the process for preparing questions during the review is given in chapter III and guidance for drafting questions is provided in box 3-2.

91. Based on the review carried out, the TERT will then identify any areas of improvement and formulate the corresponding recommendations and encouragements to the Party for improving its inventory. Further guidance on preparing recommendations and encouragements for the Party is included in chapter V.

B. Follow-up of previous simplified reviews (for developed countries)

92. Developed country Parties that submit annual NIRs are subject to a simplified review in years in which a BTR is not due. The results of simplified reviews are published on the UNFCCC website and should be consulted by the TERT during the review, particularly where issues were identified that have not yet been addressed in the current submission.

C. Implementation of previous review recommendations[33]

93. One of the core tasks of the TERT when conducting a TER is to consider whether the Party has implemented the previous review recommendations. The NID outline contained in decision 5/CMA.3 encourages the Party to report, if applicable, category-specific recalculations (including explanatory information and justifications for recalculations), changes, and planned improvements made in response to the review process.

94. The TERT's task is to assess information on changes made in response to the recommendations made by the previous TERT, which may include the progress made in implementing improvements taking into consideration the publication date of the previous TERR and national circumstances. Unless the status of addressing a recommendation is very clear from the NID, CRTs, and/or simplified review reports, or is clarified by the Party, the TERT should ask the Party a clarifying question. In particular, the TERT should not conclude, without consulting the Party, that there is no progress in addressing a recommendation made in a previous review. Based on the Party's response, the TERT's task is to classify the recommendations made in the previous review as "resolved" (the Party fully implemented the recommendation), "not resolved" (the Party did not implement the recommendation and has not taken any action to address it), or "addressing" (the Party has made sufficient progress in resolving the recommendation) in the TERR, and also to provide a rationale for its assessment. Assessing the implementation of recommendations made in previous review reports has become an even more important task of the TERT.

[33] Procedures under this section were applicable for the review of submissions by Annex I Parties under the Convention. Procedures under the Paris Agreement will be taken into consideration when the secretariat develops procedures of the review of the BTR2.

Box 6-2
Issues identified in multiple successive reviews and not addressed by the Party

The PAICC defines issues persistent.

The MPGs do not define when an issue is considered persistent.

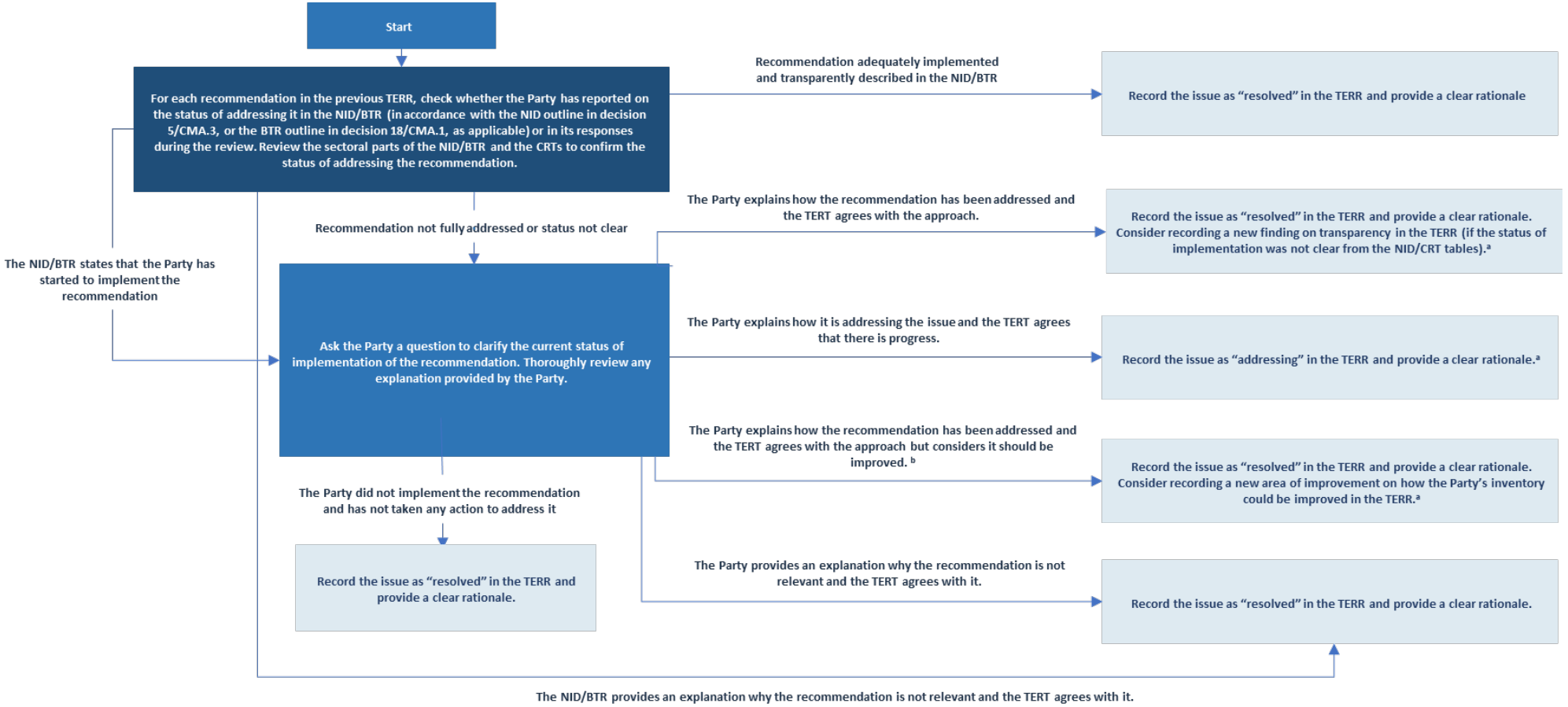
However, the UNFCCC Annex I inventory review guidelines (paragraph 83) include a concept of successive review recommendations not addressed by the Party.

The TERT will identify issues, in particular those relating to accuracy and completeness for key categories as described in paragraph 73 above, missing categories as described in paragraph 75(d) above, or potential key categories as identified by the TERT and that could not be clarified with the Party during the review week. In the case where, after such an issue has been identified in three successive reviews, in accordance with paragraphs 75(f) and 76(a) above, and has not been addressed by the Party, the TERT will include a prominent paragraph in the review report noting the issue, the number of successive reviews in which the Party has been notified of the issue, and that the Party has not addressed the issue.

Guidance for the consideration of whether a recommendation is addressed or resolved by the Party is given in figure 6-1figure 6-1, and guidance for the recording of such cases in the TERR is addressed in chapter V.D

Figure 6-1

Possible approach by the expert review team to consider whether the Party has addressed a recommendation made in the previous annual review report



[a] For previous review recommendations that have the status "not resolved" or "addressing", consider national circumstances when recording the rationale in the TERR.

[b] For example, if the Party updates the emission factor as recommended by the previous TERT but does not adequately describe what was done in the NID/BTR, and that description was not explicitly requested by the previous TERT, the issue in the previous TERR is resolved, but the present TERT may decide that there is a new transparency issue.

D. Completeness, use of notation keys

95. One of the core tasks of the TERT is to review the completeness of the Party's submission and the use of notation keys in the CRTs. It is important to remember that the use of notation keys is completely acceptable and consistent with the MPGs, and experience suggests that every Party uses notation keys in one or more CRTs. It is the TERT's responsibility to ensure that notation keys have been used correctly. Possible actions by the TERT to support this task are included in table 6-1, and figure 6-2 illustrates the proper use of notation keys by the Party, depending on data availability.

96. The MPGs allow a Party to exclude from reporting emissions/removals from categories that are considered insignificant, even though they occur in the country and methods are available in the 2006 IPCC Guidelines or any subsequent version or refinement (see Box 6-5). However, the level of significance has to be properly documented in the NID and the CRTs (e.g. in CRT9) in accordance with paragraph 32 of the MPGs. In order to be below the level of significance, emissions/removals for a unique category/gas combination must be below 0.05 per cent of the national total GHG emissions, excluding LULUCF, and or 500 kt CO_2 eq, whichever is lower. In addition, the total national aggregate of estimated emissions for all gases and categories considered insignificant must remain below 0.1 per cent of the national total GHG emissions, excluding LULUCF. Those developing country Parties that need flexibility in the light of their capacities may instead apply a threshold of 0.1 per cent of the national total GHG emissions, excluding LULUCF, or 1,000 kt CO2 eq, whichever is lower, with the total national aggregate of all gases from categories considered insignificant remaining below 0.2 per cent of the national total GHG emissions, excluding LULUCF.

Box 6-3
Flexibility provisions for developing country Parties

Paragraphs 5 and 6 of the MPGs provide flexibility to developing country Parties that need it in the light of their capacities. Flexibility applies to specific "shall" provisions and allows a Party to use the notation key "FX" in the CRTs and to describe in the NID the provision to which flexibility is applied, the capacity constraints that have informed the decision, and a self-determined time frame for improvement.

In reviewing flexibility provisions, the TERT shall apply the following principles:

(a) The TERT shall not challenge a Party's decision to apply flexibility (MPG paragraph 149(e)). The decision rests with the Party.

(b) The TERT may seek clarification to ensure transparency. Where the NID does not identify: (i) the specific MPG provision to which flexibility is applied; (ii) the capacity constraints; or (iii) the self-determined time frame for improvement, the TERT should ask the Party for this information and, if it remains absent after the review, raise an area of improvement accordingly.

(c) For each instance of "FX" in the CRTs, the TERT should verify that the corresponding information is provided in the NID.

(d) Capacity-building needs identified in relation to flexibility provisions should be documented in the TERR Addendum CBN workspace in consultation with the Party.

Box 6-4
Formulating findings where flexibility has been applied

Flexibility provisions in the MPGs operate in two distinct ways, and the TERT should take this into account when formulating recommendations and encouragements.

Some provisions reduce the scope, frequency, or level of detail of the reporting requirement while maintaining its legal nature (applicable to MPG paragraphs 25, 29, 32, 48, 57–58, 95 and 102). Where a Party's reporting is inconsistent with the reduced standard permitted by such flexibility, the TERT should raise a recommendation, as the "shall" nature of the provision is maintained. TERT should not raise recommendation to report without the use of flexibility. An exception applies to paragraph 29, where the flexibility provision explicitly encourages the Party to quantitatively estimate uncertainties even where qualitative reporting is consistent with the flexibility applied; in this case, the TERT should issue an encouragement for quantitative reporting.

Other provisions change the legal nature of the requirement while maintaining its scope, frequency and level of detail (applicable to MPG paragraphs 34–35, 85 and 92). Where a Party's reporting is inconsistent with the MPGs, the TERT should issue an encouragement rather than a recommendation, consistent with the changed legal nature of the provision.

In either case, the TERT should not include the phrase "in the next submission" in any recommendation or encouragement relating to a provision for which flexibility has been applied. Where the Party has reported a self-determined estimated time frame for improvement in accordance with paragraph 6 of the MPGs, the TERT may instead reference that time frame in the encouragement, specifying the year by which the Party has indicated it intends to address the issue.

Table 6-1
Possible actions by the technical expert review team to review the use of notation keys by the Party

Review element	*Possible action by the TERT*
Reporting on completeness in the NID	Has the Party reported, in the NID, an assessment of completeness, including information and explanations in relation to categories that are reported as “NE” (not estimated) or “IE” (included elsewhere), and information related to the geographical scope?
Use of notation keys – general	Are notation keys used to fill in all blanks in the CRTs? Are notation keys used where data were previously reported? If yes, is an explanation provided in the NID? Have any notation keys changed from the previous submission? If yes, was the change properly documented in the NID?

Review element	*Possible action by the TERT*
Use of notation key "NA"	Is the notation key "NA" (not applicable) used for activities under a given category that occur within the Party but do not result in emissions or removals of a specific gas? Where "NA" is reported and the 2006 IPCC Guidelines or its Supplements provide a method and an EF for the particular category–gas combination, carefully review the justification provided by the Party for using "NA" and consider whether a question should be asked to the Party as to why "NE" was not reported. Note that when for a specific carbon pool an IPCC default method is applied that assumes no net C stock changes occur, the correct notation key to be used is "NA" with the explanation provided in the information box that the estimate is based on a Tier 1 approach.
Use of notation key "C"	Is use of the notation key "C" (confidential) justified (i.e. is its use required to protect confidential business or military information)? Has the Party provided the basis for protecting such information, including any domestic law? Is the TERT confident that the emissions or removals reported as "C" are included in sectoral (or, if necessary, national) totals? For further information on the process for reviewing confidential data, see paragraph 97 below.
Use of notation key "IE"	Are emissions that are reported as "IE" actually included elsewhere? Such an assessment may require coordination among TERT members in different sectors. Does CRT9 document where these emissions are reported? Often Parties use the notation key "IE" because of the way national statistics are collected, resulting in the inability to allocate emissions according to the 2006 IPCC Guidelines and its Supplements. If this is the case, the TERT should consider whether a recommendation to report emissions consistent with the allocation in the 2006 IPCC Guidelines and its Supplements is appropriate.
Use of notation key "NO"	Where the notation key "NO" (not occurring) is used, has the Party provided justification that the category or process does not occur within the country? In some cases, it may be difficult for the Party to justify that a category or process is not occurring. The TERT should pay attention to use of the notation key "NO" if it has a good reason to assume that the activity is occurring in the Party, for example, if the emission is related to use or production of a product that generally occurs in developed countries or the TERT is aware of other references indicating that the process occurs/product is produced in the country.
Use of notation key "NE"	Is an explanation provided in CRT9 for the use of "NE"? Is "NE" reported for a category for which a method is provided in the 2006 IPCC Guidelines or, if applicable, the Wetlands Supplement? If the Party claims that the category is "insignificant", is the Party's determination consistent with the requirements in paragraph 32 of the MPGs?

Review element	*Possible action by the TERT*
Use of notation key "FX"	Is the notation key "FX" (flexibility) used only by a developing country Party that has applied a flexibility provision in accordance with the MPGs? Has the Party clearly indicated in the NID the specific provision to which flexibility is applied, concisely clarified the capacity constraints, and provided self-determined estimated time frames for improvements?

Box 6-5
Threshold of significance

Paragraph 32 of the MPGs defines the concept of an "insignificant category". This concept applies at the category/subcategory level where the notation key "NE" may be used in the CRTs. Parties are allowed to report "NE" (not estimated) for a category given that it meets the threshold of insignificance and that it has not been reported in previous submissions (see figure 6-3)

Note: The insignificance criteria apply to a given category for the whole time series (category–gas combination). Therefore, if a Party reports "NE" (not estimated) only for some years of the time series, even if it demonstrates that estimates for those years fall below the significance threshold, the TERT should identify this as an area of improvement related to completeness and time-series consistency, and recommend that the Party report emission estimates for that category for all years of the time series

Figure 6-2
Correct use of notation keys

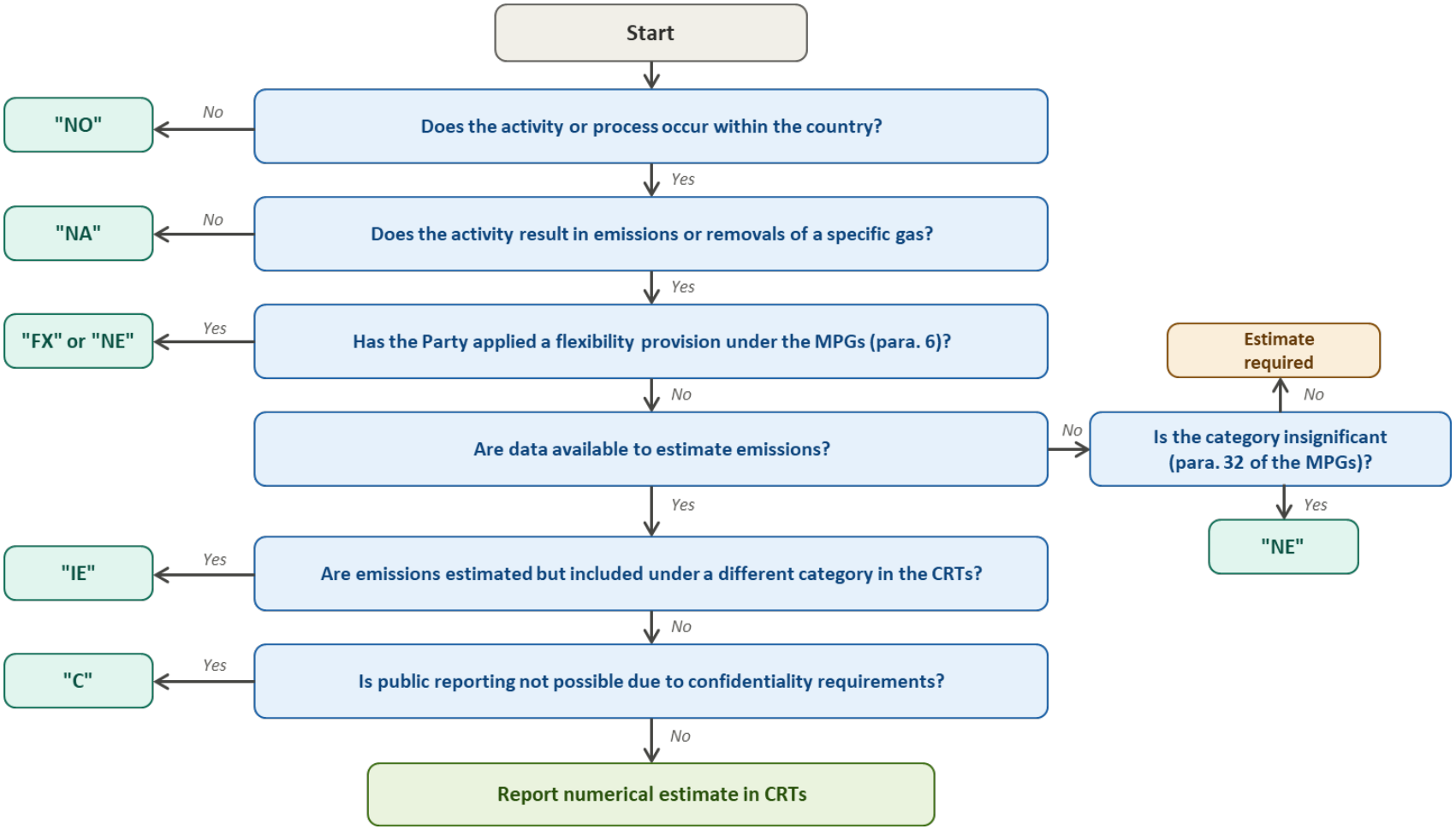
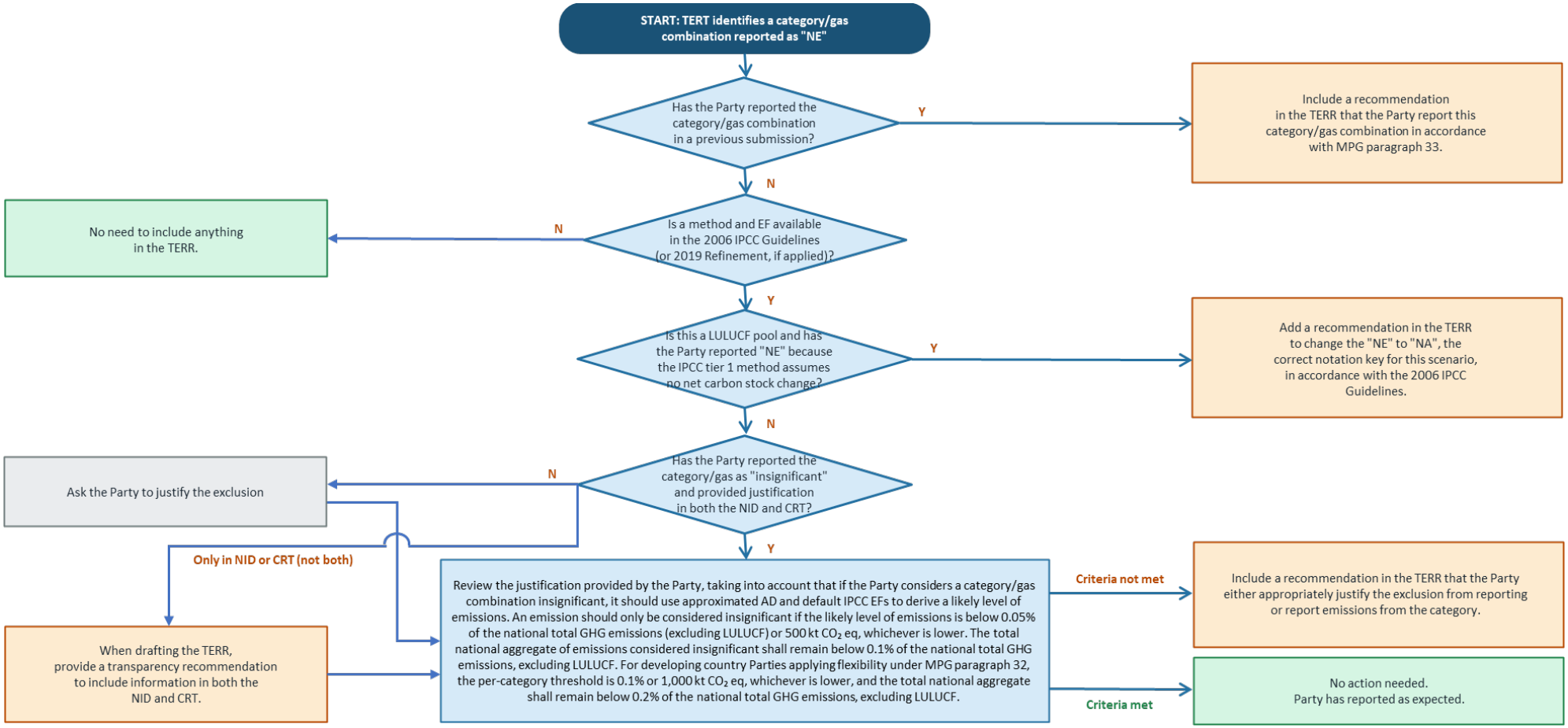


Figure 6-3
Decision tree for expert review team actions in the case of a category–gas combination reported as "NE" (not estimated)



E. Managing confidential information

97. According to the MPGs, Parties may indicate that specific data or information are confidential. Where a Party reports information as confidential, the TERT should assess whether the Party transparently describes in the CRTs and the NID where these emissions are reported and may encourage the Party to provide in the NID the specific basis for protecting the confidentiality of such information, including any domestic law. Parties should be encouraged to provide, on a confidential basis in response to a request made by the TERT, the confidential data or information on relative indicators, indices or other well-defined alternative means to allow the TERT to consider the emission estimates based on the confidential information. As a TERT member, it is important that you maintain the confidentiality of any information provided, in accordance with the "Code of Practice for Handling of Information Designated by Parties as Confidential during Review-related Activities under Article 13 of the Paris Agreement"[34]. Confidential data will be provided only to the expert(s) who review the specific sector instead of the entire TERT and will not be uploaded to the collaboration platform. The TERT must also take confidentiality into account when drafting the TERR, by not including the confidential data or information therein. In line with "Agreement for Expert Review Services for BTR Review Activities" (see chapter II.B), the expert is obligated to maintain the information confidential after the review process. The TRO will further guide and assist the TERT members in dealing with confidential data.

F. Methods, assumptions, emission factors and activity data

98. The choice of methods, selection of assumptions, development and selection of EFs and collection and selection of AD are the main drivers of inventory quality. The TERT's task is to ensure that the selection of these data is carried out by the Party in accordance with the 2006 IPCC Guidelines and its subsequent version or refinement and in line with the requirements of the MPGs. Table 6-2 provides possible TERT actions for review of these elements.

[34] Code of Practice for Handling of Information Designated by Parties as Confidential during Review-related Activities under Article 13 of the Paris Agreement

Table 6-2
Possible actions by the technical expert review team to assess, for each category, whether the 2006 IPCC Guidelines and its subsequent version or refinement are applied and sufficiently documented, in relation to the methods, assumptions, emission factors and activity data

Review element	*Possible action by the TERT*
Choice of method	The 2006 IPCC Guidelines and its subsequent version or refinement often include several alternative methods (tiers) for each category. In general, a higher-tier method will yield a more accurate estimate of emissions from a category and is therefore to be preferred. The appropriate choice of tier will depend upon national circumstances and availability of data (see the 2006 IPCC Guidelines, volume 1, figure 4.1), and on the decision tree specific to the category. Typically, the 2006 IPCC Guidelines and its subsequent version or refinement include different methodological approaches for key categories and non-key categories, including the concept of a significant subcategory for determining whether each subcategory of a key category should be considered as key. In its review of choice of method for each category, the TERT may consider the following: (i) *Does the NID include information on the IPCC tier used? (ii) *For key categories, does the NID include an explanation if the recommended methods from the appropriate decision tree in the 2006 IPCC Guidelines and its Supplements are not used? (iii) If a recommended method is not used owing to lack of data or resources, has the Party adequately explained the national circumstances in the NID? Does the Party have plans to improve the situation? (iv) If a recommended method is not used, has the Party justified its choice of an alternative method? (v) Is the method more accurate for the Party (e.g. is uncertainty smaller with the country-specific method than with a lower-tier method)? (vi) Is the Party's reporting on choice of method transparent?
Use of a method	(a) *Has the Party applied the method correctly? (b) *Does the NID include a description of any national methodology used, as well as information on anticipated future improvements? (c) *Is any country-specific method in line with the 2006 IPCC Guidelines and its Supplements? (d) *Does the NID include descriptions, references and sources of information for the specific methodologies, including higher-tier methods and models, as well as the rationale for their selection? (e) *For tier 3 methods and/or use of models, does the NID include verification information consistent with the 2006 IPCC Guidelines and its Supplements?[a] (f) *For tier 3 methods, does the NID include additional information for improving transparency, such as information described in Box 6-9 below?[a] (g) *Are the descriptions of the methods complete and transparent?
Selection of assumptions	(a) *Does the NID include descriptions, references and sources of information for assumptions as well as the rationale for their selection? (b) *Are the selection and documentation of assumptions in line with the general guidance in the 2006 IPCC Guidelines and its Supplements and with the reporting and documentation guidance for the specific category?

Review element	*Possible action by the TERT*
Development and selection of EFs	(a) *Does the NID include descriptions, references and sources of information for EFs as well as the rationale for their selection? (b) Is the development or selection of EFs and their documentation in line with the general guidance in the 2006 IPCC Guidelines and its Supplements and with the guidance for the specific category? (c) Are country-specific EFs periodically reviewed and updated to ensure accuracy if underlying conditions change?
Collection and selection of AD	(a) *Does the NID include descriptions, references and sources of information for AD as well as the rationale for their selection? (b) *Is the AD complete (i.e. includes the entire activity in the Party, such as all industrial plants or all landfills)? (c) Are the collection and selection of AD and the related documentation in line with the general guidance in the 2006 IPCC Guidelines and its Supplements and with the reporting and documentation guidance for the specific category?

*Mandatory element.

[a] For more guidance regarding review of tier 3 methods, see the text in this chapter paragraph 100.

Box 6-6

Treatment of the 2019 Refinement to the 2006 IPCC Guidelines in the Review Process

Paragraph 20 of the MPGs requires each Party to use the 2006 IPCC Guidelines and any subsequent version or refinement of the IPCC guidelines agreed upon by the CMA. The 2019 Refinement to the 2006 IPCC Guidelines has been agreed upon by the CMA and may therefore be used by Parties under the ETF. The TERT should pay attention to the treatment of the 2019 Refinement in the review process, as follows:

- For new categories or subcategories that are not covered by the 2006 IPCC Guidelines, the TERT should recognize in the TERR the estimates for such new categories, when such estimates enhance the completeness of the GHG inventory.

- For categories and subcategories covered by the 2006 IPCC Guidelines, the TERT should review whether (1) the methodologies, emission factors (EFs) and/or assumptions taken from the 2019 Refinement or a country-specific approach based on or consistent with the 2019 Refinement are well documented; (2) the Party demonstrated that they better represent national circumstances and justified their use in its NID; and (3) emission and removal estimates are accurate and time-series consistency has been maintained in accordance with the 2006 IPCC Guidelines.

- The TERT should also check that emissions and removals have not been double counted or omitted, and, if double counting or an omission is identified, raise an issue in the TERR accordingly.

Box 6-7
Use of nationally appropriate methodologies and tier 1 approaches for key categories

Each Party shall use methods from the 2006 IPCC Guidelines and should make every effort to use a recommended tier level for key categories. A Party may use nationally appropriate methodologies if they better reflect its national circumstances and are consistent with the 2006 IPCC Guidelines. In such cases, the Party shall transparently explain the national methods, data and parameters selected. A Party may use a tier 1 approach for a key category where it is unable to adopt a higher tier method owing to lack of resources but shall clearly document why the methodological choice was not in line with the corresponding decision tree of the 2006 IPCC Guidelines and should prioritise that category for future improvement.

Where a Party uses nationally appropriate methodologies, the TERT should review whether the methods, EFs or parameters used are well documented in the NID, whether the Party has demonstrated that they better reflect its national circumstances, whether they are consistent with the 2006 IPCC Guidelines, and whether emission and removal estimates are accurate and time-series consistency has been maintained.

Where a Party uses a tier 1 approach for a key category, the appropriate response depends on what the Party has documented:

(i) If the Party has clearly documented in the NID that it was unable to adopt a higher-tier method owing to lack of resources, the TERT should encourage the Party to make every effort to use a higher-tier method in line with IPCC good practice, and to report information on how it is addressing or intends to address the issue;

(ii) If the Party has not documented this in the NID but provides a clear explanation during the review, the TERT should recommend that the Party include the explanation in the NID and encourage the Party to make every effort to use a higher-tier method in line with IPCC good practice, and to report information on how it is addressing or intends to address the issue; or

(iii) If the Party has not documented its reasons in the NID and no explanation is provided during the review, the TERT should recommend that the Party either use an appropriate method from the 2006 IPCC Guidelines or document in the NID the reasons for not following the relevant decision tree.

Box 6-8
Country-specific categories for which no agreed IPCC methodology exists

Parties may report emissions or removals from categories for which no agreed IPCC methodology exists. Such reporting is consistent with good practice, as the 2006 IPCC Guidelines encourage completeness of reporting. However, the methods used must be well documented and scientifically based, and the category must be reported consistently over the time series. Each inventory sector includes an "Other" category in the CRT in accordance with the 2006 IPCC Guidelines, which may be used to report sources or sinks that do not correspond to standard IPCC categories.

In reviewing a country-specific category for which no agreed methodology exists, the TERT should assess whether the methods used are transparently documented in the NID and whether the reporting is consistent with the TACCC principles. The TERT should consider the likely significance of the category in deciding how thoroughly to examine it; where estimating a category would divert resources from key categories, and the category is unlikely to be significant, the TERT may limit its assessment accordingly. The TERT may also consider how other Parties report similar or related categories. Where the category has previously been reported by the Party, the TERT should check that reporting has been maintained consistently across the time series.

Tier 3 methods and/or use of models

99. Tier 3 methods include models, plant/technology-specific knowledge and measurement systems tailored to address national circumstances. Review of tier 3 methods is often challenging because of their complexity and the limited time available for the review, particularly during centralized and desk reviews. Care must be taken to avoid spending too much time and effort when reviewing tier 3 methods, as this may hamper the review of other estimates. In-depth review of models should be prioritized during ICRs, as it offers an ideal opportunity for the TERT to sit down with the Party and more thoroughly review the data and assumptions used in the application of tier 3 methods.

100. The first task of a reviewer in the review of estimates prepared using tier 3 methods is to check whether the transparency of the description of the tier 3 method fulfils the requirement in table 6-2 and if not, the reviewer should request the Party to provide complete information on models and tier 3 methods before the review week starts. It will allow enough time for the TERT to make a full review of completeness, consistency, comparability and accuracy of the estimates. It is not the responsibility of the TERT to judge on the application by a Party of a model or tier 3 method, including country-specific approaches, but the TERT should review whether input and output data and parameters of the model or tier 3 method have been reported transparently and accurately and are consistent across the time series. In its review, the TERT may find that the IPCC report *Use of Models and Facility-level Data in Greenhouse Gas Inventories*[35] is a useful background document. In particular, the checklist in Annex 1 of that report may be of use in reviewing the transparency of reporting on tier 3 methods, even though it does not constitute any formal requirement for Parties.

[35] Use of Models and Facility-Level Data in Greenhouse Gas Inventories

Box 6-9
Documentation requirements for models and tier 3 methods

The review of models can be deemed to have been transparently and well documented in the NID when the information provided covers:

(i) Reasons for selecting the particular model;
(ii) If an existing model is being used and adapted: area of application of the original model and how it has been adapted (description of why and how the model was adapted for conditions outside the originally intended domain of application);
(iii) Main equations/processes;
(iv) Material assumptions (important assumptions made in developing and applying the model);
(v) Domain of application of the model (description of the range of conditions for which the model has been developed to apply);
(vi) How the model parameters were estimated;
(vii) Description of key inputs and outputs;
(viii) Details of calibration and evaluation using calibration data and independent data;
(ix) Description of the approach undertaken for the uncertainty analysis and for the sensitivity analysis, and the results of these analyses;
(x) Quality assurance (QA) and quality control (QC) procedures applied and findings from these procedures;
(xi) Comparison of the results from models, tier 3 methods or country-specific approaches with the results from lower-tier or default approaches; (see figure 6-4); and
(xii) References to peer-reviewed literature (where details of research on the model can be found).

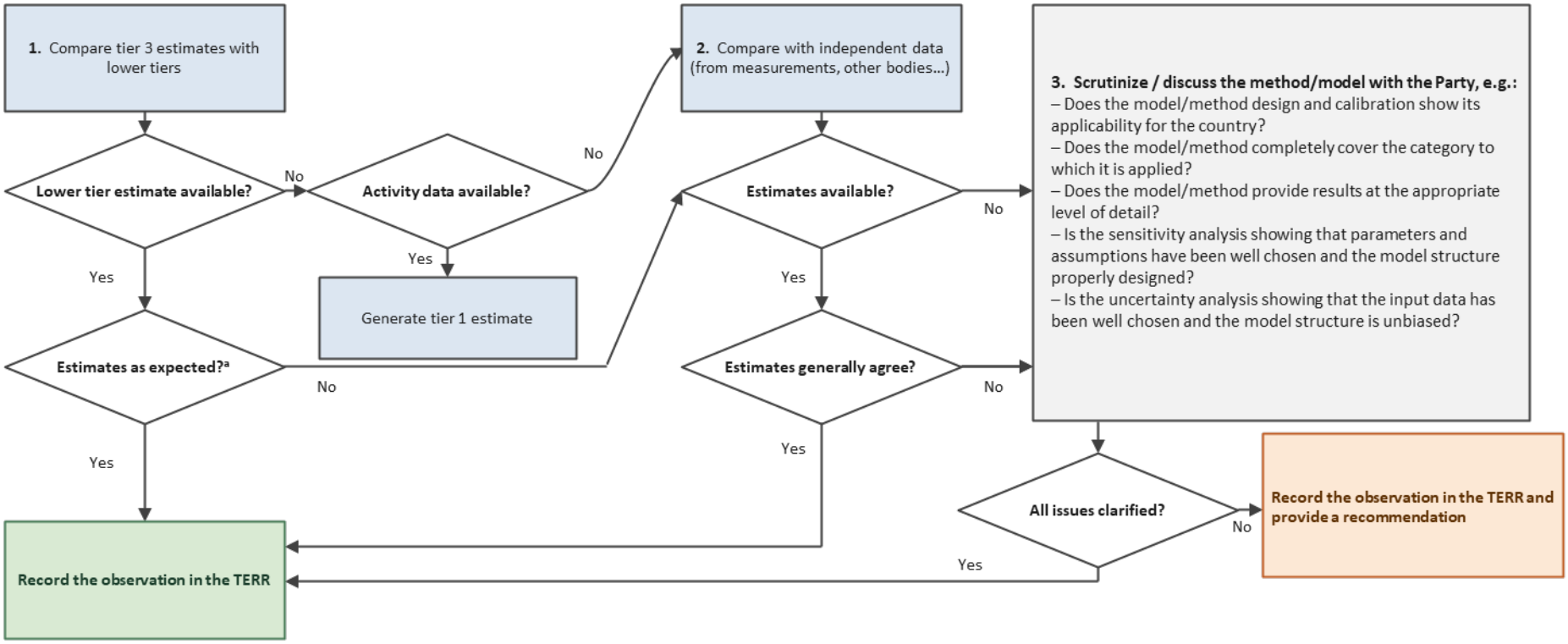
101. For the review of completeness, consistency, comparability and accuracy of the estimate generated using the tier 3 method, the TERT should use the approaches in table 6-2 and figure 6-4.

102. During DRs and CRs, a review of the accuracy of tier 3 methods is particularly challenging and may require considerable time from the reviewer. A reviewer in a CR or DR should prioritize reviewing whether the models and tier 3 methods, including country-specific approaches, have been transparently and well documented in the NID. In particular, a reviewer should review the package of materials provided by the secretariat, as well as the TERR for the most recent ICR of the Party's inventory to see if the tier 3 method was recently subject to an in-depth review. The information available may help guide the current review or even indicate that the tier 3 method does not need to be evaluated again during the current review. The reviewer should indicate in the review report whether the models and tier 3 methods were already reviewed during a previous in-country review. If further review is deemed necessary, a possible approach is to assess the accuracy of the tier 3 method by comparing it with the results of the tier 1 (or tier 2) method which are, or can be, made available. The application of tier 3 methods will generally aim at increasing the accuracy of the inventory, leading to a lower uncertainty of the estimates for a specific category or group of categories, when compared with a tier 1 estimate. At the same time, as both tier 1 and tier 3 methods are expected to be unbiased, the tier 3 estimate could be expected to fall within the uncertainty range of the tier 1 estimate.

103. Figure 6-4 suggests two possible tests to compare the results of a tier 3 estimate with a tier 1 estimate: (1) to check whether the results of the tier 3 method fall within the uncertainty range of tier 1; and (2) to check whether the uncertainty of the estimate generated by the tier 3

method is lower than the uncertainty of an estimate generated by the tier 1 method. If the results from the tier 3 method fall outside of the expected ranges, this does not necessarily mean that the method should not be used, and the reviewer should carefully assess any results and discuss them with the Party. It is possible that the tier 3 method results in a higher uncertainty estimate but is actually a less uncertain estimate of the actual emissions or removals from the category, for example if the tier 3 method makes explicit sources of uncertainty that the tier 1 method had previously not identified.

Figure 6-4
Possible technical expert review team actions in its review of accuracy of a tier 3 method



[a] *"As expected" means that: (i) the tier 3 estimate is within the uncertainty range of the lower tiers; (ii) the uncertainty of the tier 3 estimate is lower compared with lower tiers.*

G. Cross-cutting elements

104. There are several common elements to be assessed across sectors when reviewing the quality of the Party's submission. These cross-cutting elements include uncertainty analysis, QA/QC, time-series consistency, recalculations and progress in implementing planned improvements. The overall review of cross-cutting elements of an inventory is the task of the TERT's generalist (chapter VII). However, the members of the TERT in each sector also review cross-cutting elements in their sectors and cooperate with the generalist to obtain an overall understanding of the reporting of cross-cutting elements in the Party's inventory. Table 6-3 outlines possible actions that the TERT can consider when reviewing the cross-cutting inventory elements.

105. All Parties should aim at continuous improvement of their inventories. Inventory improvements are implemented through recalculations and should be carried out only to improve accuracy or completeness. Maintaining a consistent time series is of utmost importance to ensure that the reported trends of GHG emissions and removals are not affected by changes in methodologies or data sources. Potential TERT actions in relation to continuous improvement and time-series consistency are also included in table 6-3.

Box 6-10
Recalculation explanations

The MPGs require Parties to report recalculations for the starting year and all subsequent years of the inventory time series, together with explanatory information and justifications, in accordance with paragraphs 26–28 and 43 of the MPGs. This information should be provided in the NID. The CRTs include CRT8, which provides a structured overview of recalculations, and should be consulted by the TERT together with the NID when reviewing recalculations.

Table 6-3
Possible actions by the technical expert review team to assess, for each category, whether the 2006 IPCC Guidelines and its Supplements are applied and sufficiently documented in relation to cross-cutting inventory elements

Review element	*Possible action by the TERT*
Estimating and reporting category-specific uncertainties	(a) *Are uncertainties estimated for the category? (b) *Is the information on the uncertainty assessment per category sufficiently transparent (e.g. methods, underlying assumptions, data sources and documentation of expert judgements)? (c) Is the estimation of uncertainties in line with the 2006 IPCC Guidelines (general guidance on uncertainties in volume 1, and sector-specific guidance in the relevant sectoral volumes)?
QA/QC procedures	(a) * Has the Party reported information on its QA/QC plan in the NID, including information on the inventory agency responsible for implementing QA/QC, and information on QA/QC procedures already implemented or to be implemented in the future? (b) *Does the Party apply general QC procedures for each category, in line with its QA/QC plan? (c) Does the Party apply category-specific QA/QC procedures for the category in line with the 2006 IPCC Guidelines and its Supplements? (d) If the NID contains a number of errors across different categories, consider (in cooperation with the TERT's generalist) whether this may be an indication of lack of sufficient QA/QC procedures or whether the national inventory arrangements/national system are not sufficiently carrying out their functions. This issue should be discussed with the Party to gain an understanding of whether these, or other reasons, have resulted in the errors.
Consistency of time series	(a) Is the same method and AD source used for the entire time series? If not, is consistency of the time series ensured in line with the 2006 IPCC Guidelines, volume 1, chapter 5? (b) Are the parameters and EF consistent over the time series? If they are not, are the changes in these factors supported by changes in national circumstances (e.g. technological development)? (c) Is the dataset prepared on a calendar year basis and consistently across time? According to the 2006 IPCC Guidelines, use of calendar year data is good practice whenever the data are available. However, if calendar year data are unavailable, then other types of annual data (e.g. non-calendar fiscal year data, April–March) can be used for certain categories provided that they are used consistently over the time series and the collection period for the data is documented. Where a Party uses a mix of calendar year and non-calendar year data across different categories, the TERT should assess whether this reflects the normal statistical practices of the Party, is applied consistently, and is transparently documented in the NID; if so, it need not be treated as an inconsistency.

