

Promoting accuracy in GHG inventories through use of higher-tier methods:

A practical guide for LDCs and other developing countries



Acknowledgements

The authors would like to thank and acknowledge all of the speakers at, and participants in, the Promoting accuracy in GHG inventories: Are higher tier methods a feasible option for LDCs? workshop on 31 August 2022. The discussion during that workshop, coupled with the experience of the authors and the key 'real life' in-country experiences shared by Rumbidzai Mhunduru, Yasna Rojas Ponce and Héctor William Moreno Quitián, served as the building blocks for this publication. We would also like to express our sincere appreciation to Sandro Federici and Vitor Góis Ferreira for their detailed comments on an earlier version of the text. Special thanks to Lucy Southwood, Kat Price and Elaine Harty for their support in the edit, design, proofing and production of this publication.

Published by IIED, November 2023

Lisa Hanle and María Fernanda Alcobé, Promoting accuracy in GHG inventories through use of higher-tier methods: A practical guide for LDCs and other developing counties. IIED, London.

ISBN: 978-1-83759-059-9

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Publication layout and design by Kat Price.

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Executive summary

A robust greenhouse gas (GHG) inventory is fundamental to any strategy to respond to climate change. It is not surprising then, that all countries, including Least Developed Countries (LDCs), will need to submit a GHG inventory biennially under the Enhanced Transparency Framework (ETF) of the Paris Agreement.¹ Opportunely, the benefits of preparing a high-quality GHG inventory extend far beyond meeting international reporting obligations. Doing so will ensure countries identify their most significant GHG sources and sinks, which in turn enables policymakers to target effective mitigation actions, and, over time, assess whether the policies implemented are having the desired effect. And as well as informing climate policy, establishing the systems to collect the necessary inventory data can support a range of broader domestic and international policy actions.

Preparing a robust GHG inventory takes time and resources. GHGs are emitted or sequestered across all segments of the economy: energy, transportation, industrial sources, agriculture, land use, land use change and forestry, and waste. The Intergovernmental Panel on Climate Change (IPCC) has developed a series of guidelines over the past three decades to support all countries in their efforts to produce national GHG inventories that are transparent, accurate, complete, consistent and comparable.

The most recent internationally adopted guidelines by Parties to the United Nations Framework Convention on Climate Change (UNFCCC) for use under the ETF are the 2006 IPCC Guidelines for National GHG Inventories (2006 IPCC Guidelines). Designed for use by all, regardless of national circumstances, countries can choose from several tiers when preparing an inventory: a more basic, default approach (tier 1) and the higher tiers 2 and 3. Generally, moving from a lower to a higher tier improves accuracy² and reduces uncertainty,³ but cost and complexity also increase. Decision trees guide countries to choose the most appropriate method based

on their national circumstances and the significance of the source/sink, with the goal of developing an inventory that systematically neither over- nor underestimates emissions and removals, and quantifies and removes any biases⁴ identified at all tier levels.

The Paris Agreement recognises that countries are at different starting points when preparing an inventory. In addition to the choice of tiers to estimate emissions and removals, the ETF offers flexibility in the scope, frequency and level of detail of reporting, and the review process, to LDCs and other developing countries that need it, considering their capacities.

Inventory experts may instinctually want — or have been recommended by internal or the international UNFCCC review processes — to move to higher tiered methods, thinking higher is always better. In practice, though, time and resources are limited and prioritising available resources is necessary. This practical guide seeks to navigate decisions makers and inventory compilers from LDCs and other developing countries through the relevant guidance and decisions outlined by the IPCC

1 LDCs and Small Island Developing States may submit the information at their discretion.

2 **Accuracy** is a relative measure of the exactness of an emission or removal estimate. Estimates should be accurate in the sense that they are systematically neither over nor under true emissions or removals, so far as can be judged.

3 **Uncertainty** refers to random errors, and quantifies the lack of knowledge of the true value of a variable that can be described as a probability density function characterising the range and likelihood of possible values.

4 **Bias** is a systematic error of the observation and estimation method. Where identified, bias shall be quantified and removed.

and the UNFCCC, and help practitioners prepare an accurate GHG inventory based on, and consistent with, national circumstances.⁵ Case studies from Chile, Colombia and South Africa demonstrate their journey and decision making that led them to move to a higher tier to improve the accuracy of their national inventory.

Throughout, the guide explores key questions inventory experts may consider for each source or sink of GHGs in their country to decide when to move to higher tiers, including:

- ? Is this a key category?
- ? Does it offer mitigation potential or is it included in our nationally determined contribution?
- ? Are the necessary data available or potentially available to move to a higher tier? Do we have the technical expertise to apply the methodology?
- ? Are the data of sufficient quality and representative; allowing the method to be applied across the entire time series and the whole country?
- ? How much will it cost to move to a higher tier and what are the opportunity costs of investing resources in one category versus another?
- ? Are certain categories particularly attractive to domestic or international donor organisations, partnerships or foundations, or have any of these offered to host such a project on a bilateral or multilateral level?
- ? What do we need to meet international reporting obligations?

After considering the international guidance and reporting requirements, and listening to developing country voices, we conclude with several recommendations to LDCs and other developing countries striving to establish and improve their GHG inventories, summarised as follows:

- ✓ Use the key category analysis to identify the most important categories in your country and the best candidates for moving to a higher tier
- ✓ Consider your national circumstances and availability of resources before moving to higher tiers, as the 2006 IPCC Guidelines and UNFCCC decisions do
- ✓ Leave no one behind; create opportunities for effective communication and collaboration across all relevant stakeholders in your country
- ✓ Prioritise the list of categories that are candidates to implement the higher tier
- ✓ Always bear in mind the IPCC principles of transparency, accuracy, consistency, completeness and comparability when determining if you are ready and able to use the higher tier for reporting
- ✓ Where you cannot immediately move to a recommended method, include this issue in a GHG inventory improvement plan
- ✓ Get involved in the international reporting and review process, and
- ✓ Do not worry about submitting a perfect inventory; it is okay to have known gaps in your submission, as there will always be room for improvement.

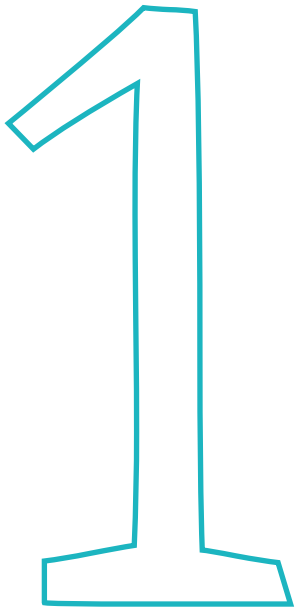
⁵ **National circumstances** encompass all elements of preparing a GHG estimate, including, but not limited to, the technical capacity of the inventory team, data availability, availability of additional resources to supply any lack of technical capacity and/or data availability, and existing quality of the lower tier estimate to be enhanced.

Why does this all matter? All countries should be actively identifying resources and preparing their GHG inventory for the first biennial transparency report (BTR) submission, due by 31 December 2024 (LDCs and Small Island Developing States may submit this information at their discretion). LDCs and other developing countries may be asking themselves: What are we required to do under the Paris Agreement? Which method should we use to estimate GHG emissions by sources and removals by sinks? Are the necessary resources available to implement the recommended method? What can we do now for our first BTR submission, and what must, or can, wait for future submissions?

Systematically assessing the state of a country's GHG inventory system and identifying opportunities to move to higher-tier methods that will lead to the greatest enhancement in understanding helps inform domestic policymakers and allows countries to make the best use of limited resources. Equally important, it helps inform the development of an inventory improvement plan that can communicate a country's capacity constraints and corresponding needs. Doing this transparently will produce a loud and clear signal to the international donor community on what LDCs and other developing countries need to prepare and improve their GHG inventories, mobilising support for future improvements.



Delegates waiting for the next negotiation session © María Fernanda Alcobé



Introduction

Greenhouse gas (GHG) inventories are the bedrock of national and international climate policy, providing a valuable snapshot of GHG emissions by sources and removals by sinks at national or subnational levels for a given year and emissions trends over time. A high-quality GHG inventory, built on the principles of transparency, accuracy, completeness, consistency and comparability (TACCC) can, in a single report, highlight a country’s most significant sources of GHGs, quantify the uncertainty of these estimates, and present information to verify whether climate policies are delivering the intended results. Availability of a GHG inventory is also often a prerequisite for participation in carbon markets; the reports also generate information to support the achievement of other development goals. And, assessed collectively across countries, GHG inventories provide a picture of whether the international community is on track to meet its climate goal. This is why preparing a GHG inventory on a biennial basis is a key requirement for all countries that have ratified the Paris Agreement.

By December 2024, countries — or “Parties” as they are referred to under the United Nations Framework Convention on Climate Change (UNFCCC) — are required to begin submitting a biennial transparency report (BTR), with discretion for Least Developed Countries (LDCs) and Small Island Developing States (SIDS) in submitting this information. The BTR must include a GHG inventory and information to demonstrate the country’s progress in implementing and achieving its nationally determined contribution (NDC). Developed countries must also report on finance, technology development and transfer, and capacity building support provided and mobilised, while developing countries are encouraged to

report on the support they need and have received. All countries are encouraged to report on adaptation.

For more than two decades, Parties have had to periodically report climate information, including a GHG inventory, with different requirements and frequencies for developed and developing countries. Under the Paris Agreement, which entered into force in 2016, all Parties operate under a single set of guidelines: the ‘Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement’ (MPGs). For LDCs and other developing countries, the requirements for preparing

a GHG inventory under the Enhanced Transparency Framework (ETF) of the Paris Agreement will represent a leap in rigour from existing requirements, which have already proven difficult to achieve.

Fortunately, the Intergovernmental Panel on Climate Change (IPCC) has been preparing, since the mid-1990s, a series of systematically comprehensive guidelines that provide robust methodologies for estimating GHG emissions by sources and removals by sinks. The 2006 IPCC Guidelines for National GHG Inventories (2006 IPCC Guidelines) are the latest agreed guidelines adopted by Parties for use under the UNFCCC, and help guide countries answer key institutional questions such as: 'Which methods should we use?', 'What data do we need, and how do we collect them?' and 'How do we estimate uncertainty and improve accuracy of our inventory?' These guidelines not only instruct countries how to estimate GHGs; they also provide valuable guidance on key elements that serve as the building blocks for countries to develop the systems they need to prepare their GHG inventory and drive its improvement over time.

The 2006 IPCC Guidelines do not contain a single standard method or approach for all to follow. Rather, they convey a set of good practices for producing a national GHG inventory. Through their adoption in the MPGs, they have become the internationally agreed good practice for preparing a GHG inventory under the Paris Agreement. What is considered good practice will vary between countries, as preparing a quality GHG inventory considers national circumstances and the significance of each sink and source being estimated. The 2006 IPCC Guidelines provide multiple methods — based on three tiers — to estimate GHG emissions by sources and

removals by sinks, generally with accuracy increasing in the higher tiers. But higher accuracy comes at a cost, as the data requirements for the tier 2 and tier 3 methods are increasingly detailed, likely with higher spatial and temporal resolution.

This guide will explain the existing guidelines for national GHG inventory development published by the IPCC, and implemented in the ETF reporting requirements, focusing on their relevance to LDCs and other developing countries. The guide is designed to provide practical guidance and tips for countries that are just beginning the journey of preparing a GHG inventory, and those that are more experienced, to help them prepare high-quality GHG inventories that best reflect their national circumstances.

