Greenhouse Gas Protocol

Mitigation Goals Accounting and Reporting Standard

Second Draft for Pilot Testing

July 2013

Introduction to this draft

This is the second draft of the *GHG Protocol Mitigation Goals Standard* for pilot testing. The first draft was developed in 2012 by the Technical Working Group (TWG), with strategic input from the Advisory Committee. The first draft was sent for review by the Review Group from November 2012 to January 2013. Over 35 organizations provided written comments, and over 100 participants attended three workshops in December to provide feedback on the draft in Doha, Qatar; Washington, DC, USA; and Beijing, China. An earlier version of this draft was reviewed by the Advisory Committee and Technical Working Group. See the table below for the full standard development timeline. The current place in the timeline is marked in red.

Standard development timeline

Month	Activity
June 2012	First Advisory Committee meeting First Technical Working Group (TWG) conference calls
June - August	TWG conference calls every two weeks
November	First draft sent to Review Group (November through January)
December	Stakeholder workshops to get feedback on first draft (in Doha, Qatar at COP18, Washington DC, USA, and Beijing, China)
February 2013	TWG calls to discuss stakeholder feedback
March	Advisory Committee meeting #2 to discuss stakeholder feedback
June	Second draft sent for Advisory Committee and TWG review
July	Second draft (for pilot testing) completed
August - November	Pilot testing in several countries and sectors
December	Pilot testing and Technical Working Group meeting to discuss pilot testing feedback
February 2014	Second draft revised based on pilot testing feedback (in consultation with Advisory Committee and TWG)
March	Final draft circulated for public comment
Spring 2014	Standard published

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Chapter 1: Introduction

Greenhouse gas (GHG) emissions, which drive climate change and its impacts around the world, are growing. According to climate scientists, global carbon dioxide emissions must be cut by as much as 85 percent below 2000 levels by 2050 to limit global mean temperature increase to 2 degrees Celsius above pre-industrial levels.[1] Every degree increase in temperature will produce increasingly unpredictable and dangerous impacts for people and ecosystems. As a result, the need to accelerate efforts to reduce anthropogenic GHG emissions is increasingly urgent.

National and subnational governments are planning and implementing a variety of climate change mitigation goals in order to reduce their emissions. As they do so, they are facing new pressures to account for GHG reductions achieved by their goals and to track and report performance over time. Effective mitigation goals require robust monitoring and evaluation methodologies that are able to generate relevant, complete, consistent, transparent, and accurate GHG information and ensure that goals are achieving their intended results.

1.1 Purpose of this standard

The *GHG Protocol Mitigation Goals Accounting and Reporting Standard* (also referred to as the *Mitigation Goals Standard*) provides a methodology for assessing and reporting progress toward national and subnational mitigation goals. While existing GHG inventory guidance allows governments to estimate GHG emissions and removals at the national and subnational levels, governments also need guidance on how to assess and report progress toward GHG mitigation goals. This standard is designed to respond to this need by creating a consistent, transparent, international, and standardized approach to evaluating goals.

The standard is intended to guide users in answering the following questions:

- Before the goal period: How to design a mitigation goal and define accounting methods for tracking progress
- During the goal period: How to track and report progress toward meeting the goal
- After the goal period: How to assess and report whether the goal has been achieved

This standard was developed with the following objectives in mind:

- To enable users to track and report progress toward mitigation goals in an accurate, consistent, transparent, complete, and relevant manner, through the use of standardized approaches and principles
- To help decision makers develop effective strategies for managing and reducing GHG emissions through a better understanding of expected and achieved emissions impacts
- To support consistent and transparent public reporting of emissions impacts and mitigation goal effectiveness according to a standardized set of reporting requirements

This standard includes both requirements (i.e., accounting and reporting steps that users must follow in order to be in conformance with this standard) and guidance (i.e., to help users implement the standard). The methodology is policy-neutral[2] and its use is voluntary (i.e., no government is obliged to conform to

[1] IPCC, Summary for Policymakers (Table SPM.5: Characteristics of post-TAR stabilization scenarios), in Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, ed. B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, 2007).

[2] “Policy-neutral” means the methodology is generic and applicable to any policy type, rather than biased toward any specific policy instruments, programs, or policy framework.

it). It does not prescribe which type of goal should be adopted but only how to design, assess, and report progress of mitigation goals. Furthermore, this standard is not associated with any international or domestic process for measuring, reporting, or verifying GHG emissions, although it may be used for this purpose.

1.2 The Greenhouse Gas Protocol

This standard was developed by the Greenhouse Gas Protocol (GHG Protocol). The GHG Protocol is a multi-stakeholder partnership of businesses, nongovernmental organizations (NGOs), governments, and others convened by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Launched in 1998, the mission of the GHG Protocol is to develop internationally accepted GHG accounting and reporting standards and tools and to promote their adoption in order to achieve a low emissions economy worldwide.

The GHG Protocol has produced the following separate but complementary standards, protocols, and guidelines:

- ***GHG Protocol Corporate Accounting and Reporting Standard* (2004):** A standardized methodology for companies to quantify and report their corporate GHG emissions. Also referred to as the *Corporate Standard*.
- ***GHG Protocol for Project Accounting* (2005):** A guide for quantifying reductions from GHG-mitigation projects. Also referred to as the *Project Protocol.*
- ***GHG Protocol Land Use, Land-Use Change, and Forestry Guidance for GHG Project Accounting* (2006):** A guide to quantify and report reductions from land use, land-use change, and forestry, to be used in conjunction with the *Project Protocol.*
- ***GHG Protocol Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects* (2007):** A guide for quantifying reductions in emissions that either generate or reduce the consumption of electricity transmitted over power grids, to be used in conjunction with the *Project Protocol.*
- ***Measuring to Manage: A Guide to Designing GHG Accounting and Reporting Programs* (2007):** A guide for program developers on designing and implementing effective GHG programs based on accepted standards and methodologies.
- ***GHG Protocol for the U.S. Public Sector* (2010):** A step-by-step approach to measuring and reporting emissions from public sector organizations, complementary to the *Corporate Standard.*
- ***GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard* (2011):** A standardized methodology for companies to quantify and report their corporate value chain (scope 3) GHG emissions, to be used in conjunction with the *Corporate Standard*. Also referred to as the *Scope 3 Standard*.
- ***GHG Protocol Product Life Cycle Accounting and Reporting Standard* (2011):** A standardized methodology to quantify and report GHG emissions associated with individual products throughout their life cycle. Also referred to as the *Product Standard*.
- ***GHG Protocol Policy and Action Accounting and Reporting Standard* (2014):** A standardized approach for estimating and reporting changes in GHG emissions resulting from the implementation of policies and actions.

1.3 Intended users

This standard is intended primarily for governments at all levels (e.g., national, state, provincial, municipal). Companies and organizations may also find the guidance provided in this standard to be useful (in addition to the guidance provided in the *GHG Protocol Corporate Accounting and Reporting Standard*) when designing goals and evaluating and reporting progress toward their achievement.

Throughout the standard, the term “user” refers to the entity implementing the standard.

1.4 Scope of the standard

This standard includes steps related to evaluating mitigation goals, including specific steps on accounting, reporting, and verification.

This standard is applicable to:

- All geographies (i.e., it is internationally applicable)
- All levels of government (e.g., national and subnational jurisdictions[3])
- Four types of mitigation goals (e.g., reduction from a base year, reduction from a baseline, reductions in emissions intensity, reduction to a fixed level of emissions)
- Economy-wide mitigation goals or sectoral goals (in any sector)
- Mitigation goals covering any and all greenhouse gases (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3))
- Both ex-ante calculation of GHG emissions and emissions reductions associated with achieving a goal and ex-post evaluation of whether the goal was achieved

1.5 Relationship to GHG inventories

GHG inventories are critical for tracking changes in overall GHG emissions and removals at a national, subnational, and company/organizational levels. They are an important first step in designing and setting a GHG mitigation goal (see Section 5.1 on developing a GHG inventory). National GHG inventories are based on IPCC *Guidelines for National Greenhouse Gas Inventories*. Subnational GHG inventories should be based on internationally accepted methods and guidelines, such as C40/ICLEI/WRI *Global Protocol for Community Emissions* (GPC) and the IPCC *Guidelines for National Greenhouse Gas Inventories*, or nationally required methods and guidelines where applicable. This standard uses the inventory and underlying inventory methodologies such as those from the IPCC as a starting point for generating the emissions data necessary for quantifying emissions and emissions reductions associated with goals. While there are key differences between inventory and goals accounting, the quality of the GHG inventory should be a key factor in determining how to design and set a goal, as some emissions sources may not have sufficient data for inclusion within the goal boundary.

While inventories should cover the full range of a jurisdiction’s emissions and removals across all sectors and gases, accounting for mitigation goals focuses only on those sectors and gases included within the goal boundary. Furthermore, accounting for goals includes treatment of transferable emissions units from outside the goal boundary (e.g., offset credits and allowances) and emissions and removals from the land-use sector, which may differ from the way they are treated under an inventory approach. Quantification and reporting of emissions and emissions reductions associated with mitigation goals is critical to achieving GHG management objectives relevant to jurisdictions, such as designing mitigation strategies and tracking GHG performance of mitigation goals, and should be carried out as a complement to developing and updating a GHG inventory on a regular basis.

1.6 Relationship to the GHG Protocol Policy and Action Standard

The *GHG Protocol Mitigation Goals Standard* and *GHG Protocol Policy and Action Standard* are relevant to goals and policies undertaken by governments and are intended to support assessing and reporting progress toward GHG mitigation objectives. The two standards were developed simultaneously as part of the same standard development process in order to ensure harmonization of overlapping topics, where

[3] This standard defines a jurisdiction as the geographic area within which an entity’s (e.g., government’s) authority is exercised. This is also known as the “geopolitical boundary.”

they exist (e.g., development of baseline scenarios, uncertainty analysis, verification procedures, and accounting and reporting principles).

The user's objectives should drive the use of a particular GHG Protocol accounting standard. The *Policy and Action Standard* enables users to estimate the expected change in emissions and removals resulting from specific policies and actions. The *Mitigation Goals Standard* enables users to evaluate and report overall progress toward national or subnational GHG reduction goals (see Table 1.1). Together with guidelines for developing national, subnational, or organizational GHG inventories (see Section 1.5), the two standards provide a comprehensive approach for measuring and managing GHG emissions.

While each standard can be implemented independently, both standards are mutually supportive. For example, users can apply the *Mitigation Goals Standard* to understand the level of GHG reductions needed to meet their GHG mitigation goal, and then use the *Policy and Action Standard* to estimate the GHG effects of selected policies and actions to determine if they are collectively sufficient to achieve the necessary reductions.[4] Conversely, users can first apply the *Policy and Action Standard* to quantify expected GHG reductions from various mitigation policies and actions to understand the range of possible GHG reductions, and then use the *Mitigation Goals Standard* to set a mitigation goal and track and report progress.

Table 1.1. Comparison of *GHG Protocol Mitigation Goals Standard* and *Policy and Action Standard*

Standard	Description
Mitigation Goals Standard	How to assess and report overall progress toward national or subnational GHG emission goals and calculate GHG emissions and reductions associated with meeting goals. Types of mitigation goals include: GHG reductions from a base year, GHG reductions from a baseline scenario, reductions in emissions intensity, or reductions to a fixed level of emissions (e.g., zero in the case of carbon neutrality).
Policy and Action Standard	How to estimate the change in GHG emissions and removals caused by specific policies and actions, relative to a baseline scenario. Types of policies and actions include: regulations and standards; taxes and charges; information instruments; implementation of new technologies, processes, or practices; etc.

Users wishing to assess goals framed in terms energy efficiency (e.g., increase energy efficiency by 30% by 2025), renewable energy (e.g., increase renewable energy generation by 25% by 2020), or other targets not expressed in terms of GHG emissions reductions should use the GHG Protocol *Policy and Action Standard* to assess the policies or actions implemented to meet the goal. The *Mitigation Goals Standard* is not applicable to these types of goals, unless they are expressed as GHG emission reduction goals.

1.7 How this standard was developed

The GHG Protocol follows a broad and inclusive multi-stakeholder process to develop greenhouse gas accounting and reporting standards with participation from businesses, government agencies, NGOs, and academic institutions from around the world.

In June 2012, WRI launched a three-year process to develop the *GHG Protocol Policy and Action Standard*. A 30-member Advisory Committee of experts provides strategic direction throughout the process. The first draft of the *Mitigation Goals Standard* was developed in 2012 by a Technical Working

[4] Aggregation of emissions reductions associated with policies and actions depends upon the consistency of the methods used to quantify their effects.

Group consisting of over 25 members. In late 2012, a Review Group of over 100 members reviewed the draft standard and many attended three stakeholder workshops (in Doha, Washington, and Beijing). In 2013, organizations from a variety of countries and sectors will pilot test the first draft and provide feedback on its practicality and usability. The standard will be published in early 2014 following additional opportunities for public comment.

1.8 Terminology: shall, should, and may

This standard uses precise language to indicate which provisions of the standard are requirements, which are recommendations, and which are permissible or allowable options that users may choose to follow. The term **"shall"** is used throughout this standard to indicate what is required in order for a user to be in conformance with the *GHG Protocol Mitigation Goals Standard* (if a user chooses to follow the standard). The term **"should"** is used to indicate a recommendation, but not a requirement. The term **"may"** is used to indicate an option that is permissible or allowable. The term "required" is used in the guidance to refer to requirements in the standard. "Needs," "can," and "cannot" may be used to provide guidance on implementing a requirement or to indicate when an action is or is not permissible.

1.9 Limitations

Users should exercise caution in comparing the results of evaluations based on this standard even for the same goal type. Differences in reported emissions reductions may be a result of differences in quantification methodology (e.g., when choices are provided) rather than real world differences. Additional consistency may be necessary to enable valid comparisons, such as consistency in quantification methodologies (e.g., inventory methodology and global warming potential (GWP) values) and data sources. In general, comparable results can best be achieved if GHG evaluations are undertaken using the same data, assumptions, and accounting methodologies, which ensures methodological consistency between assessments. To understand whether comparisons are valid, all methodologies and data sources used must be transparently reported.

This standard requires users to ensure that all emissions reductions from offset projects used to meet their goal are real, additional, permanent, transparent, verified, unambiguously owned, address leakage, and address double counting. If emissions units do not meet these principles, emissions reductions associated with goals that use such units will be misleading. No guidance is provided in this standard on calculation methodologies for offset projects. Furthermore, while the standard prohibits the double counting of transferable emissions units, such as offset credits, there are limitations in its ability to prevent double counting since the standard is voluntary and may not be implemented by all government entities. All users applying the standard should use all mechanisms at their disposal to identify and, where possible, prevent double counting. They may also exert further influence on other jurisdictions by prohibiting the sale/purchase of units from buyers/sellers that do not apply this, or a similar, standard. This would provide incentives for other jurisdictions not in conformance with the standard's practices on double counting to take measures to prevent double counting. For more information on transferable emissions units see Chapter 8.

This standard does not provide guidance on the capacities required to implement it. There are numerous data inputs, which require a GHG inventory, at a minimum. Some goal types (e.g., emissions intensity goals) also require non-GHG data inputs as well. Strong data collection systems, as well as institutional arrangements for data sharing and management, and associated human and technical resources, will strengthen any application of this standard. Investments in institutional, human and technical capacities for data management and accounting should be a key consideration in improving the use this standard.

Also, a variety of inputs inform how users decide on which type of mitigation goal they adopt and its corresponding level of ambition. While this standard outlines considerations for choosing the goal type and goal level, it does not provide comprehensive guidance on the types of analysis that should be undertaken to inform the level of ambition of mitigation goals. For example, a detailed discussion of mitigation assessments, mitigation abatement cost (MAC) curves, and other similar tools and procedures is left out. However, this standard does include guidance on developing baseline emissions scenarios, which are a critical element of mitigation assessments and can be utilized by all users regardless of goal type to understand likely emissions trajectories in the absence of a mitigation goal (see Chapter 5 for more information).

Lastly, emissions change for a variety of policy- and non-policy-related reasons. This standard enables users to understand whether emissions have changed within the goal boundary during the goal period (i.e., whether they have increased or decreased and by how much) and whether a GHG mitigation goal has been met. However, it does not offer comprehensive methods for determining *why* emissions have changed within the goal boundary (e.g., whether a decrease in emissions was the result of mitigation strategies or an economic recession). Decomposition analysis and other analytical techniques can be used to determine the drivers of changes in emissions during the goal period (for further discussion of decomposition analysis see Chapter 10).

Chapter 2: Objectives

This chapter outlines the GHG management objectives that this standard seeks to support. Before designing a mitigation goal and evaluating and reporting progress toward achieving it, users should consider which objectives are most relevant to them. The chapter also discusses how these objectives support various stages of a goal setting cycle.

This standard is intended to support users in developing effective GHG management and mitigation strategies to plan and achieve goals through relevant, complete, consistent, transparent, and accurate GHG accounting and reporting. Specifically, this standard helps users achieve the following objectives:

- Design a GHG mitigation goal
- Understand the ambition of the mitigation goal
- Inform mitigation strategies
- Assess progress during the goal period
- Assess whether the mitigation goal has been achieved
- Respond to stakeholder needs

Each objective is described further below.