General approach to the review of the inventory submission: CRT and the BTR or NID

Review element	*Possible action by the TERT*
Recalculations	It is the TERT's task to review all recalculations carried out by the Party using CRT8 (using the Comparison tool) and the NID to identify them. For developed country Parties that submit annual NIRs, the TERT should also consult the findings of the most recent simplified review report, where available, to identify any recalculations or trends that were flagged there but have not been addressed or explained in the current submission. The TERT can consider the following: (a) *Does the NID include sufficient information as to why a recalculation has been conducted (e.g. error correction, statistical reason or reallocation of categories, changes in methodologies, sources of information and assumptions)? (b) *Have the recalculations been sufficiently justified by improvement of accuracy or completeness? Are these justifications transparently reported in the NID? If the recalculation has been carried out in response to the review process, is this indicated in the NID? (c) *Have the recalculations been reported for the base year and all subsequent years of the time series up to the latest year for which the recalculations are made? (d) *Does the NID include a discussion on the impact of the recalculations on the trend in emissions at the category, sector and national total level? (e) *Does the NID include information on the procedures used for performing the recalculations, changes in the calculation methods, EFs and AD used? (f) *Does the NID include information on the inclusion of categories not previously covered? (g) *Where a simplified review was conducted for the Party's most recent annual NIR submission, have any recalculations or issues identified in that simplified review report been addressed in the current submission?
Progress of implementation of the planned improvements	Track the progress of the Party regarding planned inventory improvements and ask clarifying questions if necessary. If the Party has a number of planned improvements with limited or no progress in recent years, consider, in collaboration with the TERT's generalist, whether this may be related to problems with the Party's national inventory arrangements (e.g. lack of sophisticated prioritization of inventory improvements or lack of sufficient capacity for the performance of the required functions).

*Mandatory element.

VII. Sector-specific guidance

A. Introduction to the sectoral parts

106. This chapter provides specific guidance to assist in the review of the estimation of emissions and removals, by sector, during the review of national GHG inventories. The overall aim is to help review experts in performing their tasks, avoid duplication of efforts, and promote consistency in the different types of reviews (desk reviews, centralized reviews and ICRs).

107. The guidance presented in this document is independent of which review approach is taken (i.e. DRs, CRs or ICRs).

108. The possible TERT actions presented in the tables in this chapter are not intended as a checklist whereby the team must complete all the tasks but rather as guidance for the reviewers. The tables highlight sector-specific areas that the TERT may wish to consider, for example regarding consistency of inter-linked estimates across sectors and categories. The review tasks relevant for checking cross-cutting issues like uncertainty and QA/QC are provided in table 6-3 and TERT actions related to review of methods, EFs, AD and parameters, which are common for all sectors, are provided in table 6-2. Each of the tables, and to a large extent the tasks, in this chapter may be used independently.

B. Generalists

1. Introduction

109. The role of the generalist is to review cross-cutting inventory elements and information on national inventory arrangements. The tasks of the generalist overlap with the tasks of all sector experts and LRs, and often one of the LRs is also a generalist. The generalist can support the work of sector experts through identification of potential issues in all sectors during the review. It is important for the generalist to make sure that there is no duplication in the questions sent to the Party by the generalist and sector experts.

110. It is essential for the generalist to keep an overall view on the Party's submission in order to identify any issues which occur in multiple sectors and may thus indicate a wider problem in the inventory. Wrap-up meetings generally occur daily during the review week (less frequently for DRs), and this may be a good opportunity to identify and discuss such possible issues. At the end of the review week, the generalist should, together with LRs, seek for consensus among TERT members on the general assessment of the Party's inventory, which will be documented in the TERR.

111. Key changes related to the tasks of the generalist in the MPGs are presented in the box below.

Box 7-1

Key changes for the generalist arising from the enhanced transparency framework (ETF) under the Paris Agreement

(a) **Mandatory use of the 2006 IPCC Guidelines, with voluntary application of the 2019 Refinement and the Wetlands Supplement.** Under MPG paragraph 20, each Party shall use the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Parties are encouraged to use the 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. In addition, per decision 5/CMA.3, paragraph 28, Parties may use the 2019 Refinement to the 2006 IPCC Guidelines on a voluntary basis. Where a Party applies the 2019 Refinement, the generalist, in coordination with the relevant sector experts, should verify that its use is clearly documented in the BTR or NID, that it better represents national circumstances, and that time-series consistency has been maintained. Volume 1 of the 2006 IPCC Guidelines remains the primary reference for generalists on cross-cutting elements including key category analysis, uncertainty, time-series consistency, and QA/QC.

(b) **Shift from "national systems" to "national inventory arrangements", now applicable to all Parties.** Under the ETF, the concept of "national inventory arrangements" replaces "national systems" used under the Convention and the Kyoto Protocol. Under the ETF, national inventory arrangements apply to all Parties, and the reviewable obligation is limited to reporting. MPG paragraph 18 sets a "should" to implement and maintain arrangements, while paragraph 19 sets a "shall" to report on four specific functions: the national entity or focal point, the inventory preparation process, archiving, and official approval processes. The TERT therefore assesses the completeness of reporting on these functions in the NID, not the adequacy of the arrangements themselves. Unlike under the Convention and the Kyoto Protocol, there is no requirement for Parties to report annually on changes to their arrangements.

(c) **New flexibility provisions affecting completeness reporting.** Under the ETF, a new notation key "FX" (flexibility) was introduced by decision 5/CMA.3, which may only be used by developing country Parties applying a flexibility provision in accordance with MPG paragraphs 5–6. Where "FX" is used, the Party shall clearly indicate the specific provision to which flexibility is applied, concisely clarify capacity constraints, and provide a self-determined time frame for improvement. The generalist should verify that each use of "FX" in the CRTs is accompanied by this information in the NID, and coordinate with sector experts to ensure consistent treatment across all sectors. The thresholds for use of "NE" for categories considered insignificant continue to apply as established under the 2006 IPCC Guidelines; the only new element under MPG paragraph 32 is the higher threshold available to those developing country Parties that need flexibility in the light of their capacities, reflecting the ETF's universal applicability to all Parties.

(d) **Updated mandatory metric: AR5 GWP values, supplementary metrics, and a forward-looking update mechanism.** Under MPG paragraph 37, each Party shall use the 100-year time-horizon GWP values from the IPCC Fifth Assessment Report (AR5) to report aggregate emissions and removals of GHGs in CO_2 eq, replacing the AR4 GWP values that applied under the previous Convention reporting framework. This is a "shall" provision with no flexibility available to developing country Parties. In addition, Parties may use other metrics (e.g., global temperature potential) to report supplemental information, in which case the Party shall provide in the NID the values of the metrics used and the IPCC assessment report from which they were sourced. The mandatory metric may also be updated by CMA agreement to GWP values from subsequent IPCC assessment reports.

(e) **Time series requirements applicable to all Parties, with a differentiated flexibility structure for developing country Parties.** Under MPG paragraph 57, each Party shall report a consistent annual time series from 1990. Unlike under the Convention, this requirement now

applies to all Parties. Those developing country Parties that need flexibility with respect to this provision may instead report data covering, at a minimum, the reference year or period for their NDC under Article 4 of the Paris Agreement and a consistent annual time series from at least 2020 onwards. Under paragraph 58, the latest reporting year shall be no more than two years prior to submission; developing country Parties applying flexibility may instead have a latest reporting year three years prior to submission. The generalist is responsible for verifying time series completeness across the inventory submission and should assess these requirements against whether the Party is a developed or developing country and whether flexibility has been applied.

(f) **Identification of capacity-building needs as a formal part of the review for developing country Parties.** Under MPG paragraph 162(d), for those developing country Parties that need flexibility in the light of their capacities, the TERT shall identify capacity-building needs in consultation with the Party and communicate them at the end of the review week. This is a new formal task with no equivalent under the Convention or Kyoto Protocol review frameworks. The GHG inventory generalist has a specific coordination role: while each sector expert identifies CBNs within their own sector, the generalist should ensure that cross-cutting CBNs, such as those relating to national inventory arrangements, QA/QC, uncertainty, or key category analysis, are captured and not duplicated across the sectoral tables. CBNs may relate to flexibilities applied by the Party or to other reporting provisions identified by the Party itself.

2. Specific tasks for review of national inventory arrangements

112. National inventory arrangements include all institutional, legal and procedural arrangements made within a Party for its inventory compilation, reporting and archiving. Under MPGs paragraph 18, each Party should implement and maintain such arrangements, recognizing that they may vary depending on national circumstances and preferences and change over time.

113. MPG paragraph 19 requires each Party to report on four specific functions: its national entity or focal point with overall responsibility for the inventory; its inventory preparation process, including division of responsibilities of institutions participating in inventory preparation; its archiving of all information for the reported time series; and its processes for official consideration and approval of the inventory.

114. Under the ETF, the review of national inventory arrangements is based on what the Party reports in the NID or BTR. The TERT's task is to assess whether the NID addresses each of these functions with sufficient completeness and transparency, not to evaluate the adequacy of the arrangements themselves.

115. During an ICR, the opportunity for direct interaction with Party personnel may allow the generalist to seek additional information on the arrangements described in the NID, including through interviews with personnel involved in inventory planning, preparation and management and through examination of relevant records and documentation. The generalist's findings in this regard should inform the overall assessment of the completeness and transparency of the NID's reporting on the paragraph 19 functions.

3. Specific tasks for review of cross-cutting elements of the inventory

116. As explained in chapter VI, the generalist begins the review of cross-cutting elements by familiarising themselves with the Party's BTR submission and with any preliminary analysis prepared by the secretariat, before completing the checklist in advance of the review week. Before or during the review week, the generalist should review any areas of improvement identified in the TERR of the Party's most recent previous BTR review, noting whether they have been addressed in the current submission. The generalist must clarify with

the Party, through the question and answer procedure, any issues that appear not to have been resolved, and should classify issues accordingly only after the Party has had the opportunity to respond.

117. The next step by the generalist is to identify any potential new areas of improvement by assessing whether the Party's submission is consistent with all "shall" and "should" requirements in the MPGs with respect to cross-cutting inventory elements. Table 7-1 includes possible actions by the generalist in this regard, and also other actions that the generalist may wish to carry out in the review of cross-cutting inventory elements. Many tasks include coordination with sector experts (see chapters VI.D–F).

Table 7-1
Possible actions by the generalist in the review of inventory cross-cutting elements

Cross-cutting element	*Action by the generalist to assess whether "shall" requirements are met*	*Other possible actions by the generalist*
Key categories (see also box 7-2)	Has the Party implemented an approach 1 KCA, with and without LULUCF, for the starting year and latest reporting year, for both level and trend assessment, in accordance with MPG paragraph 25 (approach 1 must be done, even if approach 2 is done)?	(a) Has the Party used tables 4.2 and 4.3 of the 2006 IPCC Guidelines to report the KCA in the NID? (b) If the Party reports a national KCA in addition to the KCA provided in CRT 7, is the aggregation in accordance with the 2006 IPCC Guidelines and its Supplements? (c) Are there significant differences between the Party's national KCA reported in the NID and the KCA in CRT 7? If so, can the differences be explained by different aggregation levels or a different approach (if approach 2 or a hybrid approach is used in the national KCA)? (d) Has the Party used qualitative criteria in its KCA in accordance with the 2006 IPCC Guidelines? (e) Are results of the KCA used to prioritize inventory improvements?
	Has the Party described the key categories, including information on the approach used for their identification and the level of disaggregation used, in accordance with MPG paragraph 41?	
	Has the Party reported the individual and cumulative percentage contributions from key categories, for both level and trend, in accordance with MPG paragraph 42?	

Cross-cutting element	*Action by the generalist to assess whether "shall" requirements are met*	*Other possible actions by the generalist*
Uncertainties	Has the Party quantitatively estimated and qualitatively discussed the uncertainty of emission and removal estimates for all categories, including inventory totals, for at least the starting year and the latest reporting year, and estimated trend uncertainty, using at least approach 1, in accordance with MPG paragraph 29? Note that developing country Parties applying flexibility may instead provide, at a minimum, a qualitative discussion of uncertainty for key categories where quantitative input data are unavailable.	(a) Has the Party used the 2006 IPCC Guidelines, volume 1, table 3.3, for reporting on the uncertainty analysis? (b) Has the Party indicated, in the above-mentioned table, categories which are identified as key? (c) Are any expert judgements used in the uncertainty analysis documented and archived?
	Have the methods in the 2006 IPCC Guidelines for the uncertainty analysis been applied and the methods and assumptions been reported in the NID?	(a) Is the uncertainty analysis technically correct in accordance with the 2006 IPCC Guidelines? (b) Coordinate with sector experts to identify any problems with the methods and data sources used, in relation to the 2006 IPCC Guidelines. (c) Does the uncertainty analysis cover all categories? This can be checked by comparing total emissions and removals in an uncertainty reporting table with the national totals reported in the CRTs. (d) Are results of the uncertainty analysis used to prioritize inventory improvements?
	Coordinate with sector experts to check whether uncertainty of data has been discussed in sectoral parts.	

Cross-cutting element	*Action by the generalist to assess whether "shall" requirements are met*	*Other possible actions by the generalist*
QA/QC and verification	Has the Party elaborated and reported on an inventory QA/QC plan in accordance with MPG paragraphs 34 and 46? Note that developing country Parties applying flexibility are instead encouraged to elaborate a QA/QC plan.	(a) Has the Party performed QA activities, e.g. a basic expert peer review of the inventory? (b) Are QA activities implemented in accordance with the 2006 IPCC Guidelines, in particular, is QA carried out by personnel not involved in inventory preparation? (c) How are the findings of QA/QC procedures taken into account in the inventory compilation cycle (in particular, does the timing of QC activities take into consideration the time needed to implement any changes in the inventory)? (d) How is the QA/QC plan linked to planned improvements, including those arising from review recommendations, results of uncertainty analysis and KCA, and periodic assessment for the need for recalculations (new AD or EFs available, possibility to move to higher tier, etc.)?
	Has the Party implemented general inventory QC procedures in accordance with its QA/QC plan and the 2006 IPCC Guidelines, and reported on the checks implemented in the NID, in accordance with MPG paragraph 35? Note that developing country Parties applying flexibility are instead encouraged to implement and report on general inventory QC procedures.	(a) In an ICR: check evidence of the implementation of QA/QC procedures (e.g. checklists, reports of peer review) and interview the inventory compiler to understand how QA/QC is performed and whether improvements are needed. (b) Coordinate with sector experts to assess whether inventory findings, such as recurring inconsistencies between the NID and CRTs, indicate a problem in the QA/QC process. (c) Are the checks performed in accordance with the QA/QC plan?
	Coordinate with all sector experts: for any use of tier 3 methods or models, has the Party provided verification information consistent with the 2006 IPCC Guidelines?	
Completeness	Coordinate with all sector experts to assess whether the Party provides a rationale in both the CRTs and the NID where "NE" is reported	

Cross-cutting element	*Action by the generalist to assess whether "shall" requirements are met*	*Other possible actions by the generalist*
	Is the total of emissions determined to be insignificant and reported as "NE", below 0.1% of national emissions excluding LULUCF (or 0.2 per cent for developing country Parties applying flexibility under MPG paragraph 32)? Is each individual category reported as insignificant below 0.05 per cent of national total GHG emissions or 500 kt CO_2 eq, whichever is lower?	
	Where the "FX" notation key has been used by a developing country Party, has the Party clearly indicated the specific provision to which flexibility is applied, concisely clarified capacity constraints, and provided a self-determined time frame for improvement, in accordance with MPG paragraph 6?	
	Coordinate with all sector experts: do all categories reported in previous submissions continue to be reported?	
	If the Party chooses to report indirect CO_2 emissions, are national totals presented with and without indirect CO_2?	
Recalculations	Coordinate with all sector experts: Have recalculations been reported in the NID, with explanatory information and justifications?	Does the NID explain the impact of the recalculations on the trend at the category, sector and national level?
	Have recalculations been carried out with a view to improve accuracy and/or completeness?	(a) Do recalculations result in a consistent time series? (b) If a Party has used two different methods in the time series, is it able to justify why use of two methods is preferable to applying one of the splicing techniques from the 2006 IPCC Guidelines?
Implementation of previous areas of improvement	Has the Party provided information on changes in response to the review process regarding sectoral (coordinate with sector experts) and cross-cutting elements?	Assess, taking into account the publication date of the previous TERR and national circumstances, whether the Party has demonstrated sufficient progress in implementing improvements in its submission. If the Party did not provide in the NID information on changes in response to the review process or the progress made under the relevant sectors, the TERT should encourage that the Party include such information in the NID.

Cross-cutting element	*Action by the generalist to assess whether "shall" requirements are met*	*Other possible actions by the generalist*
Response from the Party during the review		Coordinate with sector experts to assess whether the Party has provided the TERT with responses to the questions raised, including the data and information necessary for the assessment of conformity with the MPGs.
Overview of all inventory findings		Coordinate with the entire TERT to assess, on the basis of all the findings of the review, whether the TERT recommends that the next review be conducted as an ICR?[a]

[a] Under MPG paragraph 158(c), a Party shall undergo an ICR for a BTR if recommended in the TERR of the Party's previous BTR.

Box 7-2
Assessment of the reporting of key category analysis

If a Party does not report how it performed the key category analysis for the starting year and the latest reporting year, using approach 1 from the 2006 IPCC Guidelines, for both level and trend assessment, and including and excluding land use, land-use change and forestry, or has not provided information on the level of disaggregation used in accordance with MPG paragraph 41, the TERT should recommend that the Party report this information in the NID.

If a Party has not reported the individual and cumulative percentage contributions from key categories, for both level and trend, in the NID in accordance with MPG paragraph 42, the TERT should recommend that the Party include this information in the NID.

Where a developing country Party has applied flexibility under MPG paragraph 25, using a threshold no lower than 85 per cent in place of the standard 95 per cent threshold, the TERT should verify that the Party has clearly indicated the provision to which flexibility is applied, concisely clarified its capacity constraints, and provided a self-determined time frame for improvement, in accordance with MPG paragraph 6. If this information is absent, the TERT should recommend that the Party include it in the NID or CRTs.

Box 7-3
Indirect CO_2 emissions

When indirect CO_2 emissions are reported by a Party, the TERT should assess the accuracy, consistency, comparability and transparency of the indirect CO_2 emission estimates. When an issue has been identified with the reported estimates in relation to these principles, the TERT should encourage the Party, as necessary, to improve the accuracy, consistency, comparability and transparency of the estimates and the relevant background information provided.

The TERT may cross-check NMVOC estimates originating the indirect CO_2 emission estimates against those reported in the air pollutant inventories submitted under the Convention on Long-range Transboundary Air Pollution (CLRTAP), and it should ask the Party for the reasons for any discrepancies and, where relevant, encourage the Party to correct the estimates.

Where a Party has elected to report indirect CO_2 emissions, the TERT should verify that the Party has reported the national totals with and without indirect CO_2, and if not, recommend the Party to report national totals with and without indirect CO2. The TERT should also ensure that no double counting occurs.

C. Energy

1. Introduction

118. In the 2006 IPCC Guidelines, the energy sector has three main categories: fuel combustion; fugitive emissions from fuels; and CO_2 transport and storage. Under the ETF, the reporting of the energy sector is organized in the CRTs as follows:

(a) Fuel combustion activities (sectoral approach):

(i) Energy industries;

(ii) Manufacturing industries and construction;

(iii) Transport;

(iv) Other sectors;

(v) Other;

(b) Fugitive emissions from fuels:

(i) Solid fuels;

(ii) Oil and natural gas and other emissions from energy production;

(c) CO_2 transport and storage

(i) Transport of CO_2;

(ii) Injection and storage;

(iii) Other.

119. In addition, as a verification activity, the Parties should report CO_2 emissions calculated using the reference approach and compare the results of the sectoral and reference approaches.

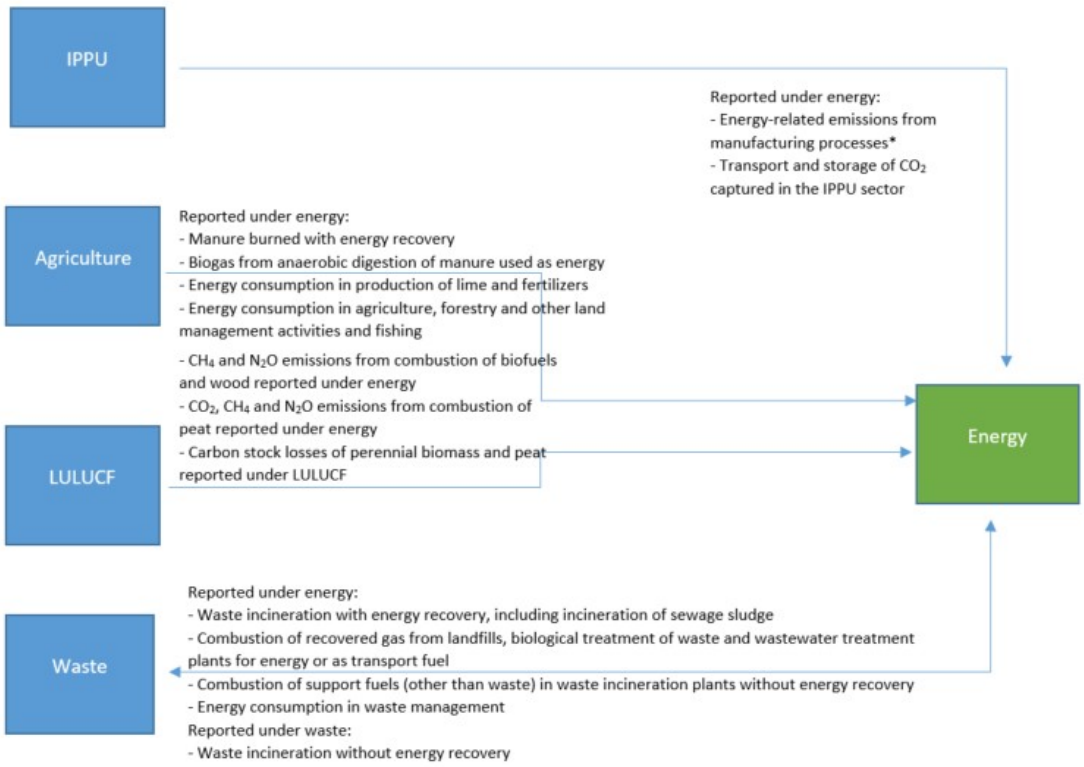
120. Memo items reported in the CRTs for this sector include emissions from international aviation and navigation bunkers, multilateral operations, CO_2 emissions from biomass and amount of CO_2 captured. These memo items are not included in sectoral or national totals.

2. Sector-specific issues

Integration of the energy sector

121. The categories in the energy sector interact with the categories in other sectors (see figure 7-1).

Figure 7-1
Overview of the interaction of the energy sector with other inventory sectors



* Combustion emissions from fuels obtained directly or indirectly from the feedstock for an IPPU process will normally be allocated to the part of the category in which the process occurs. These categories are normally 2.B and 2.C. However, if the derived fuels are transferred for combustion in another source category, the emissions should be reported in the appropriate part of Energy Sector source categories (normally 1.A.1 or 1.A.2).

122. Table 7-2 includes possible TERT actions common for several categories under fuel combustion activities. The energy expert may consider going through the list when reviewing the inventory for the energy sector.

Table 7-2
Possible actions by the technical expert review team in its review of emissions from fuel combustion

Check	*Action by the TERT, task*
Feedstocks and non-energy use	Has the Party provided information in the NID and CRT1.A(d) on how and where feedstocks and non-energy use of fuels have been reported in the inventory? Is it possible to confirm, coordinating with the IPPU expert, that all relevant emissions have been included in the inventory (including natural gas used for hydrogen production) and that no double counting has occurred? Note: Consistent with the 2006 IPCC Guidelines, reporting of all CO_2 emissions related to the non-energy-uses of fuels is required.
Reference and sectoral approach	Has the Party reported CO_2 emissions from the reference approach and compared these emissions with those calculated using the sectoral approach, for verification purposes? Have any differences been adequately explained?

Check	*Action by the TERT, task*
Fuel combustion	Where the Party has reported use of "other fossil fuels" has it explained (in the documentation box for CRT 1.A(a)s4) which fuels are included?
	Has the Party reported, as an information item in CRT 1.A(a)s4, total emissions from waste incineration with energy recovery subdivided into biogenic and fossil emissions? Has the Party explained in the documentation box for CRT 1.A(a)s4 under which fuel types those emissions are included? Check that the information is consistent with the reporting of fuel consumption by category, in particular in the categories energy industries and manufacturing industries and construction
	Has the Party included all fuel combustion activities in its inventory, reporting in the category "other" any activities not covered under other categories, such as military stationary and mobile fuel consumption?
Indirect emissions	Has the Party excluded from its sectoral and national totals any indirect N_2O from this sector?
	If the Party has decided to include indirect CO_2 in the national total, check whether possible double counting occurs, in particular if tier 1 is used. Tier 1 EFs include all carbon in the fuel (oxidation factor = 1), and therefore indirect emissions resulting from carbon monoxide or hydrocarbons emitted during fuel combustion are already included in the EF and should not be double counted through the estimation of indirect CO_2

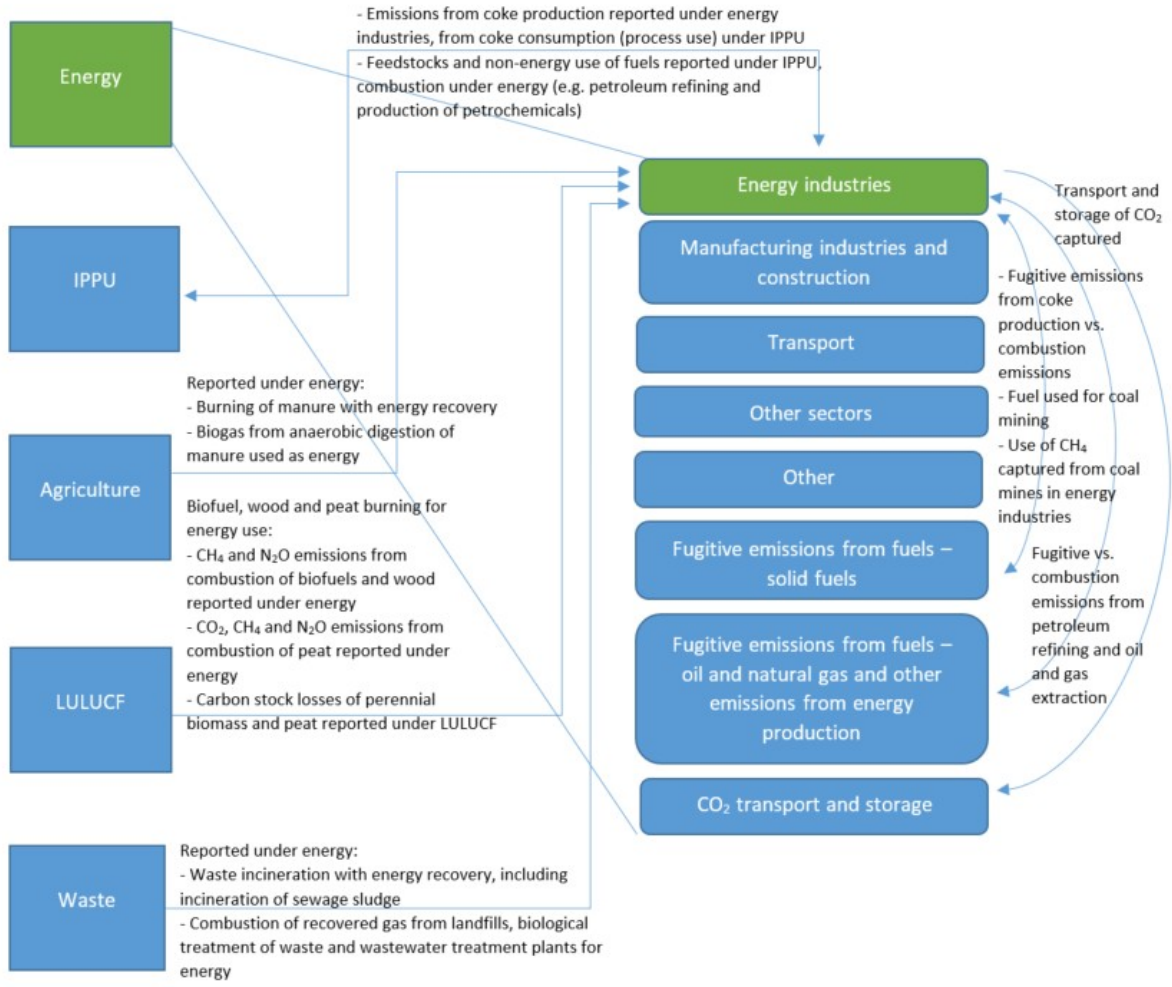
Energy industries

123. Table 7-3 provides a summary of key elements for the energy industries category, and figure 7-2 summarizes linkages between the energy industries category and the other categories in the energy sector and with other sectors.

Table 7-3
Summary of key elements of the energy industries category

Overview	*Category-specific information*	
Category name	Energy industries	
Reported in CRT	1.A(a)s1	
Main subcategories and GHGs to be reported	Public electricity and heat production	CO_2, CH_4, N_2O
	Petroleum refining	CO_2, CH_4, N_2O
	Manufacture of solid fuels and other energy industries	CO_2, CH_4, N_2O

Figure 7-2
Main linkages between the energy industries category and the other categories in the energy sector and other sectors



124. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the energy expert may consider going through the list of potential TERT actions in table 7-4 when reviewing emissions from the energy industries category.

Table 7-4
Possible actions by the technical expert review team in its review of emissions from the energy industries category

Subcategory	*Action by the TERT, task*
All	If country-specific EFs are used, how are they derived? Are they based on measurements at full boiler load or are start-up or partial load conditions appropriately taken into account?
	How are the EFs for waste and other unconventional fuels (such as refinery gas, fuel oils and residues in refineries) derived?

Subcategory	*Action by the TERT, task*
	If unconventional fuels are used, what factors, if any, has the Party used to convert the fuel amount to energy units?
	Are AD based on fuel combusted rather than fuel delivered, allowing for distinction between energy and non-energy use of fuels and appropriately taking into account changes in stocks?
	How does the Party consider the fuel stock held by enterprises in its inventory?
	Where both combustion and process emissions occur, has the Party correctly allocated the emissions between the energy and IPPU sectors following the guidance in the 2006 IPCC Guidelines (in particular box 1.1. of volume 3)? Has the Party transparently explained how it is ensured that no double counting or omission occurs?
	If the Party reports amount of CO_2 captured, is the estimate based on plant-specific data?
	If the Party reports amount of CO_2 captured, is the estimate consistent with the reporting under CO_2 transport and storage?
	If CO_2 is reported to be captured in processes involving both combustion and process emissions reported under the energy sector and the IPPU sector, respectively, how has the Party ensured that the amount captured is not double counted?
Petroleum refining	Is the reporting of emissions from petroleum refining consistently reflected under fuel combustion activities (1.A.1.b Petroleum refining) and fugitive emissions (e.g. 1.B.2.a.4 Refining and storage)?
	Has the Party appropriately distinguished emissions from petroleum refining and production of petrochemicals if conducted in the same facility, in particular ensuring that no double counting or omission occurs? Are there mass and carbon balances available to check that?
Manufacture of solid fuels and other energy industries	Has the Party reported under manufacture of solid fuels all emissions arising from fuel combustion for the production of coke, brown coal briquettes and patent fuel? Has the Party made a carbon balance in particular for coke production?
	Has the Party distinguished fugitive emissions from coke production from combustion emissions and reported fugitive emissions under the category solid fuel transformation? Note that the 2006 IPCC Guidelines does not provide a method to estimate fugitive emissions from coke production.
	Is the reporting of emissions from oil and gas extraction consistently reflected under fuel combustion activities (1.A.1.c.ii Oil and gas extraction) and fugitive emissions (e.g. 1.B.2.a Oil and 1.B.2.b Natural gas)?
	Has the Party reported under other energy industries all combustion emissions from own-energy use for the production of charcoal, bagasse, saw dust, cotton stalks and carbonizing of biofuels as well as fuel used for coal mining, and from pre-combustion processing for CO_2 capture and storage? Other energy industries may also include, if not reported elsewhere, fuel combustion in gas liquefaction plants, oil shale extraction and shale oil treatment, nuclear fuel reprocessing and manufacture of liquid and gaseous fuels from “in situ” primary fuels

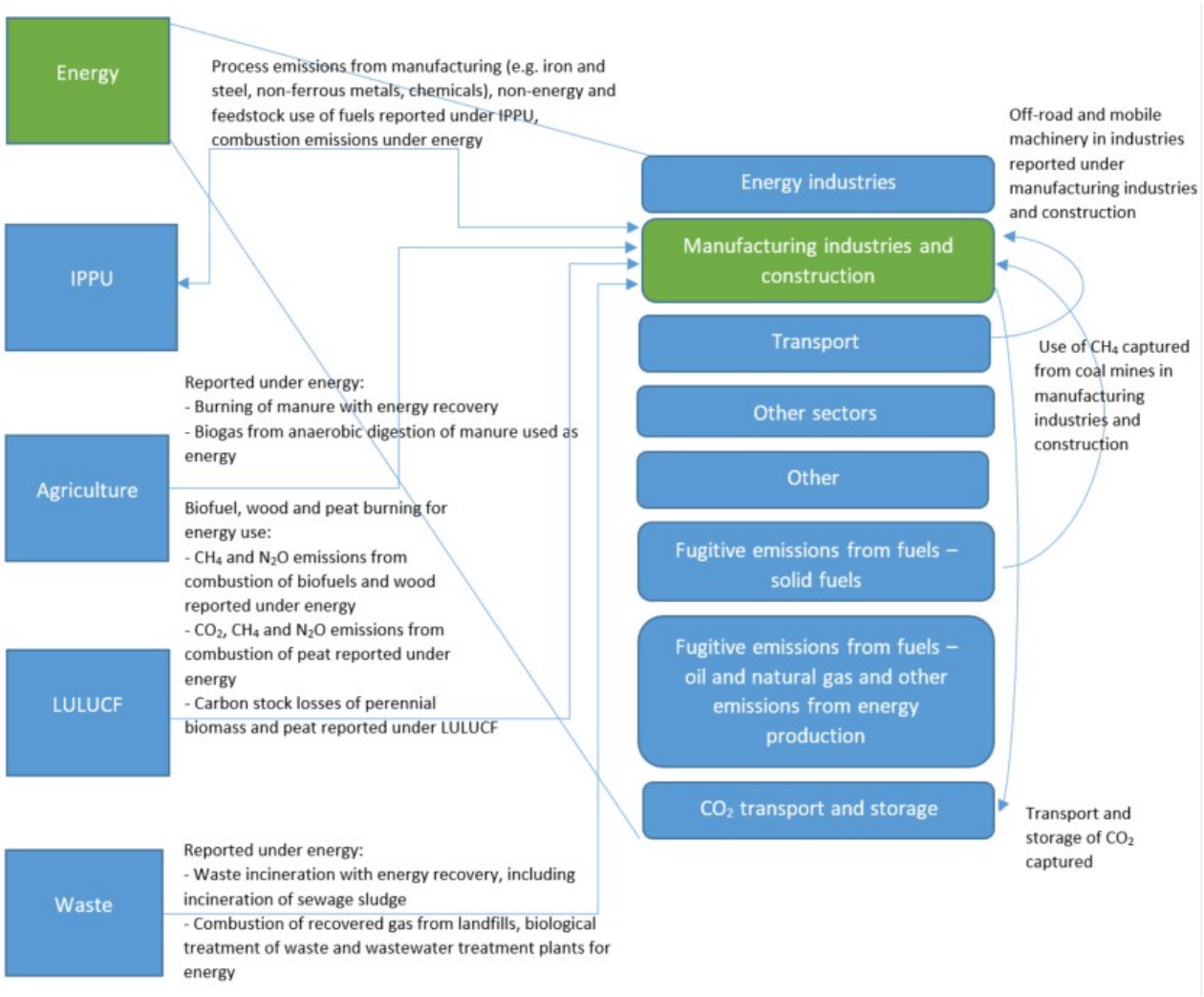
Manufacturing industries and construction

125. Table 7-5 provides a summary of key elements for the manufacturing industries and construction category, and figure 7-3 summarizes linkages between the manufacturing industries and construction category and the other categories in the energy sector and with other sectors.

Table 7-5
Summary of key elements of the manufacturing industries and construction category

Overview	*Category-specific information*	
Category name	Manufacturing industries and construction	
Reported in CRT	1.A(a)s2	
Main subcategories and GHGs to be reported	Iron and steel	CO_2, CH_4, N_2O
	Non-ferrous metals	CO_2, CH_4, N_2O
	Chemicals	CO_2, CH_4, N_2O
	Pulp, paper and print	CO_2, CH_4, N_2O
	Food processing, beverages and tobacco	CO_2, CH_4, N_2O
	Non-metallic minerals	CO_2, CH_4, N_2O
	Other	CO_2, CH_4, N_2O

Figure 7-3
Main linkages between the manufacturing industries and construction category and the other categories in the energy sector and other sectors



126. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the energy expert may consider going through the list of potential TERT actions in table 7-6 when reviewing emissions from the manufacturing industries and construction category.

Table 7-6
Possible actions by the technical expert review team in its review of emissions from the manufacturing industries and construction category

Subcategory	*Action by the TERT, task*
All	If country-specific EFs are used, how are they derived? Are they based on measurements at full boiler load or are start-up or partial load conditions appropriately taken into account?
	How are the EFs for waste and other unconventional fuels (such as refinery gas, fuel oils and residues in refineries) derived?

Subcategory	*Action by the TERT, task*
	If unconventional fuels are used, what factors has the Party used, if any, to convert the fuel amount to energy units?
	Are AD based on fuel combusted rather than fuel delivered, allowing for distinction between energy and non-energy use of fuels and appropriately taking into account changes in stocks?
	How does the Party consider the fuel stock held by enterprises in its inventory?
	Where both combustion and process emissions occur, has the Party correctly allocated the emissions between the energy sector and the IPPU sector following the guidance in the 2006 IPCC Guidelines (in particular box 1.1. in volume 3)? Has the Party transparently explained how it is ensured that no double counting or omission occurs?
	How has the Party ensured that double counting with non-energy use of fuels does not occur?
	If the Party reports amount of CO_2 captured, is the estimate based on plant-specific data?
	If the Party reports amount of CO_2 captured, is the estimate consistent with the reporting under CO_2 transport and storage?
	If CO_2 is reported to be captured in processes involving both combustion and process emissions reported under the energy sector and the IPPU sector, respectively, how is it ensured that the amount captured is not double counted?
	Are emissions arising from off-road and other mobile machinery in industries included?
Iron and steel (See also Box 7-4)	Is fuel combustion in coke ovens excluded from this category and reported under manufacture of solid fuels and other energy industries?
	Is the reporting on fuel consumption for iron and steel (1.A.2.a) consistent with the reporting of iron and steel production under IPPU (2.C.1) ensuring that no double counting or omission occurs?
	In case of integrated iron and steel plants with on-site coke production, has the Party appropriately distinguished between the emissions in the energy sector and the IPPU sector? In particular, the reviewer should ensure that no double counting or omission occurs. Carbon consumed in the form of coke oven gas at an iron and steelmaking facility and the resulting CO_2 and CH_4 emissions should be reported under IPPU, unless the coke oven gas is sold off site, in which case, emissions are reported under the energy sector. Carbon consumed in the form of blast furnace gas at an on-site coke production facility and the resulting CO_2 and CH_4 emissions should be reported under energy
	Are gases from basic oxygen steel furnaces recovered and included with blast furnace gas? If not, how are the emissions from this source reported?
Chemicals	If steam cracking of petrochemical feedstock occurs, what procedure has been employed to identify the quantities of by-products used as fuel?

Box 7-4
Iron and Steel

In case of the review of the allocation of GHG emissions from iron and steel between the energy and IPPU sectors, The TERT should pay attention to:

- Are the total reported bottom-up calculated estimates of CO_2 emissions from non-energy use of fuels including uses as feedstock and reductant at different subcategory levels complete, consistent and transparent?
- Are the feedstock or reductant requirements of processes in balance with the non-energy use or feedstock supply recorded in the national energy statistics?

In particular, the TERT should request the Party to provide information for the purpose of verifying the estimated emissions from iron and steel industry and demonstrating that no double counting or omission has occurred, if this information was not provided in the NID.

The TERT should encourage the Party to provide accurate information (e.g. a carbon balance) in the NID to

increase the transparency of its reporting. If the TERT identifies an issue of accuracy, in particular an underestimation of emissions, the TERT should recommend that the Party provide more transparent information to demonstrate that there has been no double counting or omission of emissions from iron and steel industry.

When the Party is using a different allocation of emissions from that recommended in the 2006 IPCC Guidelines and is reporting the emissions as "IE" under the energy or IPPU sectors, the TERT should check whether the Party has transparently reported where the emissions have been included and ensured the accuracy of the estimates. If this is not the case, the TERT should follow up with a relevant recommendation.