The natural tendency for inventory compilers, many of whom have highly technical expertise, is to immediately jump to using higher-tier methods for all categories to increase accuracy. They strive for perfection, but perfection is not possible. This guide seeks to examine this issue, assessing the pros and cons of using various tiers and presenting good practices to support decision making in moving from lower to higher tiers. Each country has its own unique journey to prepare a GHG inventory, shaped by its national circumstances; but they can learn from the experience of others. Chile, Colombia and South Africa offer windows into their experiences of moving to higher-tier methods, shedding light on their decision making through three different case studies. We end the guide with key recommendations and tips to help LDCs and other developing countries, regardless of where their journey begins, to prepare quality GHG inventories that are consistent with their national circumstances.

In their own words



A main motivator for moving to a higher-tier method to estimate emissions from livestock in Colombia was to access results-based payment programmes. The results brought even more benefits, bringing Colombia's emission calculation closer to our national circumstances and allowing the country to target mitigation measures that are most effective in reducing livestock emissions. The development process has also allowed farmers to identify with, and feel more involved in, the GHG inventory. This is really important for building bridges between IPCC's scientific information, people and decision makers.

Héctor William Moreno Quitián, Colombia

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What is a GHG inventory?



A GHG inventory is a document containing category, sector-level and total anthropogenic GHG emissions by sources and removals by sinks across a country's national boundary in a given period.

Under the Paris Agreement, Parties are required to report GHG information from 1990 through to two years before submitting the inventory, with some flexibility for developing countries who need it. Inventory information is reported in tabular and explanatory format, covering five sectors — energy, industrial processes and product use, agriculture, land use, land use change and forestry (LULUCF)⁶ and waste — with GHGs reported on a mass and total carbon dioxide equivalent basis for a basket of seven gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride.

Developing a GHG inventory is a cyclical process, building on the previous one. Although every country will develop its own institutional arrangements to elaborate which organisations do what and when, they will follow a general process, which repeats every two years under the Paris Agreement. This fundamental cycle highlights important steps in inventory development that, once conducted, help inform decision makers on the appropriate time to move to higher-tier methods. Figure 1

illustrates this cycle, with some questions GHG inventory experts and decision makers face.

Before trying to answer these questions, it is important to take a closer look at what the 2006 IPCC Guidelines say about some of the key building blocks related to methodological choice (choosing the appropriate tier) and consider how Parties have implemented the guidelines through UNFCCC decisions. National circumstances play a pivotal role in these considerations.

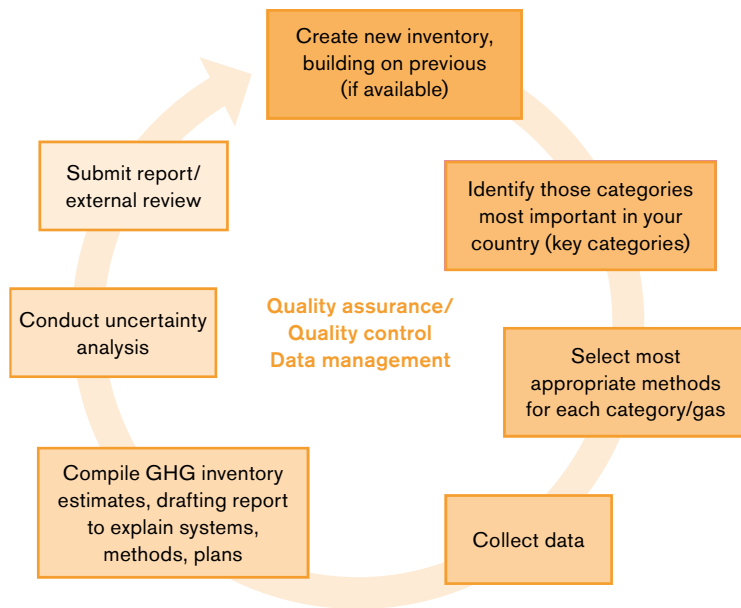


Did you know?

Annex I to UNFCCC Decision 5/CMA.3 provides the common reporting tables for GHG inventories under the Paris Agreement. There are over 100 categories across the five sectors, many more when we consider requirements for reporting on GHGs for multiple fuels and animal types. It is important to prioritise those categories that are most relevant for your country.

⁶ The 2006 IPCC Guidelines include only four sectors, combining agriculture and LULUCF into a single agriculture, forestry and other land use (AFOLU) sector. Parties to the UNFCCC have decided through successive decisions to split AFOLU reporting into two sectors. The methods contained in the 2006 IPCC Guidelines continue to apply, even when reporting is separated.

Figure 1. Illustrative GHG inventory cycle



Adapted from: 2006 IPCC Guidelines, Vol. 1, Chapter 1

Key questions for GHG inventory experts and decision makers at beginning of inventory cycle

- ? Do I know the most significant categories leading to GHGs in my country?
- ? Which tier methods do I deem most appropriate for those categories?
- ? Do I have, or can I collect, the necessary data to implement that good practice tier?
- ? What is the level of uncertainty of my estimates? Could I reduce those sources of uncertainty in the future?
- ? Have internal or external reviews recommended my country move to a higher tier for one or more categories?



Members of the G-77/China huddle outside of the informal consultations on methodological issues under the Paris Agreement © IISD

3

Key elements of the 2006 IPCC Guidelines guiding tier choice



The 2006 IPCC Guidelines are the main reference for preparing a GHG inventory that is consistent with good practice. Inventory compilers will not typically read them once and then set them aside. Rather, they will continually refer to them as they prepare successive inventories under changing national circumstances. Parties to the Paris Agreement adopted the 2006 IPCC Guidelines, noting that countries may also use the updated information in the 2019 Refinement to the 2006 IPCC Guidelines when preparing submissions under the ETF.⁷

Although we consider these in turn below, in practice, like with everything in GHG inventory development, these elements are highly dependent on the others and countries should therefore consider them holistically, rather than in a linear fashion, with a view to gradually improving the inventory over time. These are also not the only elements of the 2006 IPCC Guidelines that are relevant when selecting tiers. We examine quality assurance / quality control (QA/QC) reporting and documentation later.



Explore the **2006 IPCC Guidelines** and the **2019 Refinement to the 2006 IPCC Guidelines**, published by the IPCC Task Force on National Greenhouse Gas Inventories.

Available to download from <https://tinyurl.com/mswkc2vn> and <https://tinyurl.com/fnj5evd9>, respectively.

Methodological choice, application of inventory quality principles, and conducting an uncertainty analysis are key elements of the 2006 IPCC Guidelines that are relevant to any discussion about moving to higher-tier methods.

Methodological choice: how to choose a tier

Methodological choice is about selecting the appropriate method to estimate GHG emissions or removals, considering a country's national circumstances. The key category analysis is designed to help countries select the most appropriate methods. This identifies the source and sink categories a country should prioritise within its national system because they are estimated to have a significant influence on its total GHG inventory in terms of absolute levels, trends, or uncertainty. It is best practice to use higher-tier methods for key categories, if national circumstances allow.

There are two approaches for calculating key categories. In Approach 1, they are those that, when summed

⁷ The 2019 Refinement was published to provide updated data, information, and supplementary methods for GHG sources and sinks that were not well covered by the 2006 IPCC Guidelines, or for which new technologies or processes had emerged since the guidelines were published. Parties may, but are not required to, use the updated guidelines.

together and ranked from highest to lowest, contribute 95% of total national absolute emissions.⁸ Approach 2 considers the uncertainty of the estimates, so key categories are those that add to 90% of total national absolute emissions, sorted in descending order according to their contribution to uncertainty.



Countries should assess key categories both quantitatively and qualitatively. For a spreadsheet to quantitatively identify key categories, refer to Table 4.2 of **Vol. 1, chapter 4 of the 2006 IPCC Guidelines**. For those using the **IPCC Inventory Software**, the key category analysis will also be generated in the software (see Box 2).

Available to download from <https://tinyurl.com/mt9bc2zn>.

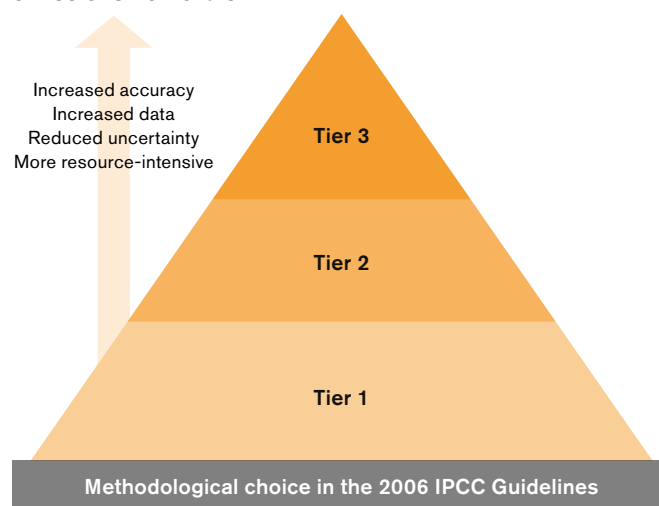
As well as undertaking a **quantitative identification** of key categories, it is good practice to conduct a **quantitative identification**. This relies on other, non-quantitative factors, to determine whether a category is key. A qualitative assessment may ask, for example, whether emissions from a source are currently low, but growing rapidly. Such categories may require additional attention and the application of higher-tier methods. It may also ask whether emissions and removals estimates from a category are increasing or decreasing due to mitigation activities. Countries should consider categories that target mitigation actions as key, even if they are not identified through a quantitative key category analysis. This is because, to track the success of policies and measures, or progress towards a target, it is important to ensure that the GHG inventory 'sees' the impact of the mitigation action (Box 1).

The 2006 IPCC Guidelines provide multiple tiers (methods or approaches) for estimating GHG emissions by sources or removals by sinks for each category. The default method (tier 1) and has been designed to use readily available activity data (AD) — that is, drivers of emissions and removals, such as the amount of fuel consumed or area of forest burned — and default EFs so that any country, anywhere in the world, can, with some

basic AD, develop an estimate. The tier 1 methods are a good starting point for countries, as they provide insight into the magnitude of emissions and removals from each category. Remember, one of the first steps in preparing a GHG inventory is to assess the significance of categories in the country (see **Key questions** in Figure 1). Applying a tier 1 method is a good way to accomplish this.

Even if a country decides to immediately move to a higher method, the results from the tier 1 method provide a basis for considering the validity of the results from the higher-tier method. It is important to know, though, that tier 1 methods are based on default circumstances that may not be fully representative of conditions in every country. Should the results from applying higher-tier methods not be consistent with the results from the tier 1 method, this does not necessarily mean that there is a problem. But a country should understand why such differences exist. The opposite scenario is also worth considering. If the results from the tier 2 method are not all that different from the tier 1 results, it does not mean the effort to move to a higher tier was a waste of time and resources. Assuming the tier 2 method was implemented correctly, it shows that the tier 1 method was also reasonably representative of national circumstances.