Design a GHG mitigation goal

Mitigation goals can take a variety of forms depending on users' objectives and circumstances. There are several choices involved in the design and establishment of a goal, including: coverage of sectors, gases, geography, and direct and indirect emissions; inclusion of transferable emissions units; the choice and estimation of base year or baseline scenario emissions; the choice of target year or target period; the treatment of the land-use sector; and the choice of goal type and goal level. Chapter 5 provides users with guidance and considerations on how to make these decisions and design a mitigation goal. In addition, the chapter discusses the advantages and disadvantages of setting a single year goal or multi-year goal. While users that have already defined their goal can skip much of the guidance provided in Chapter 5, all users are required to meet its reporting requirements.

Understand the ambition of the mitigation goal

Once a goal has been designed, it is important that users calculate ex-ante the emissions level that needs to be achieved by the target year or target period in order to meet the goal. This information provides decision makers and stakeholders with a target emissions level against which the ambition of the goal can be understood and its achievement will ultimately be assessed. Chapter 9 provides methods and guidance for calculating the target year emissions level associated with meeting the goal.

Inform mitigation strategies

In addition to calculating the target year emissions level associated with meeting a goal, it is important that users also understand ex-ante the emissions reductions needed by the target year or target period in order to achieve their goal. This information provides a quantitative basis for the development and prioritization of mitigation strategies, through low emissions development strategies or other processes, necessary for reaching the goal. It can also help users to understand the overall mitigation potential of their goal and how it might contribute to the stabilization of atmospheric concentrations of GHGs. Chapter 9 provides methods and guidance for calculating emissions reductions needed by the target year to meet the mitigation goal.

Assess progress during the goal period

During the goal period, regular assessments of progress offer users information on the effectiveness of implemented mitigation policies and actions and additional efforts that will be needed to meet their goal by the target year. This information can be used to inform the design of new policies, strengthen high performing ones, and/or discontinue or revise underperforming ones in order to ensure that the goal is achieved. Chapter 10 provides guidance for assessing progress during the goal period.

Assess whether the mitigation goal has been achieved

At the end of the goal period, users and stakeholders need to know whether the mitigation goal has been achieved. Chapter 10 provides guidance and methods for calculating the level of GHG emissions and emissions reductions achieved at the end of the goal period. Once calculated, actual GHG emissions in the target year can be compared with the target year/target period emissions level needed for achieving the goal (calculated ex-ante at the beginning of the goal period).

Respond to stakeholder needs

Transparently reporting the results of the goal assessment during and after the goal period is critical for providing relevant stakeholders with information about a government's performance. This information can also help governments meet international reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC), as relevant. Additionally it can provide funders with confidence in governments' progress toward their commitments. Chapter 12 provides reporting requirements for transparently disclosing all relevant information associated with goal assessment.

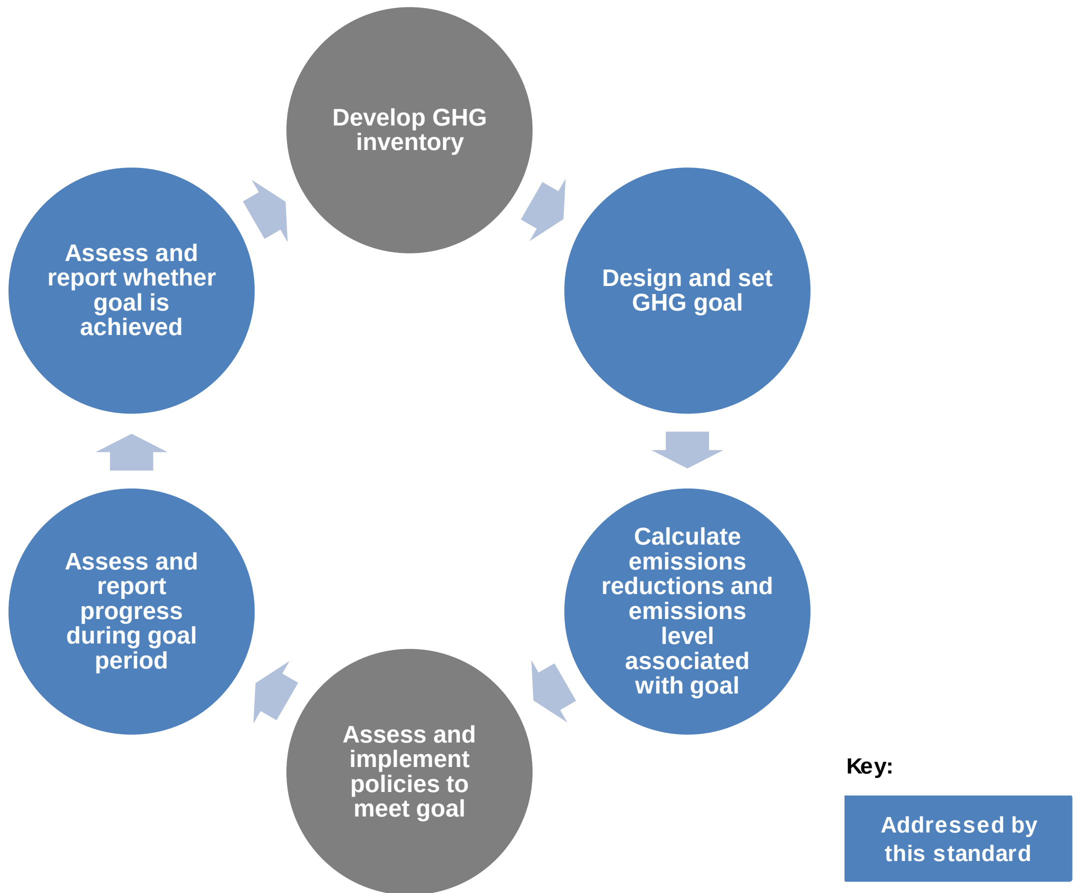
Goal setting cycle

The objectives listed above are relevant to multiple stages throughout a goal setting, implementation, and tracking cycle. Figure 2.1 outlines a sequence of steps that may be followed to set a mitigation goal, assess and implement policies to meet the goal, and assess and report on progress. The cycle is shown as an iterative process with continual improvement whereby goal setting is informed by previous experience. If the goal is changed significantly during the goal period, users may need to begin the accounting process again and consider it as a new goal (further described in Chapter 5). Figure 2.1 is an example only, as there are numerous ways in which goal setting could be carried out.

See Chapter 5 for guidance on designing a mitigation goal, Chapter 10 for calculating the emissions reductions and emissions levels associated with the goal, and Chapter 11 for assessing progress during the goal period and evaluating achievement at the end of the goal period. For guidance on assessing the emissions impacts of mitigation policies and actions, refer to the *GHG Protocol Policy and Action Accounting and Reporting Standard.*

For an example of tracking progress at multiple stages of a goal setting cycle, see Box 2.1, which provides an illustration of New York City's goal assessment during the goal period.

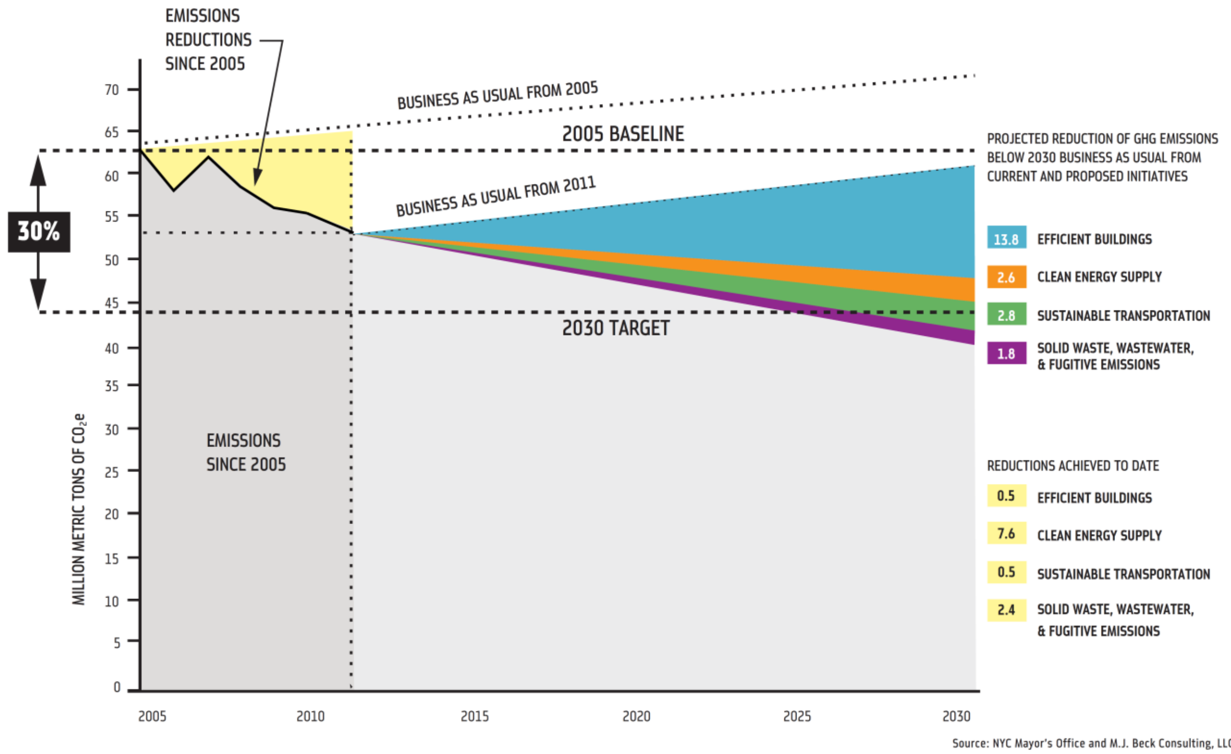
Figure 2.1. Example of goal setting, implementation, and tracking cycle



Box 2.1. Example of evaluating progress: New York City

Figure 2.2 (taken from a 2013 progress assessment report by New York City and based on 2011 data) illustrates the various types of information that needs to be generated in order to assess progress towards a goal. This standard can support users in generating these types of information, as outlined below.

Figure 2.2. New York City's progress toward meeting its goal[5]



- The dashed line "2005 Baseline" represents base year emissions, based on the city's GHG inventory.[6] (See Chapter 6)
- The dashed line "2030 Target" represents the target year emissions level associated with meeting New York City's goal – 30% reduction from 2005 base year emissions. (See Chapter 9)
- The solid line represents the actual emissions level reported by the city between the start of the goal period (2005) and the reporting year (2011), based on the GHG inventory. (See Chapter 10)
- The difference between the solid line and the dashed line "2005 Baseline" are the achieved emissions reductions between 2005 and 2011. (See Chapter 10)
- The dotted line "Business as usual 2005" is the informational baseline scenario developed by the city to inform the development of mitigation policies and actions. (See Chapter 6)
- The dotted line "Business as usual 2011" represents the updated informational baseline scenario used to design/revise future mitigation strategies (each of the colored wedges).[7] (See Chapter 6)

Taken together, the progress achieved as of 2011 and the planned mitigation strategies are projected to provide the emissions reductions needed to reach the city's mitigation goal. Without this interim progress report, decision makers would lack information on the progress achieved to date toward the city's goal and the additional emissions reductions needed by the target year to achieve it.

[5] New York City, "PLANYC: Progress Report 2013," 2013, p.46, http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_progress_report_2013.pdf.
[6] In this standard 'baseline' refers to a baseline scenario, not a base year. For more information see Chapter 6.
[7] Refer to the *GHG Protocol Policy and Action Standard* for assessing the GHG effects of individual mitigation policies and actions.

Chapter 3: Key concepts, overview of steps, and summary of requirements

This chapter provides an overview of key concepts used in this standard, a summary of the steps involved in goals accounting and reporting, as well as a list of the requirements that must be followed by the user to be in conformance with this standard.

3.1. Key concepts of mitigation goals accounting

This section outlines several key terms and concepts involved in mitigation goals accounting and reporting, including:

- Types of mitigation goals
- Base year and base year emissions
- Baseline scenario and baseline scenario emissions
- Single year and multi-year goals
- Goal period
- Emissions reductions
- Annual versus cumulative emissions
- Ex-ante and ex-post assessment
- Transferable emissions units
- Avoiding double counting of GHG reductions
- Aggregation of emissions reductions across goals

Types of mitigation goals

A mitigation goal is a commitment made by a jurisdiction to reduce greenhouse gas emissions or emissions intensity to a certain level to be achieved a future date. As mentioned in previous chapters, this standard supports accounting for multiple goal types. The standard can be applied to goals at the national or subnational levels, and can be applied to either economy-wide or sectoral goals. The standard also applies to several types of goals. Specifically, this standard applies to four different goal types:

1. **Base year goals**: Reductions in emissions relative to a base year or base period
2. **Intensity goals**: Reductions in emissions intensity (emissions per unit of output) relative to a base year or base period
3. **Baseline scenario goals**: Reductions in emissions relative to a baseline scenario
4. **Fixed level goals**: Reductions in emissions to a fixed level of emissions

See Chapter 5 for further information on goal types.

Base year and base year emissions

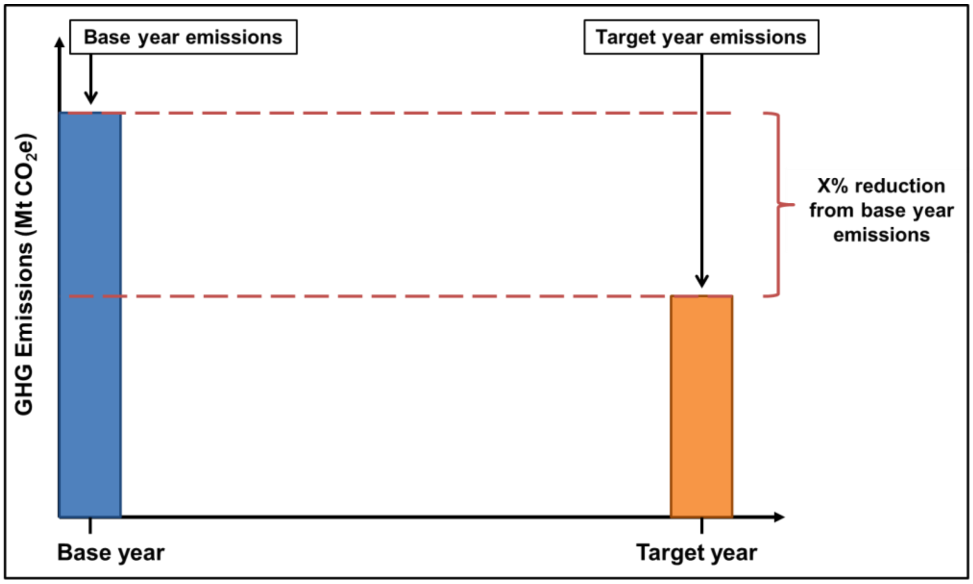
A base year is a specific year against which some goal types are tracked over time. It is the first year of the goal period (see Figure 3.1). The base year emissions level is the GHG emissions level calculated in the base year.

A base period is an average of multiple years against which a jurisdiction's emissions are tracked over time. Some users may choose a base period instead of a base year when there are significant fluctuations in emissions levels over time. A base period emissions level is the average amount of emissions over the base period.

See Chapter 6 for more information on how to select the base year or base period and calculate base year emissions.

A base year/base period is relevant to both base year goals and intensity goals. These goals are most often framed in terms of a percent reduction below base year emissions to be achieved by the target year or target period. See Figure 3.1.

Figure 3.1. Base year emissions

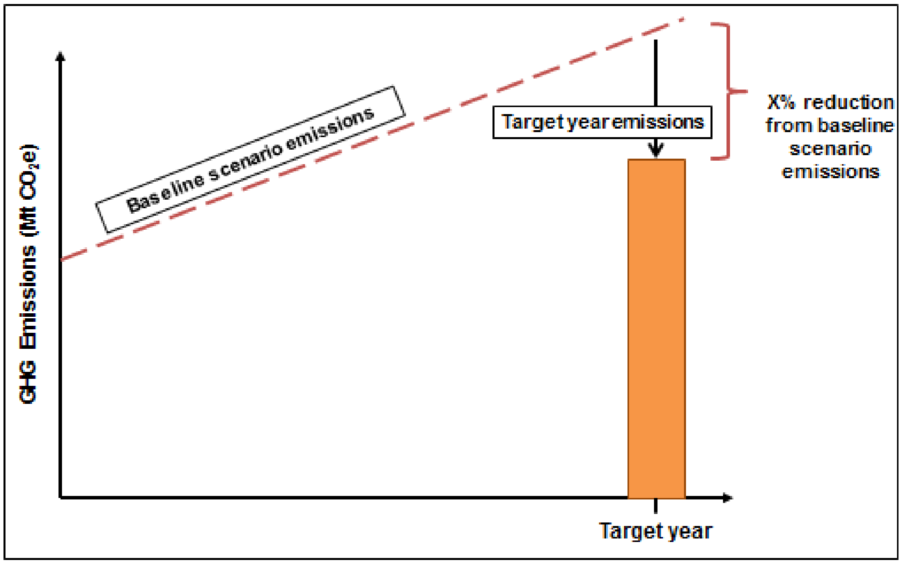


Baseline scenario and baseline scenario emissions

A baseline scenario is a reference case that represents the events or conditions most likely to occur in the absence of activities taken to meet the mitigation goal. Developing a baseline scenario requires the user to make baseline scenario assumptions (e.g., related to emissions drivers such as economic activity, energy prices, population growth, and policies and measures). A baseline scenario emissions level is an estimate of the net GHG emissions level resulting from GHG emissions and removals within the goal boundary.