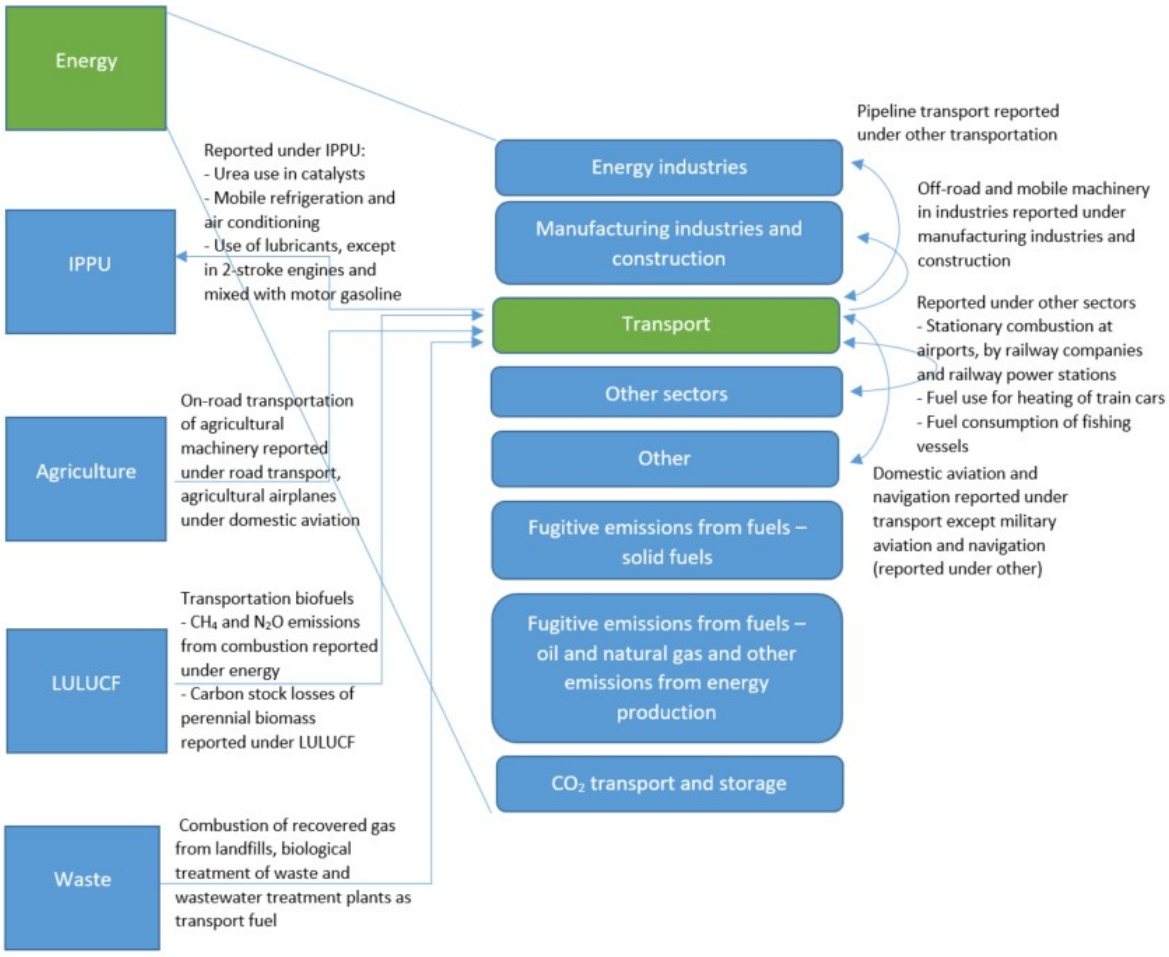
Transport

127. Table 7-7 provides a summary of key elements for the transport category, and figure 7-4 summarizes linkages between the transport category and the other categories in the energy sector and with other sectors.

Table 7-7
Summary of key elements of the transport category

Overview	*Category-specific information*	
Category name	Transport	
Reported in CRT	1.A(a)s3	
Main subcategories and GHGs to be reported	Domestic aviation	CO_2, CH_4, N_2O
	Road transportation	CO_2, CH_4, N_2O
	Railways	CO_2, CH_4, N_2O
	Domestic navigation	CO_2, CH_4, N_2O
	Other transportation	CO_2, CH_4, N_2O

Figure 7-4
Main linkages between the transport category and the other categories in the energy sector and other sectors



128. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the energy expert may consider going through the list of potential TERT actions in table 7-8 when reviewing emissions from the transport category.

Table 7-8
Possible actions by the technical expert review team in its review of emissions from the transport category

Subcategory	*Action by the TERT, task*
Domestic aviation	Is the Party able to separate domestic and international aviation in line with the 2006 IPCC Guidelines? Has the Party reported emissions from international aviation based on fuel sold to aircraft engaged in international transport and excluded this amount from domestic aviation?
	Has the Party excluded emissions from military aviation (should be reported under Other – mobile)?
	Has the Party excluded emissions from stationary combustion at airports (should be included under commercial/institutional) and fuel consumption for ground transport (should be included under other transportation)?
	Has the Party included non-scheduled flights and general aviation such as agricultural

Subcategory	*Action by the TERT, task*
	aeroplanes, private jets or helicopters? These should be included if the quantity of fuel consumed is significant
	Have flights to all parts of the national territory been classified as “domestic” according to the IPCC definition?
	Has the Party excluded the use of aviation fuels in applications other than aviation, such as engine and airframe testing?
Road transportation	Has the Party excluded CO_2 emissions from urea used as catalyst (should be reported under 2.D.3 Non-energy products from fuels and solvent use – other)?
	Does the AD used include on-road only and exclude off-road vehicles or machinery?
	If data on fuel sold is used, has the Party ensured that fuel sold for transportation uses is not used for other purposes? (For example, in some countries oil for residential heating is subsidized to lower its price and may be consumed as a transport fuel)
	If a Party has used EFs from the COPERT model to estimate CO_2 emissions from road transport has the Party transparently documented how the EFs applied are appropriate to the national circumstances of that Party, particularly when the category is key? Note* The carbon content of fuels sold in the country should be used to estimate the CO_2 emissions from road transportation in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
	Does the Party use in its calculations the carbon content of the fuels sold in the country to estimate CO_2 emissions?
	Has the Party carried out QA/QC activities by comparing CO_2 estimates using bottom-up (vehicle kilometre travelled) and top-down (fuel statistics) data? What are the conclusions of such a comparison?
	Are all fuels included, including liquefied petroleum gas, compressed natural gas and biofuels?
	If the Party reports use of biofuels, has it assessed the biofuel origin so as to identify and separate fossil from biogenic feedstocks? Biodiesel made from coal methanol with animal feedstocks is an example of biofuel with a fossil component
	Where cross-border transfers take place in vehicle tanks, do the emissions include all fuel loaded into the vehicles in the Party?
	If recovered gases from the waste sector (landfills, biological treatment or wastewater treatment plants) have been used as transport fuel, are emissions reported in the energy sector and is double counting with the waste sector emissions avoided?
	If wastes (such as waste cooking oil) are used to produce biofuels, is double counting with the waste sector avoided?
	How is the use of lubricants as an additive in 2-stroke engines reported? It should be included in the road transport fuel use, but may also be reported separately as a lubricant
Railways	Has the Party excluded emissions from stationary fuel consumption by railway companies and by railway power stations (should be reported under commercial/institutional)?
	If natural gas or coal is used for heating cars, are these emissions included under stationary combustion, in particular, is it ensured that no double counting or omission occurs?
	Are lubricants used in diesel locomotives included under IPPU?
Domestic navigation	Is the Party able to separate domestic and international navigation in line with the 2006 IPCC Guidelines? Has the Party reported emissions from international navigation based on fuel sold to ships engaged in international transport and excluded this amount from domestic navigation?

Subcategory	*Action by the TERT, task*
	Have journeys to all parts of the national territory been classified as “domestic” according to the IPCC definition?
	How does the Party ensure that no double counting or omission occurs, for example, regarding fuel consumption in passenger vessels, ferries, recreational watercraft, other inland watercraft and other gasoline-fuelled watercraft?
	Has the Party excluded emissions from military navigation (should be reported under Other – mobile)?
	Has the Party excluded emissions from fishing vessels and included them in category 1.A.4.c.iii Fishing?
Other transportation	Has the Party reported in this category all combustion emissions from all transport activities not included in other categories (including under transport, agriculture/forestry/fishing, manufacturing industries and construction or other – mobile (for military))?
	Has the Party included in fuel combustion data the lubricants that are mixed with motor gasoline and combusted, and reported other use of lubricants under IPPU?

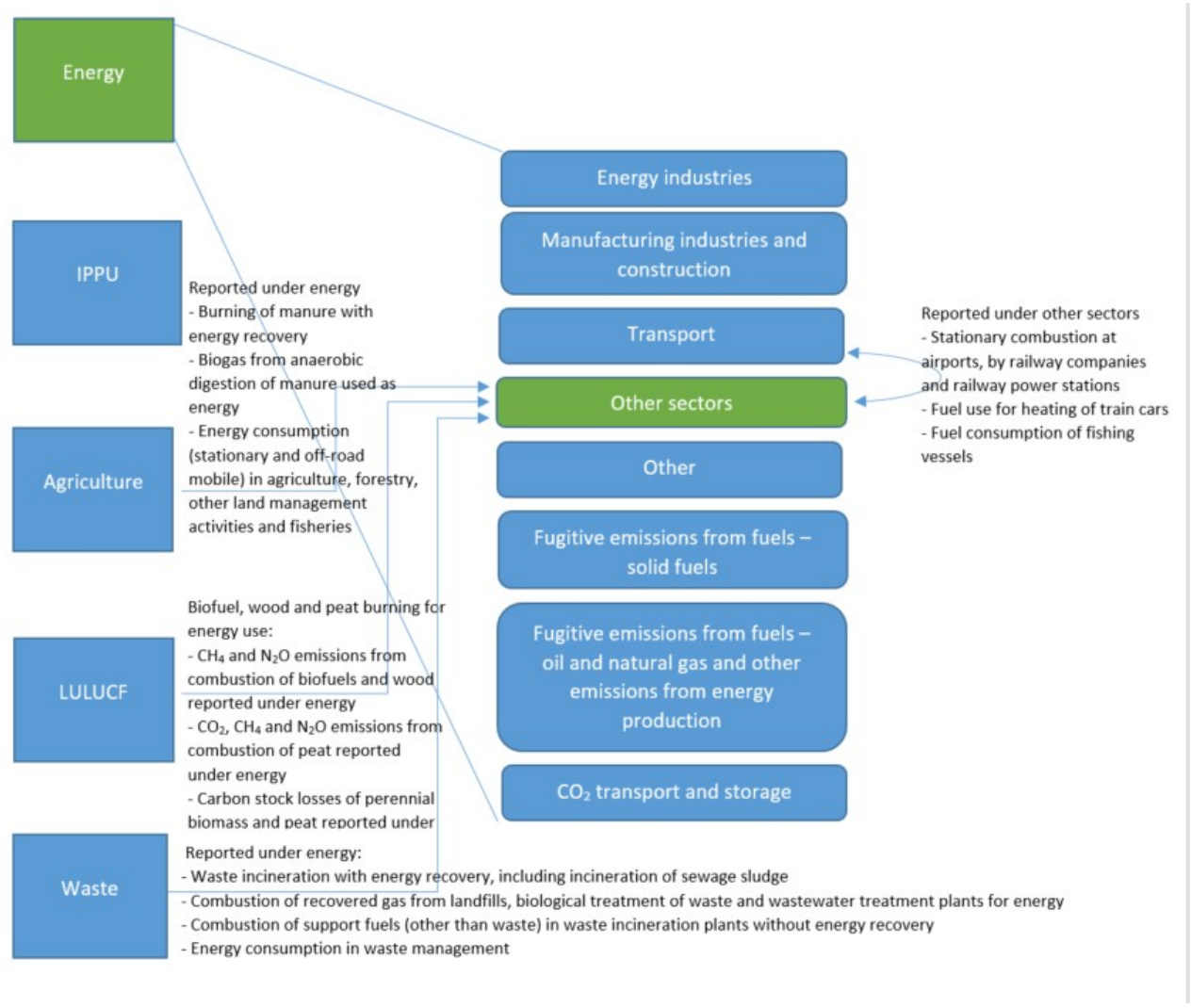
Other sectors

129. Table 7-9 provides a summary of key elements for the other sectors category, and figure 7-5 summarizes linkages between the other sectors category and the other categories in the energy sector and with other sectors.

Table 7-9
Summary of key elements of the other sectors category

Overview	*Category-specific information*	
Category name	Other sectors	
Reported in CRT	1.A(a)s4	
Main subcategories and GHGs to be reported	Commercial/institutional	CO_2, CH_4, N_2O
	Residential	CO_2, CH_4, N_2O
	Agriculture/forestry/fishing	CO_2, CH_4, N_2O

Figure 7-5
Main linkages between the 'other sectors' category and the other categories in the energy sector and other sectors



130. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the energy expert may consider going through the list of potential TERT actions in table 7-10 when reviewing emissions from the other sectors category.

Table 7-10
Possible actions by the technical expert review team in its review of emissions from the other sectors category

Subcategory	*Action by the TERT, task*
All	If country-specific EFs are used, how are they derived? Are they based on measurements at full boiler load or are start-up or partial load conditions appropriately taken into account?
	Are AD based on fuel combusted rather than fuel delivered, allowing for distinction between energy and non-energy use of fuels and appropriately taking into account changes in stocks?
	How does the Party consider the fuel stock held by enterprises in its inventory?
Commercial/	Are emissions from stationary combustion at airports, ports, by railway companies and by

Subcategory	*Action by the TERT, task*
institutional	railway power stations included in this category?
	Are emissions from combustion of support fuels (other than waste) in waste incineration plants without energy recovery reported in this category?
Agriculture/ forestry/fishing	Are emissions from pumping fuel use, grain drying and horticultural greenhouses included?
	Are emissions from fuels combusted in traction vehicles on farmland and in forests included in this category? The use of agricultural vehicles on paved roads should be excluded and reported under road transportation
	Has the Party included coastal and deep-sea fishing in this category? Fishing should cover vessels of all flags that have refuelled in the country (including international fishing)
	How is it ensured that there is no double counting between this category and "other transportation"?

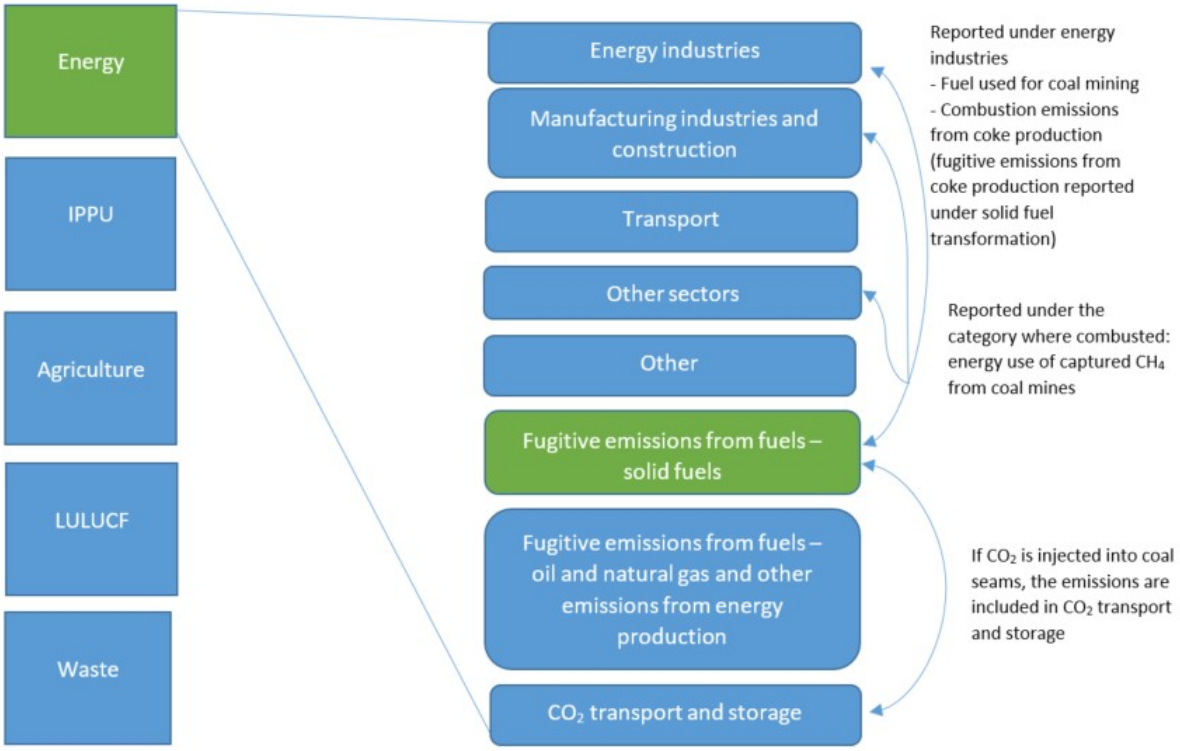
Fugitive emissions from fuels – solid fuels

131. Table 7-11 provides a summary of key elements for the solid fuels category, and figure 7-6 summarizes linkages between the solid fuels category and the other categories in the energy sector and other sectors.

Table 7-11
Summary of key elements of the solid fuels category

Overview	*Category-specific information*	
Category name	Solid fuels	
Reported in CRT	Table 1.B.1	
Main subcategories and GHGs to be reported	Coal mining and handling	CH_4
	Solid fuel transformation	CH_4
	Other	–

Figure 7-6
Main linkages between the solid fuels category and the other categories in the energy sector and other sectors



132. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the energy expert may consider going through the list of potential TERT actions in table 7-12 when reviewing emissions from the solid fuels category.

Table 7-12
Possible actions by the technical expert review team in its review of emissions from the solid fuels category

Subcategory	*Action by the TERT, task*
Coal mining and handling	If the Party reports recovery/flaring of CH_4, has the Party explained whether CH_4 is flared? Are the associated emissions from flaring reported? This includes also CH_4 drained, or ventilation gas converted to CO_2 by an oxidation process
	If the Party reports recovery of CH_4 for energy production, are the related combustion emissions included in the energy industries category?
	Has the Party explained in the documentation box of CRT 1.B.1 whether the fuel amount is based on the run-of-mine production or on the saleable production? Where AD are in the form of saleable coal, has the Party made an estimate taking into consideration the fraction lost through washing?
	Is the amount of fuel produced reported in CRT 1.B.1 in accordance with the production reported in the reference approach CRT 1.A(b)?
	If the Party reports emissions from mining activities, check whether post-mining activities and abandoned underground mines have been included. It could be expected that if coal mining is occurring in the Party, post-mining activities also occur, and if underground mining occurs, that abandoned underground mines are present
Coal mining and	Do the mining emissions include all seam gas emissions vented to the atmosphere from coal

Subcategory	*Action by the TERT, task*
handling – Underground mines	mine ventilation air and degasification systems?
	Do the post-mining emissions include CH_4 and CO_2 emitted after coal has been mined, brought to the surface and subsequently processed, stored and transported?
	If tier 3 methods are used, is CH_4 recovered from degasification systems that is subsequently vented to the atmosphere, added to the total emissions released from the ventilation systems?
Coal mining and handling – Abandoned underground mines	The reporting in the CRTs does not include the AD used for abandoned underground mines. Check from the NID the units of AD and EFs used by the Party and assess whether the emission estimates are correctly reflected in the CRTs
Coal mining and handling – Surface mines	Do the mining emissions include CH_4 and CO_2 emitted during mining from breakage of coal and associated strata and leakage from the pit floor and highwall?
	Do the post-mining emissions include all CH_4 and CO_2 emitted after coal has been mined, subsequently processed, stored and transported?
Solid fuel transformation	How has the Party ensured that there is no double counting between this category and other inventory categories, for example, in relation to coke production?

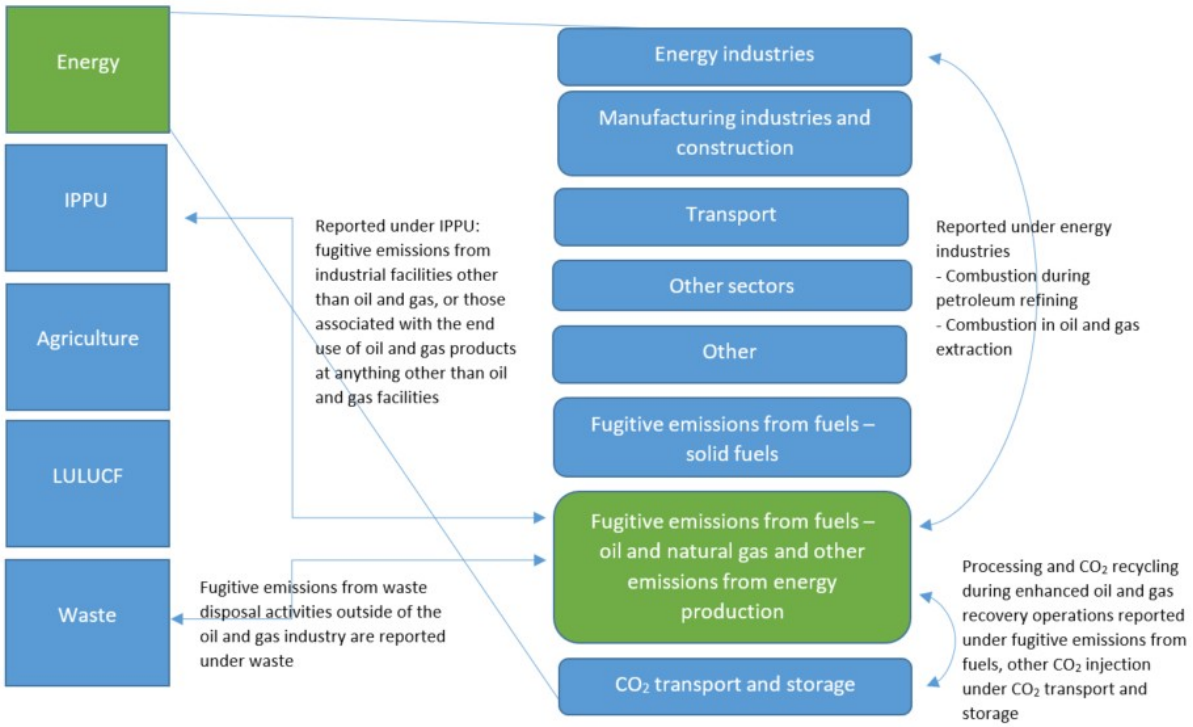
Fugitive emissions from fuels – oil and natural gas and other emissions from energy production

133. Table 7-13 provides a summary of key elements for the category oil and natural gas and other emissions from energy production, and figure 7-7 summarizes linkages between the oil and natural gas and other emissions from energy production category and the other categories in the energy sector and other sectors.

Table 7-13
Summary of key elements of the oil and natural gas and other emissions from energy production category

Overview	*Category-specific information*	
Category name	Oil and natural gas and other emissions from energy production	
Reported in CRT	Table 1.B.2	
Main subcategories and GHGs to be reported	Oil	CO_2, CH_4, N_2O
	Natural gas	CO_2, CH_4
	Venting and flaring	CO_2, CH_4, N_2O
	Other	-

Figure 7-7
Main linkages between the oil and natural gas and other emissions from energy production category and the other categories in the energy sector and other sectors



134. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the energy expert may consider going through the list of potential TERT actions in table 7-14 when reviewing emissions from the oil and natural gas and other emissions from energy production category.

Table 7-14
Possible actions by the technical expert review team in its review of emissions from the oil and natural gas and other emissions from energy production category

Subcategory	*Action by the TERT, task*
All	Regarding data on the amount of fuel produced, has the Party explained whether the fuel amount is based on the raw material production or on the saleable production?
	Has the Party reported fugitive emissions during above-ground operations such as processing and CO_2 recycling during enhanced oil and gas recovery operations under this category instead of under CO_2 transport and storage?
Oil	Is the reported amount of oil production reported in CRT 1.B.2 in accordance with the reported production data in the reference approach CRT 1.A(b)?
	If combined oil and natural gas production occurs in the Party, has the Party reported the associated emissions (including from gas fields) under 1.B.2.a Oil?
	Are the AD for oil transport consistent with the AD for oil production? If not, is the reason for the difference described in the NID?
Natural gas	Is the amount of natural gas production reported in CRT 1.B.2 in accordance with the reported

Subcategory	*Action by the TERT, task*
	production data in the reference approach CRT 1.A(b)?
	Are the AD for natural gas processing consistent with the AD for natural gas production? If not, is the reason for the difference described in the NID?
	Are the AD for natural gas transmission and storage and from natural gas distribution reasonably in line with the reported amount of natural gas included under fuel combustion activities and used as feedstock?
	Compare the reported natural gas data with the values in the 2006 IPCC Guidelines, volume 2, table 4.2.8. Are CH_4 losses higher or lower than the benchmarks explained?
Natural gas; venting and flaring	Are the EFs expressed using the same units of measure and reference conditions as the AD, or if not, have appropriate conversion factors been applied?
Flaring	Do the flaring emissions reported here include only flaring emissions associated with oil/gas extraction and refining?
Other	Has the Party reported under fuel combustion activities the use of biogas? If so, has the Party reported fugitive emissions from biogas transmission/distribution? Once biogas enters the transmission/distribution network it is indistinguishable from natural gas and emissions should be calculated accordingly

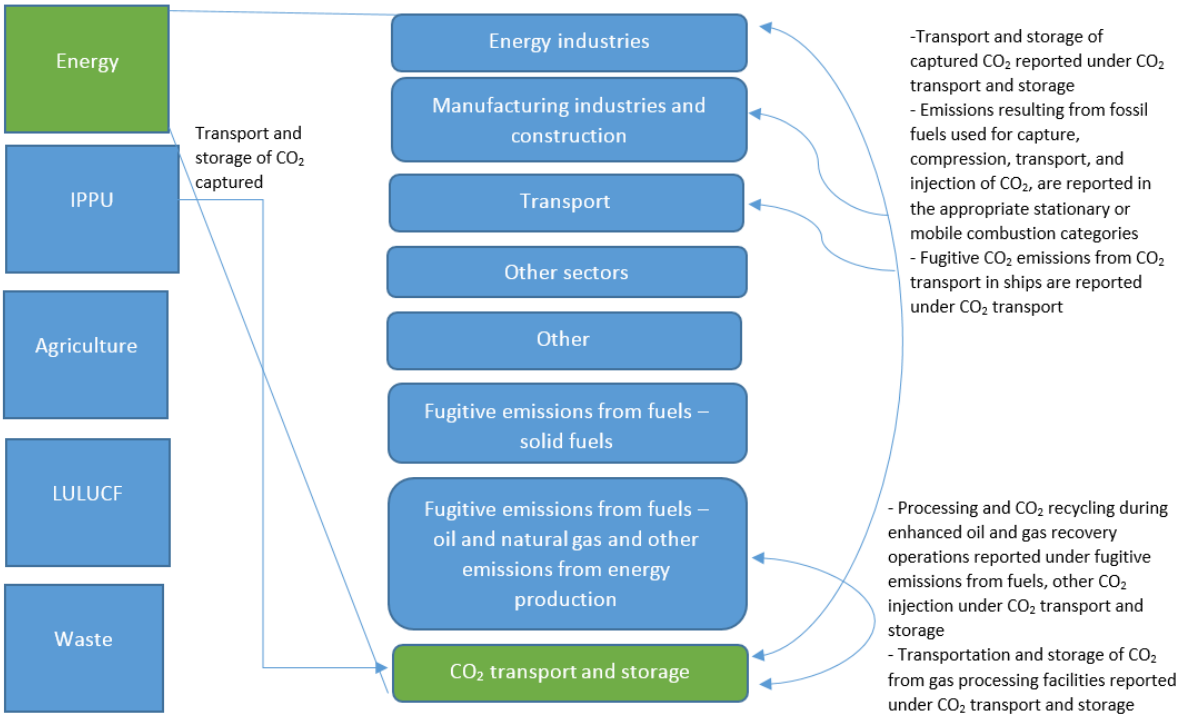
CO2 transport and storage

135. Table 7-15 provides a summary of key elements for the CO_2 transport and storage category, and figure 7-8 summarizes linkages between the CO_2 transport and storage category and the other categories in the energy sector and other sectors.

Table 7-15
Summary of key elements of the CO_2 transport and storage category

Overview	*Category-specific information*	
Category name	CO_2 transport and storage	
Reported in CRT	Table 1.C	
Main subcategories and GHGs to be reported	Transport of CO_2	CO_2
	Injection and storage	CO_2
	Other	-

Figure 7-8
Main linkages between the CO_2 transport and storage category and the other categories in the energy sector and other sectors



136. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the energy expert may consider going through the list of potential TERT actions in table 7-16 when reviewing emissions from the CO_2 transport and storage category.

Table 7-16
Possible actions by the technical expert review team in its review of emissions from the CO_2 transport and storage category

Subcategory	*Action by the TERT, task*
All	Has the Party considered the transport and, if applicable, injection/storage of CO_2 not captured in the country, but imported?
	Has the Party excluded from the AD the recycled CO_2 for enhanced recovery in oil and gas fields?
	Do the emissions from CO_2 transport and storage include both fossil and biogenic CO_2? Note that biogenic CO_2 shall be included once reported as CO_2 captured
	Is the mass of CO_2 captured for storage plus CO_2 imported for storage ("Total A" in CRT 1.C) equal to the amount of exports for storage plus CO_2 injected at storage sites plus total leakage from transport, injection and storage ("Total B" in CRT 1.C)? If not, check the potential over- or underestimates for exports, imports and potential exclusion of enhanced oil recovery operations associated with storage following the guidance in the 2006 IPCC Guidelines, volume 2, section 5.9
Storage	In cases where CO_2 is captured in another country, have the countries communicated to ensure that there is no double counting of storage?
	Does a national regulatory framework exist for monitoring CO_2 emissions from geologic storage

Subcategory	*Action by the TERT, task*
	systems? If yes, has the Party described how emissions have been estimated and reported based on this system and how the approach is consistent with IPCC good practice?

D. Industrial processes and product use

1. Introduction

137. The 2006 IPCC Guidelines combine the industrial processes sector and solvent and other product use sector into the IPPU sector. The IPPU sector is the only inventory sector under which emissions from hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3) are reported. The IPPU sector includes the following categories:

(a) Mineral industry;

(b) Chemical industry;

(c) Metal industry;

(d) Non-energy products from fuels and solvent use;

(e) Electronics industry;

(f) Product uses as substitutes for ODS;[36]

(g) Other product manufacture and use;

(h) Other.

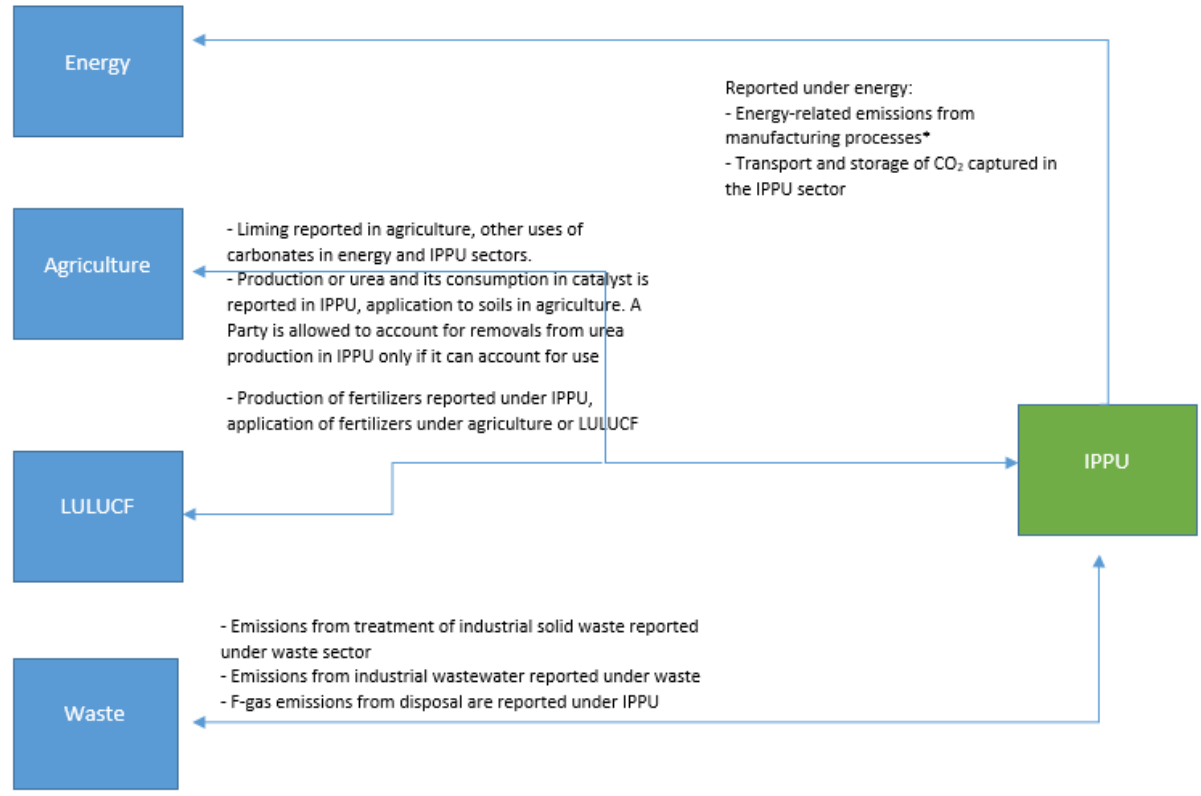
2. Sector-specific issues

Integration of the industrial processes and product use sector

138. The categories in the IPPU sector interact with the categories in other sectors (see figure 7-9).

[36] Ozone-depleting substances.

Figure 7-9
Overview of the interaction of the industrial processes and product use sector with other inventory sectors



* Combustion emissions from fuels obtained directly or indirectly from the feedstock for an IPPU process will normally be allocated to the part of the category in which the process occurs. These categories are normally 2.B and 2.C. However, if the derived fuels are transferred for combustion in another source category, the emissions should be reported in the appropriate part of Energy Sector source categories (normally 1.A.1 or 1.A.2).

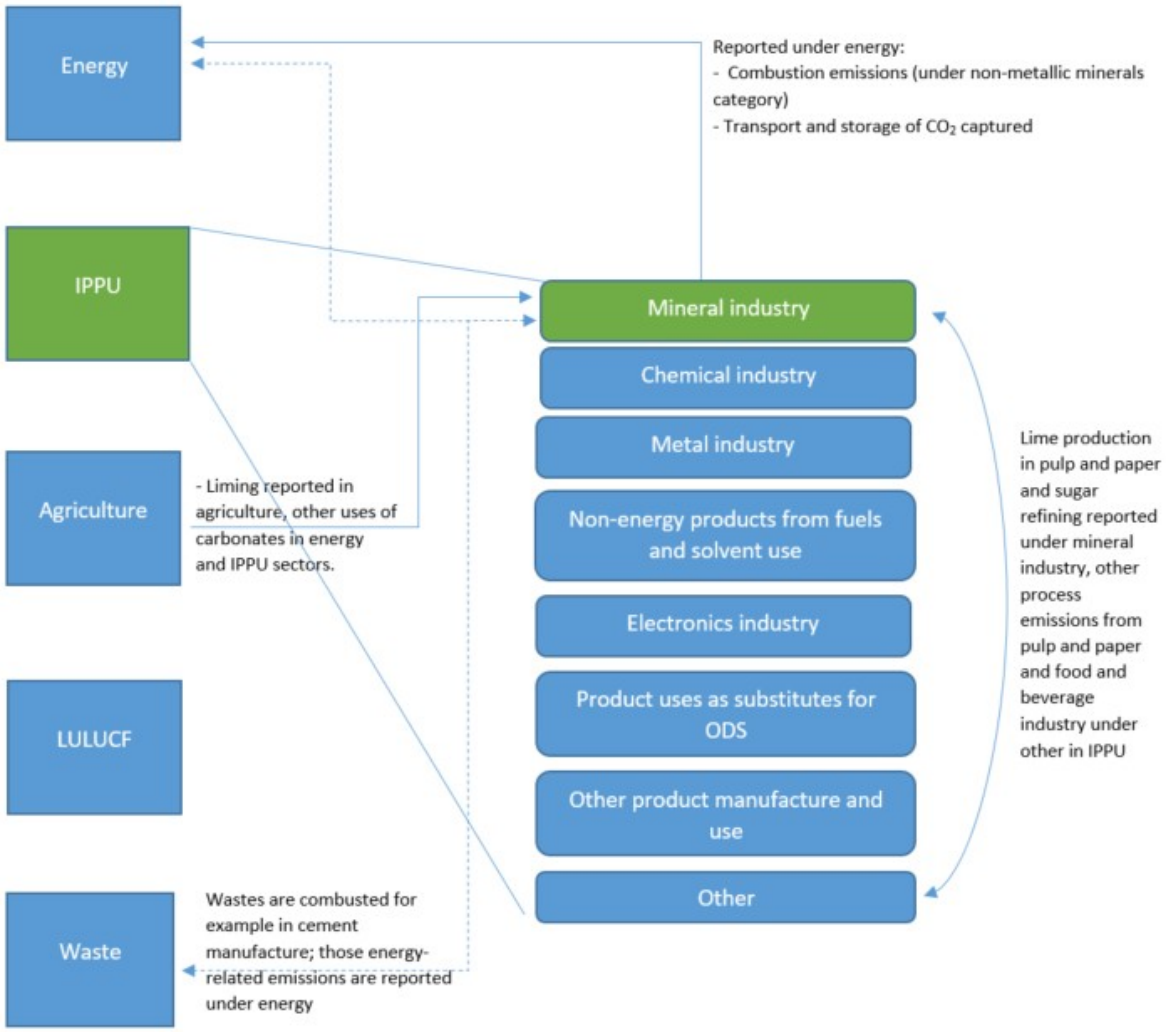
Mineral industry

139. Table 7-17 provides a summary of key elements for the mineral industry category, and figure 7-10 summarizes linkages between the mineral industry category and the other categories in the IPPU sector and with other sectors.

Table 7-17
Summary of key elements of the mineral industry category

Overview	*Category-specific information*	
Category name	Mineral industry	
Reported in CRT	Table 2(I).A-Hs1	
Main subcategories and GHGs to be reported	Cement production	CO_2
	Lime production	CO_2
	Glass production	CO_2
	Other process uses of carbonates	CO_2

Figure 7-10
Main linkages between the mineral industry category and the other categories in the industrial processes and product use sector and other sectors



140. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the IPPU expert may consider going through the list of potential TERT actions in table 7-18 when reviewing CO_2 emissions from the mineral industry category.

Table 7-18
Possible actions by the TERT in its review of CO_2 emissions from the mineral industry category

Subcategory	*Action by the TERT, task*
All	Carefully check any deviations from IPCC defaults, because the emissions are due to chemical processes and large deviations should not occur
	Has the Party correctly reported only process emissions under IPPU and included the relevant energy-related emissions in the energy sector (under non-metallic minerals)? This is particularly relevant if company-provided data are used
	If the Party reports amount of CO_2 captured, is the estimate based on plant-specific data?

Subcategory	*Action by the TERT, task*
	If the Party reports amount of CO_2 captured, is the estimate consistent with the reporting under CO_2 transport and storage? If not, has the Party explained the reasons for any differences (e.g., there is commercial use of the CO_2?)
	If CO_2 is reported to be captured in processes involving both combustion and process emissions reported under the energy sector and the IPPU sector, respectively, has the Party ensured that the amount captured is not double counted?
	Are final emissions reported in CRT 2(I).A-H after subtracting the amounts of emissions recovered, oxidized, destroyed or transformed?
Cement production	If the Party is using tier 1, are all imports and exports or clinker taken into consideration?
	Has the Party excluded any re-absorption of atmospheric CO_2 due to free lime released during the curing of concrete? Inclusion of such absorption is not in accordance with good practice
	Has the Party appropriately corrected for emission from cement kiln dust (CKD) production (added emissions from CKD if applying a tier 2 method and subtracting CKD if applying a tier 3 method)?
Lime production	Does the AD cover both marketed and non-marketed lime? Possible industries producing non-marketed lime are metallurgy (e.g. steel production and copper smelters), pulp and paper, sugar mills, production of calcium carbide, synthetic soda ash, magnesia and magnesium metal or artisanal production of lime for sanitation purposes or for whitewash
	Does the Party use AD separately for high-calcium, dolomitic and hydraulic lime? If not, are any assumptions well justified and in accordance with the 2006 IPCC Guidelines?
	If lime production is corrected for hydrated lime, has the Party first established whether the lime used to produce hydrated lime is included in total lime production statistics to avoid double counting?
	Has the Party excluded any removals of CO_2 which are due to the carbonation reaction that occurs when lime-based mortars used in construction gain their strength through the absorption of CO_2? Inclusion of such absorption is not in accordance with good practice
Glass production	Has the Party included in this category emissions from the production of glass wool, and included emissions from natural rock-based wool production under 'other', if such production is emissive?
	Does the amount of recycled scrap glass (cullet) include both in-house return of glassware broken in process or other glass spillage or retention, and foreign (i.e. external to the plant) cullet from recycling programmes or cullet brokerage services?
	How has the Party ensured that soda ash used in glass production is not double counted with 'other uses of soda ash' reported under other process uses of carbonates?
Other process uses of carbonates	Has the Party separately reported emissions from ceramics and from non-metallurgical magnesia production?
	How has the Party ensured that no double counting or omission occurs in the estimation of CO_2 emissions from uses of carbonates? The 2006 IPCC Guidelines, volume, 3, table 2.7 gives an overview of which uses are emissive and where in the inventory they should be reported?

Chemical industry

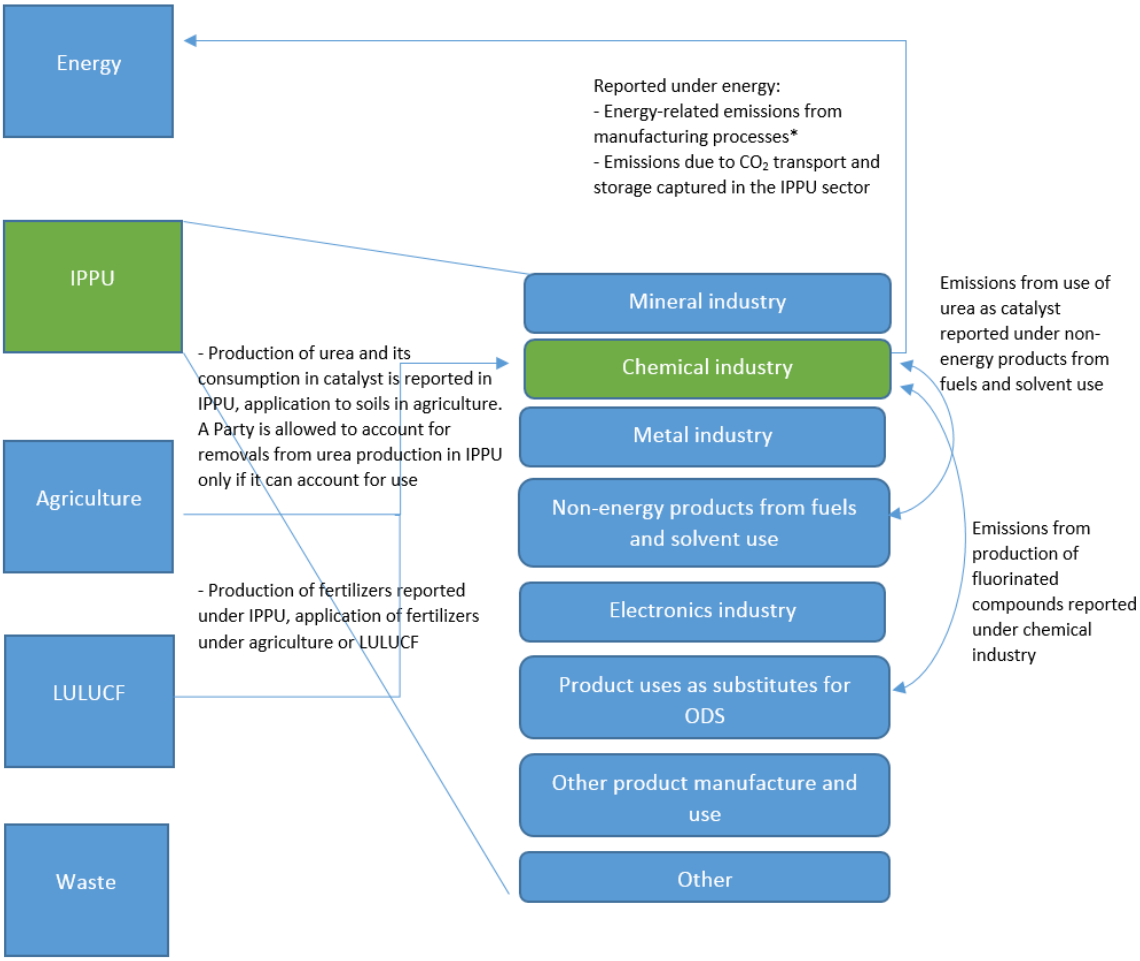
141. Table 7-19 provides a summary of key elements for the chemical industry category, and figure 7-11 summarizes linkages between the chemical industry category and the other categories in the IPPU sector and with other sectors.