Figure 2. Methodological tiers for calculating GHG emissions/removals



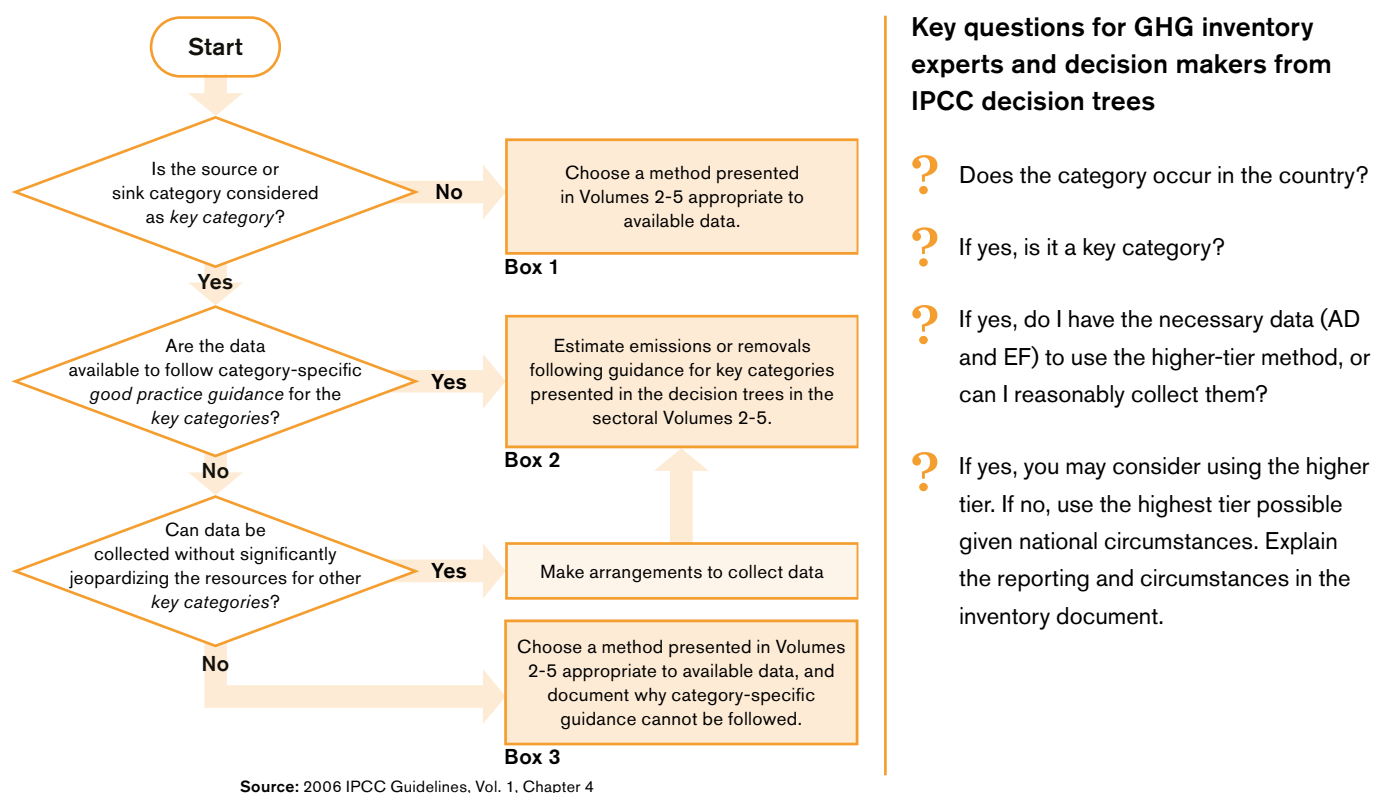
A tier 2 method may involve similar equations to tier 1 but apply country-specific data; or it may reflect a different approach to estimating GHG emissions and removals, relying on a different method and input data.

⁸ **Total national absolute emissions** are the sum of absolute values of net emission or net removal of all source and sink categories in a GHG inventory.

Tier 3 methods are typically the most complex, requiring more refined or detailed AD and corresponding EFs, or direct measurement. Models developed to reflect more complex systems, such as soil carbon, would also be considered tier 3 methods, as would any other country-specific methods if they are robust and follow the TACCC principles. Generally, moving from tier 1 to tier 3 methods reduces uncertainty and increases accuracy, but the data requirements, and often the costs, also increase (Figure 2).

The 2006 IPCC Guidelines provide decision trees for selecting the appropriate method for each category, often separately for each GHG emitted in that category. Using these decision trees is crucial in guiding a country to determine the most appropriate method for each category or gas, according to its significance and the available data for estimating emissions. Countries should use the decision tree to review each relevant category to make a first assessment on which tier to implement, based on good practice (Figure 3), bearing in mind that this initial assessment may be revised as the inventory develops.

Figure 3. Decision tree: a first assessment for deciding whether to move to a higher tier



In their own words



As is the case in many countries, Ethiopia has identified cement production as a key category and is prioritising efforts to implement a higher-tier method. We have initiated work to collect appropriate data and develop a country-specific emission factor but face several challenges. We are actively seeking financial and technical support from Parties to build on what we have started, collect the necessary activity data and conduct sample analysis from plants to help us move to a higher tier for this important source of carbon dioxide emissions in our country.

Benti Firdissa, Ethiopia

Box 1. Using higher-tier methods for categories included in NDCs

It is desirable to use higher-tier methods to estimate GHG emissions or removals for categories included in the NDC. The use of higher-tier methods helps ensure that countries estimate GHG emissions reductions or enhancement of removals most accurately. And if countries are using the inventory as the primary indicator to track progress, it may be necessary to apply higher tiers.

For example, assume country X estimates fugitive methane emissions from petroleum production using total oil production multiplied by a default emissions factor (EF) — or coefficient that quantifies the emissions or removals of a gas per unit of that activity — from the 2006 IPCC Guidelines (ranging from 1.5×10^{-6} to 3.6×10^{-3} gigagrams per 10^3 cubic metres).

To achieve its target, the country decides to undertake an extensive leak detection and repair effort across the industry, including at production wells. This programme will in practice reduce the amount of fugitive methane emissions per unit of activity, resulting in an expected decline in the EF from the baseline level. But if the national GHG inventory continues to use the default tier 1 EFs to calculate methane, the impact of the mitigation action will not be reflected in the emission estimates.

Applying the TACCC principles

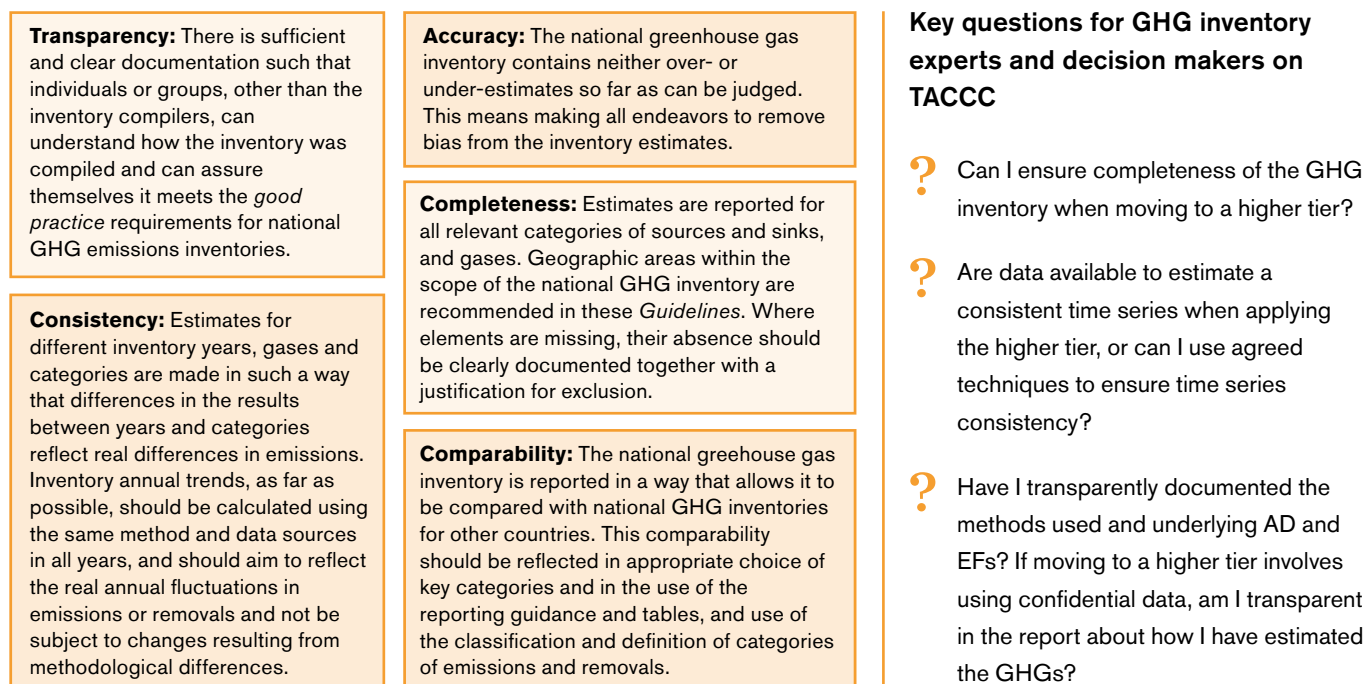
Whether this is your first or tenth GHG inventory, the quality principles of inventory development should guide all steps of the inventory process, from collecting data, to preparing estimates through to publishing the final report. The TACCC principles seek to ensure that countries undertake each step with a view to ensure the final document, and all the GHG estimates within it, are transparent, accurate, consistent, complete and comparable (Figure 4).

Considering which tier method to use to estimate GHG emissions and removals is fundamentally related to the principle of accuracy. Inventory teams strive to systematically neither over- nor underestimate emissions and removals, so far as can be judged, and minimise uncertainty as much as practicable. They can best achieve this by using the appropriate tier methods from the 2006 IPCC Guidelines. But when deciding whether to move to a higher-tier method, it is important to remember the other quality principles.

For example, a country may identify the need to move to a higher tier for enteric fermentation in cattle, because it is a significant source of methane emissions. But, before making the decision to move up a tier, it must have data that are sufficiently representative of the entire country to generate a complete GHG inventory. If these are not available, that does not necessarily mean the country cannot move to a higher tier for this category. It could proceed with using the higher tier for a portion of the source and sink category — for example, a discrete area of the country — and keep reporting the remaining portion using the lower tier. If doing this, countries must take precautions to ensure there is no double counting or omission of activity.

Countries may also have very good data for the current year but should remember that the inventory must be reported for a time series, and the principle of consistency indicates that they should use the same methods and sources of data over time to ensure that trends reflect real changes in emissions and removals and are not an artifact of the change in methods.

Figure 4. Fundamental principles for preparing a quality GHG Inventory



Source: 2006 IPCC Guidelines, Vol. 1, Chapter 1

Why does uncertainty matter?

Before exploring the influence of national circumstances on moving to a higher tier, it is important to consider uncertainty. Key categories are those that have significant influence on absolute emissions or emissions trends, or a significant impact on inventory uncertainty. So, according to the 2006 IPCC Guidelines, countries should consider moving to higher tiers for categories with higher uncertainty and where moving to the higher tier would help reduce that uncertainty and improve inventory accuracy.

The 2006 IPCC Guidelines provide two approaches for quantifying uncertainty. Approach 1 implements an error propagation equation and Approach 2 uses a Monte Carlo analysis to estimate the uncertainty of individual categories, total national emissions (with and without LULUCF) and the trend. Again, an inventory compiler's instinct may be to implement Approach 2 from the start,

but as with all aspects of inventory development, the goal is to improve over time. Approach 1 can also provide valuable insight, leaving resources to focus on applying higher tiers to estimate GHG emissions and removals for key categories.



Table 3.2 in **Volume 1, Chapter 3 of the 2006 IPCC Guidelines** outlines the calculation for the Approach 1 uncertainty analysis for both a single year (that is, the level uncertainty) and the trend. The same chapter provides more information on both Approach 1 and Approach 2 uncertainty analysis.

Available to download from <https://tinyurl.com/pkxz8tp5>.

4



Considering national circumstances

As noted above, the 2006 IPCC Guidelines are not a standard. Rather, they comprise a set of good practices that have been designed to ensure that all countries can develop a GHG inventory, considering their specific national circumstances, while meeting the TACCC principles. They can then go on to improve their initial inventory, based on their national priorities and circumstances.