The development of a baseline scenario is necessary for baseline scenario goals. Baseline scenario goals are most often framed as a percent reduction below baseline scenario emissions in a target year or target period. See Figure 3.2.

Figure 3.2. Baseline scenario emissions



Single year and multi-year goals

Some goals are designed to achieve emissions reductions by the final year of the goal period – i.e., the target year. This standard refers to such goals as single year goals. Other goals are designed to achieve emissions reductions (or reductions in intensity), or limit emissions (or emissions intensity), over several years. This standard refers to such goals as multi-year goals. Multi-year goals have a "target period" rather than a target year, during which emissions levels (or intensity) or emissions reductions (or reductions in intensity) are constrained. See Chapter 5 for more information.

Goal period

The goal period is typically the period of time between the base year and target year/period. However, because some goals are not based on a base year, the goal period differs by goal type. See Chapter 5 for more information on how the goal period is defined by goal type.

Emissions reductions

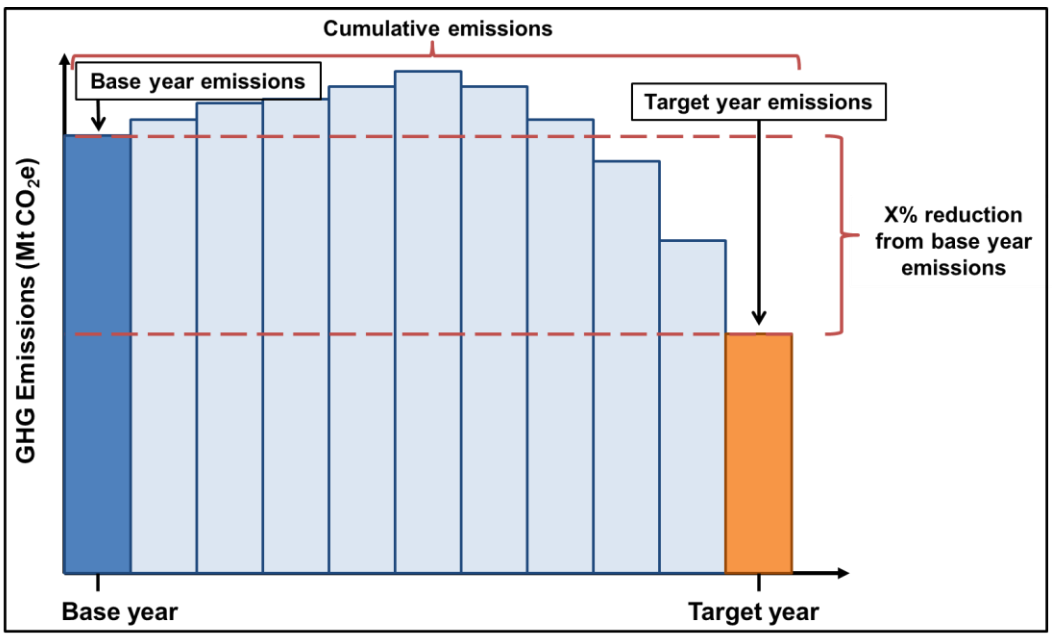
Emissions reductions are the difference in emissions measured between two different points in time (e.g., between base year emissions and target year emissions) or within the same point in time but between a baseline scenario and actual emissions levels. For example, emissions reductions associated with a base year goal are measured as the difference between emissions levels in the target year and emissions levels in the base year. In the case of baseline scenario goals, emissions reductions associated with the goal are the difference between the baseline scenario emissions level in the target year and the target year emissions level.

There is also a distinction to be made between emissions reductions that have already been achieved and that have yet to be achieved. Emissions reductions that have been achieved during the goal period are measured as the difference between emissions in the base year, start year of the baseline scenario, or adoption year of the fixed level goal, and emissions in the reporting year. Emissions reductions that need to be achieved over the remainder of the goal period if the goal is to be met are measured as the difference between the reporting year's emissions level and the target year's emissions level. See Chapters 9 and 10 for more information.

Annual versus cumulative emissions

Annual emissions are the quantity of emissions that occur during one year. Cumulative emissions are the quantity of emissions that occur over a longer period of time, typically the sum of annual emissions over a multi-year period. Calculating both annual emissions and cumulative emissions are useful for different purposes. The stabilization of atmospheric concentrations of greenhouse gases are determined by the total amount of greenhouse gases emitted year after year. While it is helpful to get a snapshot of emissions levels in a given year, this may not provide an accurate portrayal of emissions pathways because it could be an unusual year in terms of emissions growth or decline. Rather, it is more helpful to understand cumulative emissions levels and cumulative emissions reductions over the goal period. Figure 3.3 depicts the cumulative emissions level over the goal period, which is the sum of all emissions over the goal period. The same concept can be applied to emissions reductions, where the user sums annual emissions reductions achieved over the goal period to determine total emissions reductions.

Figure 3.3. Cumulative emissions



Ex-ante and ex-post assessment

As mentioned in Chapter 2, this standard supports users i

- Calculating target year emission levels and expected emissions reductions associated with meeting a mitigation goal before implementation (ex-ante calculation) (see Figure 3.4 for an example of ex-ante calculation for a single year goal);
- Evaluating progress during the goal period during a given reporting year (see Figure 3.5); and
- Evaluating whether the goal was achieved and calculating the associated emissions reductions and emissions levels reached (ex-post assessment) (see Figure 3.6)

Figure 3.4. Example of ex-ante calculation for a single year base year goal

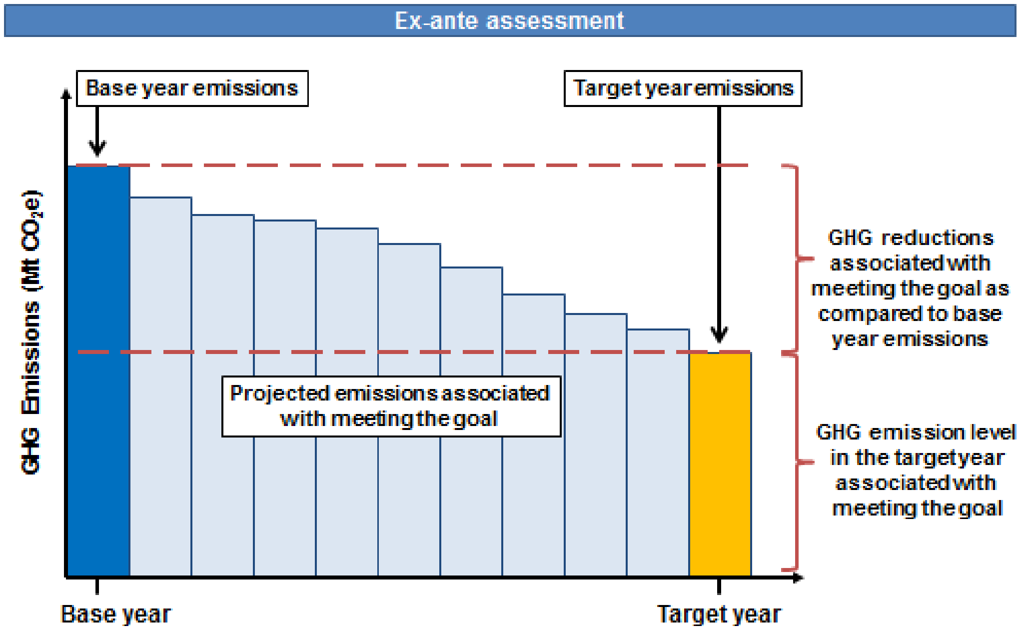


Figure 3.5. Example of assessing progress during the goal period for a single year base year goal

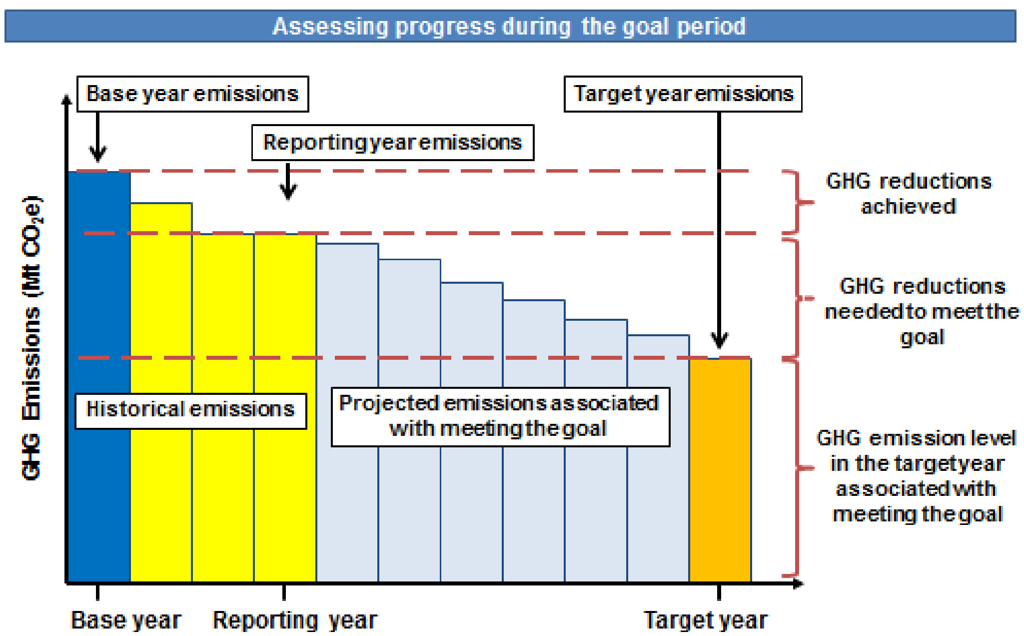
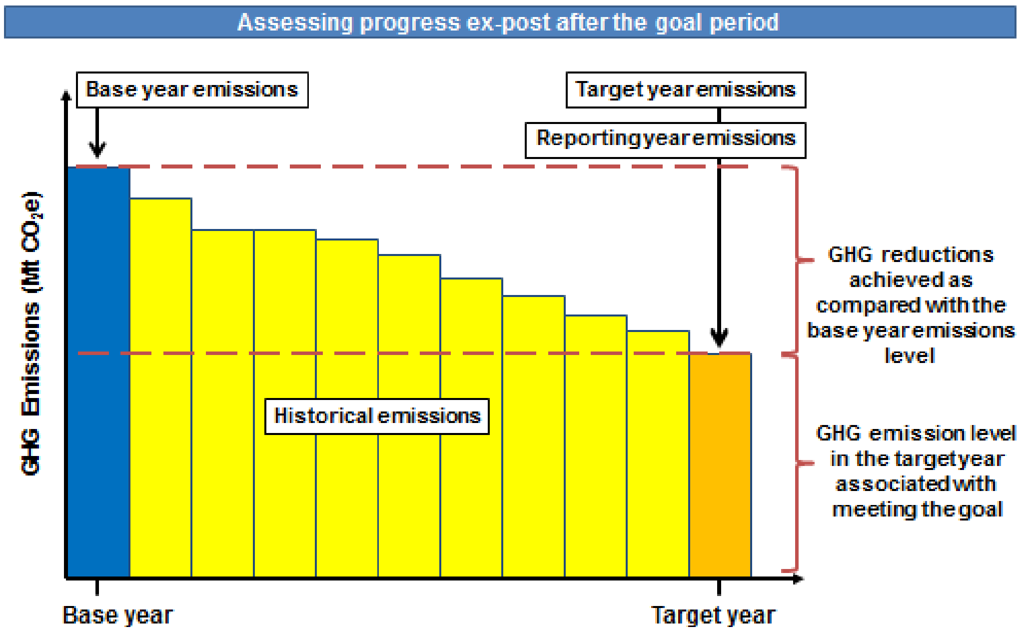


Figure 3.6. Example of assessing progress after the goal period (ex-post) for a single year base year goal



Transferable emissions units

Goals may be achieved by any combination of emissions reductions and transferable emissions units (e.g., Clean Development Mechanism (CDM) credits, units sold on voluntary markets, among others). Transferable emissions units refer to emissions allowances, issued ex-ante to participants in an emissions trading regime, and emissions offset credits, generated from emission reduction projects or programs. In both cases, transferable emissions units are generated outside of the goal boundary. It is necessary to adjust for transferable emissions units sold and purchased. See Chapter 8 for more information.

Avoiding double counting of GHG reductions

Double counting occurs if more than one jurisdiction claims the same GHG reduction toward more than one GHG reduction goal. For example, Jurisdiction A may sell transferable emissions units generated within its goal boundary to Jurisdiction B, which will apply those transferable emissions units towards its goal. Jurisdiction A may also want to count the same emissions reductions towards its goal, since the reductions occurred within its boundary. This standard does not allow double counting of emissions reductions associated with transferable emissions units and provides several means for minimizing the potential for double counting. See Chapter 8 for more information.

Aggregation of emissions reductions across goals

Because there is considerable flexibility in this standard, it is likely that users will calculate emissions levels and emission reductions associated with their goals with different approaches, and therefore the outcomes will not be comparable. As a result, users should not compare or aggregate emissions reductions achieved across several goals.

In addition to a lack of comparability, another reason that emissions reductions should not be aggregated is the risk in double counting emissions reductions associated with overlapping goals. This is especially pertinent at the subnational level, where indirect emissions reductions could be included in a jurisdiction's goal which are, by definition, another jurisdiction's direct emissions (see Chapter 5). If these emissions reductions achieved by both jurisdictions' goals are aggregated, they would be counted twice.

Only when users apply the same data and methodological choices can emissions reductions be compared or aggregated, and only direct emissions reductions should be aggregated given the risk of double counting due to goal overlap.

3.2. Steps in mitigation goals accounting and reporting

This standard is organized according to the steps a user follows in assessing and reporting progress toward a GHG mitigation goal. See Figure 3.7 for an outline of steps. See Table 3.1 for descriptions and examples of each step.

Steps in Chapters 5 may be skipped if the user has already set a goal, but this chapter includes reporting requirements that are relevant to all users. Steps in Chapter 6 may be skipped if the user already has determined base year and/or baseline scenario emissions, but includes reporting requirements that are relevant to all users. If the user is designing a goal or has just completed the design of the goal but has not begun implementation, they should use Chapter 9. Chapter 9 can be skipped by users that are already implementing a goal (but can be used if the information assists in decision making), and Chapter 10 should be used instead. All users shall fulfill the relevant reporting requirements in Chapter 12.