Table 7-19

Summary of key elements of the chemical industry category

Overview	*Category-specific information*	
Category name	Chemical industry	
Reported in CRT	Table 2(I).A-Hs1, table 2(II)B-Hs1	
Main subcategories and GHGs to be reported	Ammonia production	CO_2
	Nitric acid production	N_2O
	Adipic acid production	N_2O
	Caprolactam, glyoxal and glyoxylic acid production	N_2O
	Carbide production	CO_2, CH_4
	Titanium dioxide production	CO_2
	Soda ash production	CO_2
	Petrochemical and carbon black production	CO_2, CH_4
	Fluorochemical production	HFCs, PFCs, SF_6, NF_3
	Other	–

Figure 7-11
Main linkages between the chemical industry category and the other categories in the industrial processes and product use sector and other sectors



* Combustion emissions from fuels obtained directly or indirectly from the feedstock for an IPPU process will normally be allocated to the part of the category in which the process occurs. These categories are normally 2.B and 2.C. However, if the derived fuels are transferred for combustion in another source category, the emissions should be reported in the appropriate part of Energy Sector source categories (normally 1.A.1 or 1.A.2).

142. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the IPPU expert may consider going through the list of potential TERT actions in table 7-20 when reviewing the emissions from the chemical industry category.

Table 7-20
Possible actions by the technical expert review team in its review of the emissions from the chemical industry category

Subcategory	*Action by the TERT, task*
All	If the Party reports amount of CO_2 captured, is the estimate based on plant-specific data?
	If the Party reports amount of CO_2 captured, is the estimate consistent with the reporting under CO_2 transport and storage? If not, has the Party explained the reasons for any differences (e.g. there is commercial use of the CO_2?)

Subcategory	*Action by the TERT, task*
	If CO_2 is reported to be captured in processes involving both combustion and process emissions reported under the energy sector and the IPPU sector, respectively, has the Party ensured that the amount captured is not double counted?
	Has the Party correctly allocated emissions between the IPPU and energy sectors ("chemicals" category) and, in particular, ensured that no double counting or omission occurs? In particular, for ammonia production all natural gas consumption should be included under the IPPU sector; and for petrochemical and carbon black plants there is a need to avoid double counting with the energy sector on the combustion of off-gases for energy recovery)
	Are final emissions reported in CRT 2(I).A-H after subtracting the amounts of emissions recovered, oxidized, destroyed or transformed?
Ammonia production	If the Party uses a tier 1 method and has no information on the fuel type and/or process type, has it used the highest IPCC default emission factor in accordance with good practice?
	Has the Party included all natural gas consumption for ammonia production in the IPPU sector in accordance with the 2006 IPCC Guidelines?
	Is CO_2 from ammonia production that is recovered for downstream use excluded from the reporting in the ammonia production subcategory? If so, are the products and the purposes for which the CO_2 is used clearly explained in the NID? Is it clear that all related CO_2 emissions from these products are reported in the relevant categories in the inventory if these emissions occur within the borders of the Party concerned? If the Party has not excluded from ammonia production the CO_2 for downstream use, check whether potential double counting occurs, in particular with urea fertilizers or urea used as catalyst. The TERT may wish to ask the Party for a urea balance
Nitric acid production	Has the Party used direct measurement data (preferred method)? If the measurement data are based on sampling, is sampling and analysis conducted whenever a plant makes any significant process changes that would affect the generation rate of N_2O?
	Does the AD cover all nitric acid produced in the Party, including nitric acid production that is integrated as part of larger production processes, where the nitric acid never enters into commerce and is therefore not included in the national statistics?
Adipic acid production	Has the Party used direct measurement data (preferred method)? If the measurement data are based on sampling, is sampling and analysis conducted whenever a plant makes any significant process changes that would affect the generation rate of N_2O?
Calcium carbide	Are CO_2 emissions from combusting CO gas generated in the process of CaC_2 production included in the IPPU sector avoiding double counting with the energy sector?
	Has the petroleum coke used in calcium carbide production been indicated as non-energy use of petroleum coke and not double counted with the energy sector?
	Have the emissions from CaO (lime) production associated with the calcium carbide production been reported in the lime production category, ensuring that no double counting occurs?
	Have the emissions from the use of acetylene for welding applications, produced from calcium carbide, been included in emissions from calcium carbide production?
	Has the Party estimated emissions from the use of CaC_2 imported for acetylene production for use in welding applications; and are emissions from the use of CaC_2 that is exported by the Party not estimated?
	If acetylene produced from calcium carbide is used for production of carbon black (acetylene black process) are the emissions correctly included under petrochemical and carbon black production and not double counted under calcium carbide?
Titanium	Do the emissions from titanium dioxide include production of all titanium dioxide products

Subcategory	*Action by the TERT, task*
dioxide production	such as titanium slag, synthetic rutile (>90 per cent TiO_2) and rutile TiO_2?
Soda ash production	Has the Party excluded emissions from soda ash use and reported them in the categories where soda ash is consumed?
	Has the Party included all the soda ash production processes that occur in the Party, including natural processes, as well as the Solvay process?
	Has the Party reported all CO_2 emissions generated in the process of soda ash production in this category, including use of coke? Coke used in the production process should be deducted from the energy sector as a non-energy use of coke (2006 IPCC Guidelines, volume 3, box 3.7)
Petrochemical and carbon black production	Has the Party reported all the petrochemical production processes for which guidance is available, including production of methanol, ethylene, ethylene dichloride, ethylene oxide, acrylonitrile and carbon black?
	Has the Party correctly allocated emissions between the energy sector and the IPPU sector, in particular ensuring that no omission or double counting occurs? Combustion emissions from fuels obtained from the feedstocks should be allocated to the category in the IPPU sector. However, where the fuels are not used within the category but are transferred out of the process for combustion elsewhere (e.g. for district heating purposes) the emissions should be reported under energy
Petrochemical and carbon black production – methanol	If the Party used national methanol production statistics, has the Party considered potential production of biogenic methanol, and excluded any biogenic CO_2 emissions?
	If a methanol plant utilizes by-product CO_2 captured from other industrial processes as a feedstock for methanol production, has the Party avoided double counting by not reporting the amount of captured CO_2 as CO_2 emissions from the process from which it is captured?
Petrochemical and carbon black production – ethylene	Has the Party excluded emissions from ethylene produced in processes other than with steam crackers?
Petrochemical and carbon black production – ethylene dichloride and vinyl chloride monomer	If production statistics of ethylene dichloride are incomplete and the amount of vinyl chloride monomer production is used to estimate ethylene dichloride production, has the Party accounted for possible additional emissions from the production of ethylene dichloride used in the production of other products?
Petrochemical and carbon black production – ethylene oxide	Has the Party taken into consideration the potential incompleteness of ethylene oxide production data if ethylene oxide is converted directly to ethylene glycol or other products in an integrated plant?
Petrochemical and carbon black production – carbon black	Has the Party taken into consideration potential biogenic sources for the production of carbon black, which may be included in carbon black production statistics? Biogenic CO_2 should not be included
Fluorochemical	If the Party accounts for abatement, are process records available at the plant level to support

Subcategory	*Action by the TERT, task*
	the subtraction of emissions?
	If recovery takes place (e.g. recovery of HFC-23 in HCFC-22 manufacture), has the Party ensured that subsequent emissions from the use/destruction/storage of the recovered gas are included in the inventory?
production	Does the Party report all production and handling losses from F-gas production? These may include the telomerization process used in the production of fluorochemical fluids and polymers, photo oxidation of tetrafluoroethylene to make fluorochemical fluids, SF_6 production, halogen exchange processes to make low-boiling PFCs such as C_2F_6 and CF_4, HFC-134a and HFC-245fa, NF_3 manufacturing, and the production of uranium hexafluoride, of fluorinated monomers (e.g. tetrafluoroethylene and hexafluoropropylene), and of fluorochemical agrochemicals and/or anaesthetics
	Has the Party included emissions from recycling of used gas, during which emissions may occur as a result of handling and purification of used gas and handling of recycled gas?
	Has the Party used a national mass balance to identify small producers or recycling companies?

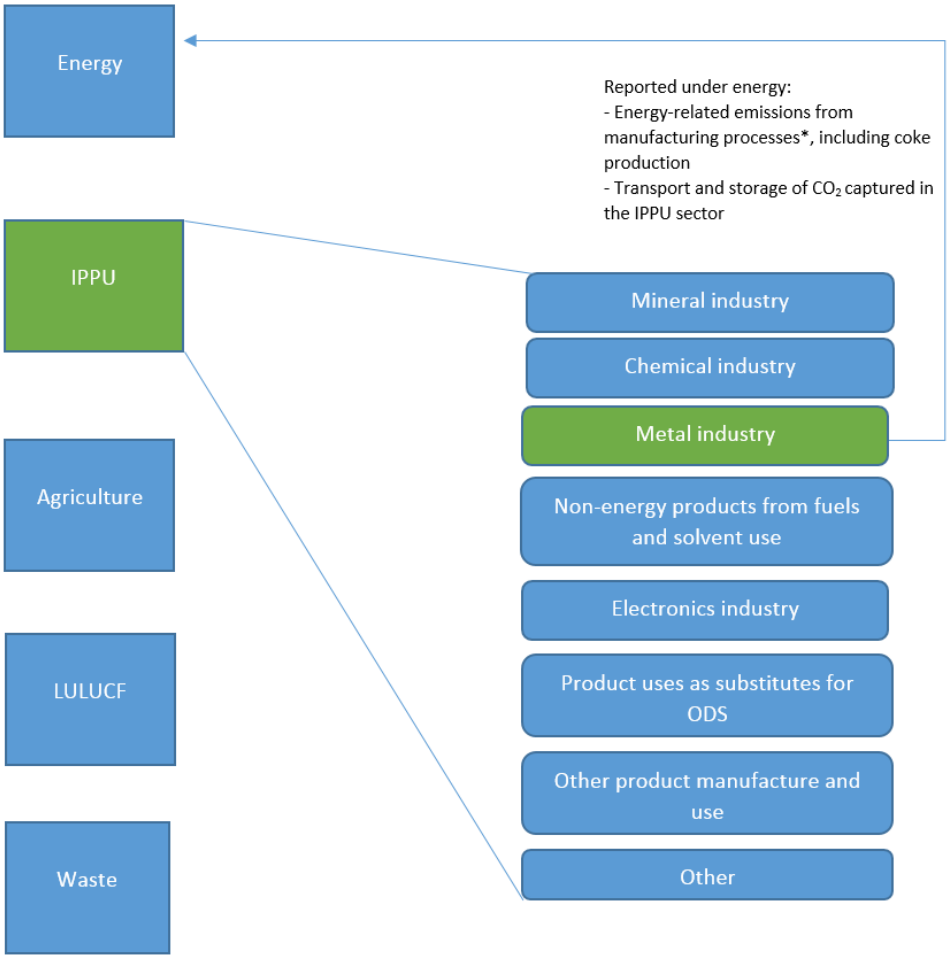
Metal industry

143. Table 7-21 provides a summary of key elements for the metal industry category, and figure 7-12 summarizes linkages between the metal industry category and the other categories in the IPPU sector and with other sectors.

Table 7-21
Summary of key elements of the metal industry category

Overview	*Category-specific information*	
Category name	Metal industry	
Reported in CRT	Table 2(I).A-Hs2, table 2(II)B-Hs1	
Main subcategories and GHGs to be reported	Iron and steel production	CO_2, CH_4
	Ferroalloys production	CO_2, CH_4
	Aluminium production	CO_2, PFCs
	Magnesium production	CO_2, HFCs, PFCs, SF_6
	Lead production	CO_2
	Zinc production	CO_2
	Other	–

Figure 7-12
Main linkages between the metal industry category and the other categories in the industrial processes and product use sector and other sectors



* Combustion emissions from fuels obtained directly or indirectly from the feedstock for an IPPU process will normally be allocated to the part of the category in which the process occurs. These categories are normally 2.B and 2.C. However, if the derived fuels are transferred for combustion in another source category, the emissions should be reported in the appropriate part of Energy Sector source categories (normally 1.A.1 or 1.A.2).

144. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the IPPU expert may consider going through the list of potential TERT actions in table 7-22 when reviewing the emissions from the metal industry category.

Table 7-22
Possible actions by the TERT in its review of the emissions from the metal industry category

Subcategory	*Action by the TERT, task*
All	Has the Party ensured that no double counting or omission of CO_2 emissions occurs between the energy and IPPU sectors?
	If the Party reports amount of CO_2 captured, is the estimate based on plant-specific data?
	If the Party reports amount of CO_2 captured, is the estimate consistent with the reporting under CO_2 transport and storage? If not, has the Party explained the reasons for any differences (e.g. there is commercial use of the CO_2?)

Subcategory	*Action by the TERT, task*
	If CO_2 is reported to be captured in processes involving both combustion and process emissions reported under the energy sector and the IPPU sector, respectively, has the Party ensured that the amount captured is not double counted?
	Are the emissions from coke production (both on-site and off-site) excluded and reported under energy?
Iron and steel production	Are CO_2 emissions from limestone or dolomite use included in the estimates for this category?
	Are the emissions from use of carbon sources (predominantly coke, but also coal, oil, natural gas, limestone, etc.) used to produce pig iron reported in this category and not double counted in the energy sector?
	Has the Party ensured that double counting or omission is avoided, in particular for integrated production and iron and steel with on-site coke production? In such a case, there may be flows of by-products (e.g. coke oven gas, blast furnace gas, coke oven by-products) between the coke production facility and the iron and steel production facility. Carbon consumed in the form of coke oven gas at an iron and steelmaking facility and the resulting CO_2 and CH_4 emissions should be categorized as IPPU emissions and reported as such. Carbon consumed in the form of blast furnace gas at an on-site coke production facility and the resulting CO_2 and CH_4 emissions should be reported under energy
	Are emissions from sinter production included in this category and not double counted in the energy sector, even if the coke fines are produced at a coke plant within the facility, or if the coke breeze is otherwise accounted for as purchased coke?
	Has the Party ensured that blast furnace derived by-product gases such as blast furnace gas, or recovered basic oxygen furnace off-gas used for energy are not double counted in the energy sector, if they have been accounted for as process emissions?
	Do the emissions from electric arc furnaces (EAFs) include, in addition to the electrode consumption, any carbon-bearing materials added to the EAF for process control purposes or contained in the charged materials themselves as iron substitutes as well as natural gas used as a reducing agent to enhance reactions in an EAF?
	Check that the steel production AD used to estimate emissions do not include electric induction furnaces from which CO_2 or CH_4 emissions are not considered to occur
Ferroalloy production	Are CO_2 emissions from limestone or dolomite use included in the estimates for this category?
	Are all emissions from carbon sources (coal, coke, limestone, dolomite, etc.) reported in this category and not in the energy sector?
Aluminium production	Does the AD include only primary aluminium production?
	Are the trends of the estimates for CF_4 and C_2F_6 emissions per tonne aluminium production consistent?
	Does the Party report SF_6 or other F-gases used in foundries?
Magnesium production	Are all emissions associated with the calcination of carbonates (magnesite and dolomite) for primary magnesium production included in this category? Check that there is not double counting with other process uses of carbonates
	Does the Party report emissions from cover gases in the magnesium casting for both primary and secondary magnesium production?
Lead production	Do CO_2 emissions include both primary and secondary production?
Zinc production	Does the Party include emissions from both primary and secondary zinc production?

Subcategory	*Action by the TERT, task*
	If a pyrometallurgical process involving the use of an Imperial Smelting Furnace is used for combined zinc and lead production, is the metallurgical coke/coal reductant used in this process allocated to lead and zinc production in order to avoid omissions or double counting?

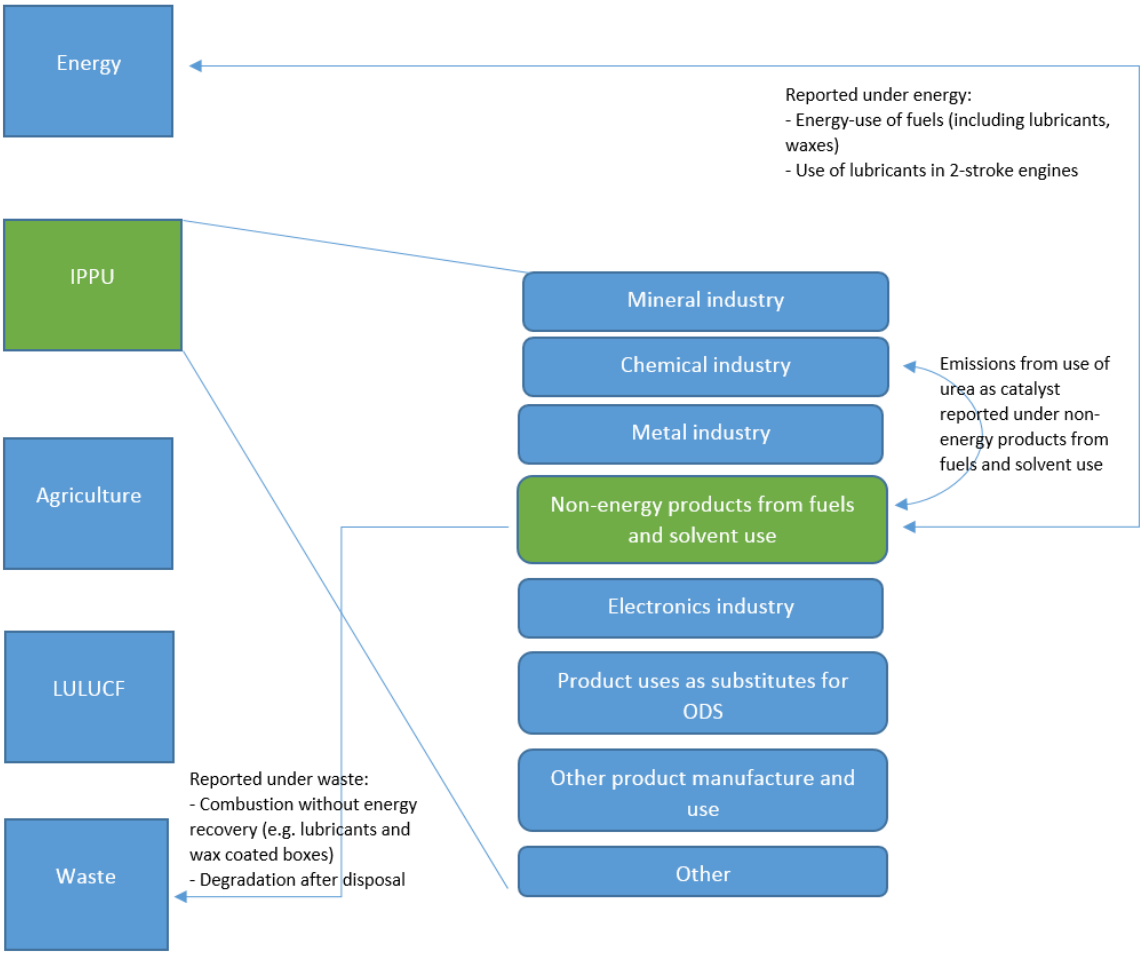
Non-energy products from fuels and solvent use

145. Table 7-23 provides a summary of key elements for non-energy products from fuels and solvent use, and figure 7-13 summarizes linkages between the non-energy products from fuels and solvent use category and the other categories in the IPPU sector and with other sectors.

Table 7-23
Summary of key elements of the non-energy products from fuels and solvent use category

Overview	*Category-specific information*	
Category name	Non-energy products from fuels and solvent use	
Reported in CRT	Table 2(I).A-Hs2	
Main subcategories and GHGs to be reported	Lubricant use	CO_2
	Paraffin wax use	CO_2
	Other	CO_2

Figure 7-13
Main linkages between the non-energy products from fuels and solvent use category and the other categories in the industrial processes and product use sector and other sectors



146. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the IPPU expert may consider going through the list of potential TERT actions in table 7-24 when reviewing the CO_2 emissions from the non-energy products from fuels and solvent use category.

Table 7-24
Possible actions by the technical expert review team in its review of the emissions from non-energy products from fuels and solvent use category

Subcategory	*Action by the TERT, task*
All	Has the Party reported emissions from non-energy uses of fossil fuels under the IPPU sector, rather than in the energy sector?
Lubricants	Has the Party reported the emissions from lubricant use in 2-stroke engines, where the lubricant is mixed with another fuel and thus on purpose co-combusted in the engine, in the energy sector and excluded it from this category to prevent double counting?
	Are the emissions from lubricant combustion for energy or in waste incinerators without energy recovery included in the energy sector and the waste sector, respectively, and not included in this category?

Subcategory	*Action by the TERT, task*
	Are any emissions that occur as a result of degradation after disposal accounted for separately in the waste sector and not included in this category?
Paraffin wax use	Do the emissions from paraffin wax use cover petroleum jelly, paraffin waxes and other waxes, including ozokerite (mixtures of saturated hydrocarbons, solid at ambient temperature)?
	Are emissions from the incineration (without energy recovery) of wax-coated boxes reported under the waste sector?
	Are any emissions from paraffin waxes that are produced as a result of energy recovery included in the energy sector, and excluded from this category?
Other	Has the Party reported CO_2 emissions from urea used as a catalyst under non-energy products from fuels and solvent use – other?

Electronics industry

147. Table 7-25 provides a summary of key elements for the electronics industry category. There are no direct interactions between this category and the other categories/sectors in the 2006 IPCC Guidelines.

Table 7-25
Summary of key elements of the electronics industry category

Overview	*Category-specific information*	
Category name	Electronics industry	
Reported in CRT	Table 2(II).B-Hs1	
Main subcategories and GHGs to be reported	Integrated circuit or semiconductor	HFCs, PFCs, SF_6, NF_3
	Thin-film transistor (TFT) flat panel displays	PFCs, SF_6, NF_3
	Photovoltaics	PFCs, SF_6
	Heat transfer fluid	SF_6
	Other	–

148. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the IPPU expert may consider going through the list of potential TERT actions in table 7-26 when reviewing the emissions from the electronics industry category.

Table 7-26
Possible actions by the TERT in its review of the emissions from the electronics industry category

Subcategory	*Action by the TERT, task*
All	Does the Party include both evaporative losses and by-product emissions? In the case of by-product emissions, has the Party reported the emissions in a separate row in CRT 2(II).B-Hs1 and included the information in the relevant AD in the documentation box?
	Does the Party have a process in place to identify any new chemicals not used by the industry before, and report all emissions from fluorinated substances that are used in the electronics industry and included in the MPGs?
	Has the Party estimated and reported emissions from research and development (e.g. university) scale plants and by tool suppliers? Has the Party included emissions resulting from the release of

Subcategory	*Action by the TERT, task*
	fluorinated compounds during gas handling (e.g. distribution)? These emissions are likely not significant, but should be considered and documented
	If the Party has implemented a tier 2 method and applied the default efficiency parameters for emissions control technology in table 6.6 of the 2006 IPCC Guidelines, has the Party demonstrated communication with the facility operators to ensure that the technologies are implemented according to manufacturers' specifications? If not, has the Party assumed a 0% destruction efficiency?
	If the Party has used a tier 1 method, has it only used tier 1 and not implemented a hybrid tier 1/tier 2? Emissions estimated with the tier 1 approach should not be combined with higher tiers

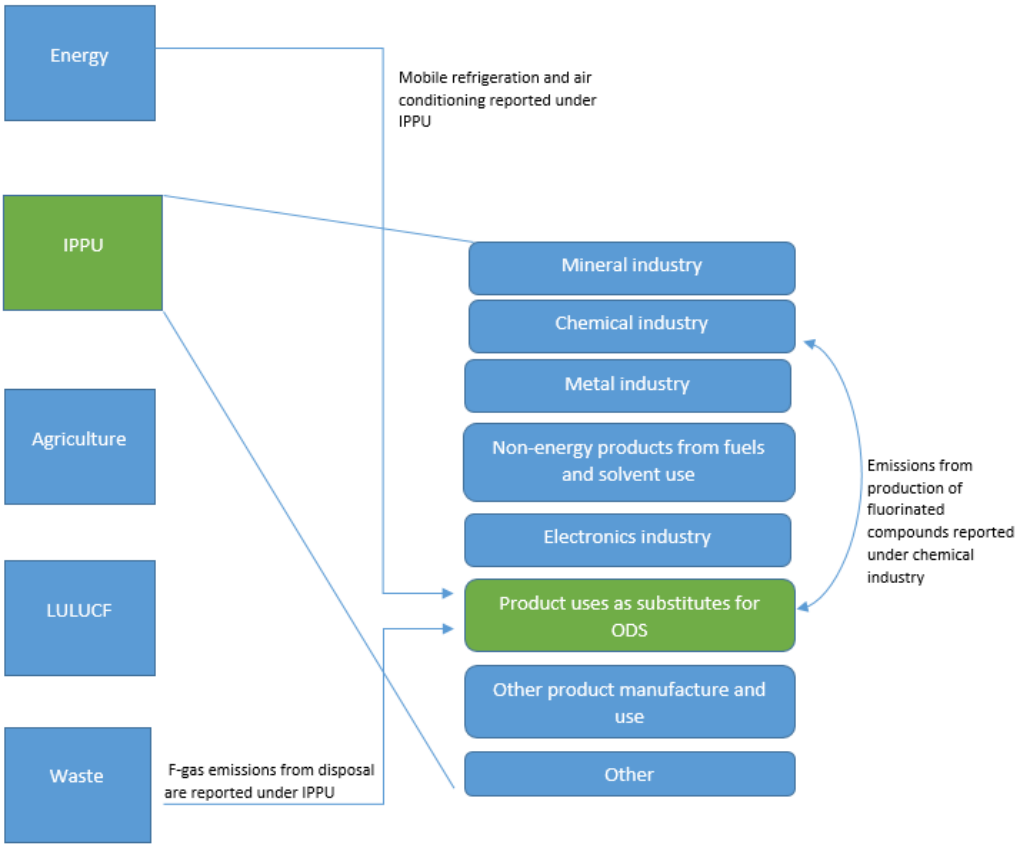
Product uses as substitutes for ODS

149. Table 7-27 provides a summary of key elements for the product uses as substitutes for ODS category, and figure 7-14 summarizes linkages between the product uses as substitutes for ODS category and the other categories in the IPPU sector and with other sectors.

Table 7-27
Summary of key elements of the product uses as substitutes for ODS category

Overview	*Category-specific information*	
Category name	Product uses as substitutes for ODS	
Reported in CRT	Table 2(II)B-Hs2	
Main subcategories and GHGs to be reported	Refrigeration and air conditioning	HFCs, PFCs
	Foam blowing agents	HFCs
	Fire protection	HFCs, PFCs
	Aerosols	HFCs, PFCs
	Solvents	HFCs, PFCs
	Other applications	HFCs, PFCs

Figure 7-14
Main linkages between the product uses as substitutes for ODS category and the other categories in the industrial processes and product use sector and other sectors



150. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the IPPU expert may consider going through the list of potential TERT actions in table 7-28 when reviewing the emissions from the product uses as substitutes for ODS category.

Table 7-28
Possible actions by the technical expert review team in its review of the emissions from the product uses as substitutes for ODS category

Subcategory	*Action by the TERT, task*
All	Compare the category–gas combinations reported by the Party with the main application areas for HFCs and PFCs as ODS substitutes in the 2006 IPCC Guidelines, volume 3, table 7.1, to identify potential gaps in the Party's reporting
	Has the Party included HFCs in blends and ensured that other gases not included in the MPGs such as CFCs and HCFCs in blends are not included in the amount reported for HFCs? See the 2006 IPCC Guidelines, volume 3, table 7.8, for the most common blends used in refrigeration and air conditioning
	Has the Party validated the AD across total chemical sales? What are the conclusions of any such validation?
	Where applicable (fire protection, refrigeration and air conditioning and foam blowing) has

Subcategory	*Action by the TERT, task*
	the Party appropriately accounted for banks of chemicals?
Fire protection	If the Party produces fire protection equipment, has the Party accounted for all emissions (unless the Party has documented bulk exports of the equipment)?
Refrigeration and air conditioning	How has the Party accounted for imports and exports of refrigerant and equipment (see the 2006 IPCC Guidelines, volume 3, box 7.3)?
Foam blowing agents	Compare the HFCs reported by the Party with the requirements of the 2006 IPCC Guidelines, volume 3, table 7.4, to identify potential gaps in the Party's reporting. What methods has the Party used to assess whether HFC blowing agents are used in each subapplication being practised in the country?
	Does the Party account for emissions from manufacturing, in-use, decommissioning and chemical destruction? The latter two phases are new in the 2006 IPCC Guidelines
	If it is not possible to collect AD for decommissioning, has the Party assumed that all blowing agent is lost over the lifetime of the foam?
Aerosols	Has the Party reported HFCs and PFCs acting as solvents contained in aerosols in this category and excluded them from the "solvents" category to prevent double counting?
	If there is no domestic aerosol production, how has the Party ensured completeness of AD considering that import statistics may be incomplete?
Solvents	What steps has the Party taken to prevent double counting between the use of HFCs and PFCs in solvents (e.g. in electronics cleaning) and in the electronics industry category?
	Does the Party properly account for recovery and recycling of solvents?

Box 7-5

Further guidance on how to ensure consistency in the assessment of the completeness of the reporting of fluorinated gases (F-gases) as substitutes for ozone-depleting substances (ODS)

(i) Perform a comparison of the activity data (AD) used by the Party in its estimates with data from global or regional data sets (e.g. information reported under the Kigali Amendment to the Montreal Protocol[37] or the European Environment Agency[38]);

(ii) If possible, compare the AD included in models applied to calculate F-gas estimates with data on total annual sales from chemical manufacturers or importers (provided by the Party) to understand trends and identify potential issues;

(iii) If the mass balance approach is used (tier 2b), check, if possible, the calculation of the bank of F-gases and ensure that emissions are not underestimated or overestimated. Reviewers may ask the Party under review to provide the underlying calculations of the bank of F-gases;

(iv) If the EF approach is used (tier 2a), review the EFs applied at the sub-application level and compare these with the IPCC default EFs.[39] Reviewers may ask the Party under review to provide the EFs by sub-application, if these are not available in the NID;

(v) Check the information provided by the Party in the column for reporting gases recovered at disposal in CRT 2(II)B-H (sheet 2) by performing cross-checks between disposal and banks (AD in operating systems from previous years), considering the default lifetime by type of equipment;

(vi) Check blends reported by a Party (not all blends are covered by the 2006 IPCC Guidelines) and the shares of different substances in such blends. Reviewers may ask the Party under review to provide the composition of new blends of gases reported and how the reported CO_2 eq emissions were calculated;

(vii) Check how import or export in bulk or in products by F-gas species has been treated and if and how related AD

[37] Available at https://ozone.unep.org/countries/data.
[38] Available at https://www.eea.europa.eu/publications/fluorinated-greenhouse-gases-2020.
[39] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, vol. 3, chap. 7, table 7.9.

and EFs were reported;

(viii) Check the time series for category 2.F product uses as substitutes for ODS for each F-gas species and sub-application regarding the AD (e.g. filled into new manufactured products and average annual stocks in operating systems), EFs and other parameters (e.g. product manufacturing factor and product life factor) and emissions (from manufacturing and from stocks) to identify outliers or errors in inter-annual growth. Reviewers may ask the Party under review to provide information on AD of replenishments into the existing stock.

Other product manufacture and use

151. Table 7-29 provides a summary of key elements for the other product manufacture and use category. There are no direct interactions between this category and the other categories/sectors in the 2006 IPCC Guidelines.

Table 7-29
Summary of key elements of the other product manufacture and use category

Overview	*Category-specific information*	
Category name	Other product manufacture and use	
Reported in CRT	Table 2(I).A-Hs2, table 2(II).A-Hs1	
Main subcategories and GHGs to be reported	Electrical equipment	PFCs, SF_6
	SF_6 and PFCs from other product use	PFCs, SF_6
	N_2O from product uses	N_2O
	Other	-

152. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the IPPU expert may consider going through the list of potential TERT actions in table 7-30 when reviewing the emissions from the other product manufacture and use category.

Table 7-30
Possible actions by the technical expert review team in its review of the emissions from the other product manufacture and use category

Subcategory	*Action by the TERT, task*
Electrical equipment	Under emissions from manufacturing, has the Party included emissions from the SF_6 uses listed in the 2006 IPCC Guidelines, volume 3, section 8.2.2.4 (Completeness)?
	Has the Party estimated emissions that occur during: new electrical equipment installations; leakage, refill, maintenance, and equipment failures; the disposal of discarded electrical equipment; the recycling or destruction of SF_6 recovered from equipment?
SF_6 and PFCs from other product use	Has the Party reported: SF_6 and PFCs used in military applications (e.g. in airborne radar systems and heat transfer fluids in high-powered electronic applications); SF_6 used in universities and research; SF_6 and PFCs from adiabatic uses and sound-proof glazing; and PFCs used as heat transfer fluids in commercial and consumer applications and in cosmetics and medical applications?
	If the Party uses distributor data, does the Party have a check in place to ensure that all SF_6 and PFC distributors are identified, and to assess the existence of new distributors?
	If the Party uses data per application on import, export and consumption from national SF_6 and PFC producers and distributors, has the Party: (a) Checked that domestic consumers only purchase SF_6 and PFCs from national suppliers; (b) Confirmed that imports and exports in products (e.g. sport attributes) are negligible?

Subcategory	*Action by the TERT, task*
N_2O from product uses	What steps has the Party taken to identify all relevant N_2O uses? At a minimum, use of N_2O in medical applications and as a propellant in aerosol products are likely to exist in the country
	If the Party uses data per application on import, export and consumption from national N_2O manufacturers and distributors, has the Party: (a) Ensured that all N_2O manufacturers and distributors are identified, including any new distributors? (b) Checked that domestic consumers only purchase N_2O from national suppliers? (c) Confirmed that imports and exports in products are negligible?

E. Agriculture

1. Introduction

153. The 2006 IPCC Guidelines combines the agriculture and LULUCF sectors into the agriculture, forestry and other land use (AFOLU) sector. However, under the ETF, the MPGs require each Party to report agriculture and LULUCF as separate sectors. This sectoral structure is reflected in the CRTs and in the NID outline established by decision 5/CMA.3. Accordingly, agriculture and LULUCF are also covered separately in this handbook. The generalist and the respective sector experts should be mindful of potential allocation issues between the agriculture and LULUCF sectors and ensure that any cross-sectoral categories are consistently reported in accordance with the 2006 IPCC Guidelines.

154. The agriculture sector includes the following categories:

(a) Enteric fermentation;

(b) Manure management;

(c) Rice cultivation;

(d) Agricultural soils;

(e) Prescribed burning of savannas;

(f) Field burning of agricultural residues;

(g) Liming;

(h) Urea application;

(i) Other carbon-containing fertilizers;

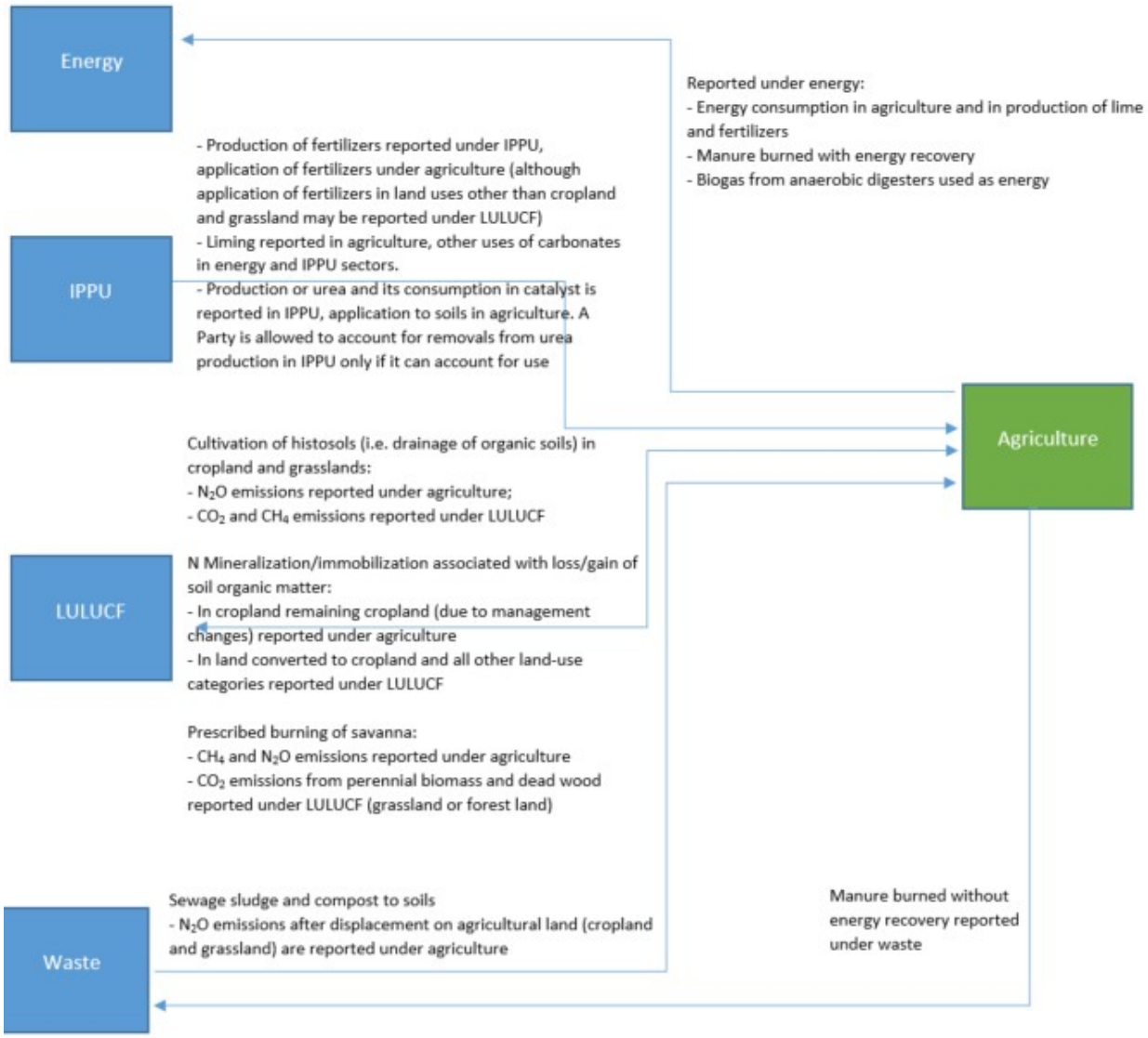
(j) Other (please specify).

2. Sector-specific issues

Integration of the agriculture sector

155. The agriculture sector has a high level of integration (see figure 7-15).

Figure 7-15
Overview of the interaction of the agriculture sector with other inventory sectors



Livestock characterization

156. The methods for estimating methane (CH_4) and nitrous oxide (N_2O) emissions from livestock-related categories all require information on livestock subcategory definitions, annual populations and feed intake estimates. To ensure that these definitions and data are used consistently across the categories, Parties should have developed a single "characterization" for each species. A coordinated livestock characterization ensures consistency across the different categories.

157. In performing the characterization according to the appropriate level of detail, it is necessary to first identify the livestock species common to multiple categories. Subsequently, the emission estimation methods for each of the pertinent categories should be assessed (i.e. tier 1, tier 2 or tier 3) and the most detailed characterization required for each livestock species must be identified. Characterization may be achieved on either a basic or enhanced

level. Generally, an enhanced characterization is required for categories if either enteric fermentation or manure management are estimated by the Party using tier 2 methods.

158. In the review of livestock population characterization, the review expert may consider going through the list of potential actions presented in table 7-31.

Table 7-31
Possible actions by the technical expert review team in its review of livestock population characterization

Check	*Action by the TERT, task*
General	How are young animals included in the livestock characterization? Is an assumption made about accompanying young animals that are otherwise not in the statistics?
	Has the Party used the same livestock characterization to estimate CH_4 emissions from enteric fermentation, CH_4 and N_2O emissions from manure management and direct and indirect N_2O emissions from manure applied to soils?
	Do the annual population statistics take into account seasonal births or slaughters? Some countries must interpret the agricultural census data (e.g. seasonal births and slaughters are included or excluded, sometimes three-year averages are used)
	Has migration of livestock within or between countries led to double counting or under counting of animals?
	Is the feed intake calculated each year or is it based on assumptions?
	If the Party divides the country into regional subdivisions, are sufficient data on feeding characteristics and manure management systems available to support this regional disaggregation?
	If an enhanced characterization is used, is there an expected relationship between digestibility, feed intake and growth (e.g. low digestibility leads to lower feed intake and reduced growth)?
	Does the Party use live weight in accordance with the 2006 IPCC Guidelines instead of slaughter weight?
	Is average weight increase estimated? How?