In the previous section, we highlighted guidance from the 2006 IPCC Guidelines that informs decisions on moving to a higher tier. In this section, we focus on other key national circumstances that influence methodological choice, including availability of resources and technical capacity.

In their own words

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Funding is usually the main stumbling block in moving to a higher tier; this can be overcome by partnering with donors or with local research institutions.

South Africa is currently looking into partnering with local institutions to develop research projects that are aligned with improving the national inventory. This is an important step, considering that not all improvement projects will get donor funding for implementation. Such partnerships will help to bridge this gap and ensure that all key categories are eventually dealt with accordingly and hence resulting in more accurate inventories.

Rumbidzai Mhunduru, South Africa

LDC capacity constraints in preparing GHG inventories

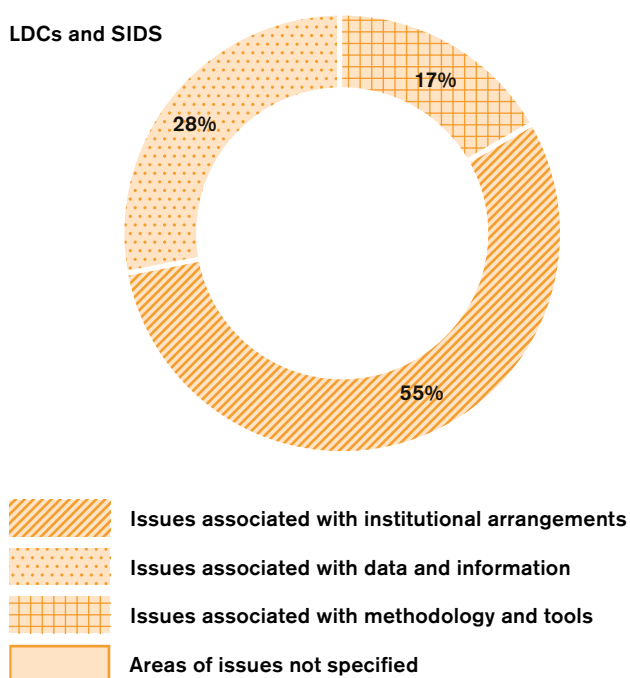
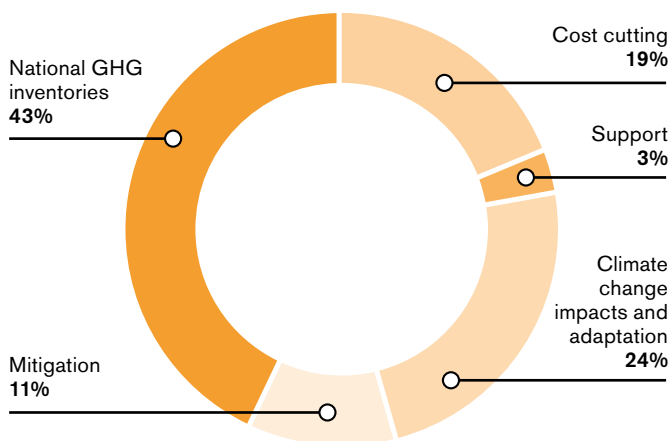
The Consultative Group of Experts (CGE) provides technical assistance to developing countries under

the UNFCCC and Paris Agreement to help them fulfil their reporting obligations under the ETF. Based on the results of a country survey on problems, constraints, lessons learned and capacity-building needs for preparing national communications (NCs) and biennial

update reports (BURs) — transparency reports under the UNFCCC — the group observed that 43% of LDCs and SIDS identified the national GHG inventory as the most challenging thematic area in preparing their climate reports (CGE 2022).



Find out more about the CGE and the resources it offers, including for preparing a GHG inventory at <https://unfccc.int/CGE>.



Source: CGE Technical Paper 2022 Distilled (CGE 2022)

Figure 5. Main capacity constraints for LDCs

The GHG inventory is not simply a narrative report. Rather, it is a compilation of sometimes thousands of individual point estimates from over 100 categories spanning decades. A deeper dive into the specific areas of GHG inventory development that pose a challenge to LDCs and SIDS suggests that issues associated with data and information, and methodology and tools, comprise approximately 83% of the challenges. Availability of appropriate quality data and the technical ability to manipulate those data into scientifically robust, and agreed, methodologies to estimate GHG emissions by sources and removals by sinks is essential for moving to higher tiers.

The International Institute for Environment and Development (IIED) produced a study in May 2021 that analysed key capacity gaps and needs, as self-identified by LDCs in 109 climate transparency reports submitted under the UNFCCC, reflecting 47 first NCs, 40 second NCs, 15 third NCs, 1 fourth NC and 6 BURs. Consistent with the CGE survey results, IIED's study found that the capacity gaps clustered into five areas: lack of data, data quality, data management, methodological issues and institutional issues. The report concluded that, on top of the difficulties LDCs experience in obtaining the quantity and quality of data needed to estimate GHG emissions and removals, inadequate institutional arrangements and data management systems make it difficult for them to coordinate, gather and process the necessary data. LDCs also expressed difficulties in accessing technical expertise to correctly apply the IPCC Guidelines, develop country-specific EFs, or use software to prepare the GHG Inventory (IIED 2021). Specifically, they identified the following capacity constraints, drawn from their individual national circumstances:

- 1. Lack of data:** LDCs reported a scarcity of data for one or more of the categories required for estimating GHG inventories, with varying impact across sectors. Typically, energy statistics were more readily available than agriculture or LULUCF data, both important sectors in LDCs.
- 2. Poor data quality:** The quality of data input impacts the accuracy and uncertainty of final emissions and removals estimates. Since the 2006 IPCC Guidelines provide the necessary default EFs, at least for a tier 1 method, the first concern is AD. Countries have different challenges associated with collecting the necessary AD for the default EFs.

Higher tiers typically require more disaggregated data, which may be more difficult to obtain.

3. **Data management:** Data are not always in the correct format — for example, countries may have information on the dollar value of goods sold, or percentages sold, but not the absolute amount. Some LDCs reported a lack of data management system and/or formal arrangements to support data gathering, compilation and archiving, including tools, software, hardware. The lack of a sustainable system, exacerbated by external experts preparing the GHG inventory on an ad hoc basis, have made it difficult to ensure continuity in GHG estimations.
4. **Methodological issues:** A lack of national EFs was the most prominent methodological issue, noting that the default factors available in the 2006 IPCC Guidelines are not specific to national circumstances. LDCs reported that the absence of country-specific EFs for different categories prevented them from using

higher-tiered methods, increasing the uncertainty of their inventories. Countries also reported a lack of in-house technical expertise for applying the higher-tier methods or taking advantage of the IPCC Inventory Software (see Box 2).

5. **Institutional issues:** Many LDCs reported having difficulty implementing sustainable procedures and training of national entities to compile, review and submit the national report. The Paris Agreement's requirement to submit a GHG inventory biennially could exacerbate the challenges surrounding institutional arrangements; but it can also be an opportunity. Establishing a set team, operating under standard procedures and with regular communication and predictable financial support, will produce a robust and sustainable inventory system.

The IIED report identified the key LDC capacity needs as: obtaining or improving AD and EFs; strengthening institutional arrangements; increasing human capacity



Delegates gather for the pilot Consultative Group of Experts (CGE) informal forum to engage in an implementation-focused exchange to facilitate addressing the technical assistance needs of transitioning to the enhanced transparency framework © IISD.

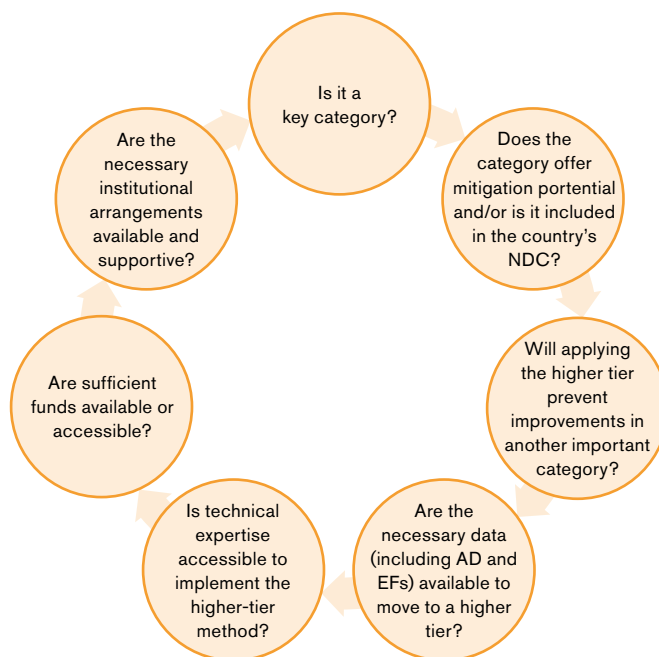
and access to technology; and creating avenues to access financial or in-kind resources to support necessary improvements.

In 2018, the Parties requested that the Global Environment Facility (GEF) consider options for improving the efficiency of support for reporting, including the ability to apply for funding for more than one report in one application (Decision 18/CMA.1, paragraph 9). If granted, this would further support stability and continuity of national activities.

Framework for considering national circumstances

By nature, GHG inventory development, particularly the choice to move to higher-tier methods to improve accuracy, is inherently based on a country's national circumstances. Figure 6 summarises the key considerations LDCs and other developing countries should undertake when making this decision. Their answers to the questions will depend on their specific national circumstances.

Figure 6. Key considerations for moving to a higher tier



Note: Available data refers to having data of sufficient quality that are also complete (covering all relevant activities for that category in the country) and available over the entire timeframe.

In their own words

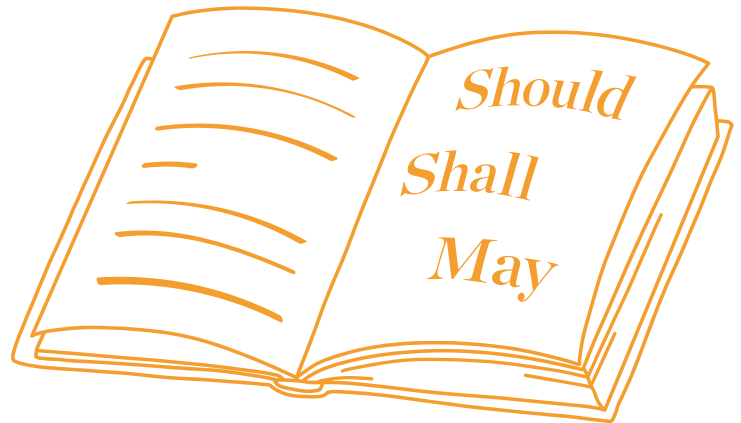


In my experience in Latin America, it is very important to explain to stakeholders that it is possible to improve the GHG inventory, but doing so requires good coordination between relevant institutions (data providers, research institutions, universities, among others).

Yasna Rojas Ponce, Chile

[CLICK HERE FOR THE FULL CASE STUDY](#)





ETF requirements

The 2006 IPCC Guidelines do not mandate countries do anything. Rather, they provide a set of good practices for developing a national GHG inventory according to the TACCC principles. Countries that have ratified the Paris Agreement, however, are required to adhere to the decisions adopted under that agreement. Two primary decisions are relevant for developing GHG inventories and other matters related to transparency, and for considering issues surrounding the move to higher tiers. These are decision 18/CMA.1 (the MPGs), and 5/CMA.3 (Guidance for operationalising the MPGs).

Decision 18/CMA.1: what to report and flexibility for developing countries that need it

Outlining the requirements for preparing the BTR, including developing a GHG inventory, the MPGs outline what countries **should** and **shall** report. When prioritising inventory activities, it is important for LDCs and other developing countries to pay close attention to what **must** be reported (that is, the **shall** requirements) and what **should** or **may** be reported, particularly if they are relatively new to GHG inventory reporting.