Figure 3.7. Overview of steps in mitigation goals accounting

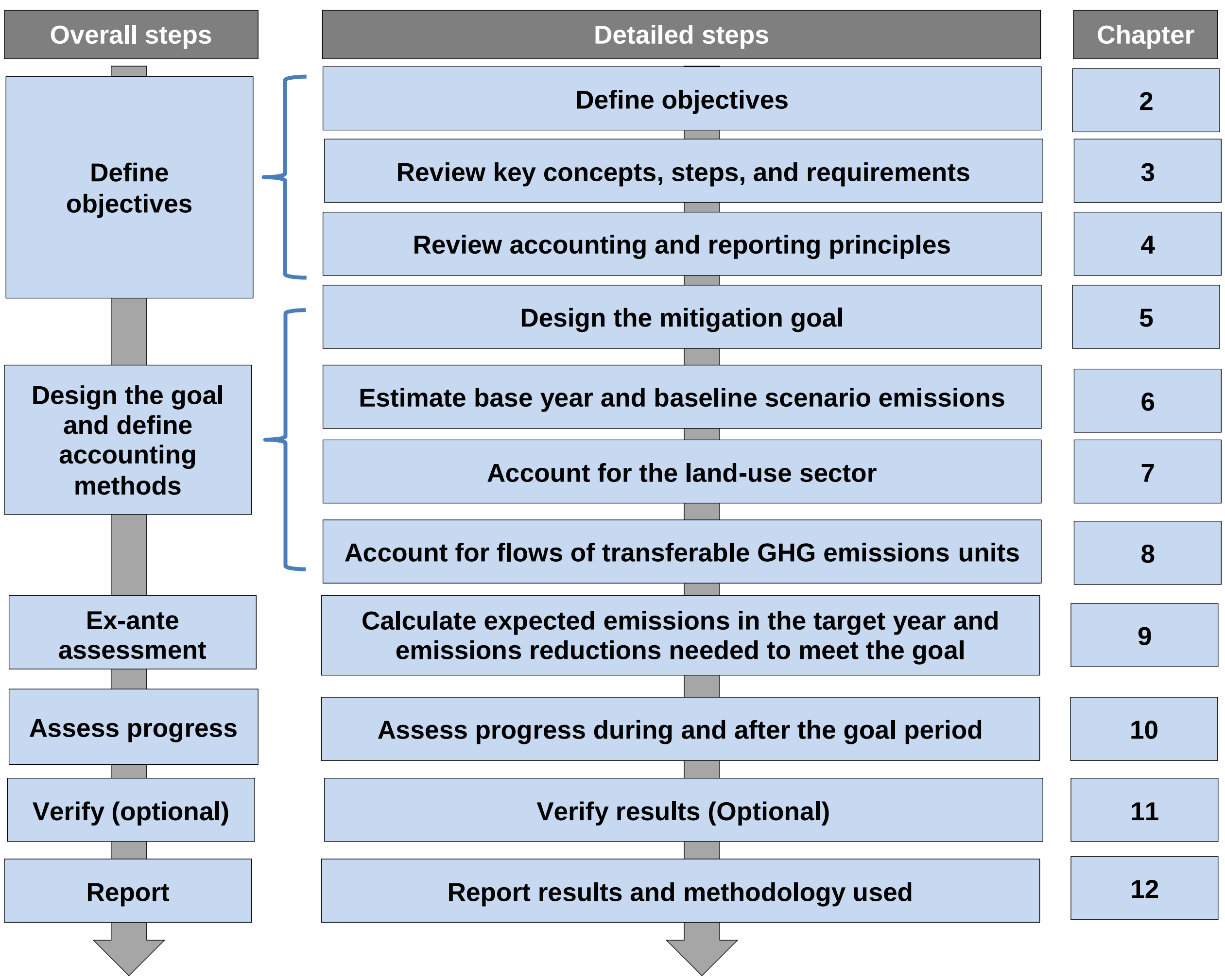


Table 3.1. Description and example of steps by chapter

Chapter	Step	Example of output from following the guidance in each chapter
Chapter 4: Accounting and reporting principles	Take stock of accounting and reporting principles and apply to all methodological and data choices.	N/A
Chapter 5: Designing a mitigation goal	Define the GHGs, sectors, direct and indirect emissions, and geography covered by the goal. Choose a goal type, goal level, and target year.	The goal covers all seven Kyoto gases, all IPCC sectors, all direct (Scope 1) emissions, and the mainland geopolitical territory of the national jurisdiction. The mitigation goal is single year target for a national jurisdiction to reduce GHG emissions by 20% from 1990 levels by 2020.
Chapter 6: Estimating base year or baseline scenario emissions	Choose a base year and determine base year emissions, and/or develop a baseline and determine baseline scenario emissions, depending on the goal type.	The base year is 1990 and base year emissions are 900 $MtCO_2e$.
Chapter 7: Accounting for the land-use sector	Decide on how the land-use sector will be included in the mitigation goal.	The entire land-use sector will be covered by the mitigation goal. Land-based accounting will be used and will have comprehensive coverage of all carbon pools and fluxes in the inventory. A base year accounting approach will be used and no natural disturbance mechanism will be adopted.
Chapter 8: Accounting for transferable emissions units	Decide on the use of transferable emissions units (e.g., offset credits) and how double counting will be avoided.	The goal will be met in part by the use of transferable emissions units. However, they will be no more than 3% of overall reductions and they will all be generated under the Clean Development Mechanism. A transaction log will be used to prevent double counting between the selling and purchasing jurisdictions.
Chapter 9: Calculating expected emissions in the target year and emissions reductions needed to meet the goal	Calculate expected GHG reductions (ex-ante) that will be achieved if the goal is successfully met.	If the goal is met, the emission level in in the target year will be 720 $MtCO_2e$. Emissions reductions associated with meeting the goal are 180 $MtCO_2e$ (900 $MtCO_2e$ - 720 $MtCO_2e$), relative to the 1990 base year.
Chapter 10: Assessing progress during and after the goal period	Track progress during the goal period and assess achieved reductions at the end of the goal period (ex-post).	The emissions level within the goal boundary is 710 $MtCO_2e$ in 2020. The goal was achieved.
Chapter 11: Verification	Identify level of assurance, type of verification, determine competency of verifier, identify verification process	The verification will be conducted by a third-party verifier. Reasonable assurance will be provided. The timing of the verification will be ex-post.
Chapter 12: Reporting	Fulfill all reporting requirements.	All reporting requirements are completed.

3.3. Checklist of accounting requirements

This standard presents accounting and reporting requirements to help jurisdictions develop a GHG evaluation that represents a true and fair account of changes in GHG emissions resulting from a mitigation goal. Standardized approaches and principles are designed to increase the consistency and transparency of GHG evaluations. Table 3.2 provides a checklist of all the accounting requirements included in this standard in order to help users keep track of requirements contained in subsequent chapters. Each subsequent chapter provides additional guidance and explanations of relevant terms and concepts. Accounting requirements are also summarized in a box at the beginning of each chapter. See to Chapter 12 for reporting requirements.

Table 3.2. Checklist of requirements

Chapter	Requirement
Chapter 4: Accounting and reporting principles	• GHG accounting and reporting shall be based on the following principles: relevance, completeness, consistency, transparency, and accuracy.
Chapter 5: Designing a mitigation goal	• To develop an inventory, national jurisdictions shall use the IPCC *Guidelines for National Greenhouse Gas Inventories*. • Uncertainty related to emissions data shall be addressed in a manner that is consistent with the inventory methods used. • QA/QC of emissions data shall be addressed in a manner that is consistent with the inventory methodology being used. • If users update GWP values during the goal period, inventory emissions for all previous years in the goal period, including the base year, shall be recalculated. • Users shall apply GWP values provided by the Intergovernmental Panel on Climate Change (IPCC), based on a 100-year time horizon. • Users shall identify the geographic boundary of their goal. • Users shall define the sectors covered by the goal. • Users shall define their goal by scope. • Users choosing a baseline scenario goal shall define whether the baseline scenario will be static or dynamic. • Users with single year goals shall define a target year. • Users with multi-year goals shall define a target period. • The goal level shall be applied to all emissions and removals inside the goal boundary and be expressed in terms of carbon dioxide equivalent (CO_2e). • Users with separate goals for each scope or a combination of single and separate goals for scopes goals shall define their goal level by scope. • If users make significant revisions to the goal boundary or change the goal boundary during the goal period (e.g., add sectors or gases), they shall make recalculations to base year or baseline scenario emissions, emissions levels and emissions reductions associated with meeting the goal, and recalculate emissions for all previous years in the goal period. • Significance of a revision to the goal boundary shall be determined using a significance threshold. • If users change their goal type, change from a single year to a multi-year goal, or change the goal level during the goal period assessing progress towards the existing goal shall stop and a new goal shall be established.
Chapter 6: Estimating base year or baseline	Users with base year goals and intensity goals shall: • Users shall establish a single base year or base period for all sectors and gases included in the goal boundary for which representative, reliable, and verifiable

scenario emissions	emissions data are available to enable comprehensive and consistent tracking of emissions over time. • Calculate base year emissions for all sectors, gases, and scopes covered by the goal (and by scope, if relevant) • Apply GWP values provided by the IPCC based on a 100-year time horizon • Calculate base year emissions intensity (only for users with intensity goals) • Develop a base year emissions recalculation policy and recalculate base year emissions when significant changes in key parameters occur • Develop a significance threshold to determine whether changes in parameters are significant. • Apply recalculation policy in a consistent manner • Recalculate base year emissions if GWP values are updated during the goal period Users with baseline scenario goals (static and dynamic) shall: • Develop a goal baseline scenario that covers the same sectors and gases as the goal and estimate baseline scenario emissions (by scope, if relevant) • Use metric tons carbon dioxide equivalent as the goal baseline scenario metric • Baseline scenario inputs shall be based on the principles of relevance, accuracy, completeness, consistency, and transparency • Goal baseline scenarios shall be developed in a relevant, complete, consistent, transparent, and accurate manner, and represent a conservative emissions pathway • If applicable, choose a third party baseline scenario for the goal baseline scenario that covers the same sectors and gases as the goal. If a jurisdiction's goal and the third party baseline scenario cover different sectors and gases, the third party baseline scenario shall not be used without necessary modifications. • Establish a timeframe for the goal baseline scenario that matches the goal period, at a minimum • Develop, at the start of the goal period, a goal baseline scenario emissions recalculation policy and define a recalculation significance threshold • Recalculate goal baseline scenario emissions if it becomes evident that a key parameter is no longer valid • Use a significance threshold to determine the significance of GHG effects associated with a policy or measure • Define a single baseline scenario for setting the goal In addition to the requirements above, users with dynamic baseline scenario goals shall: • Develop, at the start of the goal period, a goal baseline scenario emissions update policy and define a update significance threshold • Use defined significant threshold to determine whether changes in emissions drivers are significant • Update goal baseline scenario emissions if changes in emissions drivers are significant • Apply the update policy in a consistent manner

Chapter 7: Accounting for the land-use sector	• Users shall account for the land-use sector using one of the following approaches:
	    o Include the land-use sector in the boundary of the mitigation goal
	    o Separately account for the land-use sector as a sectoral goal
	    o Use the land-use sector as an offset for the mitigation goal
	    o Do not account for the land-use sector
	• Users shall not change the land-use sector approach during the goal period. If a user changes the way in which the land-use sector in treated in the goal during the goal period, the existing mitigation goal shall be set aside and a new goal shall be established, for which the accounting starts over again.

	• Within elected land-use categories or activities, users shall account for emissions and removals arising from land use as well as land-use change.
	• Users shall account for all significant pools, fluxes, and activities within elected land-use categories or suites of activities
	• Users including the land-use sector within the goal boundary shall use the same accounting methodology as is used for the goal type.
	• Users shall account for all elected land-use categories/activities using the same methodology.
	• Users applying base year or forward-looking baseline accounting approaches that invoke a natural disturbance mechanism during the goal period shall ensure consistency with the treatment of natural disturbances in the base year/period or baseline scenario.
	• If a natural disturbance mechanism is used, the user shall do the following:
	  o Not exclude any removals on lands affected by a natural disturbance event/circumstance from accounting until they have balanced the quantity of emissions removed from accounting.
	  o Account for emissions associated with salvage logging.
	  o Not exclude emissions from natural disturbances on those lands that are subject to land-use change following the disturbance.

Chapter 8: Accounting for transferable emissions units	• Users shall set a threshold that defines the extent to which transferable emissions units will be used to meet their goal. • Offset credits used towards goals shall meet the following quality principles: real, additional, permanent, transparent, verified, owned unambiguously, address leakage. • Allowances from cap-and-trade systems outside the goal boundary shall come from emissions trading systems with these features: strong monitoring and verification protocols; transparent reporting and tracking of unit; stringent caps. • Users shall not double count, double sell, or double claim GHG reductions. • To prevent double counting, users shall adjust reporting year emissions levels by adding sold emissions units to GHG inventory emissions and subtracting purchased units that are retired in the reporting year from GHG inventory emissions.
Chapter 9: Calculating expected emissions in the target year and emissions reductions needed to meet the goal	• Users shall calculate the expected emissions level (or emissions intensity level) and emissions reductions (or reductions in emissions intensity) associated with meeting their goal, by scope as relevant.
Chapter 10: Assessing progress during and after the goal period	• At the end of the goal period, users shall evaluate whether the mitigation goal has been achieved • Users with multi-year goals shall evaluate progress on an annual basis throughout the target period. • Emissions data for the evaluation shall come from official inventories that have been reviewed by third parties and are publicly available. • National jurisdictions shall apply IPCC methods to develop a GHG inventory. • If users update inventory methods or GWP values during the goal period, emissions for all previous years in the goal period, including the base year, shall be recalculated • Once emissions data are collected from the inventory, users shall adjust the inventory to the goal boundary (e.g., select only those covered sectors and

	greenhouse gases) to estimate the reporting year or target year/period's emissions level. • For the land-use sector, uncertainty shall be addressed using the IPCC *Good Practice Guidance for LULUCF* (and any updates) • Uncertainty related to baseline drivers and assumptions shall be addressed in a consistent manner. • Before evaluating progress at the end of the goal period, base year and baseline scenario emissions shall be recalculated based on any significant changes to methodology, goal boundary, and discovery of significant errors (as outlined in Chapter 6) and in accordance with users' recalculation policy. • Before evaluating progress at the end of the goal period, users with dynamic baseline scenarios shall update their baseline scenarios based on any significant changes in emissions drivers and users' update policy • Users with fixed baseline scenario goals shall not update their baseline scenario • If evaluating progress during the goal period, users shall first adjust inventory emissions within the goal boundary in the reporting year to account for land-use sector emissions and for transferable emissions units retired or sold in the reporting year. • At the end of the goal period, users shall evaluate whether they have achieved their goal. • Users shall adjust target year inventory emissions to account for land-use sector emissions and for transferable emissions units that are retired or sold in the target year. • At the end of the goal period, users shall evaluate whether they have achieved their goal. • For all goal types, including single year goals, users shall quantify the cumulative change in emissions over the goal period. • If users make any significant changes to the goal boundary, goal type, or goal level during the goal period they shall make the required recalculations. • The goal assessment report shall be completed as soon as possible after the end of the goal period (considering the availability of data to produce a quality inventory for the target year). • At the end of the goal period, users shall develop and make publically available a final goal assessment report that provides evidence of whether the mitigation goal was achieved, including all relevant methodological choices, subsequent recalculations or revisions, and all reporting requirements listed in Chapter 12. • Final goal assessment reports shall be publically available in a timely manner at the end of the goal period • If an interim assessment report is produced, it shall be made publically available in a timely manner after completion • Users shall specify when and where reports are published and how the public can obtain copies.
Chapter 12: Reporting	• See Chapter 12 for a list of reporting requirements.

Chapter 4: Accounting and reporting principles

Generally accepted GHG accounting principles are intended to underpin and guide GHG accounting and reporting to ensure the reported goal assessment represents a faithful, true, and fair account of changes in GHG emissions resulting from a mitigation goal. The five principles described below are intended to guide users in quantifying and reporting changes in GHG emissions, especially where the standard provides flexibility.

Requirements in this chapter

- GHG accounting and reporting shall be based on the following principles: relevance; completeness; consistency; transparency; and accuracy.

GHG accounting and reporting of changes in GHG emissions associated with a mitigation goal shall be based on the following principles:

Relevance: Ensure the GHG information appropriately reflects actual GHG emissions or reductions and serves the decision-making needs of users – both internal and external to the reporting entity.

Completeness: Account for and report on all GHG emission sources and activities within the goal boundary. Include all relevant information in the quantification of GHG reductions. Disclose and justify any specific exclusions.

Consistency: Use consistent methods to allow for meaningful performance tracking of emissions and reductions over time. Transparently document any changes to the data, boundary, methods, or any other relevant factors in the time series.

Transparency: Provide clear and sufficient information for reviewers to assess the credibility and reliability of GHG reduction claims. Disclose any relevant assumptions and make appropriate references to the methods and data sources used.

Accuracy: Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable confidence as to the integrity of the reported information.

Guidance for applying the accounting and reporting principles

The primary function of these five principles is to guide the implementation of the *GHG Protocol Mitigation Goals Standard* and the assurance of the GHG evaluation, particularly when application of the standard in specific situations is ambiguous.

In practice, users may encounter tradeoffs between principles when developing a goal assessment. For example, a user may find that achieving the most complete assessment requires the use of less accurate data, compromising overall accuracy. Conversely, achieving the most accurate assessment may require excluding activities with low accuracy, compromising overall completeness. Users should balance tradeoffs between principles depending on their objectives (see Chapter 2 for more information). Over time, as the accuracy and completeness of data increase, the tradeoff between these accounting principles will likely diminish.

Relevance

A relevant goal assessment report contains the information that users – both internal and external to the reporting entity – need for their decision making. Users should use the principle of relevance when designing the mitigation goal (Chapter 5), choosing a base year (Chapter 6), developing a baseline scenario (Chapter 6), deciding on treatment of the land-use sector (Chapter 7), and accounting for the flows of transferable GHG emissions units (Chapter 8). Users should also use the principle of relevance as a guide when selecting data sources to ensure they appropriately reflect the GHG effects of the mitigation goal and serve the decision-making needs of user). Users should carry out the various methodological steps with sufficient accuracy and completeness to ensure that the goal assessment is relevant (i.e., that it appropriately reflects the GHG effects of goal and serves the decision-making needs of users). Applying the principle of relevance depends on the objectives of the assessment (see Chapter 2).

Completeness

Users should ensure that the goal assessment appropriately reflects the GHG effects of the mitigation goal, and serves the decision-making needs of users, both internal and external to the reporting entity. In some situations, users may be unable to estimate emissions due to a lack of data or other limiting factors. Users should not exclude any activities from the assessment that would compromise the relevance or accuracy of the assessment. In the case of any exclusions, it is important that all exclusions be documented and justified. Assurance providers can determine the potential impact and relevance of the exclusion on the overall assessment.