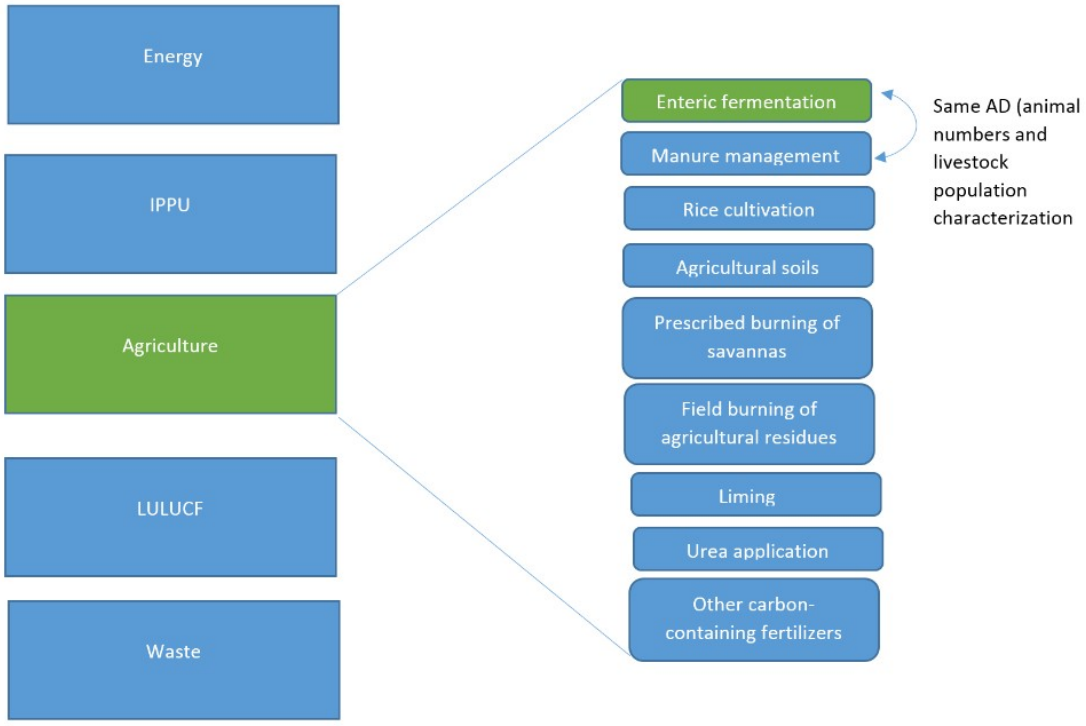
Enteric fermentation

159. Table 7-32 provides a summary of key elements for the enteric fermentation category, and figure 7-16 summarizes linkages between the enteric fermentation category and the other categories in the agriculture sector and with other sectors.

Table 7-32
Summary of key elements of the enteric fermentation category

Overview	*Category-specific information*	
Category name	Enteric fermentation	
Reported in CRT	Table 3.A	
Main subcategories and GHGs to be reported	Cattle	CH_4
	Sheep	CH_4
	Swine	CH_4
	Other livestock	CH_4

Figure 7-16
Main linkages between the enteric fermentation category and the other categories in the agriculture sector and other sectors



160. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the agriculture expert may consider going through the list of potential TERT actions in table 7-33 when reviewing CH_4 emissions from the enteric fermentation category.

Table 7-33
Possible actions by the technical expert review team in its review of CH_4 emissions from the enteric fermentation category

Subcategory	*Action by the TERT, task*
All	Are the AD (based on livestock characterization) consistent between the enteric fermentation category and the manure management category?
	If a country-specific EF is used, are the data developed through the livestock characterization used for developing the EF?
	How are improvements in the herd (e.g. cattle types) followed in the inventory in order to update the AD (e.g. milk production) and EFs?
	How is the development of feeding practices (e.g. due to availability on the farms or through import) followed in the inventory in order to update the EFs accordingly?
	Has the Party included in the EF per adult animal an assumption about accompanying young animals that are not in the statistics?
Other livestock	Has the Party reported emissions from any new livestock categories? If yes, have appropriate methods been selected and has a consistent time series been reported?

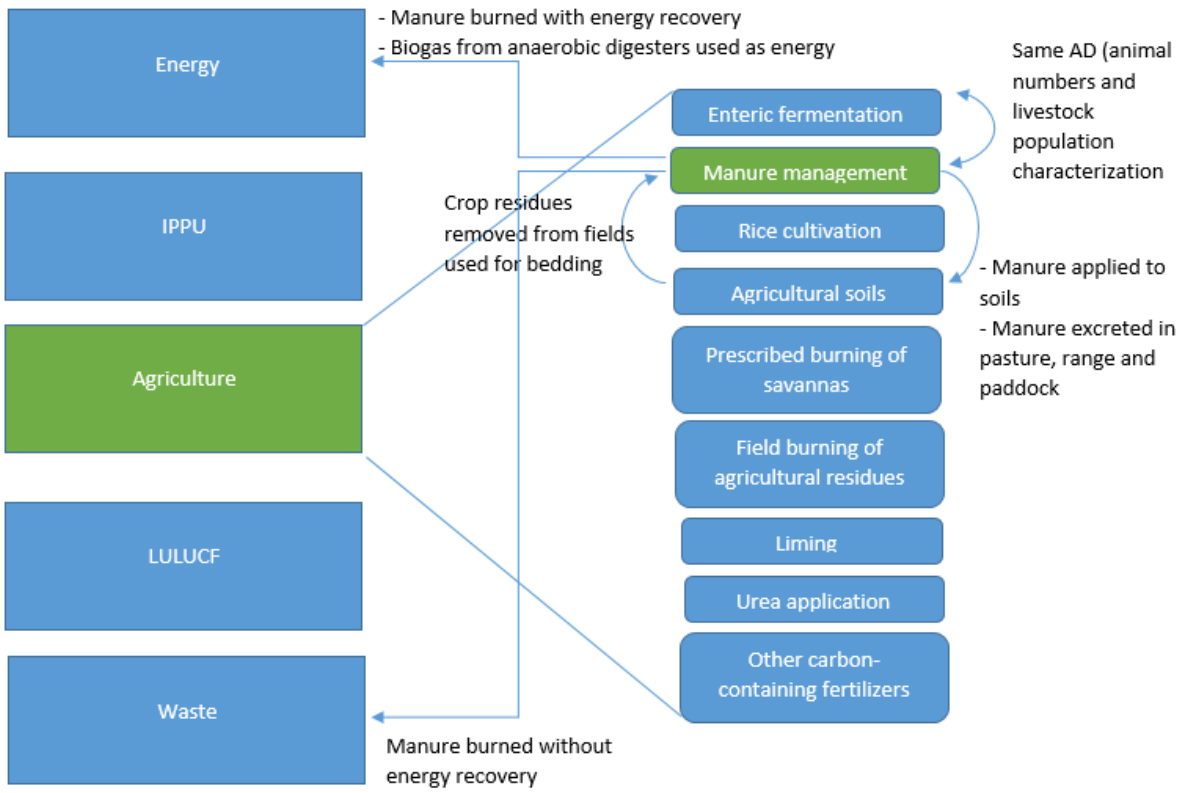
Manure management

161. Table 7-34 provides a summary of key elements for the manure management category, and figure 7-17 summarizes linkages between the manure management category and the other categories in the agriculture sector and with other sectors.

Table 7-34
Summary of key elements of the manure management category

Overview	*Category-specific information*	
Category name	Manure management	
Reported in CRT	Table 3.B(a), 3.B(b)	
Main subcategories and GHGs to be reported	Cattle	CH_4, N_2O
	Sheep	CH_4, N_2O
	Swine	CH_4, N_2O
	Other livestock	CH_4, N_2O
	Indirect N_2O emissions	N_2O

Figure 7-17
Main linkages between the manure management category and the other categories in the agriculture sector and other sectors



162. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the agriculture expert may consider going through the list of potential TERT actions in table 7-35 when reviewing CH_4 and N_2O emissions from the manure management category.

Table 7-35
Possible actions by the technical expert review team in its review of CH_4 and N_2O emissions from the manure management category

Subcategory	*Action by the TERT, task*
Cattle, sheep, swine, other livestock	Is the information on the distribution of manure management systems based on statistics or other information? Is the distribution periodically updated to reflect changing practices?
	Is the manure management system distribution consistently used for estimation of CH_4 and N_2O emissions?
	If the Party reports treatment of manure in anaerobic digesters, is the amount subdivided into different categories considering the amount of biogas recovery, flaring and storage after digestion? If biogas is used for energy production, is it included in the energy sector?
	If the Party reports that manure is burned with or without energy recovery, is this included in the energy sector or the waste sector, respectively?
	If there are multiple climate zones in the country, has the Party estimated CH_4 emissions regionally, applying appropriate parameters?
	Are the assumptions on emissions from bedding in line with 2006 IPCC Guidelines (assumed no emissions from bedding during manure management, while emissions from bedding materials assumed to occur during manure application to soils)?
	Are direct N_2O emissions estimated based on total N excreted without subtracting the amount of N lost through leaching and/or volatilization?
Indirect N_2O emissions	Has the Party reported indirect N_2O emissions from leaching/run-off during manure management? If emissions are not estimated, the TERT should work with the Party to determine if it would be a key category and therefore to be estimated. It is important to note that failure to report indirect N_2O emissions from leaching/run-off does not lead to an underestimate of N_2O emissions, and therefore TERTs do not need to raise this issue as a potential problem, only a recommendation in the TERR
	If indirect emissions are estimated, are these emissions included in the national total? (Indirect N_2O emissions from agriculture and LULUCF must be included in the national total, whereas those from other sectors should not)
	Has the Party correctly allocated indirect emissions from manure excreted in pasture, range and paddock into the agricultural soils category?

Rice cultivation

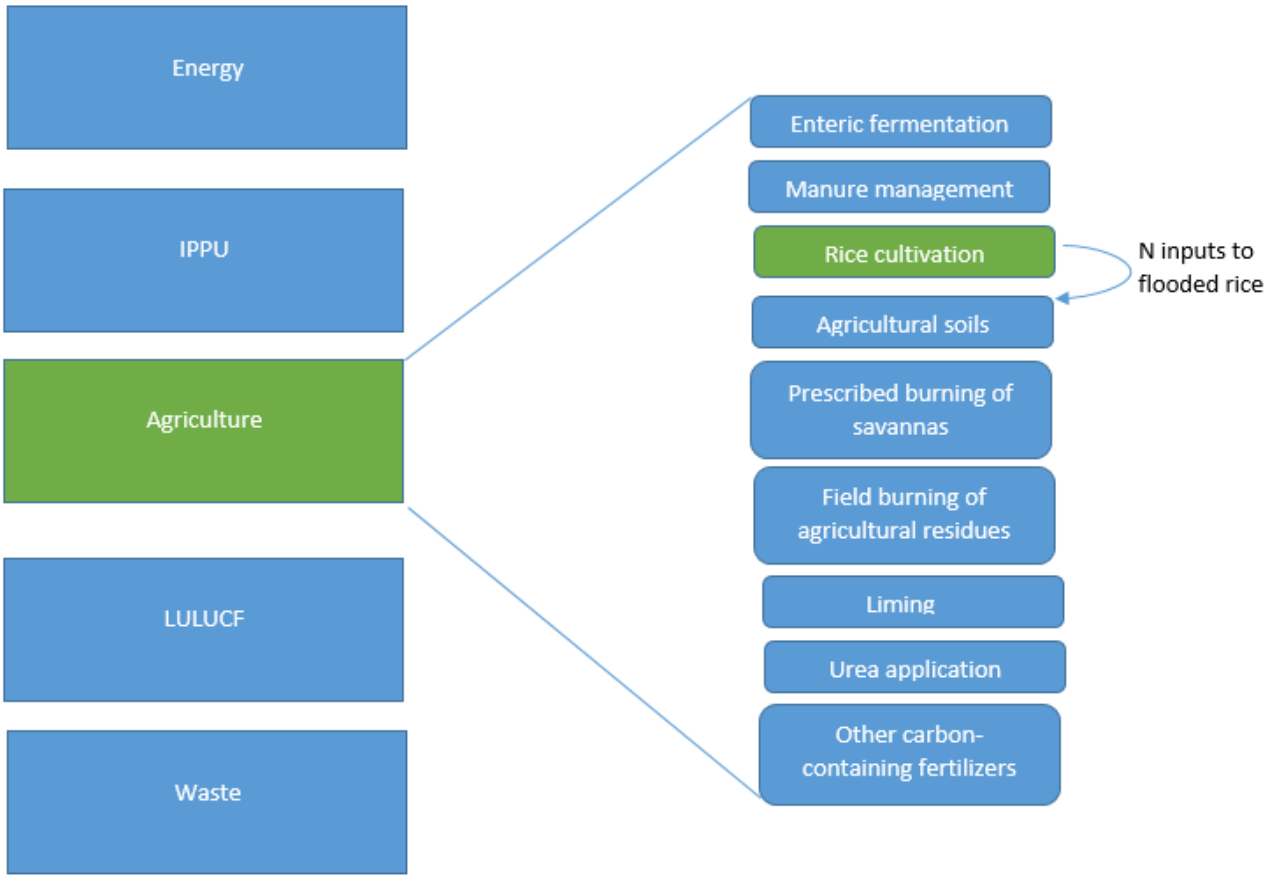
163. Table 7-36 provides a summary of key elements for the rice cultivation category, and figure 7-18 summarizes linkages between the rice cultivation category and the other categories in the agriculture sector and with other sectors.

Table 7-36
Summary of key elements of the rice cultivation category

Overview	*Category-specific information*	
Category name	Rice cultivation	
Reported in CRT	Table 3.C	
Main subcategories and GHGs to be reported	Irrigated	CH_4
	Rain-fed	CH_4
	Deep water	CH_4

Overview	*Category-specific information*	
	Other	CH_4

Figure 7-18
Main linkages between the rice cultivation category and the other categories in the agriculture sector and other sectors



164. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the agriculture expert may consider going through the list of potential TERT actions in table 7-37 when reviewing CH_4 emissions from the rice cultivation category.

Table 7-37
Possible actions by the technical expert review team in its review of CH_4 emissions from the rice cultivation category

Subcategory	*Action by the TERT, task*
All	In case of multiple cropping during the same year, is the 'harvested area' equal to the sum of the area cultivated for each cropping?
	Is the total cultivated area consistent with international data sources such as the FAO and the International Rice Research Institute?
	Are daily (instead of seasonal) EFs used, in line with the 2006 IPCC Guidelines?
	If soil submergence is not limited to the actual rice growing season, are emissions outside of the rice

Subcategory	*Action by the TERT, task*
	growing season reported?

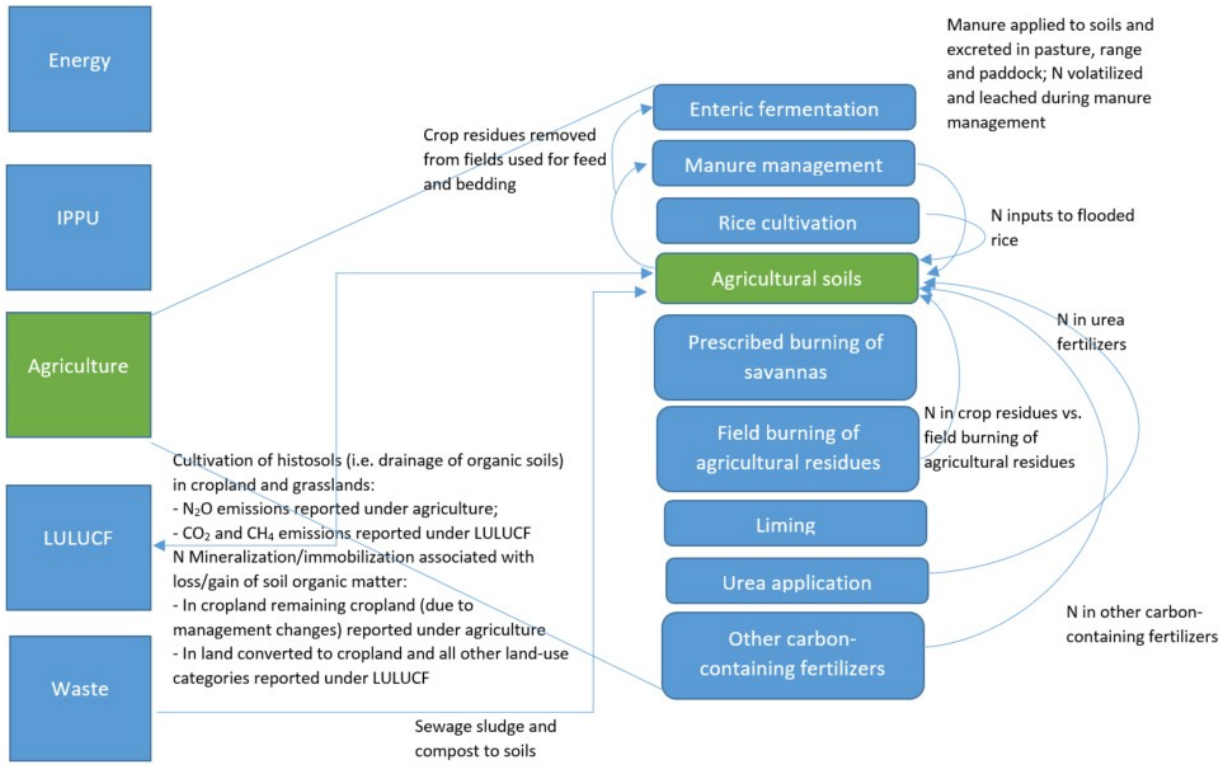
Agricultural soils

165. Table 7-38 provides a summary of key elements for the agricultural soils category, and figure 7-19 summarizes linkages between the agricultural soils category and the other categories in the agriculture sector and with other sectors.

Table 7-38
Summary of key elements of the agricultural soils category

Overview	*Category-specific information*	
Category name	Agricultural soils	
Reported in CRT	Table 3.D	
Main subcategories and GHGs to be reported	Direct N_2O emissions from managed soils	N_2O
	Indirect N_2O emissions from managed soils	N_2O

Figure 7-19
Main linkages between the agricultural soils category and the other categories in the agriculture sector and other sectors



166. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the agriculture expert may consider going through the list of

potential TERT actions in table 7-39 when reviewing N_2O emissions from the agricultural soils category.

Table 7-39
Possible actions by the technical expert review team in its review of N_2O emissions from the agricultural soils category

Subcategory	*Action by the TERT, task*
Direct N_2O emissions from managed soils – inorganic N fertilizers	Are the AD in line with the fertilizer data provided by FAO or the International Fertilizer Industry Association?
	If fertilizer data are provided disaggregated by fertilizer type, is the reporting of use of urea in line with that reported for the category "urea application"?
	If fertilizer data are provided disaggregated by fertilizer type, is the reporting of use of other carbon-containing fertilizers in line with that reported for the category "other carbon-containing fertilizers"?
	Is the Party able to separate out only fertilizers applied to cropland and grassland? If the application to other land categories cannot be identified, is this clearly described in the NID?
Direct N_2O emissions from managed soils – organic N fertilizers – animal manure applied to soils	Are the AD in line with the data provided in CRT 3.B(b) excluding manure in pasture, range and paddock, and taking into account manure used for feed, fuel and construction ($Frac_{FEED}$ + $Frac_{FUEL}$ + $Frac_{CNST}$) and loss of N from manure management systems?
	Is the estimated loss of N from manure management systems in line with the estimated N loss due to volatilization of ammonia and NO_X and, if reported, the loss of N through leaching from manure management? The total loss of N should be higher than (or equal to) losses due to volatilization and leaching
	If the Party assumes no leaching of N during manure management (not mandatory), is the estimate of total N loss before manure application to soils consistent with that approach?
	Is the Party able to separate out only organic fertilizers applied to cropland and grassland? If the application to other land categories cannot be identified, is this clearly described in the NID?
Direct N_2O emissions from managed soils – organic N fertilizers – sewage sludge applied to soils	Is the reporting on sewage sludge applied to soils in line with data in the waste sector? (Cross-check with the waste sector to ensure there is no double counting of N_2O emissions from the N in sewage sludge.) What assumptions has the Party made regarding N content in sewage sludge, if the amount of sewage sludge in weight units is used as a basis for the calculation?
	If the Party reports "NO" or "NE", check with the waste expert whether there is an indication that sewage sludge application occurs. If so, the Party should report the emissions to ensure completeness
Direct N_2O emissions from managed soils – organic N fertilizers – other organic fertilizers applied to soils	Is the reporting on compost addition to soils in line with data in the waste sector? What assumptions has the Party made regarding N content in compost, if the amount of compost in weight units is used as a basis for the calculation? Has the Party ensured that compost N is not double counted?
Direct N_2O emissions from managed soils – urine and dung deposited by grazing animals	Is the N input the same as reported in CRT 3.B(b) for pasture, range and paddock?
	If the Party uses default EFs, is the IEF equal to the weighted average of EFs in table 11.1 in the 2006 IPCC Guidelines, when weighted based on N input for

Subcategory	*Action by the TERT, task*
	cattle, poultry and pigs ($EF_{3PRP, CPP}$) and N input for sheep and other animals ($EF_{3PRP, SO}$)?
Direct N_2O emissions from managed soils – crop residues	Are the data on crop residues in line with the data reported for field burning of agricultural residues (i.e. is the amount of agricultural residues burned equal to or smaller than the amount of crop residues minus the amount used for feed, bedding or construction)?
	If the Party has no data on $Frac_{REMOVE}$, has it assumed no removal, in line with the 2006 IPCC Guidelines?
Direct N_2O emissions from managed soils – mineralization/immobilization associated with loss/gain of soil organic matter	Are losses of soil carbon in cropland remaining cropland (reported in the LULUCF sector) accompanied by N_2O emissions from mineralization associated with loss of soil organic matter reported in this category? Note that N_2O immobilization associated with a gain of organic matter resulting from the management of mineral soils can be reported only when a Party applies a tier 3 approach
	Are the emissions correctly allocated between the agriculture sector and the LULUCF sector, that is, only mineralization/immobilization in cropland remaining cropland included under the agriculture sector and the rest in the LULUCF sector CRT 4(III)?
Direct N_2O emissions from managed soils – cultivation of organic soils (i.e. histosols)	Is the area of cultivated histosols in line with the area of organic soils reported in the LULUCF sector for cropland remaining cropland, land converted to cropland, grassland remaining grassland and land converted to grassland? Large differences (e.g. “NO” reported for this category although organic soils in cropland or grassland occur) in these data may indicate a problem in the inventory
Direct N_2O emissions from managed soils	Is the Party applying EFs for direct emissions to total N input to soils, before subtracting the amount of N lost through volatilization, leaching and run-off?
Indirect N_2O emissions from managed soils – atmospheric deposition	Does the atmospheric deposition include NO_X from burning of savannas and crop residues (these emissions should be excluded from this category)?
Indirect N_2O emissions from managed soils – N leaching and run-off	Does the Party consider, in its estimate of N losses by leaching/run-off only those areas where soil water-holding capacity is exceeded, as a result of rainfall and/or irrigation? Note that consideration of soil water-holding capacity is a new element in the 2006 IPCC Guidelines
Indirect N_2O emissions from managed soils – N leaching and run-off	Is the Party able to estimate the quantity of N mineralized from organic soils? If yes, is this included in the indirect N_2O emissions from leaching/run-off?

Box 7-6
Nitrous oxide (N2O) emissions from mineralization/immobilization in agricultural soils

When carbon loss occurs as a result of land-use/management change, the TERT should check that an estimate of associated direct and indirect N_2O emissions has been reported under the agriculture sector or whether the notation key "NE" (not estimated) has been used together with the justification that these emissions fall under the insignificance threshold. If the Party does not estimate soil organic carbon changes in mineral soils under cropland remaining cropland, the TERT should recommend that the Party estimate such changes as well as the associated N_2O emissions from nitrogen (N) mineralization. If a Party reports data in CRT 3.D for N mineralization, they should be consistent with loss of soil carbon under cropland remaining cropland reported in CRT 4.B.

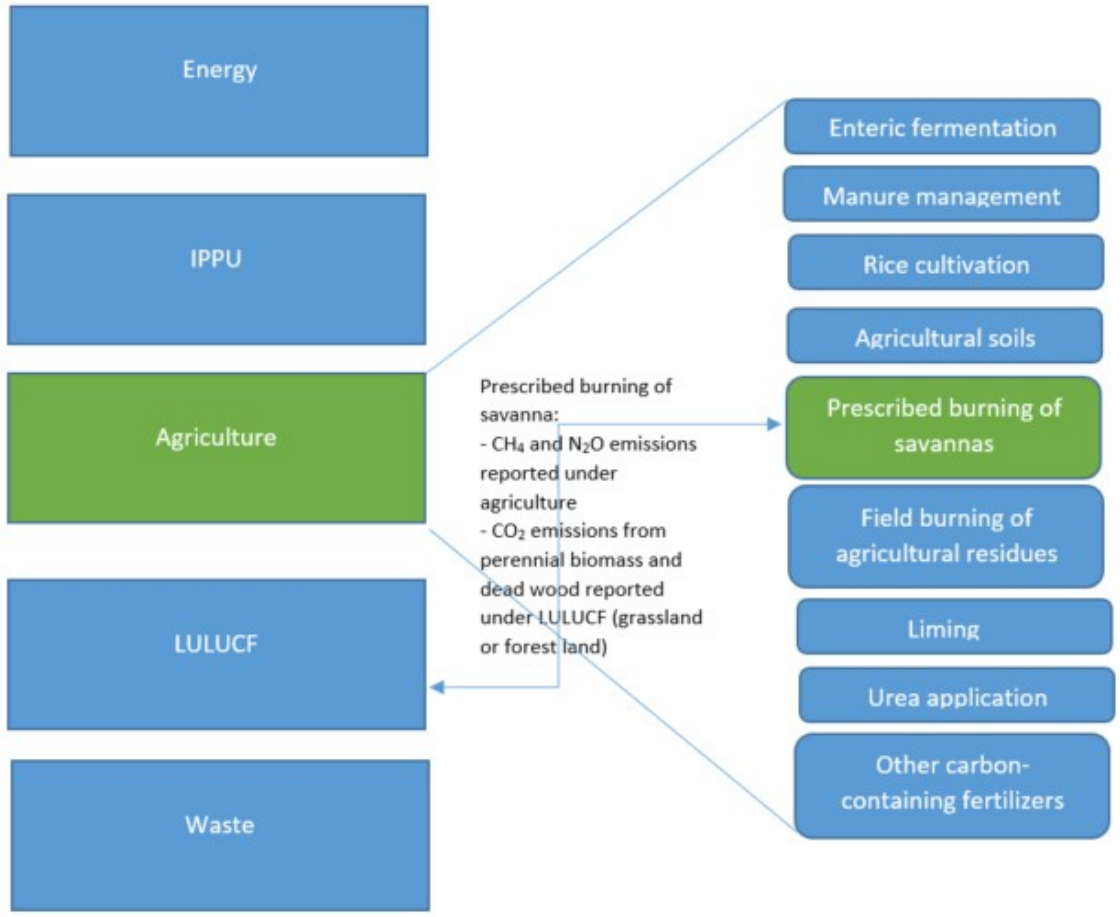
Prescribed burning of savannas

167. Table 7-40 provides a summary of key elements for the prescribed burning of savannahs category, and figure 7-20 summarizes the linkages between the prescribed burning of savannas category and the other categories in the agriculture sector and with other sectors.

Table 7-40
Summary of key elements of the prescribed burning of savannas category

Overview	*Category-specific information*	
Category name	Prescribed burning of savannas	
Reported in CRT	Table 3.E	
Main subcategories and GHGs to be reported	Forest land	CH_4, N_2O
	Grassland	CH_4, N_2O

Figure 7-20
Main linkages between the prescribed burning of savannas category and the other categories in the agriculture sector and other sectors



168. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the agriculture expert may consider going through the following list of potential TERT actions in table 7-41 when reviewing CH_4 and N_2O emissions from the prescribed burning of savannas category.

Table 7-41
Possible actions by the technical expert review team in its review of CH_4 and N_2O emissions from prescribed burning of savannas

Subcategory	*Action by the TERT, task*
All	Has the Party reported CH_4 and N_2O emissions from prescribed burning of savannas separately from other fires in forest land and grassland (i.e. avoiding double counting with CRT 4(V)), even though the guidance in the 2006 IPCC Guidelines has a common approach for all fires in forest land and grassland?
	If savanna burning is included in CRT 4(V), has the Party provided a justification in the NID?
	Has the Party correctly applied a combustion factor?
Forest land	Is the Party accounting for the burning of dead organic matter?

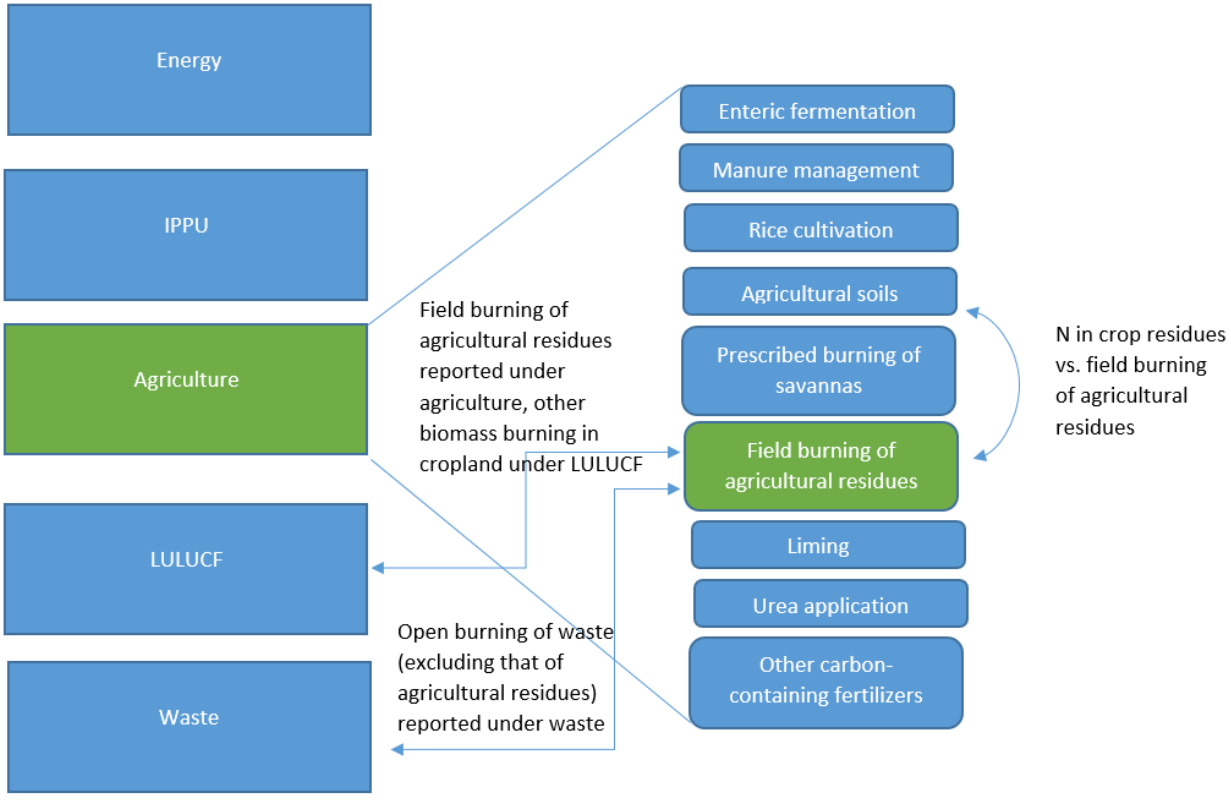
Field burning of agricultural residues

169. Table 7-42 provides a summary of key elements for the field burning of agricultural residues category, and figure 7-21 summarizes the linkages between the field burning of agricultural residues category and the other categories in the agriculture sector and other sectors.

Table 7-42
Summary of key elements of the field burning of agricultural residues category

Overview	*Category-specific information*	
Category name	Field burning of agricultural residues	
Reported in CRT	Table 3.F	
Main subcategories and GHGs to be reported	Cereals	CH_4, N_2O
	Pulses	CH_4, N_2O
	Tubers and roots	CH_4, N_2O
	Sugar cane	CH_4, N_2O

Figure 7-21
Main linkages between the field burning of agricultural residues category and the other categories in the agriculture sector and other sectors



170. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the agriculture expert may consider going through the list of potential TERT actions in table 7-43 when reviewing CH_4 and N_2O emissions from the field burning of agricultural residues category.

Table 7-43
Possible actions by the technical expert review team in its review of CH_4 and N_2O emissions from the field burning of agricultural residues category

Subcategory	*Action by the TERT, task*
All	Has the Party adequately separated reporting of field burning of agricultural residues in the agriculture sector from biomass burning in cropland (reported in CRT 4(V)), by avoiding omission or double counting of emissions? Note that the 2006 IPCC Guidelines has a common approach for estimation of fires in cropland
	Is the amount of agricultural residues burned consistent with the amount of crop residues minus the amount used for feed, bedding or construction?

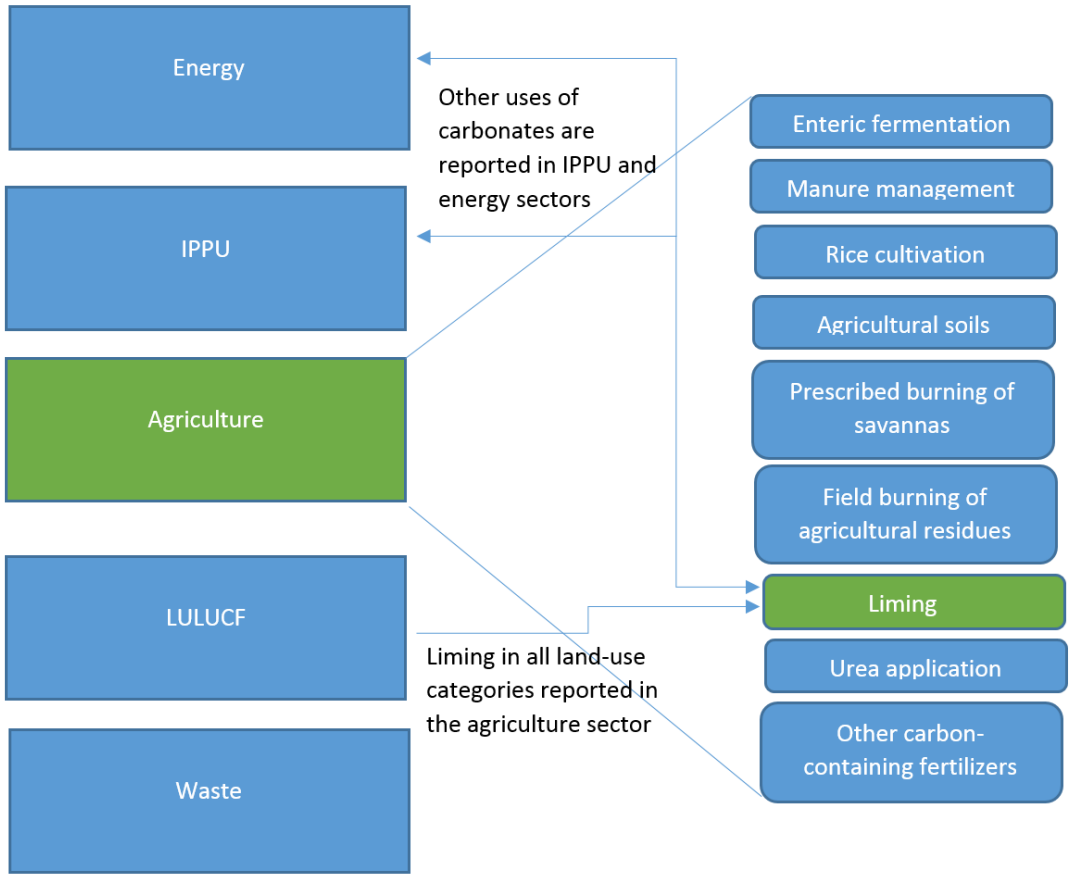
Liming

171. Table 7-44 provides a summary of key elements for the liming category, and figure 7-22 summarizes the linkages between the liming category and the other categories in the agriculture sector and other sectors.

Table 7-44
Summary of key elements of the liming category

Overview	*Category-specific information*	
Category name	Liming	
Reported in CRT	Table 3.G-I	
Main subcategories and GHGs to be reported	Limestone $CaCO_3$	CO_2
	Dolomite $CaMg(CO_3)_2$	CO_2

Figure 7-22
Main linkages between the liming category and the other categories in the agriculture sector and other sectors



172. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the agriculture expert may consider going through the list of possible TERT actions in table 7-45 when reviewing CO_2 emissions from the liming category.

Table 7-45
Possible actions by the technical expert review team in its review of CO_2 emissions from the liming category

Category	*Action by the TERT, task*
All	Are AD based on actual usage statistics? If based on annual sales or estimated through a balance of production, imports and exports are data sufficient to estimate national emissions?
	Are the AD available separately for limestone and dolomite or have assumptions been made? Are any assumptions sufficiently justified and documented?

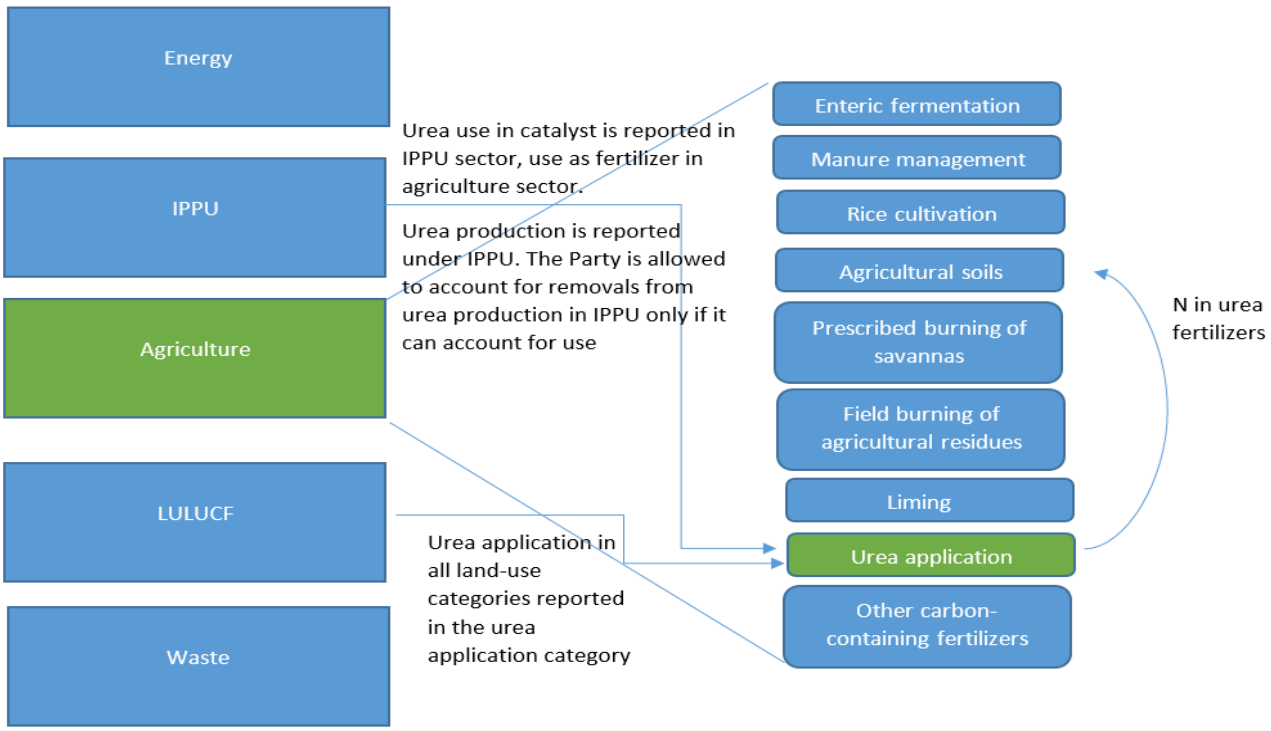
Urea application

173. Table 7-46 provides a summary of key elements for the urea application category, and figure 7-23 summarizes the linkages between the urea application category and the other categories in the agriculture sector and other sectors.

Table 7-46
Summary of key elements of the urea application category

Overview	*Category-specific information*	
Category name	Urea application	
Reported in CRT	Table 3.G-I	
Main subcategories and GHGs to be reported	Urea application	CO_2

Figure 7-23
Main linkages between the urea application category and the other categories in the agriculture sector and other sectors



174. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the agriculture expert may consider going through the list of possible TERT actions in table 7-47 when reviewing CO_2 emissions from the urea application category.

Table 7-47
Possible actions by the technical expert review team in its review of CO_2 emissions from the urea application category

Category	*Action by the TERT, task*
All	Does the reporting on urea application cover all land uses?
	Are the AD (amount of urea fertilizers used) consistent with the data used in the category direct and indirect N_2O emissions from agricultural soils (category 3.D)?
	Are the AD based on fertilizer use or sales instead of production?
	If AD are estimated through a balance of production, imports and exports are data sufficient to

Category	*Action by the TERT, task*
	estimate national emissions?

Other carbon-containing fertilizers

175. The 2006 IPCC Guidelines do not provide a specific method and EF for this category and therefore it is not considered as a mandatory category. However, it could be expected that Parties report emissions from this category using a similar approach to that used for urea (i.e. use of fertilizer as AD, EF based on carbon content). If that is the case, reviewers could undertake the same checks outlined in table 7-47.

F. Land use, land-use change and forestry

1. Introduction

176. The review of the LULUCF sector requires good knowledge of the requirements in the MPGs as well as the methodologies and guidance contained in the 2006 IPCC Guidelines and the Wetlands Supplement.

177. The 2006 IPCC Guidelines combines the agriculture and LULUCF sectors into the agriculture, forestry and other land use (AFOLU) sector. However, under the ETF, the MPGs require each Party to report agriculture and LULUCF as separate sectors. This sectoral structure is reflected in the CRTs and in the NID outline established by decision 5/CMA.3, and accordingly the two sectors are also covered separately in this handbook. The LULUCF expert and the generalist should be mindful of potential allocation issues between the agriculture and LULUCF sectors and ensure that any cross-sectoral categories are consistently reported in accordance with the 2006 IPCC Guidelines.