When drafting the MPGs, Parties understood that some developing countries have less experience in preparing national GHG inventories and that the leap between the previous and the new ETF reporting requirements are

greatest for developing countries, particularly LDCs and SIDS. As such, the MPGs include **flexibility provisions** for developing countries that do not have the capacity to fulfil the requirements, providing alternative means to comply with a reporting requirement, in some cases turning a **shall** provision in the MPGs into a **should**. Of particular relevance for LDCs and **other developing countries** in the context of this guide, there is flexibility in defining key categories as those that contribute to 85% (rather than 95%) of total national emissions, excluding LULUCF. This reduces the number of key categories and helps **these countries** focus their limited resources. These flexibility provisions are in addition to the options available to all countries of selecting the most appropriate tier method from the 2006 IPCC Guidelines to estimate emissions and removals.

Table 1 is a high-level overview of GHG inventory requirements and shows where countries with capacity constraints have flexibility. This list is not exhaustive, but it can help countries consider the overall requirements and timing when evaluating whether they can implement a higher tier. Table 2 identifies specific provisions that may be relevant when deciding whether to move to a higher tier.

The MPGs also outline the procedures for reviewing the BTR submission and the subsequent facilitative multilateral consideration of progress. Both these processes can be extremely beneficial to LDCs and other developing countries in identifying opportunities to move to higher tiers and improve their GHG inventory.



Did you know?

There is a distinction between **shall** and **should** requirements in the ETF decisions.

Shall requirements are of the highest importance, and Parties that do not meet them will receive a **recommendation** in the subsequent review report of their submission.

Should provisions lead to an **encouragement**. In limited cases, the decisions indicate that Parties **may** do something. A **may** typically indicates a Party has a choice in the matter, and depending on the context may, or may not, lead to an encouragement.

Where resources are limited, countries should first focus to the **shall** requirements.

For more information on the conduct and outputs of the review process of BTR submissions, refer to section VII of the MPGs, available to download from <https://unfccc.int/documents/193408>.

Table 1. High-level GHG inventory reporting requirements in MPGs

✦ Must submit the first BTR by 31 December 2024.	✓ LDCs and SIDS can submit at their discretion .
✦ Must use the 2006 IPCC Guidelines and may use the 2019 Refinement to the 2006 IPCC Guide	
✦ Must report by UNFCCC sector: energy, industrial processes and product use, agriculture, LULUCF and waste. The 2006 IPCC Guidelines refer to the AFOLU sector, and countries must use the individual methods from those guidelines but report emissions/removals from the agriculture and LULUCF sectors separately to the UNFCCC.	✓ The IPCC Inventory Software can help with this split (see Box 2).
✦ Must identify key categories.	✓ Developing countries applying flexibility can use different measures to define a key category.
✦ Must quantify uncertainty and discuss qualitatively.	✓ Developing countries applying flexibility can apply only a qualitative assessment for key categories, and are encouraged to provide a quantitative assessment for all categories.
✦ Must develop a quality assurance / quality control plan and implement procedures accordingly.	✓ Developing countries applying flexibility are encouraged to develop and implement these.
✦ Must report carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride.	✓ Developing countries applying flexibility only have to include fluorinated gases if they are included in their NDC, as part of an Article 6 activity or previously reported in the inventory.
✦ Must report GHG emissions/removals from 1990 onwards.	✓ Developing countries applying flexibility must cover at minimum the NDC base year/period and annually from 2020 onwards.
✦ Must report GHG emissions/removals through to two years before submission (2022 for the 2024 submission).	✓ Developing countries applying flexibility can report through 2021 for the 2024 submission.

Note: This list is not exhaustive.



Remember that no publication, guidance document or other material — including this practical guide — can replace official decisions by Parties. Always refer to the relevant decisions when planning for and reporting the GHG inventory contained in the BTR.

For all MPG requirements, refer to Decision 18/CMA.1, available to download from <https://unfccc.int/documents/193408>.

Decision 5/CMA.3: how to report

While the MPGs identify **what** countries should report, Decision 5/CMA.3 provides the **how**. This decision includes three annexes containing the common reporting table (CRT) and formats. The CRT enables countries to report their GHG inventory information and, along with the national inventory document (NID), which explains the information reported, makes up a national inventory report. The CRT is a set of 60 tables outlining the AD, emissions and other parameters that countries must report for the energy, industrial processes and product

Box 2. Using the IPCC Inventory Software to prepare a more accurate and sustainable GHG inventory and system

The 2006 IPCC Inventory Software, developed by the Technical Support Unit of the IPCC Task Force on National Greenhouse Gas Inventories Programme, enables countries to prepare a GHG inventory following the methods contained in the 2006 IPCC Guidelines. The latest version of the software contains all the methods available in the guidelines (tier 1, tier 2 and tier 3), as well as those in the '2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands' (Wetlands Supplement), allowing users to calculate GHG emissions by sources and removals by sinks at category, sectoral and national levels for the latest year and the time series.

Using the IPCC Inventory Software can help address some of the key challenges LDCs identified in their latest NCs and BURs under the UNFCCC: the lack of capacity for using IPCC methods and issues surrounding data management. Calculations are embedded in the software, minimising the chance of error and data are stored in a database, allowing countries to build on their previous GHG inventory rather than start from scratch for every submission.

The IPCC Inventory Software includes the default EFs and parameters outlined in the 2006 IPCC Guidelines and the Wetlands Supplement. Defaults are generally not available for tiers 2 and 3, so countries choosing to move to the higher tiers would need to supply their own country-specific parameters and ensure that the relevant AD are available corresponding to those EFs. Regardless of the tier applied, it is the country's responsibility to have appropriate AD.

The software also prepares a key category analysis and uncertainty analysis. For countries that are just starting out, preparing tier 1 estimates using the IPCC Inventory Software will provide the necessary data to produce an initial key category analysis, which can help prioritise the categories to apply the higher tiers to. However, categorisations differ slightly, particularly for the AFOLU sector, from those used by the UNFCCC.

In Decision 5/CMA.3, Parties requested that the UNFCCC and IPCC work together to make the IPCC Inventory Software interoperable with the UNFCCC electronic reporting tool they will use to officially submit the GHG component of their BTR. As of mid-2023, this work is in progress. Once finalised, Parties choosing to use the IPCC Inventory Software to estimate emissions by sources and removals by sink will be able to export all the necessary information to compile the UNFCCC reporting tables in a format (Json file) they can upload to the UNFCCC reporting tool to prepare the official GHG inventory submission of their BTR.

Download the latest version of the IPCC Inventory Software from <https://tinyurl.com/5n6z62s5>

use, agriculture, LULUCF and waste sectors, as well as crosscutting information on total emissions, trends, key categories, recalculations, methods and EFs used, among others. There is another table countries can use to explain any flexibility provisions they have used and their self-determined timeframe for addressing the capacity constraints leading to their use.

Regardless of the methodology (tier 1, tier 2 or tier 3) Parties use to estimate emissions and removals, they must report the results in the CRT, providing clarifying information on the methods and data used in the NID. Generally, the same cells are reported in the CRT for all tiers. In some limited cases, countries using the higher tiers will need to provide additional information.

Decision 5/CMA.3 also directs the UNFCCC secretariat to prepare electronic reporting tools for submitting this information, and requests the secretariat facilitate interoperability between the electronic reporting tool and the IPCC Inventory Software (Box 2). The decision also provides an outline that countries are **encouraged** to

use to prepare their NID, and notes that Parties **may** use the 2019 Refinement to the 2006 IPCC Guidelines for estimating their GHG emissions and removals.

Moving to a higher-tier IPCC method

We have explored what the 2006 IPCC Guidelines identify as good practices for preparing a national GHG inventory, and the tiers presented in those guidelines for preparing category-level GHG emission and removal estimates. This approach enables all countries, regardless of national circumstances, to prepare a GHG inventory. The last issue to consider is what is countries are required to report under the ETF.

In Table 1, we presented the high-level requirements for reporting under the ETF. Table 2 highlights the provisions that are relevant when considering whether to move to a higher tier, and what they mean in practical terms. These provisions are outlined in the MPGs and Decision 5/CMA.3.

Table 2. Relevant ETF requirements when considering moving to a higher tier

Reference	Provision	Things to consider
Para 20 (annex, MPGs)	Each Party shall use the 2006 IPCC Guidelines and shall use any subsequent version or refinement of the IPCC guidelines agreed upon by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA). Each Party is encouraged to use the '2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands'.	All Parties are required to use the methodologies in the 2006 IPCC Guidelines and may choose to use the 2019 Refinement to these guidelines. The use of the word may indicates that this is not required. Reference to use of the 2006 IPCC Guidelines includes guidance on tiers, data collection, estimating uncertainty, key category analysis, QA/QC, and reporting and documentation.
Para 28 (5/CMA.3)	Parties may use, on a voluntary basis, the IPCC 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.	

Reference	Provision	Things to consider
Para 21 (annex, MPGs)	Each Party should make every effort to use a recommended method (tier level) for key categories in accordance with those IPCC guidelines.	Countries identify the recommended method by applying the decision tree (Figure 3) for each category, and (if applicable), gas. For key categories, the decision tree will usually indicate using at least a tier 2 method. Should make every effort is softer than shall , but stronger than should .
Para 23 (annex, MPGs)	A Party may be unable to adopt a higher-tier method for a particular key category owing to lack of resources. In such cases, the Party may use a tier 1 approach, and shall clearly document why the methodological choice was not in line with the corresponding IPCC decision tree.	The MPGs acknowledge and allow for exceptions where a country cannot use the recommended tier. In these cases, they must document in their NID why they could not implement the recommended method, particularly if this is due to a lack of resources. The review team assessing the inventory will take this into consideration.
Para 23 (annex, MPGs)	The Party should prioritise for future improvement any key categories for which the good practice method elaborated in the IPCC guidelines cannot be used.	Preparing a GHG inventory improvement plan as part of QA/QC activities documenting the scope and timeline of planned improvements is a good way to keep track of planned improvements. Categories where a higher tier is recommended , but the country does not have the capacity to implement the higher tier, are good candidates for including in the review report as an identified capacity building need (see para 162 of the MPGs in this table).
Para 24 (annex, MPGs)	Each Party is encouraged to use country-specific and regional emission factors and activity data, where available, or to propose plans to develop them.	Noting that moving to a higher tier generally reduces uncertainty and increases accuracy, the MPGs encourage Parties to identify complete AD corresponding to these EFs are available. LDCs or other groups of countries sharing similar circumstances could work opportunities to develop and use country-specific EFs and ensure together to develop regional EFs that apply to multiple countries,
Para 26 (annex, MPGs)	To ensure time series consistency, each Party should use the same methods and a consistent approach to underlying activity data and emission factors for each reported year.	Before implementing a higher-tiered method, it is important to ensure there are appropriate data to apply the method for the entire time series. For LDCs and other developing countries, this means either back to 1990, or if they apply flexibility, at least to the base year/period of the NDC and every year from 2020 onwards.
Para 27 (annex, MPGs)	Each Party should use surrogate data, extrapolation, interpolation and other methods consistent with splicing techniques contained in the IPCC guidelines to estimate missing emission values resulting from lack of activity data, emission factors or other parameters in order to ensure a consistent time series.	If the Party cannot apply the same method for the entire time series, it should apply 'splicing' techniques from the 2006 IPCC Guidelines (see Volume 1, chapter 5) to build a consistent time series. If this is not possible, it can still be valuable to collect data to move to the higher tier, this allows countries to check the reasonableness of their current method. Some countries also find that they can use a higher tier for one region or subpopulation, but not the entire country. This may be acceptable, but they must transparently demonstrate in the NID that there is no double-counting or omission of AD in such a case.