Consistency

Users of GHG data typically track emissions over time in order to identify trends and assess performance. The consistent application of accounting approaches, goal boundary, and calculation methods is essential to producing comparable GHG emissions data over time. If there are changes to methods, data, or other factors affecting emissions estimates, they need to be transparently documented and justified, and may warrant recalculation of base year and/or baseline scenario emissions (see Chapter 6).

Transparency

Transparency relates to the degree to which information on the processes, procedures, assumptions and limitations of the goal assessment are disclosed in a clear, factual, neutral, and understandable manner based on clear documentation (i.e., goal assessment report). Information should be recorded, compiled, and analyzed in a way that enables internal reviewers and verifiers to attest to its credibility.

Specific exclusions need to be clearly identified and justified, assumptions disclosed, and appropriate references provided for the methods applied and the data sources used. The information should be sufficient to enable a party external to the goal assessment process to derive the same results if provided with the same source data. A transparent report will provide a clear understanding of the relevant issues and a meaningful assessment of emissions performance over time. More information on reporting is provided in Chapter 12.

Accuracy

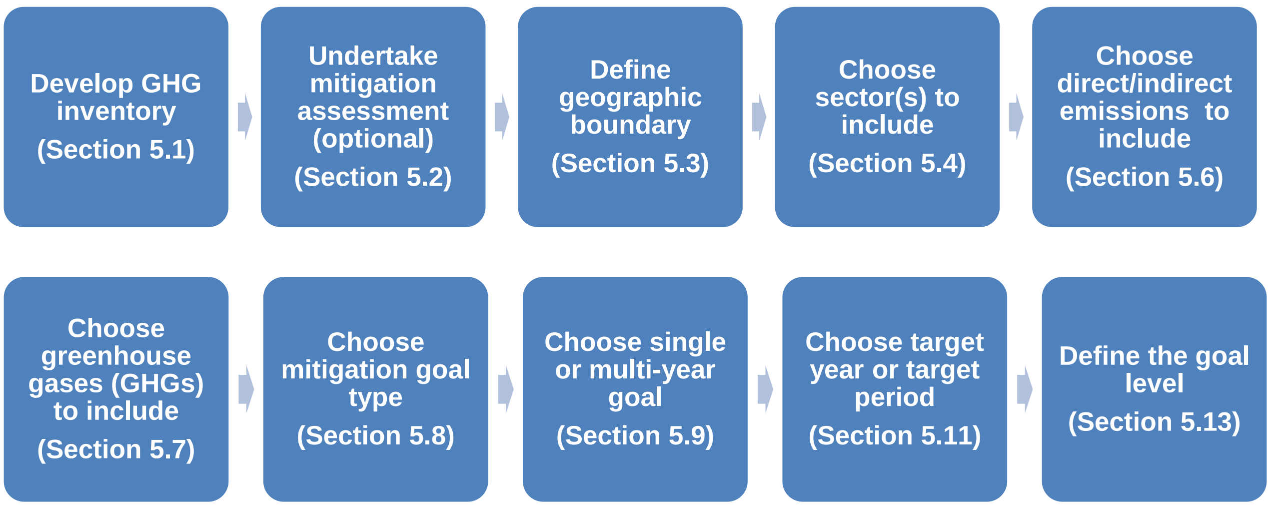
Data should be sufficiently accurate to enable intended users to make decisions with reasonable confidence that the reported information is credible. It is important that any estimated data be as accurate as possible to guide the decision-making needs of the user and ensure that the GHG information is relevant. GHG measurements, estimates, or calculations and non-GHG data, especially socioeconomic data used to develop baselines scenarios, should be systemically neither over nor under the actual value, as far as can be judged. Users should reduce uncertainties in the quantification process as far as practicable and ensure the data are sufficiently accurate to serve decision-making needs. Reporting on measures taken to ensure accuracy and improve accuracy over time can help promote credibility and enhance transparency.

Accuracy should be pursued as far as possible, but once uncertainty can no longer be practically reduced, conservative estimates should be used. Users should apply conservative assumptions, values, and procedures when uncertainty is high and the cost of measures to reduce uncertainty is not worth the increase in accuracy. Conservative values and assumptions are those that are more likely to overstate GHG emissions or underestimate GHG reductions.

Chapter 5: Designing a mitigation goal

This chapter provides guidance on designing a mitigation goal. It is primarily intended for users that have not already designed and set a mitigation goal. Users that have already designed a mitigation goal may skip the accounting steps in this chapter; however, the reporting requirements in this chapter apply to all users.

Figure 5.1. Overview of steps in this chapter[8]



Accounting requirements in this chapter[9]

Section 5.1

- To develop an inventory, national entities shall use the IPCC's internationally accepted inventory methods.
- Uncertainty related to emissions data shall be addressed in a manner that is consistent with the inventory methods used.
- QA/QC of emissions data shall be addressed in a manner that is consistent with the inventory methodology being used.
- If users update GWP values during the goal period, inventory emissions for all previous years in the goal period, including the base year, shall be recalculated.
- Users shall apply GWP values provided by the Intergovernmental Panel on Climate Change (IPCC), based on a 100-year time horizon.

Section 5.6

- Users shall define their goal by scope.

Section 5.11

- Users with single year goals shall define a target year.
- Users with multi-year goals shall define a target period.

Section 5.13

- The goal level shall be applied to all emissions and removals inside the goal boundary and be expressed in terms of carbon dioxide equivalent (CO_2e).

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[8] This figure does not include steps specific to the land-use sector and transferable emissions units, since these topics are only mentioned in this chapter but fully discussed in Chapters 7 and 8 respectively.
[9] This table lists the accounting requirements in the chapter. Reporting requirements for this chapter are listed in Chapter 12 and are not listed below. While some sections in this chapter do not have requirements, each section in the chapter contains recommendations.

- Users with separate goals for each scope or a combination of single and separate goals for scopes shall define their goal level by scope.

Section 5.15

- If users make significant revisions to the goal boundary or change the goal boundary during the goal period (e.g., add sectors or gases), they shall make recalculations to base year or baseline scenario emissions, emissions levels and emissions reductions associated with meeting the goal, and recalculate emissions for all previous years in the goal period.
- Significance of a revision to the goal boundary shall be determined using a significance threshold.

  If users change their goal type, change from a single year to a multi-year goal, or change the goal level during the goal period assessing progress towards the existing goal shall stop and a new goal shall be established.

5.1. Develop a GHG inventory

Developing a GHG inventory is a critical first step in designing and setting a GHG mitigation goal. The development of a GHG inventory is also required during the goal period to track changes in GHG emissions and removals and at the end of the goal period to assess whether a mitigation goal has been achieved. This standard uses the inventory and underlying inventory methodologies, such as those from the Intergovernmental Panel on Climate Change (IPCC), as a starting point for generating the emissions data necessary for quantifying emissions and emissions reductions associated with mitigation goals.

To develop an inventory, national entities shall use the IPCC's internationally accepted inventory methods, and should use the most up-to-date methods, currently the IPCC *2006 Guidelines for National Greenhouse Gas Inventories*. Subnational entities should, in addition to IPCC methods, use internationally accepted methods and guidelines such as the C40 Cities Climate Leadership Group (C40), ICLEI – Local Governments for Sustainability, and World Resources Institute (WRI) *Global Protocol for Community-Scale Greenhouse Gas Emissions* (GPC).

Key GHG inventory concepts

Below is a short list of key concepts related to the estimation and development of GHG inventories. For more information see the IPCC *2006 Guidelines for National Greenhouse Gas Inventories*.

The most common methodological approach for estimating GHG emissions from a source is to multiply activity data by an emissions factor. See Equation 5.1.

Equation 5.1. GHG emissions estimation method

$$\textbf{Emissions} = \text{Activity data X Emissions factor}$$

Activity data are the quantified extent to which a human activity takes place. For example, vehicle kilometers traveled or rate of fuel consumption would constitute activity data.

An **emissions factor** is a coefficient that quantifies emissions and removals per unit of activity. For example, the emissions factor of a certain fuel is the amount of GHG emissions per unit of fuel consumed.

Global warming potential (GWP) values describe the radiative forcing impact (or degree of harm to the atmosphere) of one unit of a given GHG relative to one unit of carbon dioxide, and convert GHG emissions data for non-CO_2 gases into units of carbon dioxide equivalent (CO_2e). Users shall apply GWP values provided by the Intergovernmental Panel on Climate Change (IPCC), based on a 100-year time horizon. Users should apply GWP the most recent values provided by the IPCC. Users shall report the GWP values used for each greenhouse gas. Users should use the same GWP values throughout the goal period in order to enable consistent performance tracking over time. If users update GWP values during the goal period, inventory emissions for all previous years in the goal period, including the base year, shall be recalculated and reported.

Key categories are used to identify categories of emissions sources that have the most significant impact on a jurisdiction's total GHG inventory in terms of: absolute level of emissions and removals, trends in emissions and removals, or uncertainty. As recommended by the IPCC, key categories should be the priority areas for users when prioritizing resources for data collection, quality assurance/quality control, and reporting.

Uncertainty is a lack of knowledge of the true value of a variable (e.g., activity data or emissions factor). When developing an inventory, estimates of uncertainty are needed for individual emissions sources and sinks and total inventory emissions. See Chapter 3 of Volume 1 of IPCC *2006 Guidelines for National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* for guidance on estimating uncertainties associated with GHG inventories. Uncertainty related to emissions data shall be addressed in a manner that is consistent with the inventory methods used. For example, users applying IPCC inventory methods shall use IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (and any updates) to address uncertainty.[10] Users shall disclose and justify how emissions data uncertainty is addressed.

Verification of inventory data and emissions estimates is critical to ensuring the environmental integrity of calculations of emissions and emissions reductions associated with a mitigation goal. IPCC guidance on verification should be used by third-party verifiers to assess the quality and credibility of GHG inventories. Quality assurance (QA) and quality control (QC): QA/QC of emissions data shall be addressed in a manner that is consistent with the inventory methodology being used. For example, for national jurisdictions, QA/QC shall be addressed in the manner prescribed by the IPCC Guidelines for National Inventories. QA/QC of subnational inventories should be addressed at the same level of detail and rigor as provided in the IPCC Guidelines for National Inventories and the source(s) of such methods shall be clearly reported in the performance tracking plan. Chapter 12 provides further guidance on verification of inventory data and reports. Users shall disclose data quality assurance and control procedures used for data collected.

Direct and indirect emissions

Activities within a jurisdiction's geopolitical boundary can result in emissions from sources that are located inside and outside of that jurisdiction (see Figure 5.2). For example, emissions from purchased electricity generated outside of a jurisdiction's geopolitical boundary are the result of that jurisdiction's activities (e.g., electricity use) but occur at sources outside of it. Categorizing emissions as direct or indirect emissions helps users manage all emissions that result as a consequence of activities within their jurisdiction's boundaries.[11]

- Direct emissions are emissions from sources within a jurisdiction's geopolitical boundary.
- Indirect emissions are emissions that are a consequence of activities within a jurisdiction's boundary, but occur at sources outside that boundary.

[10] IPCC, *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, 2000, http://www.ipcc-nggip.iges.or.jp/public/gp/english/

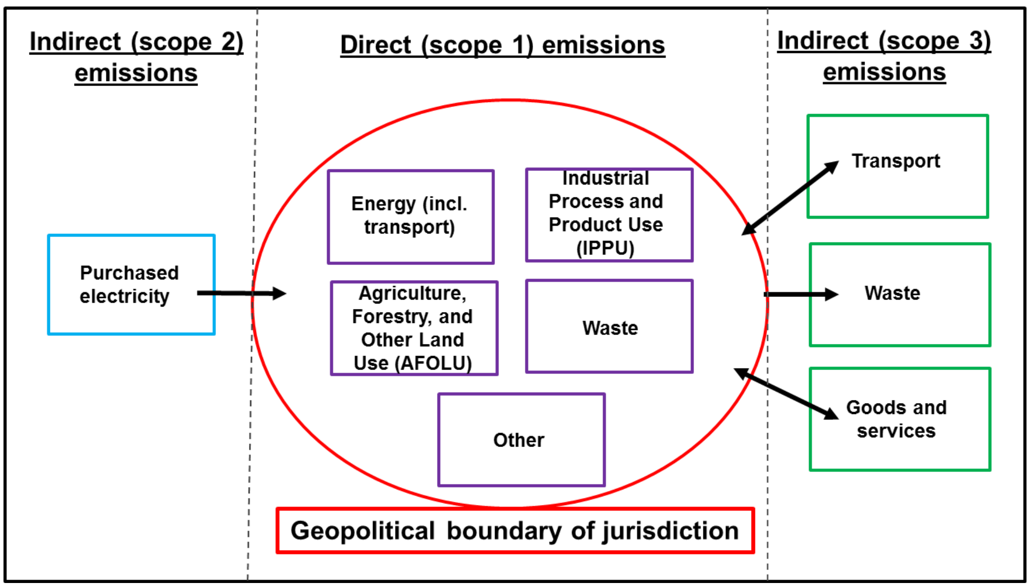
[11] The terms "direct" and "indirect" as used in this document should not be confused with their use in GHG inventories where 'direct' refers to the seven Kyoto gases and 'indirect' refers to the precursors NOx, NMVOC, and CO.

To further distinguish between direct and indirect emissions, this standard adopts the GHG Protocol's scopes framework.[12] See Figure 5.2 for an illustration of the scopes framework for jurisdictions.

- **Direct emissions (scope 1):** All direct emissions from sources within the geopolitical boundary of a jurisdiction.
- **Indirect emissions from imported energy (scope 2):** Energy-related indirect emissions that occur outside a jurisdiction's geopolitical boundary as a consequence of consumption/use of grid-supplied electricity and/or heating and cooling within the jurisdiction.
- **All other indirect emissions (scope 3):** All other indirect emissions that occur outside a jurisdiction's geopolitical boundary as a result of activities within that boundary, as well as trans-boundary emissions due to exchange/use/consumption of goods and services.

When developing a GHG inventory, users should categorize emissions sources as scope 1, scope 2, or scope 3, when applicable.

Figure 5.2. Scopes framework for jurisdictions



5.2. Undertake a mitigation assessment

After developing a GHG inventory, users should carry out a mitigation assessment to inform the design of the mitigation goal. Mitigation assessments can help users develop and analyze different emissions reduction scenarios based on their objectives, jurisdictional circumstances, and available resources – human, technical, financial, and data. Furthermore, mitigation assessment methods such as marginal abatement cost (MAC) curves can provide an indication of the magnitude of available reduction opportunities and the potential costs associated with each. The basic analytical framework for mitigation assessments includes:[13]

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[12] This terminology is subject to change. Final terminology will be consistent with the *Global Protocol for Community-Scale GHG Emissions (GPC)*.
[13] Based on Dennis Tirpak et al., "Chapter 27: Methods for assessment of mitigation options," in *Climate Change 1995: The IPCC Second Assessment Report: Scientific-technical analyses of impacts, adaptations, and mitigation of climate change*, eds. Robert T. Watson, M.C. Zinyowera, and Richard H. Moss, Cambridge, UK: Cambridge University Press 1995, http://www.ipcc-wg2.gov/publications/SAR/SAR_Chapter%2027.pdf.

- Development of a baseline scenario that represents the most likely growth in emissions that would occur in the absence of mitigation strategies (see Chapter 6)
- Identification and characterization of mitigation strategies, including policies, actions, and technologies, based on factors such as mitigation potential, cost, and co-benefits
- Development of alternative scenarios that represent likely emissions trajectories that would occur if mitigation strategies were implemented
- Estimation of incremental costs and benefits of mitigation strategies

Detailed guidance on carrying out complete mitigation assessments can be obtained from the IPCC and the UNFCCC, among other sources.[14] Chapter 6 of this standard provides guidance on developing a baseline scenario, which is one necessary element of a mitigation assessment.

Outputs from the mitigation assessment should provide the basis for designing and setting a mitigation goal, especially regarding which sectors and gases are covered by the goal, the goal type, and the goal level. Furthermore, undertaking a mitigation assessment before designing a goal helps to assess whether the mitigation goal adopted by a user is feasible and ambitious. Mitigation assessments are often parts of low emissions development strategies, which can assist in the development of the goal.

5.3. Define the geographic boundary of the goal

After the inventory is established and a mitigation assessment has been performed, the next step in designing the goal is to define the geographic boundary. The geographic boundary is the physical territory covered by the goal. In most instances, the geographic boundary will conform to the geopolitical boundary of the jurisdiction. For example, for a country it would be the country's territory and for a city it would be the geographic area located within the city's political boundary. However, in some cases users may choose to include or exclude certain parts of the jurisdiction's territory from the goal.