178. The LULUCF sector differs from other sectors in that it covers carbon stocks in carbon pools. Carbon stocks are composed of organic matter[40] which, through photosynthesis, removes CO_2 from the atmosphere and through mineralization/redox causes the emission to the atmosphere of CO_2, N_2O and CH_4 (nitrogen oxides (NO_X), carbon monoxide (CO) and non-methane volatile organic compounds do not add to total net emissions). Carbon stocks may:

(a) Increase, thus resulting in a net CO_2 removal from the atmosphere, and in the case of soil organic matter (SOM) also a net immobilization of nitrogen (N);

(b) Decrease, thus resulting in a net CO_2 emission to the atmosphere, and in the case of SOM also net N_2O emissions; further, in the case of redox of organic matter, CH_4 emissions could also be associated with carbon stock losses;

[40] Carbon stocks in carbon pools are usually measured as “organic matter stock”. To convert dry organic matter into carbon, the 2006 IPCC Guidelines provide default carbon fraction values for:

- Biomass:
  - Volume 4, table 4.3;
  - 0.5 for woody biomass and 0.47 for herbaceous biomass for grassland (volume 4, section 6.3.1.4);
  - 0.5 for flooded lands (volume 4, equation 7.10);
  - 0.5 for settlements (volume 4, section 8.2.1.2);
- Litter:
  - 0.37 (volume 4, equation 2.19);
  - 0.4 for cropland, grassland and settlements (volume 4, sections 5.2.2.4, 6.2.2.2 and 8.3.2.2);
- Dead wood:
  - 0.50 for cropland, grassland and settlements (volume 4, sections 5.2.2.4, 6.2.2.2 and 8.3.2.2);
- SOM mineral soils: 0.58 (volume 4, section 2.3.3.1);
- Peat: volume 4, table 7.5.

(c) Be in equilibrium, in this case carbon stock gains and losses are equal over a time period (e.g. a management cycle).

179. Further, since carbon stocks in carbon pools naturally vary across time, towards equilibrium levels, past carbon stock losses and gains have a legacy effect, affecting current trends of carbon stock changes.

180. The technical review of this sector requires the checking and assessment of both quantitative and qualitative data and information from the reporting of carbon stock changes and associated GHG emissions and removals owing to management and use of land and its conversion from one land-use category to another and/or from one management system to another.

Special considerations for LULUCF inventories

181. The LULUCF inventory is complicated by several considerations:

(a) Many Parties already have national programmes in place to estimate forest inventories and produce agriculture censuses and land-use maps. In such a case, instead of implementing a new inventory process, some Parties choose to elaborate existing data to meet inventory reporting requirements. This may create apparent difficulties in the comparison of annual reports among countries and, if estimates are based on interpolation between periodic inventories, apparent inconsistencies in time series within countries;

(b) High levels of natural variability may exist, which may require additional information for properly quantifying, in terms of emissions and removals, the impact of human activities on ecosystems;

(c) Analysis of trends is complicated by: (a) the length of time over which activities and disturbances impact upon carbon dynamics; (b) changes in the methodologies employed by Parties as they rationalize accounting rules with existing inventory practices, including by enhancing the quality and quantity of information collected as well as the frequency of collection; and (c) gross changes in subcategories not singled out in CRTs that can have significant effects on the time series of net values of a category, although being not singularly reported it is not evident what the cause of the trend in the time series is.

182. Table 7-48 provides a high-level overview of the review routines and tasks. Further details are provided in the remainder of this section.

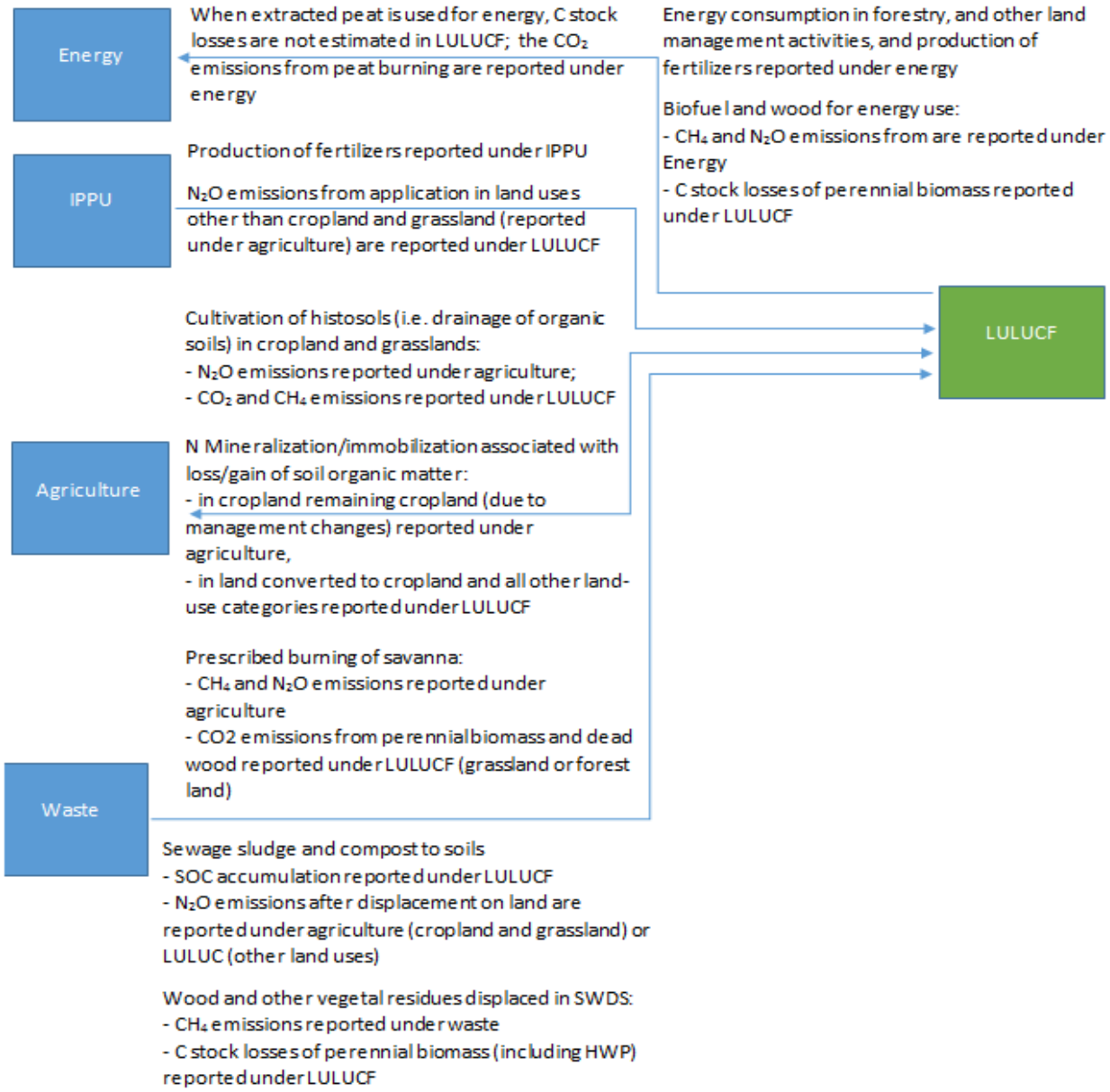
Table 7-48
General steps that should be undertaken for the review of the land use, land-use change and forestry sector

Check	*Action by the TERT, routine for the review of the LULUCF sector*
General	In coordination with the generalist on the TERT, assess whether the institutional, procedural and legal arrangements for the inventory preparation are robust enough to ensure TACCC of the LULUCF inventory
	Check whether categories, subcategories or subdivisions for which the Party has prepared estimates are appropriate and correspond to the national circumstances. The review should be implemented at the level of subdivisions reported
	Assess the consistency of the land representation, including whether lands have been correctly stratified into managed and unmanaged lands and if transition matrices have been reported in the NID for years of the transition time period not reported in the CRTs (in general for the period 1971–1989)
	Assess for which carbon pools the Party has reported estimates, considering that for some carbon pools under some categories, the IPCC assumes no net carbon stock changes in the absence of land-use/management changes; including whether disturbance matrices for significant carbon stock changes have been reported in the NID
	Assess whether the Party has estimated all gains and losses for each pool reported (e.g. for biomass, growth rate, harvesting, natural mortality, disturbances e.g. fires, pests), noting whether each pool is mandatory in accordance with the MPGs
	Assess whether the Party has estimated all GHG emissions/removals associated with carbon stock changes and if the estimated GHG fluxes are consistent with each other
Natural disturbances on managed land	Where a Party has addressed emissions and subsequent removals from natural disturbances on managed land in its GHG inventory, assess whether the Party has reported information on the approach taken and how it is consistent with IPCC guidance, and whether it has indicated if the resulting estimates are included in national totals. This check applies only where the Party has chosen to address natural disturbances; it does not constitute a requirement for all Parties to do so. The LULUCF expert should coordinate with the generalist on this element.

2. Sector-specific issues

183. The LULUCF sector is highly integrated with the agriculture sector and, to a lesser extent, with the energy sector and the waste sector (see figure 7-24).

Figure 7-24
Linkages between the emissions/removals estimated in the land use, land-use change and forestry sector and the emissions estimated in other inventory sectors



184. The 2006 IPCC Guidelines provide default methods, EFs and other parameters for the estimation and reporting of carbon stock changes in carbon pools and associated GHG emissions and removals. It is mandatory for Parties to report an estimate for each inventory category for which the 2006 IPCC Guidelines provide methods and default EFs. Table 7-49 reports, for each inventory category, information on which carbon pools and subcategories are required to be reported, if significant, because an IPCC tier 1 method is available (the notation "M" is used). Table 7-50 reports, for each inventory key category, information on which carbon pools and subcategories are required to be reported, if significant, because an IPCC method is available (the notation "M" is used).

Table 7-49
Tier 1: mandatory reporting according to the 2006 IPCC Guidelines

Tier 1			Land use													
			FL		CL		GL		WL				SL		OL	
Carbon pool – GHG			FL-FL	L-FL	CL-CL	L-CL	GL-GL	L-GL	WL-WL		L-WL		SL-SL	L-SL	OL-OL	L-OL
									PL-PL	L-PE	FlL					
Living biomass		Above-ground	M	M	M [a]	M [b, c]		M [b, c]		M [c]	M [c]			M [c]		M [c]
		Below-ground		M		M [b, c]		M [b, c]		M [c]	M [c]			M [c]		M [c]
Dead organic matter		Deadwood		M [3]		M [c]		M [c]						M [c]		M [c]
		Litter		M		M [c]		M [c]						M [c]		M [c]
Soil organic matter		Mineral		M	M	M	M	M						M		M [d]
		Organic	M	M	M	M	M	M	M					M		N/A
HWP			M (may be assumed 0 if net carbon stock change is judged insignificant)													
N_2O	Direct	Fertilization [e]	M	M									M	M		
		N mineralization		M		M	M	M						M		Y
		Drainage	M	M					M				M	M		
		Burning	M	M	M	M	M	M	M	M			M	M		Y
	Indirect	Fertilization [e]	M	M									M	M		
		N mineralization		M		M	M	M						M		Y
CH_4		Burning	M	M	M	M	M	M	M	M			M	M		M

Notes: M = mandatory, grey shading = not applicable, blank = not mandatory.

Abbreviations: CL = cropland, CL – CL= cropland remaining cropland, FL = forest land, FlL = flooded land, FL – FL = forest land remaining forest land, GHG = greenhouse gas, GL = grassland, GL – GL = grassland remaining grassland, HWP = harvested wood products, L – CL = land converted to cropland, L – FL = land converted to forest land, L – GL = land converted to grassland, L – OL = land converted to other land, L – PE = land converted to peat extraction, L – SL = land converted to settlements, L – WL = land converted to wetlands, OL = other land, OL – OL= other land remaining other land, PL = peatland, SL = settlements, SL – SL= settlements remaining settlements, WL = wetlands, WL – WL= wetlands remaining wetlands.

[a] To be reported only for perennial crops.

[b] Net carbon stock gain in biomass pool for annual crops is to be reported only once in the year after conversion.

c Only applicable if the Party has reported carbon stock changes or the IPCC provides default carbon stock values for the biomass or DOM carbon stock for the previous land

use. In such a case carbon stock is to be reported as instantaneously oxidized in the year of conversion.

d Carbon stock level after conversion is to be set at 0.

e N_2O emissions from N fertilization in forest land and settlements are to be reported under the LULUCF sector and those in cropland and managed grassland are to be reported in the agriculture sector. If the Party is not able to separate emissions from N fertilization in different land-use categories, all emissions are to be reported under the agriculture sector.

Table 7-50
Tier 2: mandatory reporting according to the 2006 IPCC Guidelines

Tier 2		Land use												
		FL		CL		GL		WL			SL		OL	
Carbon pool – GHG		FL-FL	L-FL	CL-CL	L-CL	GL-GL	L-GL	WL-WL		L-WL	SL-SL	L-SL	OL-OL	L-OL
								PL-PL	L-PE	FlL				
Living biomass	Above-ground	M	M	M [a]	M [b]	M	M [b]		M	M	M	M		M
	Below-ground	M	M	M [a]	M [b]	M	M [b]		M	M	M	M		M
Dead organic matter	Deadwood	M	M	M	M	M	M		M		M	M		M
	Litter	M	M	M	M	M	M		M		M	M		M
Soil organic matter	Mineral	M	M	M	M	M	M				M	M		M
	Organic	M	M	M	M	M	M	M	M		M	M		N/A
HWP		M												
N_2O Direct	Fertilization [c]	M	M								M	M		
	N mineralization	M	M		M	M	M				M	M		Y
	Drainage	M	M					M	M		M	M		
	Burning	M	M	M	M	M	M	M	M		M	M		Y
N_2O Indirect	Fertilization [c]	M	M								M	M		
	N mineralization	M	M		M	M	M				M	M		Y
CH_4	Burning	M	M	M	M	M	M	M	M		M	M		M

Notes: M = mandatory, grey shading = not applicable, blank = not mandatory.

Abbreviations: CL = cropland, CL – CL= cropland remaining cropland, FL = forest land, FlL = flooded land, FL – FL = forest land remaining forest land, GHG = greenhouse gas, GL = grassland, GL – GL = grassland remaining grassland, HWP = harvested wood products, L – CL = land converted to cropland, L – FL = land converted to forest land, L – GL = land converted to grassland, L – OL = land converted to other land, L – PE = land converted to peat extraction, L – SL = land converted to settlements, L – WL = land converted to wetlands, OL = other land, OL – OL= other land remaining other land, PL = peatland, SL = settlements, SL – SL= settlements remaining settlements, WL = wetlands, WL – WL= wetlands remaining wetlands.

a To be reported only for perennial crops.

b Net carbon stock gain in biomass pool for annual crops is to be reported only once in the year after conversion.

[c] N_2O emissions from N fertilization in forest land and settlements are to be reported under the LULUCF sector and those in cropland and managed grassland are to be reported in

the agriculture sector. If the Party is not able to separate emissions from N fertilization in different land-use categories, all emissions are to be reported under the agriculture sector.

185. In the MPGs, each Party is encouraged to use the Wetlands Supplement, which contains additional methodologies and default factors associated with activities on organic soils, coastal wetlands and wetlands mineral soils (see the glossary of the Wetlands Supplement for complete definitions of activities). If the Party decides to report GHG emissions and removals from one category or activity for which methods are not contained in the 2006 IPCC Guidelines but they are contained in the Wetlands Supplement, the methods contained in the Wetlands Supplement establish: (1) the good practice the Party is expected to apply for preparing those estimates; and (2) the completeness of reporting, for example, if the Party decides to report GHG emissions from peat fires, it is mandatory to report CO_2 and CH_4 emissions (for N_2O the Wetlands Supplement does not provide default EFs) and EFs used by the Party have to be compared with the IPCC defaults in order to judge their accuracy.

186. The Wetlands Supplement contains additional methodologies and default factors (see the glossary of the Wetlands Supplement for complete definitions of activities) that Parties may decide to apply (see previous paragraph). If a Party decides to apply the Wetlands Supplement, Table 7-51 reports, for each inventory category, information on which carbon pools and which subcategories are required to be reported, if significant, because a tier 1 method is available in the Wetlands Supplement (the notation "Y" is used). Table 7-52 reports, for each inventory key category, information on which carbon pools and subcategories have to be reported, if significant, applying a method from the Wetlands Supplement (the notation "Y" is used).

Table 7-51
Tier 1: mandatory reporting, if following the Wetlands Supplement

Tier 1			Any land use and/or land-use change category							
			Drained inland organic soils		Rewetted organic soils		Coastal wetlands		Inland wetlands mineral soils	
Carbon pool – GHG			On site	Off site	On site	Off site	On site	Off site	On site	Off site
LB	CO_2	Forest management [b]					Y			
		Drainage [c]					Y			
		Extraction [d]					Y			
		Rewetting/ restoration [e]								
DOM	CO_2	Forest management [b]					Y			
		Drainage [c]					Y			
		Extraction [d]					Y			
		Rewetting/ restoration [e]								
SOM [1]	CO_2	Drainage [c]	Y	Y			Y		Y	
		Extraction [d]					Y			
		Rewetting/ restoration [e]			Y	Y	Y		Y	
		Burning	Y		Y		Y			
	N_2O (direct)	Drainage [c]	Y							
		Extraction [d]					Y			
		Rewetting/ restoration [e]								
		Aquaculture use					Y			
		Burning								
	CH_4	Drainage [c]	Y							
		Extraction [d]								
		Rewetting/ restoration [e]			Y		Y		Y	
		Burning	Y		Y		Y			

Notes: Y = default method and factors provided, grey shading = not applicable, blank = not mandatory.
Abbreviations: DOM = dead organic matter, GHG = greenhouse gas, LB = living biomass, SOM = soil organic matter.
[a] It may include DOM as well as LB of non-tree wooden vegetation.
[b] Forest management practices in mangroves.
[c] Conversion from saturated to drained soils by establishing a net of ditches and removing original vegetation.
[d] Excavation to enable port, harbour and marina construction, including aquaculture and salt production.
[e] Conversion from drained to saturated soils by restoring hydrology and reestablishment of vegetation.

Table 7-52
Tier 2: mandatory reporting, if following the Wetlands Supplement

Tier 2	Any land use and/or land-use change category			
	Drained inland	Rewetted organic	Coastal wetlands	Inland wetlands

			organic soils		soils				mineral soils	
Carbon pool – GHG			On site	Off site	On site	Off site	On site	Off site	On site	Off site
LB	CO_2	Forest management [b]					Y			
		Drainage [c]					Y			
		Extraction [d]					Y			
		Rewetting/ restoration [e]								
DOM	CO_2	Forest management [b]					Y			
		Drainage [c]					Y			
		Extraction [d]					Y			
		Rewetting/ restoration [e]								
SOM [a]	CO_2	Drainage [c]	Y	Y			Y		Y	
		Extraction [d]					Y			
		Rewetting/ restoration [e]			Y	Y	Y		Y	
		Burning	Y		Y					
	N_2O (direct)	Drainage [c]	Y							
		Extraction [d]					Y			
		Rewetting/ restoration [e]			Y					
		Aquaculture use					Y			
		Burning	Y		Y		Y			
	CH_4	Drainage [c]	Y						Y	
		Extraction [d]								
		Rewetting/ restoration [e]			Y		Y		Y	
		Burning	Y		Y		Y			

Notes: Y = default method and factors provided, grey shading = not applicable, blank = not mandatory.
Abbreviations: DOM = dead organic matter, GHG = greenhouse gas, LB = living biomass, SOM = soil organic matter.
[a] It may include DOM as well as LB of non-tree wooden vegetation.
[b] Forest management practices in mangroves.
[c] Conversion from saturated to drained soils by establishing a net of ditches and removing original vegetation.
[d] Excavation to enable port, harbour and marina construction, including aquaculture and salt production.
[e] Conversion from drained to saturated soils by restoring hydrology and reestablishment of vegetation.

187. For each land category, carbon stock changes and associated GHG emissions/removals to be reported have been listed (together with references to equations to be used) in tables 7-59 through to 7-65. Note that all references to methods provided in the Wetlands Supplement are to be considered only if the Party decides to report GHG emissions and removals from one category or activity for which methods are not contained in the 2006 IPCC Guidelines but they are contained in the Wetlands Supplement. In other cases, reference to the Wetlands Supplement is for information purposes only.

Table 7-53
Carbon stock changes in pools and associated GHG emissions/removals that have to be estimated for forest land

Estimations at the tier 1 level								
	Biomass (B)[a]		**Dead organic matter (DOM)**		**Soil organic matter (SOM)**		**Harvested wood products (HWP)**	**Other emissions**
	Above (AB)	**Below (BB)**	**Dead wood (DW)**	**Litter (L)**	**Mineral soils (MS)**	**Organic soils (OS)**	**HWP**	
FL-FL	**Net carbon stock change (2.7)** **Carbon stock gain (2.9, 2.10)** **Carbon stock losses (2.11, 2.12, 2.13, 2.14)**	**0**	**0**		**0**	**CO_2 emissions from drained organic soils (2.26)** *CO_2 emissions from drained organic soils (2.2)* *On-site CO_2 emissions from drained organic soils (2.3)* *Off-site CO_2 emissions from drained organic soils (2.4, 2.5, 2A.1)* *CO_2 emissions from burning of drained organic soils (2.8)* *CO_2 emissions from rewetted organic soils (3.3)* *On-site CO_2 emissions from rewetted organic soils (3.4)* *Off-site CO_2 emissions from rewetted organic soils (3.5, 3.6)* *CO_2 emissions from burning of rewetted*	**Assumed 0, if judged insignificant (i.e. annual net carbon stock change in HWP pool, is less than the size of any key category), otherwise default tier 1 methods provided in the 2006 IPCC Guidelines (volume 4, chapter 12)** **Note that HWP are reported altogether regardless of the land of origin of wood**	**CH_4 and N_2O emissions from biomass burning (2.27)** **N_2O emissions from drained organic soils (11.1)** **N_2O emissions from N inputs (11.1 11.3)** **N_2O emissions from SOM mineralization (11.8)[d]** **indirect N_2O emissions (11.9, 11.10)** *CH_4 emissions from drained organic soils (2.6)* *N_2O emissions from drained organic soils (2.7)* *CH_4 emissions from burning of drained organic soils (2.8)[e]* *CH_4 emissions from rewetted organic soils (3.8)* *N_2O emissions from rewetted organic soils (3.9)* *CH_4 emissions from burning of rewetted organic soils (2.8)[e]* *CH_4 emissions from drained inland mineral soils (5.1)*
L-FL	**Net carbon stock change (2.4)** **Carbon stock gain (2.9, 2.10)** **Carbon stock losses (2.11, 2.12, 2.13, 2.14)[b]**		**0[c]**	**Net carbon stock change (2.23)**	**Net carbon stock change (2.25)**			

<table>
<tr><th colspan="8">Estimations at the tier 1 level</th></tr>
<tr><td></td><td colspan="2">Biomass (B)[a]</td><td colspan="2">Dead organic matter (DOM)</td><td colspan="2">Soil organic matter (SOM)</td><td>Harvested wood products (HWP)</td><td rowspan="2">Other emissions</td></tr>
<tr><td></td><td>Above (AB)</td><td>Below (BB)</td><td>Dead wood (DW)</td><td>Litter (L)</td><td>Mineral soils (MS)</td><td>Organic soils (OS)</td><td>HWP</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="2"></td><td></td><td>organic soils (2.8)
CO_2 removals for revegetation/creation of</td><td></td><td>CH_4 emissions for revegetation/creation of mangroves (4.9)</td></tr>
<tr><td colspan="8">Estimations at the tier 2 level</td><td>N_2O emissions from</td></tr>
<tr><td>FL-FL</td><td colspan="2">As tier 1, <u>plus</u> below-ground biomass carbon stock changes estimated</td><td colspan="2">Net carbon stock change (2.17, 2.18) or (2.17, 2.19)
Carbon stock gain (2.20, 2.21, 2.22, 2.14)</td><td rowspan="2">Net carbon stock change (2.25)</td><td rowspan="2">As tier 1
As tier 1</td><td rowspan="2">As tier 1, <u>but</u> instantaneous oxidation not applicable</td><td rowspan="2">CH_4 and N_2O emissions from biomass burning (as tier 1)
N_2O emissions from drained organic soils (as tier 1)
N_2O emissions from N inputs (as tier 1)
N_2O emissions from SOM mineralization (as tier 1)
Indirect N_2O emissions (11.10, 11.11)
As tier 1, <u>plus</u> N_2O emissions from burning of SOM in organic soils estimated</td></tr>
<tr><td>L-FL</td><td colspan="2">Net carbon stock change (2.15, 2.16)
Carbon stock gain (as tier 1)
Carbon stock losses (as tier 1)</td><td colspan="2">As tier1, <u>plus</u> dead wood carbon stock changes estimated</td></tr>
</table>

Notes: 0 indicates that the tier 1 methodology assumes no net carbon stock change. The IPCC equations to be applied are provided in parentheses (those from the Wetlands Supplement are given in italics) Note that where AD land-use categories do not allow for the separation of FL-FL and L-FL, for the IPCC default, L-FL does not apply. Note that, in land under conversion from categories for which the IPCC does not provide default values for the biomass or DOM pools, reporting of carbon stock changes is nevertheless mandatory (to ensure accuracy) if the Party has reported carbon stock changes in the pool under the previous land use.

Abbreviations: AD = activity data, EF = emission factor, FL – FL = forest land remaining forest land, IPCC = Intergovernmental Panel on Climate Change, L – FL = land converted to forest land, SOC = soil organic carbon.

[a] Where the 2006 IPCC Guidelines and its Supplements provide default biomass stocks for one or both the land use categories involved, and the country has an approach 2 or 3 land representation, then equation 2.15 and 2.16 must be applied.

[b] Where IPCC default values are available for the two land use categories in conversion (i.e. cropland converted to forest land and grassland converted to forest land), equations 2.15 and 2.16 apply.

[c] Tier 1 does not provide for forest dead wood default values in the 2006 IPCC Guidelines, volume 4, table 2.2, although the Wetlands Supplement, table 4.7, does provide default values for dead wood in mangrove forests.

[d] Only in case an SOC loss is reported.

[e] Note that N_2O emissions from fires on organic soils are not estimated at tier 1, because the Wetlands Supplement does not provide default EFs.

Table 7-54

Carbon stock changes in pools and associated GHG emissions/removals that have to be estimated for cropland and grassland

<table>
<tr><th colspan="8">Estimations at the tier 1 level</th></tr>
<tr><th></th><th colspan="2">Biomass (B)[a]</th><th colspan="2">Dead organic matter (DOM)</th><th colspan="2">Soil organic matter (SOM)</th><th>Harvested wood products (HWP)</th><th rowspan="2">Other emissions</th></tr>
<tr><th></th><th>Above (AB)</th><th>Below (BB)</th><th>Dead wood (DW)</th><th>Litter (L)</th><th>Mineral soils (MS)</th><th>Organic soils (OS)</th><th>HWP</th></tr>
<tr><td>CL-CL
GL-GL</td><td>Carbon stock change (2.7)[b]
Carbon stock gain (2.9)
Carbon stock losses (2.12)[c]</td><td>0</td><td colspan="2">0</td><td rowspan="2">Carbon stock change (2.25)</td><td rowspan="2">CO_2 emissions from drained organic soils (2.26)
CO_2 emissions from drained organic soils (2.2)
On-site CO_2 emissions from drained organic soils (2.3)
Off-site CO_2 emissions from drained organic soils (2.4, 2.5, 2A.1)
CO_2 emissions from burning of drained organic soils (2.8)</td><td rowspan="2">Assumed 0, if judged insignificant (i.e. annual net carbon stock change in HWP pool, is less than the size of any key category), otherwise default tier 1 methods provided in the 2006 IPCC Guidelines (volume 4, chapter 12)
Note that HWP are reported altogether regardless of the land of origin of wood</td><td rowspan="2">Non-CO_2 emissions from biomass burning (2.27)
N_2O emissions from SOM mineralization (11.8)[f]
Indirect N_2O emissions (11.10)[h]
CH_4 emissions from drained organic soils (2.6)
CH_4 emissions from burning of drained organic soils (2.8)[g]
CH_4 emissions from rewetted organic soils (3.8)
CH_4 emissions from burning of rewetted</td></tr>
<tr><td>L-CL
L-GL</td><td colspan="2">Carbon stock change (2.4)[d]
Carbon stock gain (2.9)
Carbon stock losses (2.12)[c]</td><td>0</td><td>Carbon stock change (2.23)[e]</td></tr>
</table>

Estimations at the tier 1 level								
	Biomass (B)[a]		**Dead organic matter (DOM)**		**Soil organic matter (SOM)**		**Harvested wood products (HWP)**	**Other emissions**
	Above (AB)	**Below (BB)**	**Dead wood (DW)**	**Litter (L)**	**Mineral soils (MS)**	**Organic soils (OS)**	**HWP**	
						CO_2 emissions from rewetted organic soils (3.3) *On-site CO_2 emissions from rewetted organic soils (3.4)*		*organic soils (2.8)*[(g)] *CH_4 emissions from rewetted mineral soils (5.1)*
Estimations at the tier 2 level						*Off-site CO_2*		
CL-CL GL-GL	**Carbon stock change (2.7)** **Carbon stock gain (2.9, 2.10)** **Carbon stock losses (2.11, 2.12, 2.13, 2.14)**		**Carbon stock change (2.18) or (2.19)** **Carbon stock gains (2.20, 2.21, 2.22, 2.14)**		**Carbon stock change (2.25)**	**As tier 1** *As tier 1*	**Default methods provided in the 2006 IPCC Guidelines (volume 4, chapter 12)**	**As tier 1** *As tier 1, <u>plus</u> N_2O emissions from burning of SOM in organic soils estimated*
L-CL L-GL	**Carbon stock change (2.15, 2.16)** **Carbon stock gain (2.9, 2.10)** **Carbon stock losses (2.11, 2.12, 2.13, 2.14)**							

Notes: 0 indicates that tier 1 methodology assumes no net carbon stock change). The IPCC equations to be applied are provided in parentheses (*those from the Wetlands Supplement are given in italics*). Note that where AD land-use categories do not allow for the separation of CL-CL and C-FL or GL-GL and C-GL, for the IPCC default, L– FL

does not apply. Note that in land under conversion from categories for which IPCC does not provide default values for the biomass or DOM pools, reporting of carbon stock changes is nevertheless mandatory (to ensure accuracy) if the Party has reported carbon stock changes in the pool under the previous land use.

Abbreviations: AD = activity data, CL – CL= cropland remaining cropland, GL – GL = grassland remaining grassland, HWP = harvested wood products, L – CL = land converted to cropland, L – GL = land converted to grassland, 2006 IPCC Guidelines = 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

[a] Where the 2006 IPCC Guidelines and its Supplements provide default biomass stocks for one or both the land use categories involved, and the country has an approach 2 or 3 land representation, then equation 2.15 and 2.16 must be applied.

[b] Changes in biomass pools are calculated only for perennial crops.

[c] All biomass harvested is assumed to be oxidized in the year of removal.

[d] The tier 1 method assumes below-ground biomass carbon stocks in cropland to be constant and only accounts for losses from the previous land use for L-CL categories. Where IPCC default values are available for the two land use categories in conversion (i.e. cropland converted to forest land and grassland converted to forest land), equations 2.15 and 2.16 apply.

[e] The tier 1 method assumes DOM stocks to be constant for cropland and grassland and only accounts for losses from previous land use for the conversion categories from forest land (FL-CL and FL-GL).

[f] Note that for CL-CL, N_2O emissions are reported in the agriculture sector (CRT 3.D).

[g] Note that N_2O emissions from fires on organic soils are not estimated at tier 1.

[h] Limited to N mineralization associated with loss of SOM resulting from change of land use or management on mineral soils in all land-use categories except for cropland remaining cropland.

Table 7-55
Carbon stock changes in pools and associated GHG emissions/removals that have to be estimated for wetlands – peatlands

Peatlands						
Estimations at the tier 1 level						
	Biomass (B)[a]		**Dead organic matter (DOM)**		**Soil organic matter (SOM)**	**Other emissions**
	Above (AB)	**Below (BB)**	**Dead wood (DW)**	**Litter (L)**		
WL-WL	**0**		**0**[b]		**CO_2 from managed peatlands (7.3)** **On-site CO_2 emissions from managed peatlands (7.4)** **Off-site CO_2 emissions from managed peatlands (7.5)**[d] *CO_2 emissions from drained organic soils (2.2)* *On-site CO_2 emissions from drained inland organic soils (2.3)* *Off-site CO_2 emissions from drained inland organic soils (2.4, 2.5, 2A.1)*[e] *CO_2 emissions from fires on drained inland organic soils (2.8)* *CO_2 emissions from rewetted organic soils (3.3)* *On-site CO_2 emissions from rewetted organic soils (3.4)* *Off-site CO_2 emissions from rewetted organic soils (3.5, 3.6)* *CO_2 emissions from burning of rewetted organic soils (2.8)* *CO_2 emissions/removals from rewetting of coastal wetlands (4.7)*	**N_2O emissions from peatlands (7.7)** **non-CO_2 emissions from fires (2.27)** *CH_4 emissions from drained inland organic soils (2.6)* *N_2O emissions from drained inland organic soils (2.7)* *CH_4 emissions from burning of drained inland organic soils (2.8)*[f] *CH_4 emissions from rewetted organic soils (3.8)* *N_2O emissions from rewetted organic soils (3.9)* *CH_4 emissions from burning of rewetted organic soils (2.8)*[f] *CH_4 emissions from rewetting of coastal wetlands (4.9)*
L-WL	**Carbon stock losses from biomass clearing only (2.4)**[b]					

Peatlands						
Estimations at the tier 1 level						
	Biomass (B)[a]		**Dead organic matter (DOM)**		**Soil organic matter (SOM)**	**Other emissions**
	Above (AB)	**Below (BB)**	**Dead wood (DW)**	**Litter (L)**		
					CO_2 emissions from drainage of coastal wetlands (4.8)	
Estimations at the tier 2 level						
WL-WL	**0**		**0**		**CO_2 from managed peatlands (7.3)** **On-site CO_2 emissions from managed peatlands (7.6)** **Off-site CO_2 emissions from managed peatlands (7.5)**[(d)] *As tier 1*	**As tier 1** *As tier 1, plus N_2O emissions from burning of SOM in organic soils (2.8)*
L-WL	**CO_2 emissions from peatland being drained for peat extraction (7.8)** **Carbon stock losses from biomass clearing (2.16)**		**CO_2 emissions from peatland being drained for peat extraction (7.8)** **Carbon stock losses from DOM (2.23)**		**CO_2 emissions from peatland being drained for peat extraction (7.8)** **On-site CO_2 emissions from managed peatlands (7.9)** **Off-site CO_2 emissions from managed peatlands (7.5)**[(d)] *As tier 1*	**As tier 1** *As tier 1, plus N_2O emissions from burning of SOM in organic soils (2.8)*

Notes: 0 indicates that tier 1 assumes no net carbon stock change. The IPCC equations to be applied are provided in parentheses (*those from the Wetlands Supplement are provided in italics*). Where AD land-use categories do not allow for the separation WL-WL and L-WL, for the IPCC default, L – WL does not apply. Note that in land under conversion from categories for which IPCC does not provide default values for the biomass or DOM pools, reporting of carbon stock changes is nevertheless mandatory (to ensure accuracy) if the Party has reported carbon stock changes in the pool under the previous land use.

Abbreviations: AD = activity data, IPCC = Intergovernmental Panel on Climate Change, L – WL = land converted to wetlands, WL –WL = wetlands remaining wetlands.

[a] Where the 2006 IPCC Guidelines and its Supplements provide default biomass stocks for one or both the land use categories involved, and the country has an approach 2 or 3 land representation, then equation 2.15 and 2.16 must be applied.

[b] C gains are assumed to be zero

[c] Note that tier 1 does not consider carbon stock changes in the DOM pool.
[d] All carbon in horticultural peat is assumed to be emitted during the extraction year. All CO_2 emissions from peat used for energy are reported in the energy sector.
[e] Does not include carbon losses associated with horticultural use of peat.
[f] Note that tier 1 does not estimate N_2O emissions from peatlands burning.

Table 7-56
Carbon stock changes in pools and associated GHG emissions/removals that have to be estimated for wetlands – flooded lands

<table>
<tr><th colspan="8">Flooded lands</th></tr>
<tr><th colspan="8">Estimations at the tier 1 level</th></tr>
<tr><th></th><th colspan="2">Biomass (B)[a]</th><th colspan="2">Dead organic matter (DOM)</th><th colspan="2">Soil organic matter (SOM)</th><th rowspan="2">Other emissions</th></tr>
<tr><th></th><th>Above (AB)</th><th>Below (BB)</th><th>Dead wood (DW)</th><th>Litter (L)</th><th>Mineral soils (MS)</th><th>Organic soils (OS)</th></tr>
<tr><td>WL-WL</td><td colspan="6">2006 IPCC Guidelines do not provide guidance on carbon stock changes in flooded land remaining flooded land</td><td rowspan="2">2006 IPCC Guidelines do not provide guidance on CH_4 emissions in flooded land remaining flooded land[(b)]
N_2O emissions from flooded land are included in the estimates of indirect N_2O from agricultural or other run-off and wastewater</td></tr>
<tr><td>L-WL</td><td colspan="2">Carbon stock change (7.10)</td><td colspan="4">2006 IPCC Guidelines do not provide guidance on carbon stock changes in DOM and SOM pools in land converted to flooded land</td></tr>
<tr><th colspan="8">Estimations at the tier 2 level</th></tr>
<tr><td>WL-WL</td><td colspan="6">2006 IPCC Guidelines do not provide guidance on carbon stock changes in flooded land remaining flooded land</td><td>as tier 1</td></tr>
<tr><td>L-WL</td><td colspan="2">as tier 1</td><td colspan="4">as tier 1</td><td>as tier 1</td></tr>
</table>

Notes: The IPCC equations to be applied are provided in parentheses (*those from the Wetlands Supplement are provided in italics*). Where AD land-use categories do not allow separation of WL-WL and L-WL, for the IPCC default, L – WL does not apply. In land under conversion from categories for which IPCC does not provide default values for the biomass or DOM pools, reporting of carbon stock changes is nevertheless mandatory (to ensure accuracy) if the Party has reported carbon stock changes in the pool under the previous land use.

Abbreviations: AD = activity data, IPCC = Intergovernmental Panel on Climate Change, L – WL = land converted to wetlands, WL –WL = wetlands remaining wetlands.

[a] Where the 2006 IPCC Guidelines and its Supplements provide default biomass stocks for one or both the land use categories involved, and the country has an approach 2 or 3 land representation, then equation 2.15 and 2.16 must be applied.

[b] Methodology provided in the 2006 IPCC Guidelines, volume 4, appendix 3.

Table 7-57
Carbon stock changes in pools and associated GHG emissions/removals that have to be estimated for wetlands – other

Aquaculture ponds, salt production ponds, rewetting/creation of coastal wetlands							
Estimations at the tier 1 level							
	Biomass (B)[a]		**Dead organic matter (DOM)**		**Soil organic matter (SOM)**		**Other emissions**
	Above (AB)	**Below (BB)**	**Dead wood (DW)**	**Litter (L)**	**Mineral soils (MS)**	**Organic soils (OS)**	
WL-WL L-WL L-SL L-OL	*Initial carbon stock change with extraction (4.2)* *Initial biomass carbon stock change with extraction (4.4)* *Initial carbon stock change with excavation (4.3)* *CO_2 from rewetting/creation of coastal wetlands (4.7)*		*Initial carbon stock change with extraction (4.2)* *Initial DOM carbon stock change with extraction (4.5)* *Initial carbon stock change with excavation (4.3)* *CO_2 from rewetting/creation of coastal wetlands (4.7)*		*Initial carbon stock change with extraction (4.2)* *Initial DOM carbon stock change with extraction (4.6)* *Initial carbon stock change with excavation (4.3)* *CO_2 from rewetting/creation of coastal wetlands (4.7)*		*CH_4 from rewetting/creation of coastal wetlands (4.9)* *N_2O from aquaculture (4.10)*
Estimations at the tier 2 level							
WL-WL L-WL L-SL L-OL	*As tier 1*		*As tier 1*		*As tier 1*		*As tier 1*

Notes: 0 indicates that tier 1 assumes no net carbon stock change. The IPCC equations to be applied are provided in parentheses (*all provided in the Wetlands Supplement*). Note that in land under conversion from categories for which the IPCC does not provide default values for the biomass or DOM pools, reporting of carbon stock changes is nevertheless mandatory (to ensure accuracy) if the Party has reported carbon stock changes in the pool under the previous land use.

Abbreviations: IPCC = Intergovernmental Panel on Climate Change, L – OL = land converted to other land, L – S = land converted to settlements, L – WL = land converted to wetlands, WL – WL= wetlands remaining wetlands.

[a] Where the 2006 IPCC Guidelines and its Supplements provide default biomass stocks for one or both the land use categories involved, and the country has an approach 2 or 3 land representation, then equation 2.15 and 2.16 must be applied.