Reference	Provision	Things to consider
Para 39 (annex, MPGs)	Each Party shall report methods used... and the descriptions, assumptions, references and sources of information used for the emission factors and activity data used to compile the GHG inventory.	<p>As the ETF name suggests, transparency is vital.</p> <p>Countries must clearly describe the method they have chosen in their NID — the tier, and any country-specific methods — how they applied them, and if applicable, the reasons they are unable to apply a recommended method.</p> <p>They must also include information on the EFs, AD and assumptions applied in those methods. Reviewers usually like to see the underlying data in the NID, but this is not always reasonable, given the amount of data or confidentiality. Where this is not possible, it is appropriate to include references for the data sources.</p> <p>If any publications support the development of country-specific EFs, countries should reference — and if possible, summarise — these in the NID.</p> <p>They should also describe any QA/QC activities conducted or any estimates, particularly in the first year of applying a new higher-tier method or EF.</p>
Paras. 74 -75 (annex, MPGs)	Each Party shall provide a description of each methodology and/or accounting approach used. The information referred to above shall include, as applicable and available to the Party's NDC under Article 4 ... (b) IPCC guidelines used ... (d) Where applicable to its NDC, any sector-, category- or activity-specific assumptions, methodologies and approaches consistent with IPCC guidance.	This report focuses on the GHG inventory and use of higher-tier methods for preparing a more accurate GHG inventory. But the ability to better track progress towards the NDC may be a driver for choosing a higher tier. If the GHG inventory is being used to track progress towards the NDC, we would expect a correlation between the information presented in the inventory section and the use of that information for tracking progress.
Para 86 (annex, MPGs)	Each Party shall describe the methodologies and assumptions used to estimate the GHG emission reductions or removals due to each action, policy and measure, to the extent available.	

Reference	Provision	Things to consider
Para 2 and Annexes IV and V (5/CMA.3)	<p>Encourages Parties to prepare their biennial transparency report and national inventory document in accordance with the outlines contained in annexes IV and V, respectively.</p>	<p>Countries are not required to follow the outlines for the BTR or the NID contained in annexes IV and V, doing so could be beneficial.</p> <p>The outlines provide frameworks for organising the inventory document (and BTR), promoting transparency of information and facilitating updates in subsequent submissions.</p> <p>The NID outline is a recipe for how and where to present methodological issues, such as methods, AD and EF choices, assumptions underlying the emissions and removals estimates, the rationale for selecting them, descriptions of national methods and models, and information on planned improvements, including those related to methods, EF choices and AD.</p> <p>Reviewers tend to look for information in the sections outlined in the NID. When the inventory is documented in this way, it can help minimise questions from reviewers during the review week, reducing countries' workload during this time.</p>
Paras 158-159 (annex, MPGs)	<p>A Party shall undergo an in-country review for: ... (a) The first biennial transparency report.</p> <p>Those developing country Parties that need flexibility in the light of their capacities have the flexibility to instead choose to undergo a centralised instead of an in-country review but are encouraged to undergo an in-country review.</p>	<p>For the first BTR, a review team will come to the country to review the submission, including the GHG inventory, for consistency with the MPGs. LDCs and other developing countries may choose to apply <i>flexibility</i> and be subject to a centralised review, in which case, a team will meet remotely (often in Bonn) and conduct the review from there.</p> <p>In-country reviews offer a valuable opportunity for countries to work one-to-one with experienced international GHG inventory experts and gain further insight into the appropriateness of the methods applied and opportunities for moving to higher tiers. In-country reviews also tend to attract the attention of decision makers in the host country, elevating the importance of acquiring robust GHG data, which can in turn garner more support to attract investment for future improvements.</p>
Para 162 (annex, MPGs) Annex VI, section II.E (5/CMA.3)	<p>For in-country, centralised and desk reviews: ... (d) The technical expert review team shall communicate to the Party concerned draft areas of improvement, constituting preliminary recommendations (for shall provisions) and/or encouragements (for non-shall provisions), and, for those developing country Parties that need flexibility in the light of their capacities, any capacity-building needs identified in consultation with the Party concerned, at the end of the technical expert review week.</p>	<p>A key principle inscribed in paragraph 3 of the MPGs is the importance of facilitating improved reporting and transparency over time. The technical expert review report is a key output of the review to help achieve this. A specific section of this report is dedicated to communicating capacity-building needs, identified based on in-depth discussions between the review team and the country. As such, it is a prime opportunity for LDCs and other developing countries to articulate their capacity-building needs. For example, if enteric fermentation of cattle is a key category, but the county has been unable to implement the recommended tier 2 method, they can communicate this to the international community through section II.E of the final technical expert review report.</p>

Reference	Provision	Things to consider
<p>Paras. 172-173 (annex, MPGs)</p>	<p>Technical experts shall be nominated to the UNFCCC roster of experts by Parties and, as appropriate, by intergovernmental organisations.</p> <p>Technical experts shall complete the training programme referred to in decision 18/CMA.1, paragraph 12(c), prior to serving on a technical expert review team.</p>	<p>This provision presents a slightly different angle to inform a country's consideration on when to move to higher tiers. The ETF will demand a significant number of qualified experts to support the review process of other countries' BTRs, including GHG inventories. Getting nominated to the roster of experts and passing the exam to become part of a review team provides a tremendous opportunity for experts from LDCs and other developing countries to share their knowledge and perspective and learn what others are doing and therefore enhance their own knowledge. Other countries may have found solutions to similar challenges when preparing country-specific EFs or developing a consistent time series upon moving to a higher tier. Experts can bring this knowledge home and apply it in their country. Plus, experts in a centralised review will be on a team with other international experts, providing myriad opportunities to exchange views and ideas, thereby enhancing the capacity of their national experts.</p>



Informal consultations pursuant to the modalities, procedures and guidelines for the transparency framework for action and support
 © IISD

6

Quality assurance, quality control, reporting and documentation



Although not unique to a discussion about moving to higher tiers, it is important to consider QA/QC, reporting and documentation in this guide.

Quality assurance and control

Quality assurance/quality control (QA/QC) and verification refer to a series of checks, reviews, and assessments, conducted by various individuals throughout the inventory preparation process, to ensure that the inventory submitted meets the data quality objectives of TACCC. Figure 7 defines the terms QA, QC and verification. For further insights refer to the 2006 IPCC Guidelines, volume 1, chapter 6, Box. 6.1.

The 2006 IPCC Guidelines provide an extensive list of possible checks to carry out on the inventory, both general procedures and category-specific checks that countries can document in an overall QA/QC plan. The MPGs **require** (or **encourage** LDCs and other developing countries that choose to apply flexibility) to prepare a QA/QC plan and implement general QC procedures accordingly. Countries **should** undertake more detailed checks in key categories, particularly where they use higher-tier methods and are also **encouraged** to conduct a basic peer review of their inventory. This series of checks and peer review — including the review reports prepared by technical expert review teams — identifies recommendations for future improvements.

As resources are limited, and some recommendations can take years to address, countries will not be able to implement all improvements immediately. They may find it useful to prepare a GHG inventory improvement plan that documents recommendations and identifies a plan and timeline for addressing them.



Volume 1, Chapter 6 of the 2006 IPCC

Guidelines describes elements of a QA/QC plan and contains a list of possible generic and category-specific checks. It is important to prepare a QA/QC plan that is practical. A shorter plan with key checks may be preferable to a long list that is merely checked off but not actually used. Like everything else with inventory preparation, countries can improve the QA/QC over time.

Download the checklist from
<https://tinyurl.com/2p98fd47>

Reporting and documentation

Each category discussion in the 2006 IPCC Guidelines includes a section on reporting and documentation, outlining the information that is considered good

practice to include in an inventory document. Generally, regardless of the tier, countries must provide information on the methods, AD, EFs and assumptions used for inventory preparation, including references to external documentation where relevant. Using higher tiers often brings additional requirements to explain exactly the method followed to estimate emissions and removals, the AD used, and the derivation of any country- or region-specific EFs. It is also good practice to verify estimates that have been generated using tier 3 methods, including models. Not all information needs to be included in the NID, as countries can use references to external studies instead, but if doing so, they should at least summarise the information in the NID.



The discussion for each source and sink category in Volumes 2–5 of the 2006 IPCC Guidelines contains a separate section titled ‘Reporting and Documentation’. Countries can learn more about what to report in the NID by reviewing the relevant sections for source and sink categories that apply to them.

[Report of the IPCC Expert Meeting on Use of Models and Measurements in GHG Inventories \(IPCC 2011\)](#) provides additional guidance on — and experiences of — using and reporting on higher-tier methods and models.

Available to download from <https://tinyurl.com/47h4xswr>.

Figure 7: Defining QA/QC and verification



Delegates huddle during the final stages of the SBSTA closing plenary. © IISD



Moving to a higher tier: case studies from Chile, Colombia and South Africa

Beyond theory, it is enlightening to learn from the experiences of other countries, and the decision making that drove them to implement higher tiers. In this section, Chile, Colombia and South Africa share their journeys to move to a higher tier, describing the key drivers and considerations that led to their decisions to adopt a

higher tier. The case studies from the LULUCF, AFOLU and energy sectors explore the benefits received and challenges encountered along the way, and overall lessons learned. We hope that LDCs and other developing countries can relate to one or more parts of these journeys and think about how this may apply in their own country.



Poster session during the SBs © María Fernanda Alcobé



Chile: collaboration to improve the accuracy of its national forest inventory (NFI)

Author: Yasna Rojas Ponce

Sector	LULUCF
Key category	Forest land
Tier	3

Natural forest covers 14.5 million hectares in Chile, with 50% of this area included in Chile's GHG inventory. Since 2000, Chile has published seven national GHG inventories⁹ NC1 2001, NC2 2011, BUR1 2014, BUR2 2016, BUR3 2018, BUR4 2020 and BUR5 2022.

For its first two GHG inventories, in NC1 (2001) and NC2 (2011), Chile applied a tier 1 method, treating the AD (area of forest) for second-growth forest as a constant, remaining unaltered for the time series (1984–2006), and using expert judgement to determine natural forest growth parameters, such as mean annual increment. As a result, the GHG inventory reported the same annual carbon gain during the time series for second-growth forest.

Motivation and creating institutional arrangements

The motive for applying a higher-tier method was to use more representative information on the country's natural forests from the NFI that reflected the changes in the different stages of forest. Chile created the GHG inventory national system to prepare its third GHG inventory (BUR1 1990–2010), fostering discussions across ministries on how to improve the GHG inventory. The institutions in charge of generating of forest information — *Instituto Forestal* (INFOR) and *Corporación Nacional Forestal* (CONAF), responsible for forest parameters and land use change, respectively — participated in the process for the LULUCF sector.

Seeking support to move to the higher tier

An internal process involving INFOR experts reviewed the information used in the country's first two GHG inventories and determined that national data were available to show the growth of the forest and the changes in area of forest in the time series, enabling Chile to improve its inventory.



9 <https://snichile.mma.gob.cl/>



The first step considered using NFI information on growth of natural forest by forest type, instead of relying on expert judgement. The NFI information on parameters of forest growth was included in the BUR1 (2014) but did not include data on forests in extreme geographic areas. In the absence of information on all forests, Chile used a combination of the data and expert judgement for areas that were not covered in the NFI.

The improvements in parametric data on natural forest management used to support a move to the higher tier were made possible through the implementation of the GEF 2015–2018 project, 'Integrated national monitoring and assessment system on forest ecosystems (SIMEF) in support of policies, regulations and sustainable forest management practices incorporating REDD+¹⁰ and biodiversity conservation in forest ecosystems'.¹¹ This project allowed Chile to extend the NFI to the islands and archipelagos of the Aysen and Magallanes regions, providing more complete information covering millions of hectares of forests in inaccessible areas that were previously not included in the inventory.