In determining the geographic boundary, users should first take into account the geographic coverage of their GHG inventory to ensure that adequate data exist for tracking and assessing progress for the relevant geographic territory. Users may also choose to consider the extent to which they are able to influence emissions from any offshore or non-contiguous territories to determine whether to include such emissions within the goal's boundary. For example, the United Kingdom uses its GHG inventory as the basis for assessing progress toward its various mitigation goals, but has selected different geographical boundaries for each goal.[15] The UK's domestic goal includes the UK and the Crown Dependencies of Jersey, Guernsey and the Isle of Man, while its Kyoto Protocol commitment includes the Crown Dependencies of Jersey, Guernsey, and the Isle of Man, and the Overseas Territories of Cayman Islands, Falkland Islands, Bermuda, Montserrat and Gibraltar. Finally, the UK's contribution to the EU emissions reduction goal includes only the UK and Gibraltar.

Users should include their contiguous geopolitical territory and all non-contiguous territories, protectorates, dependencies, and departments under the authority of the jurisdiction within the goal boundary. This approach is common practice for developing GHG inventories by national jurisdictions, as outlined by IPCC guidelines. Users may choose to include only a subset of their non-contiguous territories

[14] See Dennis Tirpak et al., "Chapter 27: Methods for assessment of mitigation options," in *Climate Change 1995: The IPCC Second Assessment Report: Scientific-technical analyses of impacts, adaptations, and mitigation of climate change*, eds. Robert T. Watson, M.C. Zinyowera, and Richard H. Moss, Cambridge, UK: Cambridge University Press 1995, http://www.ipcc-wg2.gov/publications/SAR/SAR_Chapter%2027.pdf, "Mitigation Assessments," UNFCCC, accessed November 12, 2012, http://unfccc.int/resource/cd_roms/na1/mitigation/index.htm, and Sathaye et al., *Greenhouse Gas Mitigation Assessment: A guidebook*, prepared by Countries Studies Management Team and Lawrence Berkeley Laboratory, 1995, http://ies.lbl.gov/iespubs/ggma/ghgcontents.html.

[15] For more information see: AEA, "Summary of difference between geographical coverages of reported GHG emissions," Report to UK Department of Energy and Climate Change, 2009, pg. 2, http://uk-air.defra.gov.uk/reports/cat07/0905261531_ED45322_GeographicalCoverage_GHG_Inventories_Final.pdf.

within the goal boundary, depending on objectives, data availability, and significance of non-contiguous emissions sources. However, this approach should not be used to exclude significant emissions from the goal boundary.

Users shall disclose and justify the geographic boundary of their goal, including any protectorates, departments, overseas territories, dependencies or other non-contiguous territories included or excluded from the goal boundary. Users should provide a rationale for any territories that are excluded from the goal boundary and an indication of the magnitude of emissions (in Mt CO_2e) associated with the excluded territories.

5.4. Choose which sectors are covered by the goal

After defining the geographic boundary, the next step is to choose which sectors are to be covered by the goal. The IPCC *2006 Guidelines for National Greenhouse Gas Inventories* groups GHG emissions and removals into five main sectors: energy; industrial processes and product use (IPPU); agriculture, forestry and other land use (AFOLU); waste; and other. Each sector is further broken down into categories and sub-categories. For example, transport is a category of energy, and road transportation is a sub-category of transport. Users should include all IPCC sectors within the goal boundary. If all IPCC sectors are not included within the goal boundary, users should, at a minimum, include sector(s) with the most significant contribution to their overall emissions, according to their inventory. Incomplete sectoral coverage may leave out potentially significant emissions sources and not accurately reflect the emissions impact or mitigation potential of the jurisdiction. For example, India's national goal to reduce the GHG emissions intensity of its GDP does not cover the agricultural sector. In 2007, the agricultural sector accounted for 18% of India's emissions.[16] While exclusion of a sector may make sense, depending on objectives and jurisdiction's context, clarifying that this significant source of emissions is excluded, and the rationale, is important for ensuring transparency.

Instead of including all IPCC sectors within the goal boundary, some users may choose to set a sectoral goal as a way to target a specific sector, subsector, or selection of sectors. For example, a user may establish a goal to reduce emissions from the energy sector by 20%.

Users shall report which sectors and subsectors are included in the goal boundary and disclose and justify any exclusions.

Defining covered sectors

Once users have chosen which sectors are covered by the goal, it is necessary to define which emissions sources are included in each covered sector. Users should use sector definitions from the most recent IPCC *Guidelines for National Greenhouse Gas Inventories*. (See Box 5.1 for 2006 IPCC sector definitions). Users may use sector definitions from older IPCC *Guidelines for National Greenhouse Gas Inventories* or the IPCC *Good Practice Guidance for Land use, Land-use Change, and Forestry*, especially if the older IPCC guidelines are used to estimate the jurisdiction's inventory or define land-use categories.[17] In either case, the IPCC guidelines provide clear sector definitions for use in developing a

[16] See Planning Commissions, "Low Carbon Strategies for Inclusive Growth: An Interim Report," Government of India, 2011.

[17] The 2006 IPCC *Guidelines for National Greenhouse Gas Inventories*, the older 1996 *Guidelines*, and the IPCC *Good Practice Guidance for Land use, Land-use Change, and Forestry* define and categorize sectors and subsectors differently. For example, the 2006 *Guidelines* group agriculture, forestry, and land use into AFOLU while the 1996 *Guidelines* categorize agriculture and land-use change and forestry as separate sectors. For more information on the differences between the 2006 and 1996 *Guidelines* see Julia Busche et al., "Changes and implications of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories," Background Paper for the Workshop on the implications of the implementation of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, 30-31 October 2008, 2008, http://acm.eionet.europa.eu/docs/meetings/081030_ghg_inv_ipcc_gdlns_impl_ws/background_paper_2006_

GHG emissions inventory. Furthermore, this approach ensures consistency between the GHG inventory and the mitigation goal.

In some instances, users may choose to deviate from IPCC sector definitions in order to target specific activities or use particular policy tools. For example, a city may discover that the majority of its emissions come from commercial and residential buildings and may want to establish a goal that applies to these end-use sectors, which do not correspond to IPCC sectors. While the IPCC is the most widely recognized reference for sectoral definitions, there are other established bodies that provide alternative sector definitions, including, for example, the North American Industrial Classification Standard (NAICS) and the International Standard Industrial Classification (ISIC).

Users shall disclose and justify the definitions of the sectors included in the goal. If sector definitions are used that deviate from the most recent IPCC guidelines, users shall provide an explanation for why IPCC defined sectors were not used and information on the alternative sector definitions, including an explanation of how non-IPCC sector definitions map onto the IPCC sectors.[18] It will also be important to define sectors in a way that avoids double counting of sources among different sectors.

Box 5.1. IPCC sector definitions

The *2006 IPCC Guidelines for National Greenhouse Gas Inventories* group emission and removals into five sectors.[19]

Sector	Definition	Examples of categories and sub-categories	GHGs
Energy	The energy sector includes all GHG emissions arising from combustion and fugitive releases of fuels, including energy industries, manufacturing industries and construction (e.g., iron and steel), and transport.	Fuel combustion activities (incl. transport)	CO_2, CH_4, N_2O
		Fugitive emissions from fuels	
		CO_2 transport and storage	
Industrial Processes and Product Use (IPPU)	The IPPU sector includes all GHG emissions arising from industrial processes and product use, excluding those related to energy combustion; extraction; processing and transport of fuels; and CO_2 transport, injection, and storage.	Chemical industry	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6
		Metal industry	
		Non-energy products from fuels and solvent use	
Agriculture, Forestry, and Other Land Use (AFOLU)	The AFOLU sector includes all GHG emissions and removals from forest land, cropland, grassland, wetlands, settlements, and other land. It also includes all GHG emissions from livestock and manure management, managed soils, and liming and urea application.	Livestock	CH_4, N_2O, CO_2
		Enteric fermentation	
		Land	

GL_version5.pdf. The *Good Practice Guidance* expands upon and complements the land-use sector categories and definitions of the 1996 *Guidelines*. For more information see Section 3.1.2 of the *Good Practice Guidance* (http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Chp3_1_Introduction.pdf).

[18] For example, see U. S. Environmental Protection Agency (U.S. EPA), "Chapter 2: Trends in greenhouse gas emissions," in *Inventory of U.S. greenhouse gas emissions and sinks: 1990-2011*, Washington, DC, 2013, p 2-16 and 2-17, http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2013-Chapter-2-Trends.pdf.

[19] IPCC, *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 1: General Guidance and Reporting*, Prepared by the National Greenhouse Gas Inventories Programme, Edited by Simon Eggleston et al., 2006, http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol1.html.

Waste	The waste sector includes all GHG emissions from solid waste disposal, biological treatment of solid waste, incineration and open burning of waste, and waste water treatment and discharge.	Solid waste disposal Incineration and open burning of waste Wastewater treatment and discharge	CO_2, CH_4, N_2O
Other	This sector includes indirect N_2O emissions from atmospheric deposition of nitrogen in NOx and NH_3 and any other emissions category that cannot be included in the above sectors.	Indirect N_2O emissions from atmospheric deposition of nitrogen in NOx and NH_3 International aviation International water-borne transport	N_2O, NOx, NH_3

5.5. Decide on treatment of emissions and removals from the land-use sector

Due to its unique properties, accounting methods for the land-use sector are separately presented in this standard, which can differ from a GHG inventory accounting approach. Users are required to account for emissions and removals from the land-use sector using one of the following approaches: (1) include land-use sector within the goal boundary; (2) treat the land-use sector as a separate sector-specific goal; (3) exclude the land-use sector from the goal boundary and use it as an offset for emissions within the goal boundary; or (4) do not account for the land-use sector. See Chapter 7 for further guidance, accounting methodologies, and reporting requirements for land-use sector emissions and removals.

5.6. Choose which direct and indirect emissions are covered by the goal

After defining the sectoral coverage of the goal, the next step is to choose which direct and indirect emissions will be included in the covered sectors in the goal boundary. For definitions of direct and indirect emissions see Section 5.1.

National jurisdictions should include all direct emissions in the goal boundary. They may also include significant indirect emissions. However, currently there is little precedent for inclusion of indirect emissions in national mitigation goals since they are based upon national inventories, which typically cover direct emissions only.

Subnational jurisdictions should include all direct emissions in the goal boundary. In addition, subnational jurisdictions should include all significant indirect emissions in the goal boundary, since a large proportion of emissions associated with subnational jurisdictions may occur outside of their geopolitical boundaries; GHG inventories for subnational jurisdictions typically include indirect emissions; and indirect emissions are typically relevant for subnational decision making. Examples of indirect emissions include emissions associated with: electricity purchased from outside the jurisdiction, waste disposed of outside the jurisdiction, and transportation outside of the jurisdiction's boundary (e.g., related to commuting or from airports that serve the jurisdiction, but that are located outside of its geopolitical boundary).

Users shall disclose and justify which direct and indirect emissions sources are covered by the goal boundary, categorized by scope.

Leakage

Including indirect emissions in the goal boundary can avoid leakage. Leakage refers to an increase in emissions outside of the mitigation goal boundary that results as a consequence of activities (policies, actions, and projects) implemented to achieve the goal. Leakage can occur if emission reductions in one jurisdiction cause an increase in emissions in a different jurisdiction or if emission reductions in the sectors and gases covered by the goal cause an increase in emissions from uncovered sectors and gases. Users should minimize leakage by including all sectors and gases within the goal boundary as well as significant sources of indirect emissions. To identify and quantify sources of leakage associated with specific mitigation policies and actions, users should use the *GHG Protocol Policy and Action Accounting and Reporting Standard*.

Defining goals by scope

After choosing which direct and indirect emissions sources are included in the goal boundary, users shall define their goal by scope. See Section 5.1 for a definition of the scopes framework for jurisdictions. Goals may be defined by scope in one of three ways:

- **Single goal across scopes**: Under this approach a single goal is defined that includes any combination of scope 1 + scope 2 + scope 3 emissions. Emissions are calculated and reported as an aggregate of the combined emissions from the selected scopes. While emissions and emissions reductions are still required to be reported separately by scope ex-post (e.g., during and after the goal period), users with a single goal across scopes are not required to separately report emissions or emissions reductions by scope ex-ante (e.g., before the start of the goal period).
- **Separate goals for each scope**: Under this approach a separate goal is defined for each included scope. Goals may be defined for scope 1, 2, and/or 3. Emissions are calculated and reported separately by scope both ex-ante and ex-post.
- **A combination of single and separate goals for scopes:** Under this approach a goal is defined as a combination of the above two approaches. For example, a single goal is defined for total scope 1 + 2 + 3, as well as separate sub-goals for individual scopes. Emissions are calculated and reported as an aggregate of the combined scopes and separately by scope ex-ante and ex-post.

See Box 5.2 for examples of each of the three approaches. See Table 5.1 for advantages and disadvantages for each approach.

Box 5.2. Examples of defining a base year goal by scope

1. Single goal across scopes

Scope	Goal
1 + 2 + 3	Reduce emissions 40% below 2000 levels by 2020

2. Separate goals for each scope

Scope	Goal
1	Reduce emissions 30% below 2000 levels by 2020
2	Reduce emissions 15% below 2000 levels by 2020
3	Reduce emissions 5% below 2000 levels by 2020

3. A combination of single and separate goals for scopes

Scope	Goal
1 + 2 + 3	Reduce emissions 40% below 2000 levels by 2020
1	Reduce emissions 30% below 2000 levels by 2020
2	Reduce emissions 15% below 2000 levels by 2020
3	Reduce emissions 5% below 2000 levels by 2020

Table 5.1. Advantages and disadvantages of different goal definitions

Goal definition	Advantages	Disadvantages
Single goal across scopes	• Offers greater flexibility on where and how to achieve the most cost effective emissions reductions across scopes • Simple to communicate to stakeholders	• Cannot aggregate emissions and emissions reductions across jurisdictions (see Chapter 3) • Provides less transparency • May lead to double counting
Separate goals for each scope	• Allows aggregation of emissions and emissions reductions across jurisdictions within scopes for scope 1 and scope 2 (see Chapter 3) • Allows customization of goal for different scopes based on circumstances • Provides more transparency • Avoids risk of double counting	• May result in "cherry picking" if goals are set only for scopes where reductions are easiest to achieve • May be more complicated to communicate to stakeholders
A combination of single and separate goals for scopes	• Allows aggregating emissions and emissions reductions across jurisdictions by scope (see Chapter 3) • Allows customization of goal for different scopes based on circumstances • Easier to assess and report performance for each scope while still maintaining an overarching goal • Provides more transparency	• May be more complicated to communicate to stakeholders

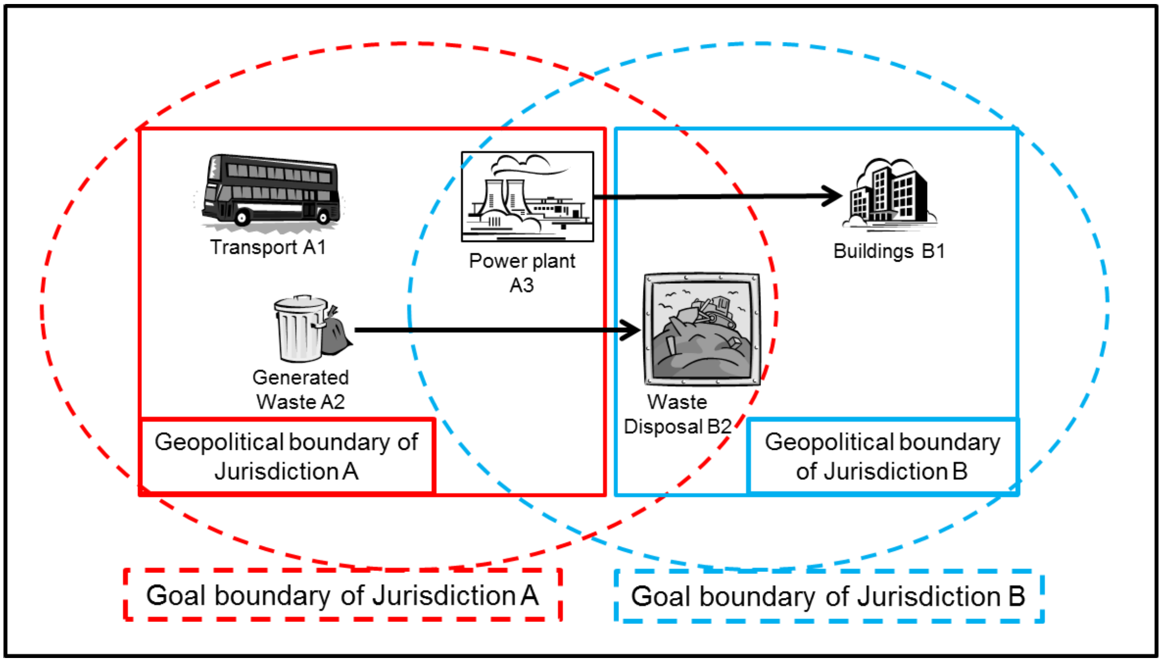
Goal overlap due to inclusion of indirect emissions

Given that one jurisdiction's indirect emissions are another's direct emissions, it is possible that the same emissions reduction contributes to meeting two goals. For example, if Jurisdiction A's goal includes purchased electricity from Jurisdiction B, and Jurisdiction A has a goal that covers scope 2 emissions, emissions reductions associated with that purchased electricity would contribute to both Jurisdiction A's and Jurisdiction B's goals. In other words, there is an overlap of the goals because both are covering the same emissions (See Figure 5.3). Goal overlap occurs when one jurisdiction's indirect (scope 2 or 3) emissions generated in another jurisdiction are counted towards both jurisdictions' goals. For subnational jurisdictions in particular, goal overlap may be encountered since a large proportion of their emissions can occur outside of their geopolitical boundaries. For national jurisdictions, goal overlap will likely be less common since most national goals include only direct (scope 1) emissions.