Table 7-58
Carbon stock changes in pools and associated GHG emissions/removals that have to be estimated for settlements

<table>
<tr><th colspan="8">Estimations at the tier 1 level</th></tr>
<tr><td></td><td colspan="2">Biomass (B)[a]</td><td colspan="2">Dead organic matter (DOM)</td><td colspan="2">Soil organic matter (SOM)</td><td>Harvested wood products (HWP)</td><td rowspan="2">Other GHG emissions</td></tr>
<tr><td></td><td>Above (AB)</td><td>Below (BB)</td><td>Dead wood (DW)</td><td>Litter (L)</td><td>Mineral soils (MS)</td><td>Organic soils (OS)</td><td>HWP</td></tr>
<tr><td>SL-SL</td><td>0</td><td>0</td><td colspan="2">0</td><td>0</td><td rowspan="2">CO_2 emissions from drained organic soils (2.26)
CO_2 emissions from drained organic soils (2.2)
On-site CO_2 emissions from drained organic soils (2.3)
Off-site CO_2 emissions from drained organic soils (2.4, 2.5, 2A.1)
CO_2 emissions from burning of drained organic soils (2.8)
CO_2 emissions from rewetted organic soils (3.3)
On-site CO_2 emissions from rewetted organic soils (3.4)
Off-site CO_2 emissions from rewetted organic soils (3.5, 3.6)</td><td rowspan="2">Assumed 0, if judged insignificant (i.e. annual net carbon stock change in HWP pool, is less than the size of any key category), otherwise default tier 1 methods provided in the 2006 IPCC Guidelines (volume 4, chapter 12)
Note that HWP are reported altogether regardless of the land of origin of</td><td rowspan="2">CH_4 and N_2O emissions from biomass burning (2.27)
N_2O emissions from drained organic soils (11.1)
N_2O emissions from N inputs (11.2, 11.3)
N_2O emissions from SOM mineralization (11.8)[c]
Indirect N_2O emissions (11.9, 11.10)[c]
CH_4 emissions from drained organic soils (2.6)
N_2O emissions from drained organic soils (2.7)
CH_4 emissions from burning of drained organic soils (2.8)[b]
CH_4 emissions from rewetted organic soils (3.8)
N_2O emissions from rewetted organic soils (3.9)
CH_4 emissions from burning</td></tr>
<tr><td>L-SL</td><td colspan="2">Carbon stock losses from biomass clearing only (2.4)[e]</td><td>0</td><td>Carbon stock change (2.23)[b]</td><td>Carbon stock change (2.25)</td></tr>
</table>

<table>
<tr><th colspan="8">Estimations at the tier 1 level</th></tr>
<tr><td></td><td colspan="2">Biomass (B)[a]</td><td colspan="2">Dead organic matter (DOM)</td><td colspan="2">Soil organic matter (SOM)</td><td>Harvested wood products (HWP)</td><td>Other GHG emissions</td></tr>
<tr><td></td><td>Above (AB)</td><td>Below (BB)</td><td>Dead wood (DW)</td><td>Litter (L)</td><td>Mineral soils (MS)</td><td>Organic soils (OS)</td><td>HWP</td><td></td></tr>
<tr><td></td><td colspan="2"></td><td></td><td></td><td></td><td>CO_2 emissions from burning of rewetted organic soils (2.8)</td><td>wood</td><td>of rewetted organic soils (2.8)[b]</td></tr>
<tr><td colspan="8">Estimations at the tier 2 level</td><td>CH_4 emissions from drained</td></tr>
<tr><td>SL-SL</td><td colspan="2">Carbon stock change (2.4, 8.1)
Carbon stock gain (8.2 or 8.3)[d]</td><td colspan="2">Carbon stock change (2.17, 2.18 or 2.17, 2.19)
Carbon stock gain (2.20, 2.21, 2.22, 2.14)</td><td rowspan="2">Carbon stock change (2.25)</td><td rowspan="2">As tier 1
As tier 1</td><td rowspan="2">As tier 1</td><td rowspan="2">CH_4 and N_2O emissions from biomass burning (as tier 1)
N_2O emissions from drained organic soils (as tier 1)
N_2O emissions from N inputs (as tier 1)
N_2O emissions from SOM mineralization (as tier 1)
Indirect N_2O emissions (11.10, 11.11)
As tier 1, <u>plus</u> N_2O emissions from burning of SOM in organic soils estimated</td></tr>
<tr><td>L-SL</td><td colspan="2">Carbon stock change (2.15, 2.16, 8.1)
Carbon stock gain (8.2, 8.3)</td><td colspan="2">As tier 1</td></tr>
</table>

*Notes***:** 0 indicates that tier 1 methodology assumes no net carbon stock change). The IPCC equations to be applied are provided in parentheses (*those from the Wetlands Supplement are given in italics*). Note that where AD land-use categories do not allow for the separation of SL-SL and L-SL, for the IPCC default, L – SL does not apply. Note that in land under conversion from categories for which the IPCC does not provide default values for the biomass or DOM pools, reporting of carbon stock changes is nevertheless mandatory (to ensure accuracy) if the Party has reported carbon stock changes in the pool under the previous land use.

Abbreviations: AD = activity data, L –SL = land converted to settlements, IPCC = Intergovernmental Panel on Climate Change, SL – SL = settlements remaining settlements.

[a] Where the 2006 IPCC Guidelines and its Supplements provide default biomass stocks for one or both the land use categories involved, and the country has an approach 2 or 3 land representation, then equation 2.15 and 2.16 must be applied.

[b] The tier 1 method assumes DOM stocks to be constant for Settlements and only accounts for losses from previous land use for the conversion category from forest land (FL-SL).

[c] N_2O emissions from N mineralization in mineral soils in SL-SL are assumed to be zero as the carbon stock change is also assumed to be zero. Therefore, N_2O emissions from N mineralization only occur in land converted to settlements.

[d] For average age of the tree population less than or equal to 20 years, tier 2 assumption is that the biomass carbon stock losses are equal to zero. Over tree population over 20 years gains and losses are assumed to be equivalent and biomass net carbon stock changes are equal to 0.

[e] C gains are assumed to be zero

Table 7-59

Carbon stock changes in pools and associated GHG emissions/removals that have to be estimated for other land

Estimations at the tier 1 level								
	Biomass (B)[a]		**Dead organic matter (DOM)**		**Soil organic matter (SOM)**		**Harvested wood products (HWP)**	**Other emissions**
	Above (AB)	**Below (BB)**	**Dead wood (DW)**	**Litter (L)**	**Mineral soils (MS)**	**Organic soils (OS)**	**HWP**	
OL-OL								
L-OL[(a)]	**Carbon stock losses from biomass clearing only (2.4)[(b)]**		**0**	**Carbon stock change (2.23)[(e)]**	**Carbon stock change (2.25)[(c)]**	**0[(1)(2)]**	**Assumed 0, if judged insignificant (i.e. annual net carbon stock change in HWP pool, is less than the size of any key category), otherwise default tier 1 methods provided in the 2006 IPCC Guidelines (volume 4, chapter 12)** **Note that HWP are reported altogether regardless of the land of**	**CH_4 and N_2O emissions from biomass burning (2.27)** **N_2O emissions from SOM mineralization (11.8)[(d)]** **Indirect N_2O emissions (11.10)**

Estimations at the tier 1 level							
						origin of wood	
Estimations at the tier 2 level							
OL-OL							
L-OL	**Carbon stock change (2.15, 2.16)** [c]		**Carbon stock change (2.23)**[e]	**As tier 1**	**As tier 1**	**As tier 1**	**As tier 1**

Notes: Grey shading indicates the cell is not applicable. 0 indicates that the tier 1 methodology assumes no net carbon stock change. The IPCC equations to be applied are provided in parentheses. Where AD land-use categories do not allow for the separation of OL-OL and L-OL, for the IPCC default, L –O does not apply. In land under conversion from categories for which the IPCC does not provide default values for the biomass or DOM pools, reporting of carbon stock changes is nevertheless mandatory (to ensure accuracy) if the Party has reported carbon stock changes in the pool under the previous land use.

Abbreviations: AD = activity data, L – OL = land converted to other land, OL – OL= other land remaining other land.

[a] Where the 2006 IPCC Guidelines and its Supplements provide default biomass stocks for one or both the land use categories involved, and the country has an approach 2 or 3 land representation, then equation 2.15 and 2.16 must be applied.

[b] C gains are assumed to be zero

[c] Both tier 1 and tier 2 methods assume complete loss of biomass/DOM carbon stocks following conversion while only tier 1 method assumes complete loss of SOM (although default SOC stock for organic soils are not provided by the IPCC).

[d] Stock changes in organic soils are assumed to be insignificant as drainage is unlikely in other land. If such an assumption is not proven to be true, CO_2 and N_2O emissions have to be estimated and also CH_4 emissions are estimated if the Party applies the Wetlands Supplement.

[e] The tier 1 method assumes DOM stocks are insignificant for other land and only accounts for losses from the previous land use for the conversion category from forest land (FL-OL).

3. Key components of a land use, land-use change and forestry inventory

Consistent representation of land areas

188. Land representation is a cross-cutting issue among LULUCF categories, so it is generally described in a section at the beginning of the LULUCF chapter in the NID, including:

(a) Land-use definitions and the correspondence of the classification systems used to the LULUCF categories;

(b) How managed and unmanaged land are distinguished;

(c) How country-specific sub-subcategories/sub-subdivisions are appropriate to national circumstances;

(d) Land databases used for the inventory preparation, and how they are consistent across time and space:

(i) With each other; and

(ii) With land categories (including subcategories/subdivisions);

(e) Approaches used for representing land areas, and how consistency across time and categories, and subcategories/subdivisions, has been ensured;

(f) Verification of land representation (e.g. through an independent time series of plots).

189. The key to an accurate LULUCF inventory is to have good data for land stratification. The historical importance of land use and management change complicates the process, because it is crucial that land representation remains consistent over time. Consequently, the use of accurate land data from the current year may be hampered by the quality of historic data in some categories/subcategories/subdivisions.

Review of the land representation

190. The 2006 IPCC Guidelines present three approaches for representing land areas. The choice of approaches used will depend on the national circumstances of the Party, including technical capacity and financial capability and availability of data. The approaches complement each other and different approaches can be used for different LULUCF categories, as well as for different portions of the country. The main potential source of errors, especially when using approaches 2 and 3, is the lack of consistency in information and in methodologies applied across time. Therefore, reviewers should check the sources of data, classification methodology used and QA/QC and verification procedures applied (e.g. to avoid subjectivity in classification) throughout the time series, as well as the methods a Party has applied to ensure time-series consistency when different data sets and methods have been applied across the time series and across the country area. Table 7-60 describes the approaches to land representation that may be applied by a Party.

Table 7-60
Approaches to land representation

Check	*Considerations*
Approach 1	Usually uses a combination of land area data sets (likely prepared for other purposes) such as forestry and agricultural statistics. When several databases are combined, overlaps and/or omissions might occur. In such cases, a Party should establish a relationship among definitions used in the various databases, as well as among those used in the databases and the definitions of the six IPCC land-use categories, with the aim of avoiding double counting and omissions.

	Approach 1 does not allow the identification and tracking of land-use/management changes, although net changes in land use/management may be identified
Approach 2	Includes information regarding conversions among land categories between two points in time only. The result of approach 2 can be presented as a land transition matrix representing the areas where land use did not change and the areas that have undergone conversions among any land-use categories. However, approach 2 does not allow for the tracking of land use and management, as well as of their changes, of specific parcels of land across the entire time series
Approach 3	Identifies and tracks cover, use and management of lands across a time series, either through sampling of geographically located points or by wall-to-wall mapping, or a combination of the two. Approach 3 is therefore capable of providing all the required information, and tracking it across time, on conditions of a specific parcel of land, including on the occurrence of specific management activities, temporal sequence of practices and disturbance events

191. Table 7-61 includes the checks that a reviewer should undertake to assess if the land representation is consistent (*note that when a land subcategory is further stratified (subdivided) the consistency of land representation needs to be ensured/checked starting from the lowest level of stratification*).

Table 7-61
Possible actions by the technical expert review team in its review of land representation

Check	*Action by the TERT, task*
General	Is total area reported constant across the time series and does it correspond to the total national territory?
	Does a gross increase in a land-use category X (e.g. forest land) correspond to an identical gross increase in the area of its subcategory "land converted to land-use category X" (e.g. land converted to forest land)?
	Does a gross increase in the subcategory "land-use category X remaining land-use category X" (e.g. forest land remaining forest land) correspond to an identical gross decrease in the subcategory "land converted to land-use category X" (e.g. land converted to forest land)?
	Does a gross decrease in the "land-use category X" (e.g. forest land) correspond to an identical aggregate gross increase in the areas of subcategories of "land-use category X converted to other land-use categories" (e.g. forest land converted to cropland + forest land converted to grassland + forest land converted to settlements + forest land converted to wetlands + forest land converted to other land)?

192. Owing to the multiplicity of stratifications that vary by land category and carbon pools (among others), it is extremely important to review the consistency of areas reported according to different stratifications. Therefore, reviewers should carefully assess the consistency of land representation for each year and across the time series. Table 7-62 illustrates checks to review the consistency of land representation for different stratifications:

Table 7-62
Possible actions by the technical expert review team in its review of the consistency of land representation for different stratifications

Check	*Action by the TERT, tasks*
General	Are land areas transferred among land categories according to the previous and current year's land use (e.g. in any given year the total area converted from forest land to non-forest land uses should be equivalent to the loss of area counted in the category forest land)?
	Does the Party divide areas under forest land, grassland and wetlands into managed and unmanaged lands, as necessary?

	Does the Party report definitions relevant to determining the extent of the managed land included in the inventory, together with evidence that these definitions have been applied consistently over time?
	If the Party's land classification scheme[a] does not match the six broad land categories given in the 2006 IPCC Guidelines, has the Party combined and/or disaggregated its own land categories so that it can use the IPCC categories for estimating and reporting emissions and removals?
	Is managed land that is subsequently left unmanaged reported as either: (a) Managed for the entire transition period (i.e. until the carbon stocks reach the new equilibrium level characteristic of the unmanaged land)? And therefore its carbon stock changes and associated emissions/removals are reported under managed land, possibly as a subdivision of, for the entire transition period; or (b) Unmanaged? Note that, in this case, carbon stock changes and associated emissions/removals have to be reported, possibly in a subdivision of unmanaged land, for the entire transition period. If the Party is not reporting those carbon stock changes and associated emissions/removals, reviewers should consider this as incompleteness in the GHG inventory
	If an unmanaged land area is subsequently managed but the land category does not change (for example, an unmanaged forest land that becomes subject to forest management activities), is the land reported under in the land remaining under the same land category (e.g. under forest land remaining forest land)?[b]

[a] The following requirements should be noted for a country-specific classification scheme: (1) There is a hierarchical order in the classification of land. The hierarchical order ensures that no double counting of land occurs; (2) To avoid gaps in the land classification, and irrespective of the country-specific definitions, the country-specific category(ies) included in "other land" have to have the lower hierarchical order and be defined in a way that includes lands without significant carbon stocks that cannot be classified under any other land-use category. The definition of a category should be based on objective criteria consisting of quantitative elements as well as the classification system, in order to avoid subjectivity in land classification.

[b] The 2006 IPCC Guidelines, volume 4, chapter 4, suggest that it is good practice to report unmanaged land (e.g. unmanaged forest land) that is subsequently managed (e.g. managed forest land) under the category "land converted to another land use" (e.g. forest land converted to forest land). However, since this is not feasible with the current structure of CRTs, Parties will report such converted land under the category "land remaining under the same use" (e.g. "forest land remaining forest land").

193. If a Party has applied a classification system for climate, soil, vegetation, management, age class and biomass density that is different than the one provided in the 2006 IPCC Guidelines, reviewers should check the issues in table 7-63.

Table 7-63
Possible actions by the technical expert review team in its review of the different classification systems

Check	*Action by the TERT, tasks*
General	Is the classification system properly described in the NID, and the raw data published, so that its replicability is ensured (transparency)? This includes the citation of relevant peer-reviewed literature
	Does the classification system cover the entire variability of the population (the Party's territory and ecosystem classes) to be classified (completeness)?
	For each level of stratification, does the classification system classify any element of the population under one and only one stratum which is to be achieved by establishing a hierarchical order (accuracy/comparability)?
	What measures (e.g. verification, reclassification of previous years' data) are applied to ensure consistency in classification across the time series (consistency)? Are they appropriate?
	Has the appropriateness of the application of the IPCC default factors to the country-specific classification scheme been assessed and have suitable adjustments to the factors been made, as necessary? This includes checking the quantitative or qualitative evidence justifying the use of the IPCC default factors and/or any adjustment of them reported in the NID

194. When reviewing land area data in CRTs 4.1, 4.A–F and 4(II), 4(III) and 4(V) in the CRT, and land matrices for the years 1971–1989 as reported in the NID, you should consider the issues included in table 7-64.

Table 7-64
Possible actions by the technical expert review team in its review of land area in the common reporting table tables for land use, land-use change and forestry

Check	*Action by the TERT, tasks*
CRT 4.1, and land matrices reported in the NID	Is the total area reported constant across the time series? Does it correspond to the total national territory?
	Does "Final area" match the sum of total areas reported for each category in the corresponding CRTs 4.A–F?
	Are area change values reported in this table annual? (Note that cumulative areas are reported in background tables while in this table annual area changes have to be reported)
	For each activity, is the total area value reported at the end of the year (row 17) the same as the area reported for that activity in the background tables?
	For each activity, is the total area value reported at the end of the year (row 17) the same area reported for that activity in the following year as the total area of the activity at the end of the previous year (column L)?
CRTs 4.A–F – check for any reported year *n*	Is the total area under each land-use change category equal to the sum of areas reported (in CRT 4.1, for each inventory year, and in the NID for years before the base year) as converted to that land category during a time period equivalent to the transition period, minus the areas further converted to other land-use categories (if countries track land transition in a way that allows gathering this information)?
	Is the total area of a land-use category X remaining land-use category X equal to the area of the previous year plus the areas converted to that category in the year $n - T$ (e.g. for 1991, the year 1971) minus the areas of that land-use category converted to other categories in the year n

Check	*Action by the TERT, tasks*
	For any reported year *n*, do reported areas of total forest land and agricultural land (cropland + managed grassland) compare with data reported to other international organizations (mainly FAO at FAOSTAT)? If not, is an appropriate explanation provided in the NID?
CRT 4.(II) – check for any reported year n	Does the sum of areas of drained organic soils under cropland and managed grassland match the area reported under "cultivation of organic soils" in the agriculture sector in CRT 3.D?

Abbreviations: CRT = common reporting table, TERT = technical expert review team, FAO = Food and Agriculture Organization of the United Nations, NID = national inventory document.

Carbon pools and carbon stock changes

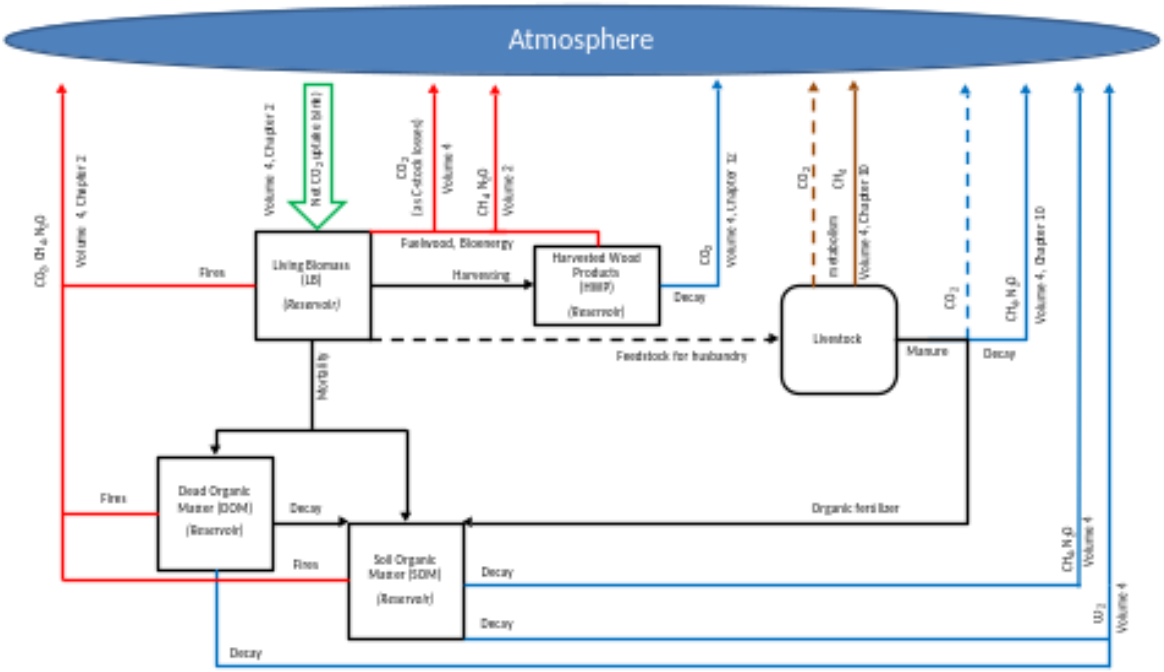
195. With the exclusion of N_2O emissions from fertilization,[41] all GHG emissions and removals from the LULUCF sector originate from carbon stock changes. This is the reason why the IPCC uses carbon stock changes as a proxy to infer GHG emissions and removals.

196. Figure 7-25 illustrates the carbon stocks in carbon pools, transfers of carbon stocks among pools and GHG fluxes to and from the atmosphere, in the AFOLU sector. The relevant volumes and chapters of the 2006 IPCC Guidelines where further guidance can be found are provided for each carbon pool, carbon stock transfer and GHG flux associated with biological sinks and reservoirs. (The dashed lines are fluxes and stocks not explicitly counted by IPCC methods). Be aware that Parties may further stratify carbon pools in sub-pools to which different methods may be applied.

[41] See the section on agriculture in this Review handbook for guidance on reviewing this source reported in CRT table 4(I).

Figure 7-25

Carbon stocks, carbon stock transfers and GHG fluxes to and from the atmosphere



Note: Net uptake = photosynthesis + autotrophic respiration. Mortality = turnover + mortality due to disturbances.

Review of carbon stock change estimates

197. Carbon stock changes are estimated by applying the gain–loss approach or the stock-difference approach or a combination of these methodological approaches. Also, tier 3 methods may be classified according to these two main methodological approaches. If tier 3 methods are used, the following elements in table 7-65 may help reviewers in the assessment of whether the inclusion/exclusion of carbon pools and the quantification of carbon stock changes is consistent with good practice:

Table 7-65

Possible actions by the technical expert review team in its review of tier 3 approaches for estimating carbon stock change

Check	*Action by the TERT, tasks*
Symmetry	(a) For a pool, if carbon stock gains are estimated are carbon stock losses also estimated and vice versa (b) For equivalent but inverse processes (e.g. grassland converted to cropland and cropland converted to grassland within the same land stratum), are total net carbon stock changes across the transition period equal in magnitude but opposite in sign?

Check	*Action by the TERT, tasks*
General	For a carbon pool, is long-term carbon stock at equilibrium consistent with environmental conditions and management practices?
	Are net carbon stock changes assumed to be 0 only in cases where the carbon stock can be assumed to be at its long-term average?
	If the carbon stock cannot be assumed to be at its long-term average, are annual carbon stock changes equal to the value calculated by dividing the difference between the long-term carbon stock at equilibrium and the actual carbon stock by the number of years of the transition period needed for the carbon pool to achieve its long-term carbon stock at equilibrium?

Abbreviation: TERT = technical expert review team.

198. It is of the utmost importance to check completeness and consistency of carbon stock transfers among pools, in order to ensure the completeness and accuracy of estimates, particularly when different methods are applied for estimating carbon stock changes in different pools (i.e. the carbon stock transfer from a pool X to another pool Y (i.e. C loss in pool X) should be equivalent to the carbon transfer into the other pool (i.e. C gain in pool Y).

199. The 2006 IPCC Guidelines provide a "disturbance matrix" (volume 4, table 2.1) that can be used to track carbon stock transfers as well as emissions to the atmosphere (i.e. mass balance), noting that it is good practice to report these, if possible, for key categories. When reviewing a disturbance matrix, check whether the Party has been filled in all its part and whether the data provided are credible and consistent with the carbon stock changes and emissions reported.

200. Table 7-66 includes issues a reviewer should assess regarding the Party's reporting of carbon stock change estimates in the LULUCF inventory.

Table 7-66
Possible actions by the technical expert review team in its review of carbon stock change estimates

Check	*Action by the TERT, tasks*
Documentation: definitions	(a) *Has the Party reported definitions of carbon pools as well as information on ancillary data, EFs and carbon stock change factors and how these correspond to the IPCC definitions and defaults, including: (b) The differences in the definitions of the carbon pools compared with those provided in the 2006 IPCC Guidelines; (c) Consistency of the definitions with the stratification applied by the Party and their appropriateness to national circumstances
Documentation: methodologies and data for estimating carbon stock changes	(a) *Has the Party provided information on the methods it has used for preparing estimates of carbon stock change and other emissions, including: (b) Verification of the results of tier 3 methods (e.g. by comparison with results of IPCC default methods); (c) Disturbance matrices for all carbon stock losses/transfers associated with disturbances (including harvesting), if possible
	(a) *Has the Party provided information on all AD, EFs and other parameters used for inventory preparation including: (b) Sources of information; (c) Descriptions of sampling protocols; (d) How any inconsistencies between different data sets (e.g. with regard to coverage, definitions etc.) have been addressed? (e) *Has the Party constructed consistenta time series of annual data where non-annual measurements are used to estimate emissions?

Check	*Action by the TERT, tasks*
Methodologies and data for estimating carbon stock changes	**For each carbon pool**: (a) Has the Party estimated all carbon stock gains and losses for each significant pool for which no assumption of zero net carbon stock change has been taken? (b) For each reported carbon stock gain, has the Party also estimated losses of carbon stock due to its subsequent decay or disturbances? (c) Unless the input carbon pool is estimated to be at equilibrium by applying tier 1 method, for each carbon stock loss that is transferred to another carbon pool is there an equivalent carbon stock gain in the other pool? (d) *Are all trends across time in gains/losses/net change explained? (e) If there is a change in land use/management, have both processes been reported (i.e. (a) the abrupt change that occurs in a single year, where it does occur and (b) the continuous change that occurs over a transition period)?
	For fuelwood: Are the estimates of fuelwood consumption reported in the energy sector consistent with the fuelwood collection reported for biomass as well as with data on fuelwood import/export?
	For HWP:[b] (a) Have all HWP been included? (b) Are the input data and variables applied consistent with the methodology applied? (c) *Are all CO_2 emissions associated with HWP carbon stock losses reported in the LULUCF sector, including those from HWP displaced in solid waste disposal sites and those for energy use?
When the stock-difference methodological approach is applied	(a) Has the Party correctly applied the time period between two consecutive carbon stock estimates or the transition period between two equilibrium stock levels when calculating annual carbon stock changes? (b) Has the calculation been done by using the same area at the two points in time (i.e. the carbon stock at times t1 and t2 has been calculated based on the area of the stratum at time t2)? (c) Have carbon stocks been estimated applying the same definitions at the two points in time (t1 and t2), or has a correction been applied to ensure consistency between definitions?

*Mandatory element.

Abbreviations: EF = emission factor, TERT = technical expert review team, HWP = harvested wood products, ICSCF = implied carbon stock change factor, IPCC = Intergovernmental Panel on Climate Change, 2006 IPCC Guidelines = 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

[a] Be aware that the consistency of ICSCFs may be affected by:

- ✓ Asynchrony among AD and associated carbon stock changes (e.g. in forest land converted to cropland, the AD are the latest 20 years cumulated areas, while the annual biomass loss is the biomass lost in the land converted in the year only);
- ✓ Variability in environmental conditions, especially for tier 3 methods.

Consequently, when assessing consistencies in the time series of ICSCFs the impact of the two above-mentioned elements should be excluded.

[b] A Party may report the HWP contribution as zero if the inventory compiler judges that the annual change in carbon in HWP stocks is insignificant. A Party may separately judge if the annual change of HWP carbon in SWDSs is significant, and report it as zero if it is not significant, although the HWP contribution is significant. Some HWP may be produced with recycled wood. Therefore, comparison between harvest and fuelwood quantities used for estimating biomass carbon stock changes with those used in reporting HWP carbon stock changes should only be done for the variable H (carbon in annual harvest of roundwood for products versus wood removed from harvest sites in the reporting country, including fuelwood).

Emissions/removals in land use, land-use change and forestry categories associated with carbon stock changes

201. In general, carbon stock gains and losses in pools are considered as CO_2 removals from/emissions to the atmosphere respectively; although for non-biomass pools such gains/losses are considered to be a carbon immobilization (i.e. an avoided emission). Also, other GHG fluxes are associated with losses and gains of carbon stocks:

(a) CH_4 and N_2O from combustion of organic matter[42] (all carbon pools);

(b) N_2O emissions from N mineralization associated with loss of organic carbon (in mineral soils), as well as N immobilization with carbon stock gain (measured as a net negative N_2O emission,[43] although technically it is an avoided emission);

(c) CH_4 emissions from anaerobic decomposition of organic matter (soil organic matter).

202. The GHG estimates for the LULUCF sector are reported in 15 CRTs. Table 7-67 provides specific checks to be undertaken when reviewing the information reported by the Party, by CRT.

Table 7-67
Specific checks of the estimates for the land use, land-use change and forestry sector, by CRT

Checks	*Action by the TERT, tasks*
One summary table, CRT 4	This table is automatically filled and does not require specific checks by the TERT
One land transition matrix, CRT 4.1	This table reports areas, and changes in areas, between the previous and the current inventory year. Check the consistency of the information reported in this table with AD reported in CRTs 4.A–F, taking into consideration that area changes reported in this table are annual while those reported in tables 4.A–F are cumulative
Six background tables, CRTs 4.A–F	These tables report carbon stock changes and associated CO_2 emissions/removals. Check: (a) Completeness of reporting; (b) Correct reporting of signs; (c) Consistency in the time series of ICSCFs
One background table, CRT 4(I)	This table reports direct N_2O emissions from fertilization. Check: (a) Completeness of reporting; (b) Consistency within the time series of ICSCFs; (c) Consistency with the information reported in the NID for agriculture, determined by the use of the same EFs or, if different EFs are applied, that differences are explained by studies or measurements the Party has reported; (d) Omissions or double counting with estimates reported in CRT 3.D
One background table, CRT 4(II)	This table reports CO_2, CH_4 and direct N_2O emissions and removals from drainage and rewetting and other management of organic and mineral soils. Check: (a) Completeness of reporting (b) Consistency within the time series of ICSCFs (c) Consistency with the information reported in CRT 3.D (agricultural soils) for drainage of organic soils in agricultural lands, and in CRTs 4.B and 4.C for CO_2 emissions/removals as well as for AD (d) Consistency of the EFs between CO_2 and N_2O emissions/removals, explained by the carbon to nitrogen ratio (C/N ratio) and the EF

[42] Be aware that the IPCC default method calculates the GHG emissions by applying default factors (see 2006 IPCC Guidelines, volume 4, table 2.5) directly to the mass of fuel burned. However, Parties may estimate these GHG emissions directly from the carbon stock loss using appropriate emission ratios and C/N ratios (for N_2O).
[43] Note that a negative emission mathematically corresponds with a removal.

Checks	*Action by the TERT, tasks*
	(e) Omissions or double counting with estimates reported in CRTs 4.A–F and CRT 3.D (f) Consistency is determined by: (i) The use of same AD (ii) Linking, if possible, CO_2 and N_2O emissions by the C/N ratio, to determine how much N is released for each tonne of carbon emitted, as well as by linking N released and N_2O emissions by the EF (kg N_2O-N/kg N)
One background table, CRT 4(III)	This table reports direct N_2O emissions and N immobilization (i.e. negative emissions) from SOM mineralization/accumulation in mineral soils. Check: (a) Completeness of reporting (b) Consistency within the time series of ICSCFs (c) Consistency with information reported for agricultural land (d) Consistency in the EFs between CO_2 and N_2O emissions/removals (e) Omissions or double counting with estimates reported in CRTs 4.A–F and CRT 3.D (f) Consistency is determined by: (i) Applying the same methodology, including parameters, for estimating these emissions in CL-CL, reported under agriculture, and L-CL reported under LULUCF; (ii) Linking CO_2 and N_2O emissions/removals by the C/N ratio of the soil organic carbon loss/gain, to determine how much N is released/immobilized for each tonne of carbon emitted, as well as by linking N released/immobilized and N_2O emissions/removals by the EF (kg N_2O-N/kg N)
One background table, CRT 4(IV)	This table reports indirect N_2O emissions. Check: (a) Completeness of reporting (b) Consistency within the time series of ICSCFs (c) Consistency with the information reported in CRTs 4(I), 4(III) and 3.D (indirect emissions from agricultural soils) (d) Omissions or double counting with estimates reported in CRT 3.D (e) Consistency is determined by: (i) Applying the same methodology, including parameters, for estimating these emissions in agriculture and LULUCF (ii) Using the same AD in table 4(I), for N inputs from fertilization, in table 4(III), for N mineralization, and this table
One background table, CRT 4(V)	This table reports CO_2, CH_4 and N_2O emissions from burning. Check: (a) Completeness of reporting (b) Consistency within the time series of ICSCFs as well as among ICSCFs (c) Consistency with the information reported in CRT 3.E (savannah burning), for CH_4 and N_2O emissions, and in CRTs 4.A–F for CO_2 emissions (d) Omissions or double counting with CO_2 emissions reported in CRTs 4.A and/or 4.C and CH_4 and N_2O emissions reported in CRT 3.D (e) Consistency is determined by: (i) Applying the same methodology, including parameters, for estimating these emissions in agriculture, CH_4 and N_2O, and LULUCF, CO_2 (ii) Linking GHG emissions by the C/N ratio of carbon stock loss by the EFs
Two background tables, CRTs 4.G s1 and 4.G s2	These tables report carbon stock changes in the HWP pool. Check: (a) Completeness of reporting; (b) Consistency within the time series of gains, losses, and net contribution, as well as in AD;

Checks	*Action by the TERT, tasks*
	(c) Consistency of half-life values with IPCC default values; (d) Consistency of AD with FAO data and with data on wood harvesting reported in the NID and in CRTs 4.A–F; (e) Omissions of CO_2 emissions reported in CRTs 4.A–4.F

Abbreviations: AD = activity data, CL-CL = cropland remaining cropland, CRT = common reporting table, EF = emission factor, TERT = technical expert review team, FAO = Food and Agriculture Organization of the United Nations, GHG = greenhouse gas, ICSCF = implied carbon stock change factor, IPCC = Intergovernmental Panel on Climate Change, L-CL = land converted to cropland, LULUCF = land use, land use change and forestry, NID = national inventory document, SOM = soil organic matter.

Review of emissions/removals in land use, land-use change and forestry categories associated with carbon stock changes

203. This section covers some of the issues that reviewers should assess during the review of GHG emissions/removals associated with carbon stock changes in the LULUCF inventory. Generally, for each estimate you should carry out the tasks included in table 7-68.

Table 7-68
Possible actions by the technical expert review team in its review of each carbon stock change estimate

Check	*Action by the TERT, tasks*
General	(a) Conduct the review at the level of disaggregation in subcategories/subdivisions
	(b) Assess the appropriateness of the Party's choice of methodological tiers, AD, EFs and other parameters according to the significance of categories/subcategories and national circumstances and their proper documentation in the submission
	(c) Check the completeness
	(d) Check time-series consistency
	(e) Check the accuracy of calculations
	(f) Check whether, for each carbon stock change estimated, corresponding GHG emissions and removals have been reported in the appropriate CRT
	(g) Check consistency among estimates for different GHG emissions and removals resulting from the same stock change, particularly when different methodologies and EFs are applied for estimating different GHGs

204. A main task prior to and during the review week is to clarify with the Party any outstanding questions regarding how the inventory estimates have been prepared, and ensuring the transparency, accuracy, consistency, completeness and comparability (TACCC) of the LULUCF estimates. Box 3-2 provides guidance for the type of questions which can provide valuable input to the TERT during the review process to ensure that the Party is meeting the reporting requirements, as well as general guidance for formulating clear and precise preliminary and follow-up questions. In addition to the general guidance, some LULUCF-specific questions are suggested for consideration by the TERT in table 7-69.

Table 7-69
Possible questions related to transparency, accuracy, completeness, comparability, or consistency

Check	*Action by the TERT, tasks*
General	(a) Has the Party stratified the land categories according to IPCC default stratification, or has it applied a country-specific classification? (b) Is the stratification applied consistent with national circumstances?

Check	*Action by the TERT, tasks*
	(c) Has the Party provided a transparent description of the methodologies used (i.e. input data and data sources, assumptions and inferences)?
	(d) Are the methodologies consistent with guidance in the 2006 IPCC Guidelines on completeness, consistency and accuracy of GHG estimates?
Methods: are the methods, AD, factors and parameters appropriate to national circumstances and correctly applied	(a) Has the Party used appropriate IPCC default parameters in preparing the estimates? If so: (i) Are the choices consistent with the information provided on the climate zone, forest/tree/crop/vegetation types and soil types in the country? (ii) Is the appropriateness of IPCC default factors demonstrated (including through expert adjustment, as appropriate, if IPCC default factors are applied to country-specific stratification)? (iii) Could country-specific values be developed based on national or regional data and research?
	(a) Has the Party used higher-tier methods? If so: (i) Has proper documentation on the values of country-specific parameters been provided? (ii) Are the country-specific values within the range of IPCC defaults and comparable to those used by other countries with similar conditions? If not, does the documentation give justification for any differences? (iii) Has the Party used models? If so, has the Party described the assumptions (principles, equations, etc.) and key parameters used in the model and provided information on any validation and/or peer review of the model? (iv) Have model outputs been verified across time by comparison with independent measurements (i.e. a model does not replace the need for monitoring carbon stock changes with direct measurements, although it significantly reduces costs and increases the accuracy of estimates)? (v) Is there any verification of estimates (e.g. by comparison with data reported by the country to the FAO, or with estimates made using the stock-difference method, or vice versa)? (vi) If a transition period longer than 20 years has been applied, has the Party reported in subdivisions under the category “Land remaining under the same use” those lands converted that have not yet achieved the new carbon stock equilibrium level?
	(a) Is the inventory methodology based on a stock inventory (e.g. NFI) (tier 2 or tier 3)? If so: (i) Has proper documentation on the forest inventory methodology, coverage (complete coverage or only for a subset) and frequency been provided in the NID? (ii) Is the sampling procedure appropriate and unbiased? (iii) Are methodologies and definitions used the same throughout the time series? (iv) Is the carbon stock change calculated at plot level? Or is it calculated by taking the difference of average densities (on a per hectare basis) or total carbon stocks? (v) Is the carbon stock change calculated every X years (X being the time period between two complete successive inventories) across the entire area? Or is calculated each year with data on parts of forest area collected in the two given years? If it is the latter, are annual data representative of the entire national forest area? (vi) Are data from the stock inventory representative of the entire land category or do

Check	*Action by the TERT, tasks*
	they need to be integrated/corrected?
Biomass	(a) For whichever methodology is applied: (i) Has below-ground biomass been included or excluded symmetrically in carbon stock gains and carbon stock losses? (ii) Has the Party calculated biomass gain? (iii) Has the Party estimated the annual carbon loss due to wood removals ($L_{wood\text{-}removals}$)? (iv) Has the Party estimated the annual carbon loss due to fuelwood removal ($L_{fuelwood}$)? (v) Has the Party estimated the annual carbon loss due disturbance ($L_{disturbance}$)? (vi) If a change in land use/management occurred in the inventory year, has the Party calculated initial biomass loss ($\Delta C_{CONVERSION}$) associated with the land use/management conversion?
	(b) If the Party has applied biomass equations, are they representative of the area for which they are applied?
	(c) If the Party has applied BCEF/BEF-D factors, do they differ from the IPCC defaults?
	(d) If a Party is applying BEF/BCEF, does it use separate values for stock, increment and losses?
	(e) Are the BCEF/(BEF, D) values used based on local measurements? Are the values within the default range of the 2006 IPCC Guidelines?
	(f) If the stem volume reported in the NFI includes non-commercial volume, has this been taken into account by modifying the BEF/BCEF or using a separate factor?
	(g) If the stem volume reported in the NFI does not include bark, has the Party taken it into account by modifying the BEF/BCEF or with the use of a separate factor?
	(h) Has all biomass affected by disturbance been reported as a carbon stock loss in the biomass pool (i.e. released to atmosphere or transferred to dead wood/litter/SOM), and as a proportional carbon stock gain in the dead wood/litter/SOM pools (unless carbon stock in the dead wood/litter/SOM is reported to be at equilibrium)?
	(i) Are the values of biomass density (i.e. biomass per hectare) consistent across the inventory (i.e. are the biomass stock values used to calculate carbon stock losses from different types of disturbances as well as for conversion to other use/management of land consistent)?
	(j) Has the Party used IPCC default values for carbon content? If it is using a value that differs significantly from the default value, has it provided a justification for that in the NID (references to research, measurements, etc.)?
	(k) If the Party applies a country-specific method: (i) Is the carbon stock increment a net gain (i.e. gross gain minus carbon stock losses by mortality) or a gross gain? a. In the former case, have carbon stock losses from mortality been double counted? b. In the latter case, have carbon stock losses from mortality been counted? (ii) Has the Party reported increases and decrease in biomass carbon stocks separately?
Dead organic matter	(a) What is the length of the transition period selected by the Party for each pool? Is it appropriate to its national circumstances and equal to or longer than 20 years?
	(b) Has the Party applied the same stratification for DOM and SOM as for biomass?
	(c) Are the values of DOM density (t dm per hectare) consistent across the inventory (i.e. are the DOM stock values used to calculate carbon stock losses from different types of disturbances as well as for conversion to other use/management of land consistent)?

Check	*Action by the TERT, tasks*
	(d) Has the Party provided separate estimates for mineral and organic soils?
	(e) Has the Party used country-specific SOC_{REF} values (i.e. SOM carbon stock under native vegetation, typically forest and unmanaged grassland), and if so, has it calculated the SOC_{REF} value according to the stratification applied by the country (e.g. climate, geographical and/or administrative regions)?
	(f) Has the Party used country-specific SOC_0 values, and if so, has it calculated such SOC_0 values according to the stratification applied by the country (e.g. climate, soil type, geographical and/or administrative regions)? Have data from paired sites been used?
	(g) Are the EF (or removal factor) values used based on local measurements? Are the values within the default range of the 2006 IPCC Guidelines?
	(h) If the Party has used a country-specific modelling approach for DOM or SOM: (i) Has the Party validated it taking into consideration measurements of litter and dead wood production from above-ground (for DOM) and below-ground (for SOM) biomass along with decomposition parameters? (ii) Has the Party calculated N_2O emissions from drainage of organic soils and mineralization of organic matter by taking into consideration the C/N ratio of organic matter? stratifying SOM according to the N content (i.e. nutrient-rich versus nutrient-poor)

Abbreviations: AD = activity data, BCEF = biomass conversion and expansion factor, BEF = biomass expansion factor, D, = basic wood density, DOM = dead organic matter, EF = emission factor, TERT = technical expert review team, FAO = Food and Agriculture Organization of the United Nations, GHG = greenhouse gas, IPCC = Intergovernmental Panel on Climate Change, NFI = national forest inventory, NID = national inventory document, SOC = soil organic carbon, SOM = soil organic matter, 2006 IPCC Guidelines = 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

[a] The IPCC Wetlands Supplement provides emission EFs for estimating GHG emissions/removals from SOM in organic soils. Table 7-70 provides references to where these details can be found in the 2006 IPCC Guidelines and the Wetlands Supplement.