The GEF project was also important for improving the periodicity of land use change reporting, positively impacting the GHG inventory and REDD+ reporting. Since BUR4 (1990–2018), Chile has used NFI information covering all forests that includes land use change reporting every two years.

The second step in moving towards tier 3 was developing a growth model for second-growth forest to show the change in natural forest and its contribution to the GHG inventory in the time series. In the process of moving to a higher tier, the knowledge within and connections between INFOR, responsible for the NFI, and CONAF, responsible for forest AD, were key. Coordination with forest inventory and forest management experts, who explained the importance of the GHG inventory, helped improve general understanding among all stakeholders of the purpose and structure of, and guidelines for developing, the GHG inventory, supporting a more efficient move from tier 1 to 3.

Chilean NFI

The NFI was designed to satisfy the national and international demand for data and information on the ecosystem as a whole and contributed greatly to improving the country's GHG inventory. It performs field measurements on a four-year cycle, assessing a quarter of the field plots every year. It calculates annual estimates by combining new ground truth data, remeasuring sample plots and correcting projections for plots that were not visited in previous years.



Second growth forest of *Nothofagus* in Chile
Credit: Marco Barrientos Alarcón

¹⁰ 'Reducing emissions from deforestation and forest degradation in developing countries and additional forest-related activities that protect the climate, namely sustainable management of forests and the conservation and enhancement of forest carbon stocks.'

¹¹ <https://simef.minagri.gob.cl/>



Challenges of moving to a higher tier

The main challenge of developing new EFs and implementing new methods was explaining the importance of their information in the GHG inventory framework to the institutions that generate the data. The national institutions that generate this information are not necessarily focused on the GHG inventory, so the national GHG inventory system needed to connect with the data providers and engage in conversations to highlight the needs for improving information. Even small efforts can produce significant advances in the GHG inventory. In Chile, existing NFI data provided some relevant information up to 2015, but being able to include all forests allowed it to elaborate the growth model, further developing the GHG inventory.

Benefits of applying a higher tier

Having new EFs allowed Chile to use representative information of its forests that reflected the evolution of the forest in the time series, thus reducing uncertainty. These improvements have brought additional benefits, as Chile also uses the NFI and GHG inventory data to support reporting for REDD+, the Montréal Process, and other international processes. And as illustrated in Chile's NDC, progressing to a higher tier in the GHG inventory has helped the country develop GHG emissions projections under different forest land scenarios.



Colombia: moving to a tier 2 method for estimating methane emissions from livestock

Author: Héctor William Moreno Quitián

Sector	AFOLU
Key category	Methane emissions from enteric fermentation and manure management
Tier	2

Before submitting its BUR3 (IDEAM et al. 2021), Colombia undertook a process to improve its inventory. The country applies a tier 2 methodological approach in one bovine management category, and is continuously working to improve on this, consulting the best available information on animal characteristics, production systems and animal diets.



Motivation

The main reason the country decided to move to a higher-tier method was to access results-based payment programmes, which aim to reduce methane emissions from enteric fermentation from livestock and improve manure management. Obtaining a higher level of detail reduces the uncertainty in their emissions calculations, allowing the country to monitor future emissions reductions by improving its production system. A tier 2 methodology allows them to do this because it is sensitive to technological changes in the production system, such as changes in diet, grazing systems and management.

Moving to a higher tier, in practice

There were three stages in moving to a higher methodological level in livestock.

- 1. Identifying key categories.** As a key category in Colombia's agriculture sector, livestock farming is the country's second source of emissions after land use change. In this first stage, it was important to direct efforts to relevant categories in the inventory and ensure the efforts required to improve estimations were relevant to the national circumstances.
- 2. Developing a detailed characterisation of the animal populations.** This involved disaggregating animal populations by age group, production level or type of production. A tier 1 method requires the livestock population to be divided into dairy cows and other cattle. But tier 2 requires a more detailed characterisation, and Colombia divided the population into seven categories: high-production cows, low-production cows, cows for meat production, bulls for reproductive purposes, pre-weaned calves, replacement heifers and fattening cattle.
- 3. Applying an appropriate model.** The country used the IDEAM-AFOLU 1 Colombia model, enabling it to calculate EFs for various livestock categories and assess uncertainty. This methodology relied on factors such as animal characteristics, production systems, dietary components and a methane conversion factor, referred to as 'Ym'.



Colombia has access to a detailed livestock census (ICA 2023), databases characterising the country's pastures (Agrosavia 2018) and a map indicating livestock farming types in each municipality (FEDEGAN 2012). The challenge was combining all these elements, where two major difficulties arose.

The first challenge was being able to stratify AD at a level consistent with the model. Since Colombia has great climatic diversity, it was necessary to stratify the country to identify moderately homogeneous zones and characterise typical animals, production systems and diets in those zones. Colombia identified ten livestock regions, with seven cattle categories each. Due to climatic conditions, seven of these regions had no high-production cows. The result was 63 EFs for enteric methane and 63 EFs for manure management.

The second challenge was ensuring that the model and EFs applied were representative of national circumstances and appropriate for the AD. More than 80% of Colombia's livestock is developed with *Bos indicus* type animals (Indian origin) and the IPCC equations were developed for *Bos taurus* (European origin) animals. Colombia adapted these equations to ensure the model could consider variations by genotype. The same happened with animal diets. Since diets are very low quality and highly diverse, Colombia concluded that the IPCC's Y_m value could underestimate GHG emissions. So, it looked for a model that allowed it to calculate Y_m from diet composition, opting to use one of the equations proposed by Ellis et al. (2007).

Benefits of the higher-tier method for livestock

One of the advantages of having these new EFs is that Colombia could calculate emissions more precisely, bringing its calculation closer to the national circumstances, and allowing the country to target key areas and develop mitigation measures that are most effective in reducing livestock emissions. It has also allowed farmers to identify with, and feel more involved in, the GHG inventory. This is vital for building bridges between IPCC's scientific information, people and decision makers.

Inventory improvements are ongoing, specifically in-situ measurements of nitrous oxide emissions from grazing animals (Figure 7). This information will help Colombia develop a tier 2 model for that category.

Figure 7. Field measurement of nitrous oxide emissions from urine and manure of grazing animals with closed static chamber



Installing the chambers in a livestock farm in the municipality of Paz de Ariporo (Casanare)
Credit: Héctor William Moreno Quitián



Assembling the closed static chambers
Credit: Héctor William Moreno Quitián



Key tips for other countries

The following tips from Colombia's experience with livestock may be relevant for other countries, not only for improving agriculture estimates, but also when considering other methodological updates:

- 1. Ensure the GHG inventory team includes professionals with strong expertise.** In the case of Colombia, these were experts in animal production.
- 2. Identify the reason you are seeking to improve the methodology.** For example, to develop an emissions reduction programme or seek access to international funding for pay-for-performance programmes.
- 3. Disaggregate the AD (in Colombia's case, animal populations) appropriately.** If there are no livestock censuses, it is possible to make estimates to disaggregate the animal populations, but it is important to estimate the uncertainty derived from that disaggregation.
- 4. Apply a model for calculating EFs that is adjusted to national circumstances and scientifically robust.**



South Africa: developing and publishing higher-tier EFs for liquid fuels

Author: Rumbidzai Mhunduru

Sector	Energy
Key category	Liquid fuels
Tier	2

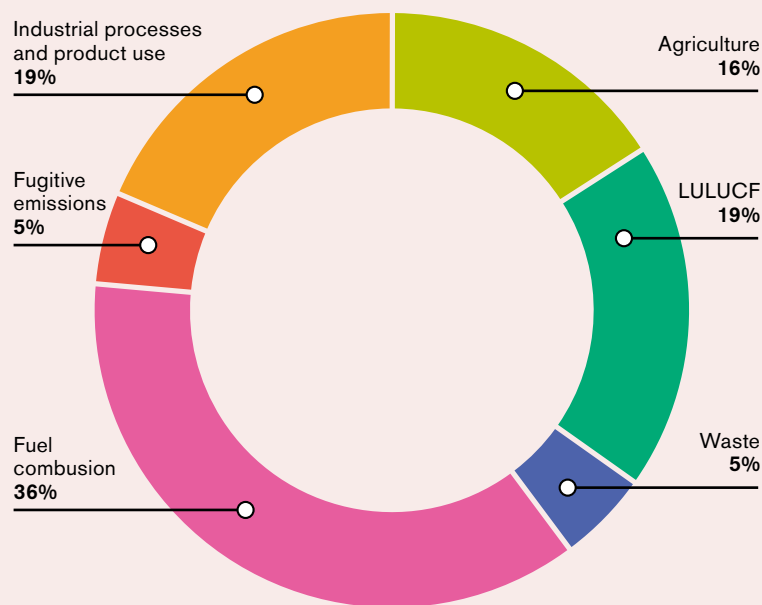
South Africa’s Department of Forestry, Fisheries and the Environment (DFFE) houses the national focal point for climate change. Within this department, the GHG Inventory and System Directorate has responsibility for compiling the national GHG inventory.



Motivation

As the energy sector is the major contributing sector to South Africa's inventory, it is important to develop country-specific EFs for major fuels. South Africa’s fourth BUR included developing EFs, carbon contents, and net calorific values of liquid fuels under the energy sector as a high priority GHG inventory improvement project. This was aligned with the key categories analysis for the 2017 inventory, which indicated that fuel combustion activities were the country’s most prominent source of emissions (Figure 8). Within fuel combustion, liquid fuels in many categories were considered key.

Figure 8. Distribution of activities on the key category list for South Africa’s BUR4



In line with good practice, countries should use higher-tier methods to report key categories. So, in 2021, with support from German development agency GIZ and the World Resources Institute, South Africa implemented a GHG improvement project to develop local carbon dioxide EFs for commonly used liquid fuels. These country-specific EFs would allow South Africa to move from using the default IPCC carbon dioxide EFs for liquid fuels to tier 2 carbon dioxide EFs for all the relevant fuel combustion activities.



Moving to a higher tier, in practice and overcoming challenges

A local service provider conducted the project, which included collecting samples of fuels during the summer and winters seasons from major retail stations along major traffic routes in different provinces. Collecting data across different seasons was important to ensure the resulting EFs were representative of the annual conditions in South Africa. After analysing the samples for carbon content and net calorific values, the project developed country-specific EFs assuming 100% oxidation of the contained carbon.

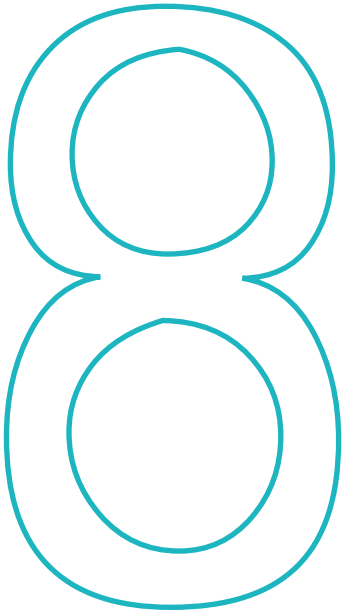
The project faced some challenges, such as the nonavailability of equipment to determine the carbon content of gaseous materials. This affected liquefied petroleum gas samples, but it was possible to calculate, rather than measure, the carbon content for these. Although this was not the desired outcome, it was still possible to determine an EF based on the local characteristics of the fuel. Budget constraints also limited the desired number of samples per fuel per season, but it was possible to use a statistically representative number of samples instead. The resulting EFs were deemed more suitable for use in South Africa than the IPCC default EFs.