The scopes framework allows for the identification of such overlap as long as emissions by scope are reported separately. Accordingly, users should define their goals separately by scope (see above) and separately report emissions by scope. For those goals that cover indirect emissions (scope 2 or 3), users shall disclose any risks of goal overlap that are known to them.

As a result of goal overlap, users should not aggregate emissions reductions achieved across jurisdictions (see Chapter 3). As Chapter 3 notes, accurate aggregation of emissions reductions across goals is difficult to achieve unless there is complete comparability among design elements of the goals, and, given the potential for goal overlap, if only direct emissions reductions are aggregated. If indirect emissions reductions are included in the summation of emissions reductions across jurisdictions, double counting could ensue given goal overlap.

Figure 5.3. Goal overlap due to inclusion of indirect emissions



In Figure 5.3 there is overlap between Jurisdiction A's and B's goals since both goals cover emissions from power plant A3 and landfill B2. If Jurisdiction A and B aggregate their emissions reductions achieved, double counting will result. Jurisdiction A and B should define their goals by scope and separately report their emissions by scope. If done correctly, emissions from power plant A3 would be counted as scope 1 for Jurisdiction A and scope 2 for Jurisdiction B. Emissions from landfill B2 would be counted as scope 3 for Jurisdiction A and scope 1 for Jurisdiction B. See Table 5.2. Categorized in this way, emissions may be separately summed across scope 1 and scope 2 between Jurisdictions A and B.

Table 5.2. Emissions sources and activities by scope for Jurisdictions A and B

Emissions source/activity	Goal boundary of Jurisdiction A	Goal boundary of Jurisdiction B
	Scope	**Scope**
Transport A1	Scope 1	n/a
Electricity generated in Jurisdiction A (Power Plant A3) and consumed in Jurisdiction B (Buildings B1)	Scope 1	Scope 2
Waste generated in Jurisdiction A (generated waste A2) and disposed in Jurisdiction B (waste disposal B2)	Scope 3	Scope 1

5.7. Choose which greenhouse gases are covered by the goal

Mitigation goals may cover a range of different greenhouse gases. Jurisdictions' GHG inventory should provide the basis for choosing which greenhouse gases to include within the goal boundary. Due to issues such as data quality, cost of and capacity related to data management, users may be able to measure greenhouse gases from some sectors with more accuracy than greenhouse gases from others. Before choosing which greenhouse gases to include within the goal boundary, users should first ensure that they can accurately monitor and measure each considered greenhouse gas with reasonable confidence.

Users should include the seven greenhouse gases covered under the Kyoto Protocol within the goal boundary: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen triflouride (NF_3). Users may include fewer greenhouse gases depending on objectives, data quality, and capacity to accurately measure and monitor each greenhouse gas. For example, China's national goal to reduce emissions intensity covers only CO_2. In 2005, CO_2 constituted approximately 80% of China's overall GHG emissions.[20] Users may also include greenhouse gases covered under the Montreal Protocol.

Users shall disclose and justify the choice of greenhouse gases included within the goal. If all seven Kyoto Protocol greenhouse gases are not covered by the goal, users shall disclose and justify excluded gases and disclose the contribution of excluded gases to the overall inventory. If multiple greenhouse gases are covered by the goal, users shall aggregate and translate all included GHGs into units of carbon dioxide equivalent (CO_2e) using IPCC global warming potential values (see Section 5.1 for more information).

5.8. Choose a goal type

After defining the goal boundary (i.e., covered geography, sectors, gases, and direct and indirect emissions), the next step is to choose a goal type. The mitigation goal type provides the basis against which emissions and emissions reductions are tracked and reported.

This standard provides guidance on four goal types:

1. Base year goals
2. Intensity goals
3. Baseline scenario goals
4. Fixed level goals

This list of goal types is not exhaustive but encompasses the large majority of goals that governments have adopted.[21] Table 5.3 classifies each goal type according to units being reduced (either emissions or emission intensity) and reference against which reductions are measured (either a base year, baseline scenario, or no reference level). Each goal type is described below.

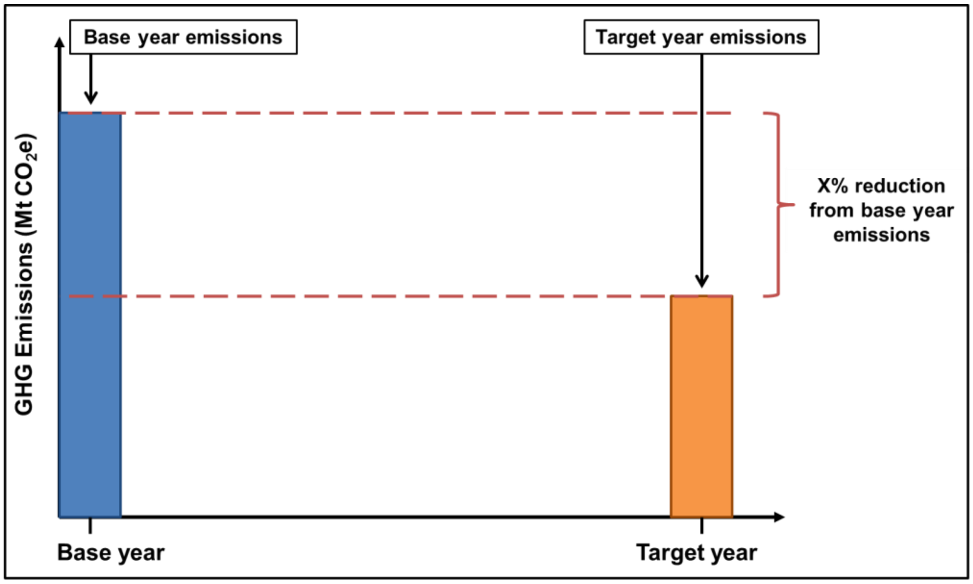
Table 5.3. Classification of goal types

<table>
<tr><th colspan="2"></th><th colspan="2">Reductions in what?</th></tr>
<tr><th colspan="2"></th><th>Reduction in emissions</th><th>Reduction in emissions intensity</th></tr>
<tr><th rowspan="3">Reductions relative to what?</th><th>Base year</th><td>Base year goal</td><td>Intensity goal</td></tr>
<tr><th>Baseline scenario</th><td>Baseline scenario goal</td><td>N/A</td></tr>
<tr><th>No reference level</th><td>Fixed level goal</td><td>N/A</td></tr>
</table>

Base year goals represent a reduction in emissions relative to an emissions level in a historical base year (see Figure 5.4). They are typically framed in terms of a percent reduction of emissions, rather than an absolute reduction in emissions.

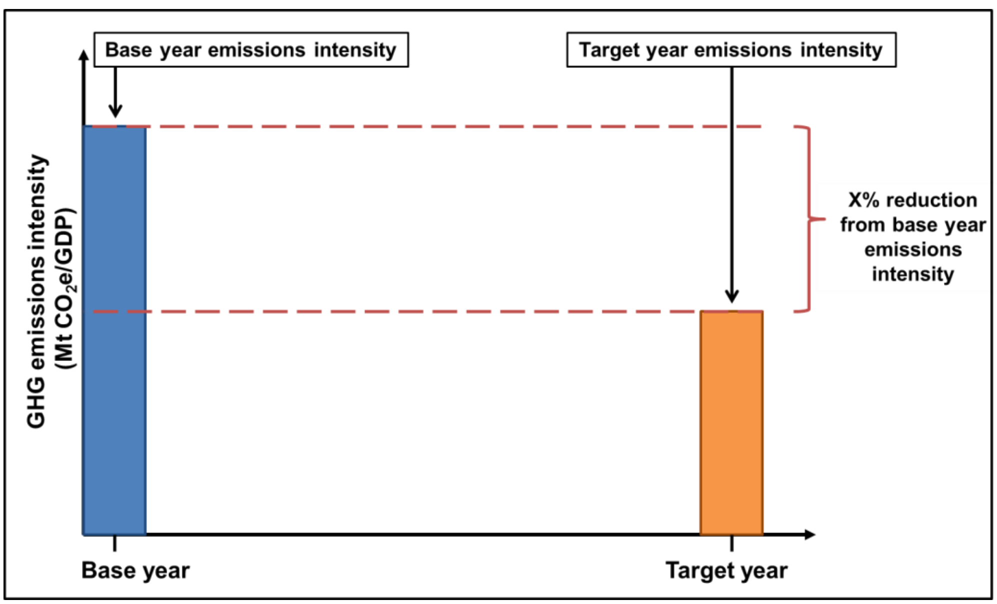
[20] Government of China, "Second National Communication on Climate Change of the People's Republic of China," 2012, http://unfccc.int/resource/docs/natc/chnnc2e.pdf.
[21] While this standard is intended for users with these four goal types, users with different goal types may still find this standard useful.

Figure 5.4. Example of base year goal



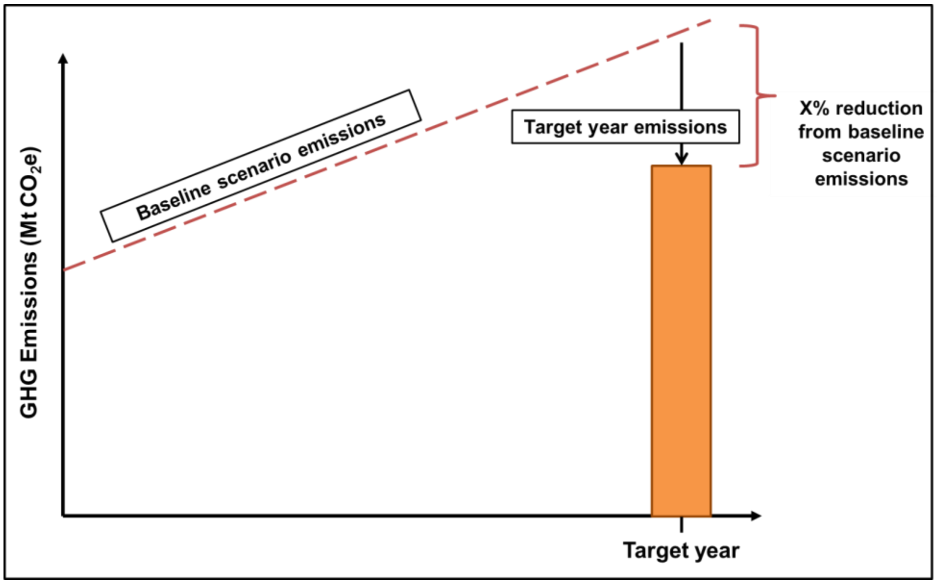
Intensity goals represent a reduction in emissions intensity relative to an emissions intensity level in a historical base year (see Figure 5.5). Emissions intensity is emissions per unit of output. Examples of units of output include gross domestic product (GDP), population, and energy use. Intensity goals are typically framed in terms of a percent reduction of emissions intensity, rather than an absolute reduction in emissions intensity.

Figure 5.5. Example of intensity goal



Baseline scenario goals represent a reduction in emissions relative to a baseline scenario emissions level (see Figure 5.6). They are typically framed in terms of a percent reduction of emissions from the baseline scenario, rather than an absolute reduction in emissions. A baseline scenario is a set of reasonable assumptions and data that best describe events or conditions that are most likely to occur in the absence of activities taken to meet a mitigation goal (see Chapter 6 for more information). These goals are sometimes referred to as a "business-as-usual" goal when the baseline scenario is designed to depict a business-as-usual emissions trajectory.

Figure 5.6. Example of baseline scenario goal

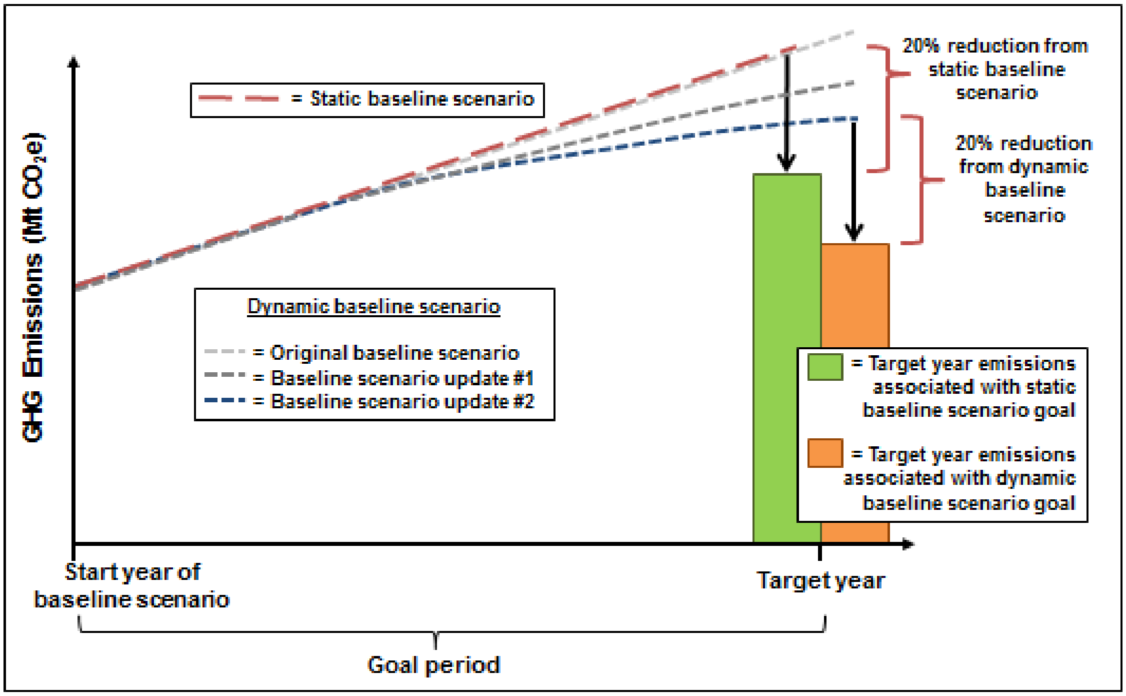


Baseline scenarios may be static or dynamic. A **static baseline scenario** is developed and fixed at the start of the goal period and not updated over time, while a **dynamic baseline scenario** is developed at the start of the goal period and updated during the goal period based on changes in emissions drivers (e.g., GDP or energy prices). A static baseline is a fixed reference case against which a goal is set and progress is tracked, but which may deviate from a "business-as-usual" scenario. In contrast, a dynamic baseline scenario is intended to represent a business-as-usual scenario, but not does represent a fixed reference case against which a goal is set and progress is tracked.

For example, assume that a user develops a baseline scenario based on an assumption that GDP will grow at an average annual rate of 5% between 2015 and 2025, but finds in 2020 that GDP grew at an average annual rate of 2% between 2015 and 2020 and is projected to grow at an average annual rate of 1% between 2020-2025. A user with a dynamic baseline scenario should update the baseline scenario based on the revised GDP growth rates, both retroactively for the period 2015-2020 and prospectively for the period 2020-2025. A user with a static baseline scenario should not make a similar update to their baseline. Chapter 6 provides more guidance on the development of baseline scenarios, including guidance on how and when to update baseline scenarios.

See Figure 5.7 for an example of how target year emissions associated with the same goal (20% reduction from baseline scenario emissions) changes depending on whether a static or dynamic is chosen. In this example, the dynamic baseline scenarios is updated downwards over the goal period, which lowers the target year emissions level that needs to be met in order to achieve the goal. However, dynamic baselines can also be updated upwards, which would have the opposite effect.

Figure 5.7. Example of static versus dynamic baseline scenario



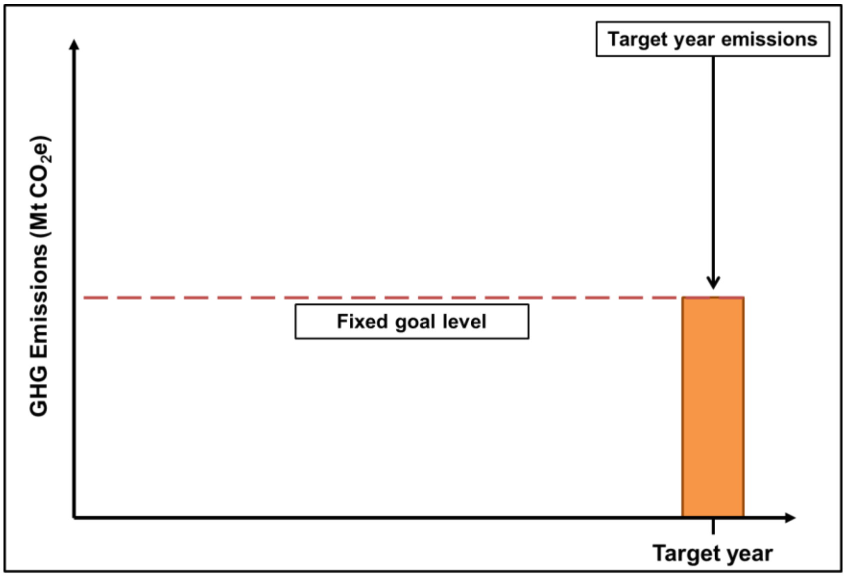
Both static and dynamic baseline scenarios have advantages and disadvantages. See Table 5.4. Users that choose a baseline scenario goal shall define and report the baseline scenario as static or dynamic.