Table 7-70
Sources of information on emission factors for estimating emissions/removals from soil organic matter in organic soils

To estimate	Information	2006 IPCC Guidelines	2003 Supplement on Wetlands
C stock changes in mineral soils of land converted to a new category	Default reference values for organic carbon content of mineral forest soils under native vegetation	table 2.3	
	Revised values of wetlands mineral soils		table 5.2
CO_2 emissions/removals from drained organic soils	Default values	table 4.6	
	Revised values		tables 2.1 and 2.2
CH_4 emissions/removals from drained organic soils	Default values		tables 2.3 and 2.4
CH_4 emissions/removals from rewetted mineral wetlands soils	Default values		table 5.4
N_2O emissions/removals associated with mineralization of SOM in mineral soils	Default values	table 11.1	
N_2O emissions/removals from drained organic soils	Default values	table 11.1	
	Revised values		table 2.5
CO_2 emissions/removals from rewetted organic soils	Default values		tables 3.1 and 3.2
CH_4 emissions/removals from rewetted organic soils	Default values		table 3.3
CO_2 and CH_4 emissions from burning of SOM of organic soils	Default values for fuel and emissions		tables 2.6 and 2.7

Abbreviations: IPCC = Intergovernmental Panel on Climate Change, SOM = soil organic matter.

Cross-cutting issues related to land use, land-use change and forestry

205. There are six major cross-cutting issues related to the estimation of emissions and removals from the LULUCF sector, which experts should be aware of when reviewing the LULUCF inventory.

206. **Uncertainty assessment**: Estimates of uncertainty need to be developed for all categories in the LULUCF inventory and for the inventory as a whole. Estimated carbon stock changes, emissions and removals arising from LULUCF activities have uncertainties associated with area or other AD, and estimation parameters such as biomass growth rates, expansion factors and other coefficients. In addition to general guidance provided above, reviewers should check EFs to determine whether the uncertainty has been calculated using:

(a) The standard deviation of the distribution (population), for example if the mean value is used to represent a single element of the population (e.g. carbon loss from deforestation); or

(b) The standard deviation of the mean (i.e. the standard error), for example, if the mean value is used to represent the entire population (e.g. the average increment rate of biomass in a stratum).

207. **Sampling**: Data for the LULUCF sector are often obtained from sample surveys. It is of the utmost importance that the reviewers ensure that estimates are unbiased, and therefore they should check whether:

(a) Samples are selected randomly within strata;
(b) Data collected are representative of the entire variability of the population sampled.

208. **KCA**: For the LULUCF sector, the KCA is performed for each gas at the level of land remaining in the same land-use category and land converted to another land-use category. In addition, the LULUCF reviewers have to give consideration as to how the Party has identified significant carbon pools. In general, according to the 2006 IPCC Guidelines, those subcategories/pools which, together, contribute more than 60 per cent to the key category should be treated as significant. Thus in practice, in most cases, the biomass carbon pool (in particular the above-ground biomass pool), remains the only significant pool. Further, since the conversion of forest land is spread over different land-use change categories, countries should identify and sum the estimates of net emissions associated with forest conversion to any other land category and compare the magnitude of the sum to that of the smallest category identified as key. If it is larger than the magnitude of the smallest category identified as key deforestation should be considered to be key.

209. **QA, QC and verification**: There are five important features of LULUCF inventory methods that generally affect QA/QC. Reviewers should consider:

(a) Reliance on periodic sampling and its influence on the representativeness of input data; by checking how from periodic data unbiased annual estimates have been inferred;
(b) The need for sufficient historical data (presented as land transition matrices for the years before 1990), because past land-use activities affect current CO_2 emissions and removals, and should check whether and how lagged emissions/removals have been calculated;
(c) The need to use sophisticated models in which the data, assumptions and inferences of the model may not always be transparent, and should check the completeness of documentation as well as by checking the suitability of the selected methods to the national circumstances;
(d) The need to verify the higher-tier estimates as the estimated model outputs; by comparison with lower-tier estimates;
(e) The multiple impacts of various natural and management variables; by tracking in disturbance matrices carbon stock transfers, carbon stock losses and associated emissions.

210. **Time-series consistency and recalculations**: In general, obtaining a consistent time series for the LULUCF sector presents challenges to inventory compilers because AD are very often not available on an annual basis. Complex models and higher-tier methods are sometimes used in the LULUCF sector for dealing with the lack of annual data. Therefore, reviewers should pay particular attention on the methods applied to compile a complete time series of AD and verify whether and how consistency has been achieved.

211. As shown in figure 7-24, the LULUCF sector has multiple links with the agriculture sector: it is important to verify the proper allocation of emissions between the agriculture and LULUCF sectors, as illustrated in table 7-71.

Table 7-71
Checks to verify the allocation of reporting between the agriculture sector and the land use, land-use change and forestry sectors

Check	*Action by the TERT, tasks*
CO_2	(a) CO_2 emissions from wildfire and prescribed burning of perennial organic matter in any land use are reported either in CRT 4(V) or in the CRT for the carbon stock changes of the relevant land use category. Note that if the stock-difference method has been applied to a carbon pool, the CO_2 emissions associated with combustion are included in the carbon stock change estimated for the carbon pool and consequently these emissions shall not be reported in CRT 4(V), where the notation key “IE” will be reported
CH_4 and N_2O	(a) CH_4 and N_2O emissions from burning of crop residues and from savannah burning are reported in the agriculture sector, CRTs 3.E and F

Check	*Action by the TERT, tasks*
	(b) CH_4 emissions from wetland rice fields are reported under agriculture (CRT 3.C) and N_2O emissions from organic or mineral soils used for cultivation are reported under agriculture (CRT 3.D). Any other CH_4 and direct N_2O emission from wetlands are reported in the LULUCF sector, including CH_4 emissions from ditches in drained organic soils under cropland and/or managed grassland, which are to be reported in CRT 4(II)
N_2O	(a) Direct and indirect N_2O emissions from fertilization of cropland and managed grassland are reported in the agriculture sector in CRT 3D. Direct N_2O emissions from fertilization of other land uses may be reported either in CRT 3.D or in CRT 4(I) while avoiding double counting. Consistently, associated indirect N_2O emissions will be reported either in CRT 3.D or in CRT 4(IV) 'Indirect N_2O emissions from managed soils'. In all cases, the allocation used by the Party should be clearly documented in the NID
	(b) Direct net N_2O emissions from N mineralization/immobilization associated with loss/gain of SOM resulting from changes of land use or management of mineral soils in managed forest land, managed grassland, managed wetlands, in settlements and resulting from changes in land use to cropland or to other land are reported in CRT 4(III), while those occurring on cropland remaining cropland are reported under agriculture in CRT 3.D
	(c) Indirect N_2O emissions from managed soils, excluding those from agricultural lands, are reported in CRT 4(IV)
	(d) Check on the use of notation keys: when carbon loss occurs as a result of land-use/management change, the TERT should check that an estimate of associated direct and indirect N_2O emissions has been reported under the agriculture sector or whether the notation key "NE" (not estimated) has been used together with the justification that these emissions fall under the insignificance threshold If the Party does not estimate soil organic carbon changes in mineral soils under cropland remaining cropland, the TERT should recommend that the Party estimate such changes as well as the associated N_2O emissions from nitrogen (N) mineralization If a Party reports data in CRT 3.D for N mineralization, they should be consistent with loss of soil carbon under cropland remaining cropland reported in CRT 4.B.

Abbreviations: CRT = common reporting table, TERT = technical expert review team, IE = included elsewhere, NID = national inventory document, SOM = soil organic matter.

G. Waste

1. Introduction

212. In the 2006 IPCC Guidelines, the waste sector includes five categories:

(a) Solid waste disposal;

(b) Biological treatment of solid waste;

(c) Incineration and open burning of waste;

(d) Wastewater treatment and discharge;

(e) Other.

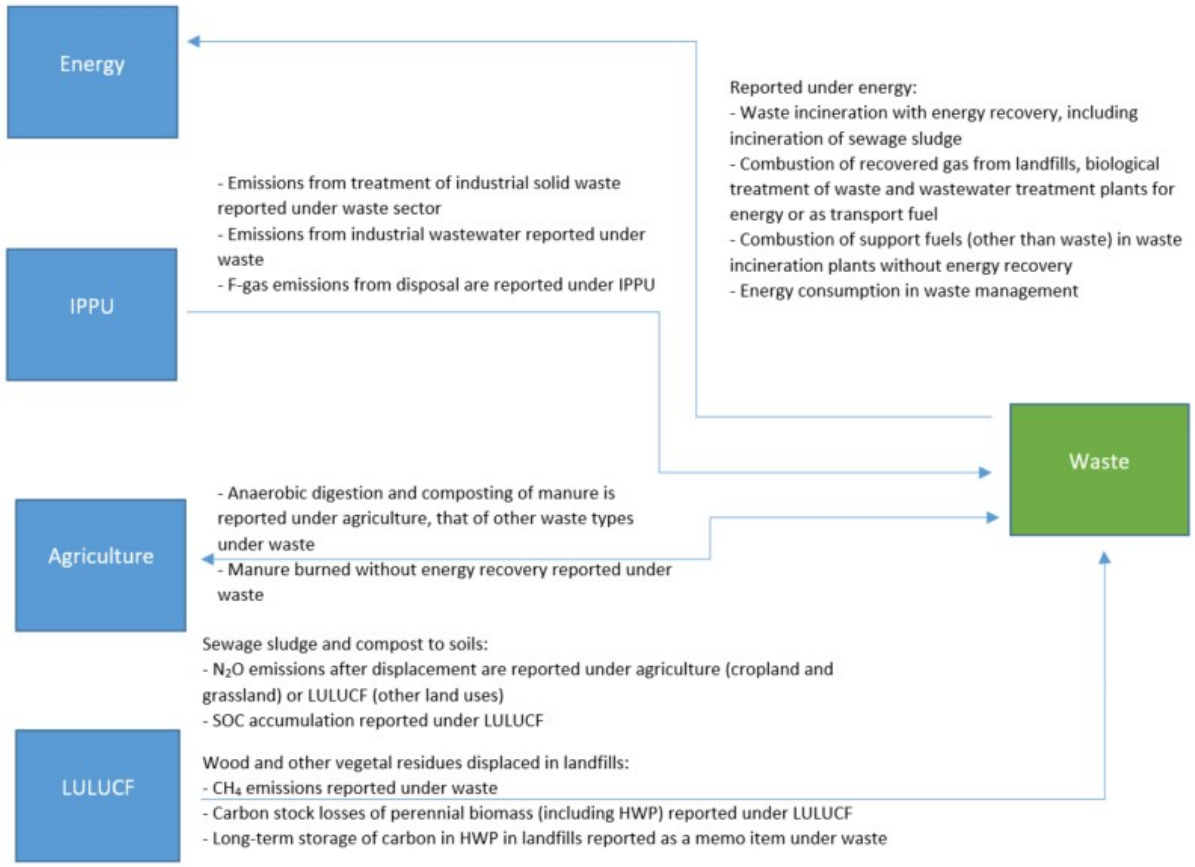
213. Additional information on long-term storage of carbon in waste disposal sites is reported as a memo item in CRT 5.

2. Sector-specific issues

Integration of the waste sector

214. Several categories in the waste sector interact with the categories in other sectors (see figure 7-26).

Figure 7-26
Overview of the interaction of the waste sector with other inventory sectors



Waste generation, composition and management data

215. The methods for estimating CH_4 and N_2O emissions from solid waste disposal, biological treatment and incineration and open burning of solid waste relies on the compilation of AD on waste generation, composition and management. AD should be collected separately for municipal solid waste (MSW), sludge, industrial and other waste. If data are only available for certain types of waste, the Party should indicate how it is making efforts to complement this data to include all types.

216. In the review of waste generation, composition and management data, the review expert may consider going through the list of potential actions presented in table 7-72.

Table 7-72
Possible actions by the technical expert review team in the review of waste generation, composition and management data

Check	*Action by the TERT, task*
General	Have AD on all types of solid waste been collected (MSW, sludge, industrial and other waste)?
	Is the Party able to provide an overview of waste generation and treatment?
	Is there a regional difference in the country in waste generation and treatment practices? If yes, have regional data been collected?
	If the Party has conducted waste stream analyses (following the streams of waste from one treatment type to another) has the Party verified the data using separately collected data on MSW generation, treatment and disposal?
Industrial waste	Is it clear where industrial waste streams are included (e.g. is this waste reported separately, included in MSW or reported elsewhere)?
	Do the industrial waste statistics include only that waste which contains degradable organic carbon and fossil carbon?
	Do the industrial waste statistics adequately account for recycling?
	If country-specific information on industrial waste management is not available, has the Party assumed the same practices as with MSW?
Waste composition	How has the Party ensured that the composition of MSW applied is sufficiently representative of national circumstances?
	Has the Party clarified whether waste composition data are based on “as generated” or “as received at the SWDS”? If the former, have the statistics used to estimate emissions from landfilling been adjusted to account for the impact of recycling and/or biological treatment?
	Has the Party made a distinction between the composition of wastes incinerated/open-burned and the composition of waste delivered to other waste management systems?

Abbreviations: AD = activity data, TERT = technical expert review team, MSW = municipal solid waste, SWDS = solid waste disposal sites.

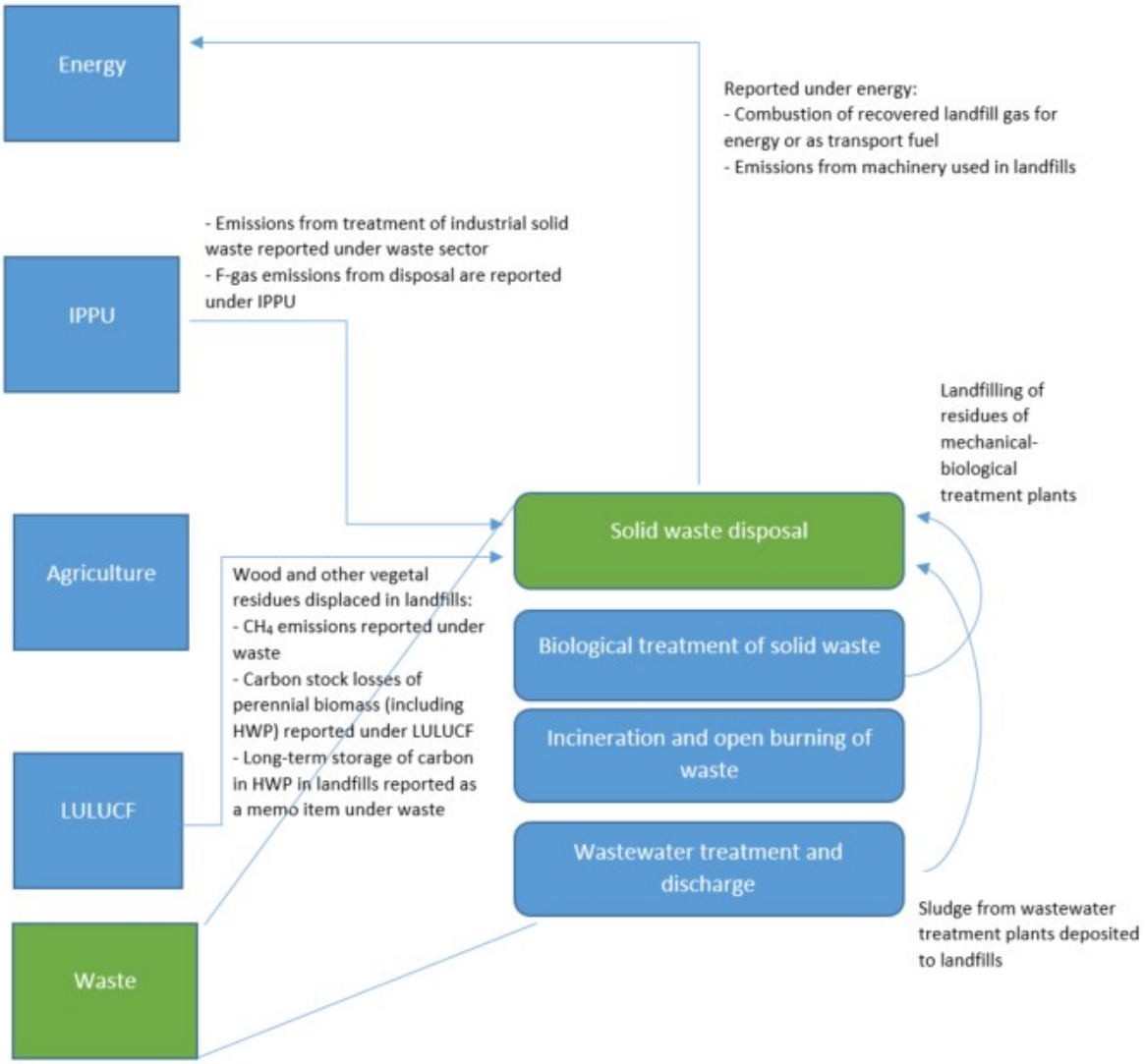
Solid waste disposal

217. Table 7-73 provides a summary of key elements for the solid waste disposal category, and figure 7-27 summarizes linkages between the solid waste disposal category and the other categories in the waste sector and other sectors.

Table 7-73
Summary of key elements of the solid waste disposal category

Overview	*Category-specific information*	
Category name	Solid waste disposal	
Reported in CRT	Table 5.A	
Main subcategories and GHGs to be reported	Managed waste disposal sites	CH_4
	Unmanaged waste disposal sites	CH_4
	Uncategorized waste disposal sites	CH_4

Figure 7-27
Main linkages between the solid waste disposal category and the other categories in the waste sector and other sectors



218. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the waste expert may consider going through the list of potential TERT actions in table 7-74 when reviewing the emissions from the solid waste disposal category.

Table 7-74
Possible actions by the technical expert review team in its review of the emissions from the solid waste disposal category

Subcategory	*Action by the TERT, task*
All	Does the Party use a first-order decay (FOD) model to estimate emissions? Note that other methods (such as direct measurements) are generally not consistent with good practice
	Has the Party used disposal data covering at least 50 years? If not, has the Party estimated emissions

Subcategory	*Action by the TERT, task*
	for the additional time period using an alternative approach?
	Is the allocation of waste among managed, unmanaged and uncategorized waste disposal sites transparent?
	Has the Party reported CO_2 emissions in this category? If so, are they owing to the combustion of disposed waste at the disposal site as a management practice (other CO_2 emissions should not be reported here)? Are the CO_2 emissions derived from non-biological or inorganic waste sources?
	Has the Party reported in CRT 5 the memo item regarding the annual change in total long-term carbon storage in HWP waste? Is the reporting in accordance with the reporting of HWP in CRT 4.Gs1?
	If the Party reports CH_4 and N_2O from flaring, are these correctly reported under 5.E Other?
	If recovered landfill gas is used for energy (stationary combustion or as transport fuel), are CH_4 and N_2O emissions from combustion correctly included under the energy sector?
	If the Party reports CH_4 recovery or flaring in SWDSs, is the amount recovered/flared based on documented references, such as metering of all gas recovered? If reporting of gas recovery is based on the monitoring of produced amount of electricity from the gas, has the Party considered the availability of load factors, heating value and corresponding heat rate, and other factors that have an impact on the amount of gas used to produce the monitored amount of electricity? If the Party uses other methods to estimate the amount of CH_4 recovered/flared, the reviewer should pay particular attention to the risk of a potential overestimation of recovery. The IPCC default for recovery is zero, and if the CH_4 recovery is estimated on the basis of the number of SWDSs with landfill gas recovery a default estimate of recovery efficiency would be 20 per cent
	If the oxidation factor is different from the IPCC default (see 2006 IPCC Guidelines, volume 5, table 3.2), is it correctly justified and documented? (Note that field and laboratory studies which determine oxidation of CH_4 only through uniform and homogeneous soil layers may lead to over-estimations of oxidation in landfill cover soils)
	Are several half-lives (e.g. three to five) and k values specified? Are the k values consistent with the half-lives specified?
	Is the reported methane correction factor consistent with the type of site?

Abbreviations: CRT = common reporting table, TERT = technical expert review team, HWP = harvested wood products, SWDS = solid waste disposal sites, 2006 IPCC Guidelines = 2006 IPCC Guidelines for National Greenhouse Gas Inventories

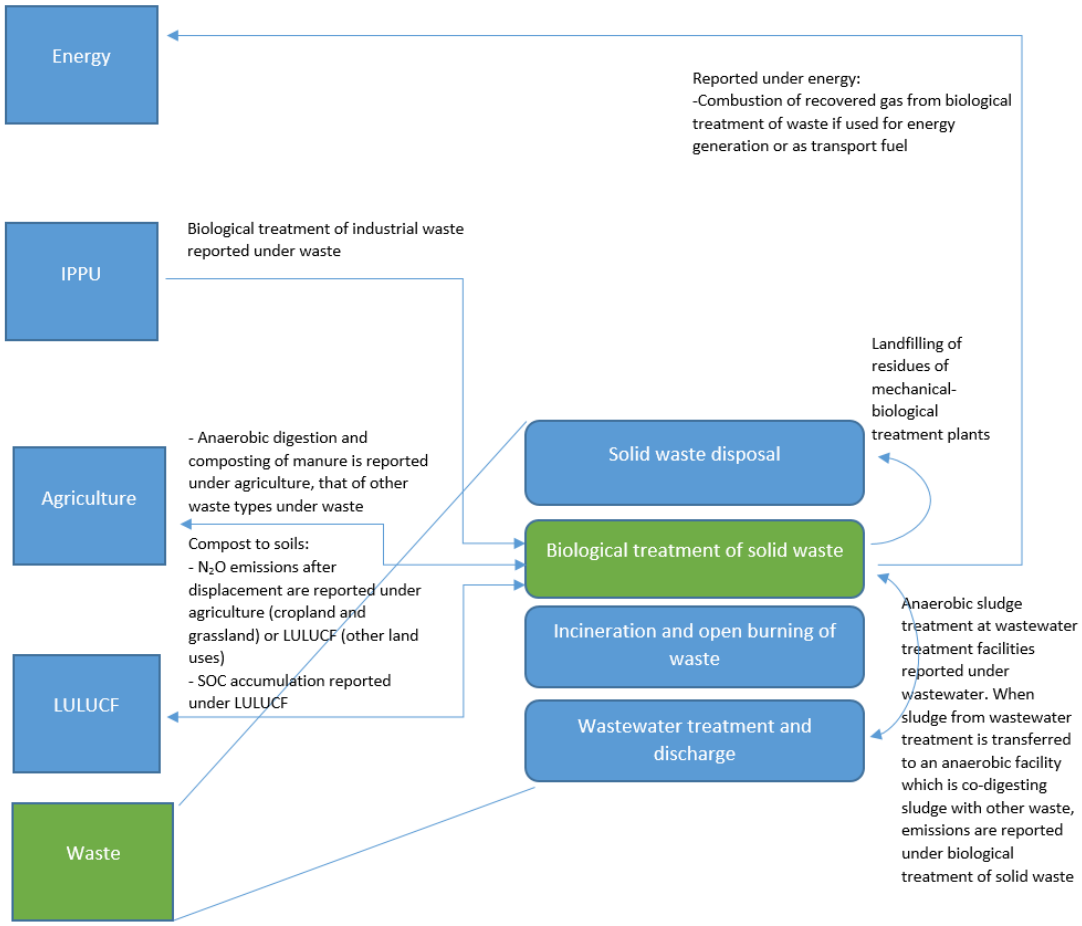
Biological treatment of solid waste

219. Table 7-75 provides a summary of key elements for the biological treatment of solid waste category, and figure 7-28 summarizes linkages between the biological treatment of solid waste category and the other categories in the waste sector and other sectors.

Table 7-75
Summary of key elements of the biological treatment of solid waste category

Overview	*Category-specific information*	
Category name	Biological treatment of solid waste	
Reported in CRT	Table 5.B	
Main subcategories and GHGs to be reported	Composting	CH_4, N_2O
	Anaerobic digestion at biogas facilities	CH_4, N_2O

Figure 7-28
Main linkages between the biological treatment of solid waste category and the other categories in the waste sector and other sectors



220. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the waste expert may consider going through the list of potential TERT actions in table 7-76 when reviewing CH_4 and N_2O emissions from the biological treatment of solid waste category.

Table 7-76
Possible actions by the technical expert review team in its review of emissions from the biological treatment of solid waste category

Subcategory	*Action by the TERT, task*
All	If composting or anaerobic digestion of manure is conducted together with other waste fractions (e.g. agricultural residues), does the Party's inventory cover all material composted and digested while ensuring that no double counting occurs?
	Are the estimated CH_4 and N_2O emissions from composting or anaerobic treatment of sludge consistent with the reported emissions from treatment of sludge in the wastewater treatment and discharge category? Has the Party ensured that no omission or double counting occurs?
	If the Party has used the IPCC default EFs, has it correctly applied the EF for wet or dry waste

Subcategory	*Action by the TERT, task*
	depending on the original AD?
	If recovered CH_4 is used for energy, are the emissions from combustion correctly included under the energy sector? Has the Party provided a reference to the category in the energy sector where the emissions are included?
	If residues from mechanical-biological treatment are landfilled, are the emissions included in the solid waste disposal category?
	If mechanical-biological treatment of waste occurs, has the Party used the methods for composting and anaerobic digestion to estimate emissions from biological treatment steps?
Composting	Are all composted waste fractions, other than MSW and manure (included in agriculture), reported under 'other'?
	If home composting is included in the AD, has this been clarified in the NID? It is not mandatory to report CH_4 and N_2O emissions from home composting activities Note: The 2006 IPCC Guidelines do not cover reporting of methane (CH4) and nitrous oxide (N2O) emissions from home composting under category 5.B.1.
Anaerobic digestion at biogas facilities	Has the Party estimated emissions of CH_4 from anaerobic digestion at biogas facilities that result from unintentional leakages during process disturbances or other unexpected events, in case the unintentional CH_4 is not flared?
	Are all digested waste fractions, other than MSW and manure (included in agriculture), reported under 'other'?

Abbreviations: AD = activity data, EF = emission factor, TERT = technical expert review team, IPCC = Intergovernmental Panel on Climate Change, MSW = municipal solid waste, 2006 IPCC Guidelines = 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

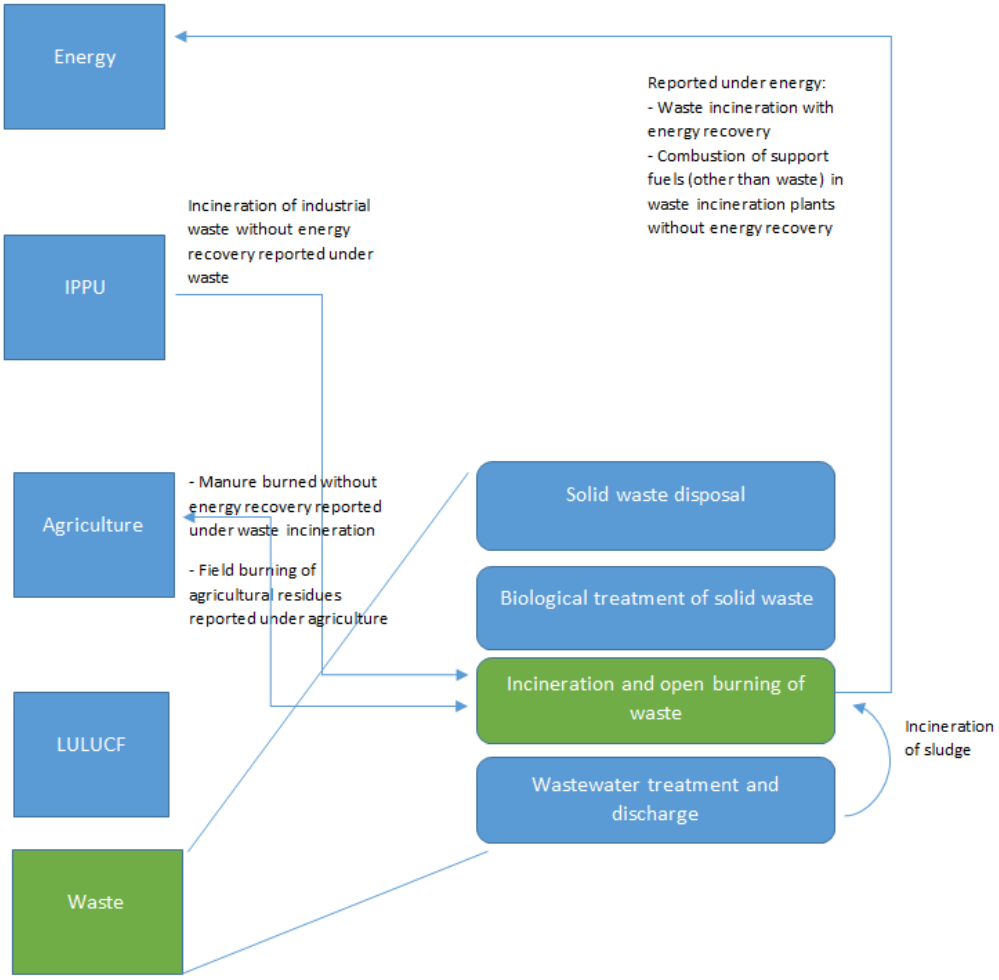
Incineration and open burning of waste

221. Table 7-77 provides a summary of key elements for the incineration and open burning of waste category, and figure 7-29 summarizes linkages between the incineration and open burning of waste category and the other categories in the waste sector and other sectors.

Table 7-77
Summary of key elements of the incineration and open burning of waste category

Overview	*Category-specific information*	
Category name	Incineration and open burning of waste	
Reported in CRT	Table 5.C	
Main subcategories and GHGs to be reported	Waste incineration	CO_2, CH_4, N_2O
	Open burning of waste	CO_2, CH_4, N_2O

Figure 7-29
Main linkages between the incineration and open burning of waste category and the other categories in the waste sector and other sectors



222. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the waste expert may consider going through the list of potential TERT actions in table 7-78 when reviewing the emissions from incineration and open burning of waste category.

Table 7-78
Possible actions by the technical expert review team in its review of emissions from the incineration and open burning of waste category

Subcategory	*Action by the TERT, task*
All	Are all CO_2 emissions reported of fossil origin? Note that biogenic CO_2 should not be reported
	Have the EFs been applied correctly (i.e. regarding wet or dry weight)?
Waste incineration	Has the Party reported only emissions from waste incineration without energy recovery in this category?
	Has the Party reported under 'fossil liquid waste' any combustion, without energy recovery, of lubricants, solvents and waste oil, if not included in other types of waste (e.g. industrial or

Subcategory	*Action by the TERT, task*
	hazardous waste)?
	Are the estimates for carbon content in incinerated waste fractions consistent with the estimates in the energy sector regarding waste incineration with energy recovery?
	If gas, oil or any other fuels are combusted in the waste incinerator as a support fuel (e.g. to start the incineration process or to maintain the required temperature), are those emissions correctly included under the energy sector? This can be particularly relevant for hazardous waste incineration
	When sludge from wastewater treatment facilities is incinerated, has the Party ensured that no double counting with the wastewater treatment category occurs? Note that emissions should be reported under waste incineration
	If the Party has used default CH_4 EFs for continuous incineration of MSW and industrial waste, has it used the EFs in volume 2 (Energy) of the 2006 IPCC Guidelines?
	If the measurement data indicates that CH_4 concentration in the exhaust gas of the furnace is below the CH_4 concentrations in the intake gas of the incinerator, has the Party applied an EF of zero in accordance with good practice?
	Does the inventory cover all waste incineration facilities as well as all waste types?
	If waste is used as a substitute fuel in industrial plants other than waste incineration plants (e.g. in cement and brick kilns, and blast furnaces), are the emissions reported under energy and not double counted?
Open burning	Has the Party demonstrated that national statistics reliably estimate total waste burned? If household waste is open-burned in rural areas, is this considered?

Abbreviations: EF = emission factor, TERT = technical expert review team, MSW = municipal solid waste, IPCC = Intergovernmental Panel on Climate Change, 2006 IPCC Guidelines = 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

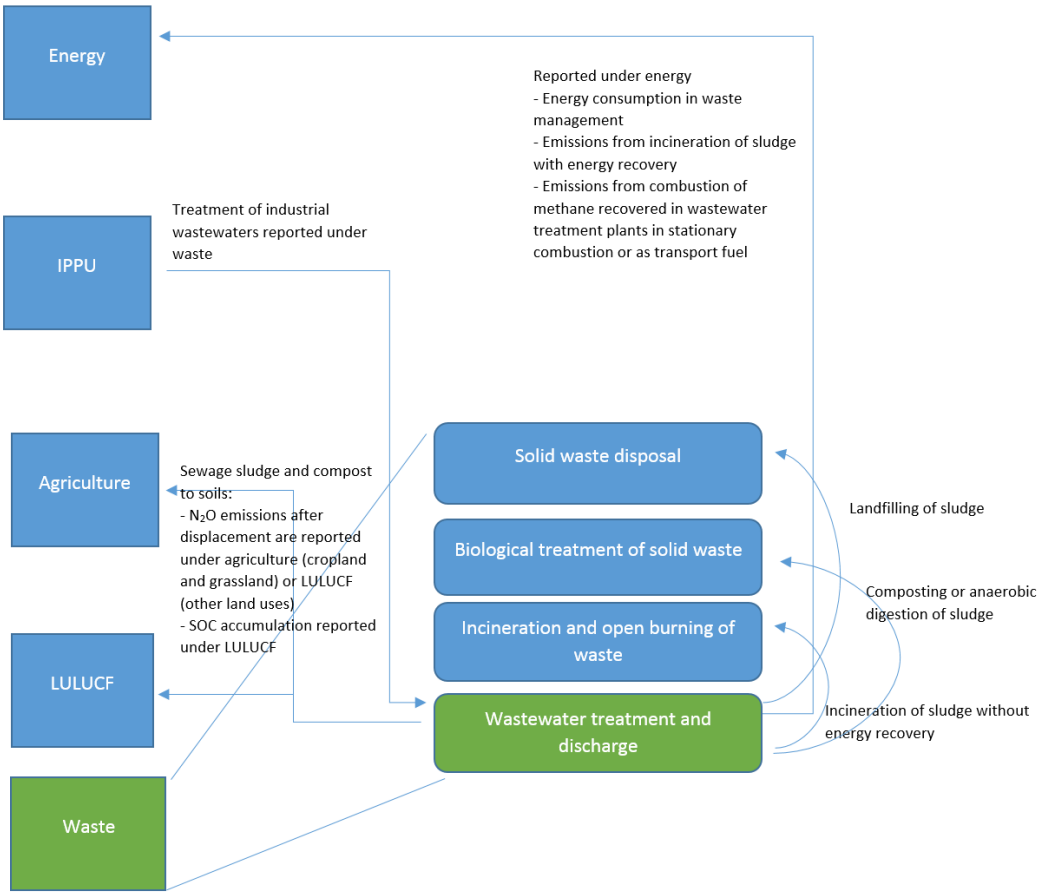
Wastewater treatment and discharge

223. Table 7-79 provides a summary of key elements for the wastewater treatment and discharge category, and figure 7-30 summarizes linkages between the wastewater treatment and discharge category and the other categories in the waste sector and other sectors.

Table 7-79
Summary of key elements of the wastewater treatment and discharge category

Overview	*Category-specific information*	
Category name	Wastewater treatment and discharge	
Reported in CRT	Table 5.D	
Main subcategories and GHGs to be reported	Domestic wastewater	CH_4, N_2O
	Industrial wastewater	CH_4, N_2O
	Other	CH_4, N_2O

Figure 7-30
Main linkages between the wastewater treatment and discharge category and the other categories in the waste sector and other sectors



224. In addition to the possible TERT actions included in chapter VI of this handbook related to cross-cutting issues, the waste expert may consider going through the list of potential TERT actions in table 7-80 when reviewing the emissions from the wastewater treatment and discharge category.

Table 7-80
Possible actions by the technical expert review team in its review of emissions from the wastewater treatment and discharge category

Subcategory	*Action by the TERT, task*
All	If the Party reports CH_4 and N_2O from flaring (which is not required for good practice), are they correctly reported under 5.E Other?
	Has the Party correctly applied the fraction of non-consumed protein added to the wastewater ($F_{NON-CON}$) and reported it in the additional information table of CRT 5.D, if appropriate for the method used?
	Has the Party correctly applied the fraction of industrial and commercial co-discharged protein into the sewer system ($F_{IND-COM}$) and reported it in the additional information table of CRT 5.D, if appropriate for the method used? Have the emissions from co-discharged protein in sewer systems been reported under domestic, rather than in industrial, wastewater?
	If the Party includes sludge removal in its estimate of the emissions from wastewater, is it based on sludge removal data (the IPCC default for sludge removal is zero)? Is the estimate of removed sludge

Subcategory	*Action by the TERT, task*
	consistent with the estimates for sludge applied to agricultural soils, sludge incinerated, composted or digested and sludge deposited in solid waste disposal sites?
	Have CH_4 emissions from sludge sent to landfills, incinerated or used in agriculture been excluded from the wastewater treatment and discharge category?
	If the Party reports CH_4 recovery/flaring, is the estimate based on documented references? The IPCC default for recovery is zero
	If recovered CH_4 is used for energy, are the emissions from combustion correctly included under the energy sector? Has the Party provided a reference to the category in the energy sector where the emissions are included?
	Has the Party included AD for total organic product as degradable carbon in accordance with the 2006 IPCC Guidelines: chemical oxygen demand for industrial wastewater and biochemical oxygen demand for domestic/commercial wastewater/sludge?
	If sludge from wastewater treatment is transferred to an anaerobic facility which is co-digesting sludge with other waste fractions, are any related CH_4 and N_2O emissions reported under biological treatment of solid waste?
	Where a Party has reported N_2O emissions from wastewater after disposal of effluent into waterways, lakes or the sea in the "Effluent" column of CRT 5.D, the TERT should treat this as consistent with the 2006 IPCC Guidelines. A finding should be raised only if the reported estimates are not aligned with the TACCC principles.
Domestic wastewater	Has the Party distinguished income group fractions (e.g. rural, urban high income and urban low income populations) to estimate CH_4 emissions, if appropriate to the method used?
	Regarding the estimates for N_2O from human sewage, has the Party specified whether total or urban population is used in the calculations and the rationale for doing so?
	Has the Party estimated emissions from uncollected wastewater?
	If the Party has advanced centralized wastewater treatment plants with nitrification and denitrification steps, have N_2O emissions been estimated?
Industrial wastewater	Has the Party identified the major industrial sectors with large potentials for CH_4 emission from wastewater and estimated emissions for them? Is the coverage of industries consistent across the entire time series?
	Does this category include only industrial wastewater treated on-site (emissions from industrial wastewater released into domestic sewer systems should be addressed and included with domestic wastewater)?

Annex I

Reference documents

Paris Agreement. Available at https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

"Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement". Annex to decision 18/CMA.1. Available at https://unfccc.int/sites/default/files/resource/CMA2018_03a02E.pdf#page=18.

"Guidance for operationalizing the modalities, procedures and guidelines for the enhanced transparency framework referred to in Article 13 of the Paris Agreement". Decision 5/CMA.3. Available at https://unfccc.int/sites/default/files/resource/CMA2021_L10a2E.pdf#page=2.

"Preparations for the implementation of the Paris Agreement and the first session of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement". Decision 1/CP.24. Available at https://unfccc.int/sites/default/files/resource/10a1.pdf#page=2.

"Preparation and submission of national communications from the Parties included in Annex I to the Convention". Decision 3/CP.1. Available at https://unfccc.int/sites/default/files/resource/docs/cop1/07a01.pdf#page=13.

Intergovernmental Panel on Climate Change. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories.* Available at https://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html.

Intergovernmental Panel on Climate Change. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. Available at http://www.ipcc-nggip.iges.or.jp/public/wetlands/index.html.

Intergovernmental Panel on Climate Change. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html.

Annex II

Acronyms and abbreviations

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
2019 Refinement to the 2006 IPCC Guidelines	*2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
AFOLU	agriculture, forestry and other land use
BTR	biennial transparency report
C	confidential
CaO	calcium oxide
CF_4	carbon tetrafluoride
C_2F_6	hexafluoroethane
CFCs	chlorofluorocarbons
CH_4	methane
CKD	cement kiln dust
CLRTAP	Convention on Long-range Transboundary Air Pollution
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
CMP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
C/N ratio	carbon to nitrogen ratio
CO	carbon monoxide
CO_2	carbon dioxide
COP	Conference of the Parties
CR	centralized review
CRT	common reporting table
CTF	common tabular format
DAI	draft areas of improvement
DOM	dead organic matter
DR	desk review
EAF	electric arc furnace
EF	emission factor
ETF	enhanced transparency framework
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
F-gas	fluorinated gas
FM	forest management
FMCP	facilitative multilateral consideration of progress
FOD	first-order decay
FTC	financial, technology development and transfer and capacity-building support
GHG	greenhouse gas
GM	grassland management
GWP	global warming potential
HCFCs	hydrochlorofluorocarbons

HFCs	hydrofluorocarbons
HWP	harvested wood products
ICR	in-country review
ICSCF	implied carbon stock change factor
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
KCA	key category analysis
LDCs	least developed countries
LR	lead reviewer
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MPGs	modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement, set out in the annex to decision 18/CMA.1
MSW	municipal solid waste
NA	not applicable
ND	natural disturbances
NDC	nationally determined contribution
NE	not estimated
NF_3	nitrogen trifluoride
NID	national inventory document
NIR	national inventory report
NMVOC	non-methane volatile organic compound
NO	not occurring
N_2O	nitrous oxide
NFI	national forest inventory
NO_X	nitrogen oxide
ODS	ozone-depleting substances
PAICC	Paris Agreement Implementation and Compliance Committee
PFCs	perfluorocarbons
QA	quality assurance
QAO	quality assurance officer
QC	quality control
RV	revegetation
SF_6	sulphur hexafluoride
SIDS	small island developing states
SOC	soil organic carbon
SODT	statistical outlier detection tool
SOM	soil organic matter
SWDS	solid waste disposal site
TACCC	transparency, accuracy, completeness, comparability, consistency
TER	technical expert review
TERR	technical expert review report
TERT	technical expert review team
TRO	technical review officer
UNFCCC	United Nations Framework Convention on Climate Change