Sharing knowledge and lessons learned

The project published an article in the *Journal of Energy in Southern Africa* (Kornelius et al. 2022), ensuring the new country-specific EFs are considered peer reviewed. They are being incorporated into South Africa's 2000–2022 inventory and will be applied throughout the time series. They were also added to the IPCC's EF Database for use by other Parties in the region or elsewhere that have a similar context as South Africa.

South Africa recently initiated another similar project, also with GIZ support, focusing on solid fuels to develop country-specific carbon dioxide EFs for commonly used solid fuels. With the project scheduled for completion in 2024, the developed EFs should be incorporated in the 2000–2024 inventory.

It is important, where possible, for countries to move away from tier 1 EFs to ensure that their inventories, which inform their policies and NDCs, are based on local or regional data. Funding is usually the main stumbling block, which countries can overcome by partnering with donors or local research institutions. South Africa is looking to partner with local institutions to develop research projects that are aligned with improving the national inventory. This is an important step, considering that not all improvement projects will get donor funding for implementation. Such partnerships will help bridge this gap and ensure that the country eventually applies higher tiers for all key categories, resulting in more accurate inventories.



Recommendations

Our case studies show that many factors affect decisions on whether, when and how to apply a higher-tier method. Each country's experience is different, but common themes emerge. As LDCs and other developing countries build and strengthen their GHG inventory teams for preparing the first BTR in late 2024 (LDCs and SIDS may submit the information at their discretion) and consider which tiers to apply when preparing GHG estimates for individual categories, we make the following key recommendations.

1. Use the key category analysis to identify the most important categories in your country, in terms of both levels and trends, and identify the best candidates for moving to a higher tier.

If this is your first inventory, you can implement a basic tier 1 method to every source/sink category, applying the tier 1 estimates into Table 4.2 in [Volume 1, Chapter 4 the 2006 IPCC Guidelines](#)¹² or the IPCC Inventory Software (Box 2) to prepare an initial key category analysis. Do not forget to consider an additional qualitative assessment of key categories to identify additional categories that may not appear in the quantitative analysis, such as those that do not classify as key using the quantitative threshold but are included in your country's NDC. This will give you a list of candidates for moving to a higher tier. In subsequent years, you can refine this list with the results of your previous GHG inventory.

2. Consider your national circumstances before moving to higher tiers; the 2006 IPCC Guidelines and UNFCCC decisions do.

While you should make every effort to use higher tiers for key categories, a quick review of the decision trees in the 2006 IPCC Guidelines will tell you that you also need to consider whether you already have — or can collect — the data you need for the higher tiers. This includes AD, EFs, and other parameters. The MPGs also recognise that national circumstances may prevent some countries from moving to a recommended tier. If your country lacks the human or financial resources to do so, explain this in your NID.

3. Leave no one behind.

The GHG inventory, by its nature, is cross-sectoral, covering activities that impact all of society. You cannot, therefore, produce the inventory in a silo. It requires coordination among stakeholders across government, the private sector, research institutions, and other nongovernmental entities. Although the structure of institutional arrangements varies across countries, communication is always key. Data providers and the inventory compiler will need to coordinate to ensure that the appropriate data are received and uncertainties of the information received well quantified, to build a GHG inventory that both fulfils

¹² www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/1_Volume1/19R_V1_Ch04_MethodChoice.pdf

international obligations and meets domestic needs. Conversations with private sector data providers can build trust and rapport, instilling confidence that data will be used in a known and appropriate way, and leading to a reliable supply of data over time. Other stakeholders can also provide valuable input — for example, by reviewing newly adopted methods or identifying alternate sources of data. Finally, seeking engagement of the donor community and establishing partnerships helps ensure timely and sufficient funds and technical support.

4. Prioritise the list of categories that are candidates for a higher tier.

Consider your national priorities and the categories that should have the highest priority. Although the exact weighting of each factor will differ between countries, the following questions can help you in this exercise: Is it a key category? Does improving the accuracy of the inventory estimates enhance your ability to estimate the impacts of mitigation actions contained in your country's NDC? What are the opportunity costs, if your country applies resources to this category over another? Do you have all the necessary AD to move to a higher tier? Are they of an appropriate quality? Are they available for the entire time series and do they cover the entire country? Does your country have the technical expertise, stakeholder support and resources it needs to implement the higher tier? Based on this analysis, you may find that you generate two lists: one where your country can immediately move to a higher method, and one where not enough data or resources are available yet, or other national inventory priorities prevail. Do not worry if the second list is longer. This is to be expected.

5. Always bear the TACCC principles in mind.

If you are interested in moving to a higher tier, can you produce a complete and consistent GHG inventory applying the higher-tier method? Are your country-specific EFs representative of the circumstances across the country? Do you have AD for all sources and sinks across the country? Can you implement the same higher-tier method over the entire time series? If not, can you apply methods from the 2006 IPCC Guidelines to ensure a consistent time series? Have you transparently documented the

use of higher-tier methods and/or models in the NID, including references to any publications explaining those methods and/or models? Have you quantified the uncertainty of your estimates? It may take several years before you can answer 'yes' to all these questions. In the meantime, the information you gather provides valuable insight on the uncertainty of existing methods and can help you conduct a QA/QC of existing estimates. If all the above conditions are satisfied for a portion of a source or sink category, you may consider implementing a hybrid approach, estimating a subset of national emissions with the higher tier while reporting the rest at a lower tier. If you follow this approach, take care to avoid omitting or double counting any emissions or removal activities.

6. Where you cannot immediately move to a recommended method, include this issue in a GHG inventory improvement plan.

Maintaining an inventory improvement plan will help you keep track of planned improvements, including priority categories for moving to a higher tier. This plan could build on the list of prioritised categories and identify key data gaps or capacity constraints to be overcome, institutions that could be involved, resource needs, and an estimated timeframe for improvement. You can update the list frequently, based on observations from the inventory team or external reviewers and it can serve as a key discussion document when the inventory team and decision makers meet to discuss inventory updates. Providing information from the improvement plan in the NID's 'planned improvements' section or the capacity-building needs section of the technical expert review report — which will both be published on the UNFCCC website — can be a good way to communicate your country's needs to a broader external audience and attract support to make plans become reality.

7. Get involved in the international reporting and review process.

Build relationships, and start conversations, with other countries with similar circumstances. Experts from multiple countries may collect technical and financial resources to generate regional EFs, and possibly AD. Work with your national focal point or

through an intergovernmental organisation to get nominated to the UNFCCC Roster of Experts¹³ to become a technical expert reviewer for other countries' GHG inventories. Not only will you be able to help other countries improve their inventories, you will also take lessons learned back home to improve your country's GHG inventory. Prepare to host an in-country review of your BTR submission, ensuring international experts come to you and allowing you to discuss the consistency of your reporting with the MPGs and identify any capacity-building needs.

8. Do not worry about submitting a perfect GHG inventory.

While it is laudable to strive to move to higher tiers to improve the accuracy of your country's GHG inventory, no one expects the first or even the tenth inventory to be perfect. Look through the review of GHG inventories submitted by developed countries: even after 25 years of submissions, you will find cases where they apply tier 1 for key categories. The important thing is to start somewhere and develop a plan to improve over time.



The World Conference Center Bonn ready for the Bonn Climate Change Conference © María Fernanda Alcobé

¹³ To learn more about becoming a technical expert reviewer, refer to the UNFCCC brochure explaining the process (<https://tinyurl.com/2bydjvuu>).



Conclusions

The GHG inventory is a key pillar of national climate actions. Understanding major GHG emissions by sources and removals by sinks, and their trends over time, informs national decision making in the near term and in long-term climate strategies. As well as helping countries understand whether they are on track to meet their NDCs, a quality GHG inventory can open doors to participate in carbon markets and help them collect data to support a range of Sustainable Development Goals.

Given the importance of the GHG inventory, it is no surprise that countries want to produce the best possible inventory. Estimating emissions by sources and removals by sinks using the IPCC's higher-tier methods can increase accuracy and reduce uncertainty. But resources are often limited, particularly in LDCs, and other developing countries and both the 2006 IPCC Guidelines and decisions adopted by Parties to the Paris Agreement recognise the impact of national circumstances on Parties' ability to report.

Identifying key categories — and by extension, those where countries should apply higher-tier methods — is an important first step. But after drafting that initial list, it is as important to prioritise the list to focus first on those categories where improvements will have the greatest impact. Countries will have their own way of making

these decisions, but could consider: whether a category is key, whether it is included in the NDC, whether data are available to support higher-tier methods, the costs, access to funding, opportunity costs of focusing on one category over another, in-country institutional arrangements for applying the higher-tier method and ability to implement the higher tier across the time series.

Developing a robust GHG inventory that not only meets international reporting requirements, but more importantly, supports domestic policy making, takes time. Inventory development is cyclical by nature and will improve over time, step by step, by learning through doing. Although a country may only focus on a subset of improvements in any one inventory cycle, generating a well-defined list of all identified improvements — with associated gaps and needs, relative priorities, costs, and anticipated timelines for addressing the gap(s) — can lead to an extremely valuable document. The NID and technical expert review report under the ETF can become powerful vehicles for highlighting the categories countries should estimate with a higher-tier method, and clearly and precisely communicating capacity constraints and corresponding needs to address them. This can then help them attract the financial and capacity building support they need to make planned improvements a reality.

Acronyms

AD	activity data
AFOLU	agriculture, forestry and other land use
BTR	biennial transparency report
CGE	Consultative Group of Experts
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
CONAF	<i>Corporación Nacional Forestal</i> (National Forestry Corporation, Chile)
CRT	common reporting tables
DFFE	Department of Forestry, Fisheries and the Environment (South Africa)
EF	emissions factor
ETF	Enhanced Transparency Framework
GEF	Global Environment Facility
GHG	greenhouse gas
INFOR	<i>Instituto Forestal</i> (Forestry Institute, Chile)
IPCC	Intergovernmental Panel on Climate Change
LDCs	Least Developed Countries
LULUCF	land use, land use change and forestry
MPGs	Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement
NC	national communication
NDC	nationally determined contribution
NFI	national forest inventory
NID	national inventory document
QA	Quality assurance
QC	Quality control
SIDS	Small Island Developing States
TACCC	transparency, accuracy, consistency, completeness and comparability
UNFCCC	United Nations Framework Convention on Climate Change

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Notes



**Knowledge
Products**

Toolkit

November 2023

Climate Change

Keywords:

Least Developed Countries (LDCs), Paris Agreement, transparency, United Nations Framework Convention on Climate Change (UNFCCC), Intergovernmental Panel on Climate Change (IPCC)

A core requirement of the Paris Agreement is for countries to report on their greenhouse gas (GHG) emissions and the action they will take to reduce them. Equipped with more accurate emission inventories, countries can make informed decisions around how to reduce their emissions, including which sectors to focus on.

This new toolkit supports decision makers and inventory compilers from Least Developed Countries and other developing countries to prepare accurate GHG inventories based on their country's capabilities, constraints and priorities. This user-friendly guide unpacks the relevant Intergovernmental Panel on Climate Change (IPCC) guidelines and United Nations Framework Convention on Climate Change (UNFCCC) decisions. It sets out the main principles, includes exercises to support decision making and explains tricky terminology. It includes case studies from Chile, Colombia and South Africa highlighting their journey and the decision making processes that enabled them to improve the accuracy of their national inventories.



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44 Southampton Buildings, London, WC2A 1AP, UK

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The UNDP-implemented, EC-funded project "support for developing countries' alliances on climate change" supports vulnerable countries to increase participation in the UNFCCC processes and build capacity to implement the Paris Agreement and build resilience to climate change.