Table 5.4. Advantages and disadvantages of static and dynamic baseline scenarios

	Advantages	Disadvantages
Static baseline scenario	• The emission level to be achieved by the target year is fixed, which offers users and decision makers an unchanging target and guarantees that a certain emissions level will be met in the target year • Allows users to calculate the emissions level associated with meeting the goal ex-ante (see Chapter 9)	• Does not reflect the level of effort associated with meeting the goal. For example, it does not 'net out' changes in emissions due to mitigation efforts from those resulting from changes in emissions drivers such as GDP or energy prices (assuming these drivers are not directly affected by mitigation policies).
Dynamic baseline scenario	• Better reflects the level of effort associated with meeting a goal, since it is updated to account for changes in emissions drivers, and users can therefore better identify changes in emissions resulting from mitigation policies and actions	• The emissions level associated with meeting the goal cannot be calculated ex-ante at the start of the goal period since the emissions level may change during the goal period due to updates to the baseline scenario • Does not offer users and policy-makers the certainty of an unchanging target, and does not guarantee that a certain emissions level will be met in the target year

Fixed levels goals represent a reduction in emissions to an absolute emissions level in a target year. For example, a fixed level goal could be to achieve 200 Mt CO_2e by 2020. The most common type of fixed level goals are carbon neutrality goals, which are designed to reach zero net emissions by a certain date. Fixed levels goals do not include a reference to an emissions level in a baseline scenario or historical base year (see Figure 5.8).

Figure 5.8. Example of fixed level goal



When choosing a goal type, users should consider:

- Their objectives
- The level of ambition required by climate science to avoid dangerous anthropogenic climate change
- Feasibility of emissions reductions based on mitigation assessment, cost, and national/subnational circumstances

Goals that are designed to achieve an absolute reduction in GHGs are the most environmentally robust and can best address stakeholder concerns on the need to mitigate absolute emissions. From a GHG accounting perspective, baseline scenario goals pose a significant risk of low environmental integrity since baseline scenarios can be very uncertain and are often inaccurate projections of future emissions levels (see Box 6.2 and Section 6.2.8 for more information). If baseline scenario emissions are over-estimated, the ambition associated with the baseline scenario goal will likely be compromised.

Accordingly, users should adopt goals that translate into an absolute emissions reduction over the goal period. This can be achieved with the most certainty with base year and fixed level goals.

If users want to select a goal type that accommodates growth in their economy or populations, they should choose an intensity goal rather than a baseline scenario goal. There is considerably less uncertainty associated with intensity goals, as they require assumptions about only one variable in addition to emissions (as opposed to projections that require assumptions about several variables as inputs to models).

Users shall report their choice of mitigation goal type. If an intensity goal is chosen, users shall report the unit of output. Users choosing a baseline scenario goal shall report whether the baseline scenario will be static or dynamic.

5.9. Choose a single year goal or multi-year goal

After choosing a mitigation goal type, the next step is to define whether the goal is a single year goal or a multi-year goal. Single year goals aim to reduce emissions by a single target year, while multi-year goals aim to reduce emissions over a defined target period. For example, a single year goal might aim to reduce emissions by 2025, whereas a multi-year goal would aim to reduce emissions over the five-year period from 2021-2025. See Figures 5.9 and 5.10. Users shall define and report their goal as either a single year goal or a multi-year goal.

Figure 5.9. Example of a single year goal

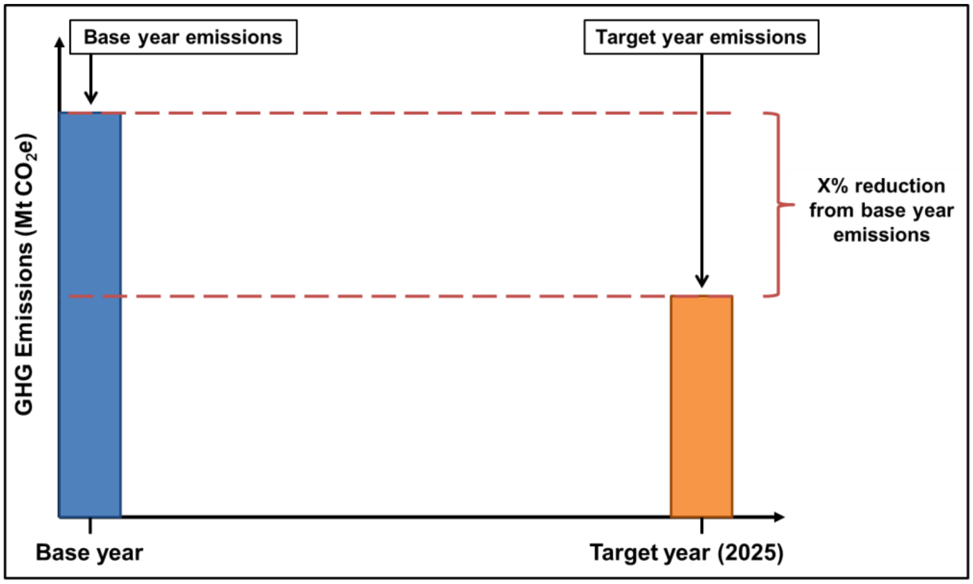
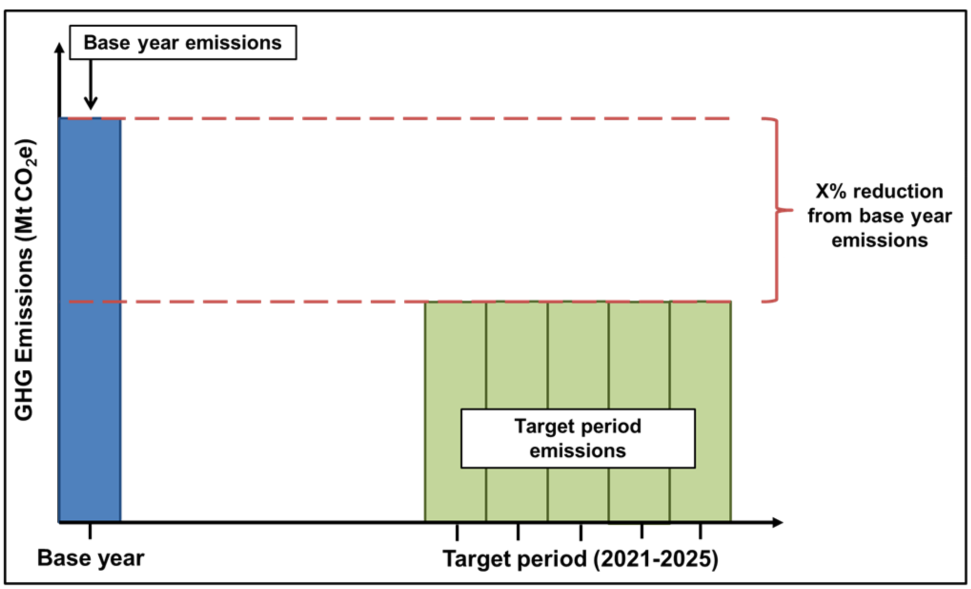


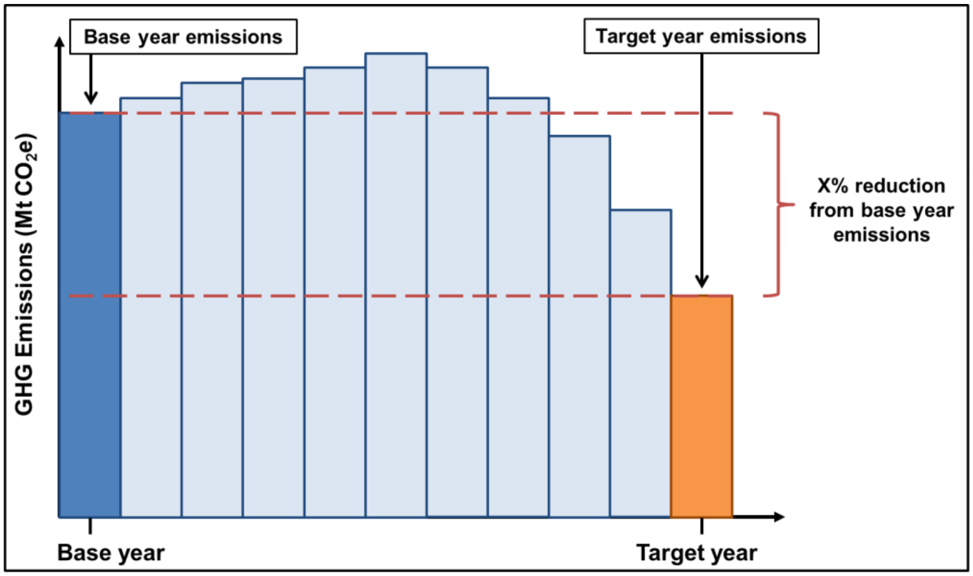
Figure 5.10. Example of a multi-year goal[22]



[22] Figure 5.10 depicts target period emissions being held constant, but they could vary annually depending on the design of the goal.

Cumulative emissions over the goal period can vary widely depending on the amount of emissions each year. The advantage of multi-year goals is that they are designed to limit cumulative emissions to a pre-determined quantity over a target period. Single year goals, on the other hand, are designed to limit emissions to a pre-determined quantity only in a single year (the target year). Therefore, a significant risk associated with single year goals is that emissions can increase during the goal period and then be reduced only shortly before the target year, which would result in a larger amount of cumulative emissions than if emissions were capped year over year by a multi-year goal (see Figures 5.11). Because a multi-year goal ensures a reduction in cumulative emissions, users should adopt multi-year goals rather than single year goals.

Figure 5.11. Example of high cumulative emissions associated with a single year goal



Approaches to setting multi-year goals

If a multi-year goal is selected, there are several ways in which it can be defined. For users with any of the four goal types, multi-years goals may be defined as:

- **Average multi-year goals**, which aim to reduce annual emissions by an average amount over a target period (see Figure 5.12); or
- **Annual multi-year goals**, which aim to reduce annual emissions by a specific amount each year over a target period (see Figure 5.13).

Figure 5.12. Example of average multi-year goal[23]

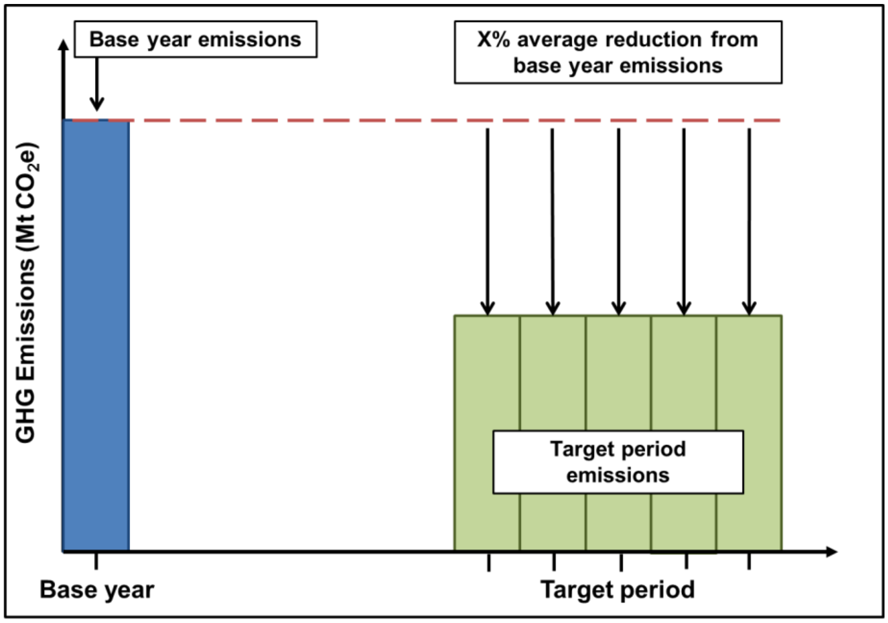
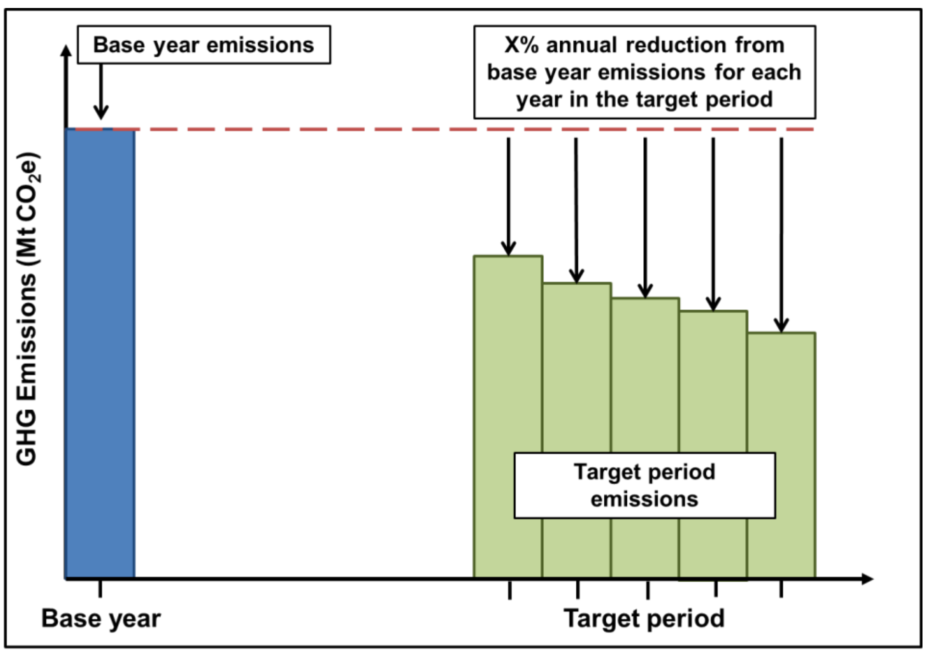


Figure 5.13. Example of annual multi-year goal

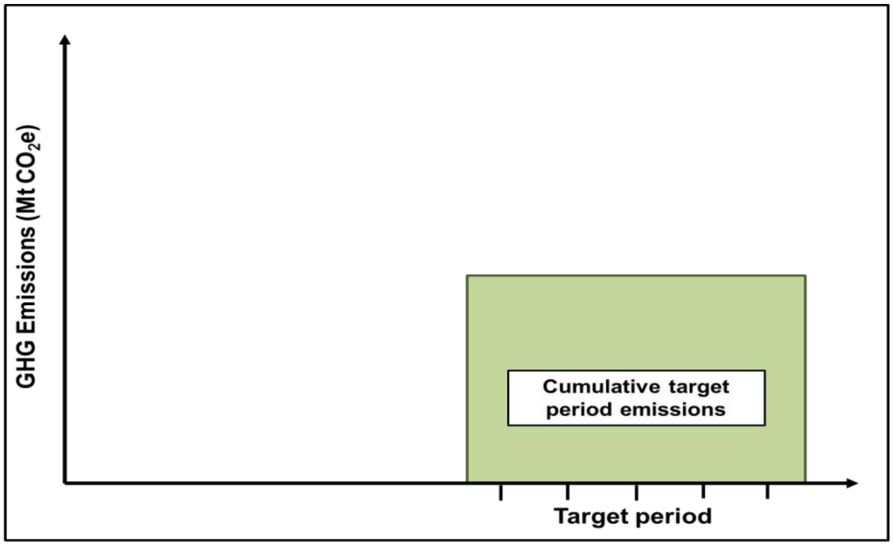


In addition to the two types of multi-year goals above, for users with fixed level goals, multi-year goals may also be defined as a cumulative multi-year goal. This type of multi-year goal is only applicable to fixed level goals because it is not designed in reference to a base year or baseline. However, annual or average multi-year goals can be converted to cumulative multi-year goals once the emissions levels are calculated for each year in the target period.

[23] Figure 5.13 depicts target period emissions being held constant, but they could vary annually.

- **Cumulative multi-year goals**, which aim to limit cumulative emissions over a target period to a fixed absolute amount (see Figure 5.14).

Figure 5.14. Example of cumulative multi-year goal



Since average and cumulative multi-year goals do not specify individual targets for each year in the target period, they offer users more flexibility in meeting their goals. For example, emissions associated with an average multi-year goal may be above the average annual emissions level defined by the goal one year and then be below this level the next. It is only critical that the average annual emissions level over the entire target period corresponds to the average annual reduction defined by the goal. Annual multi-year goals on the other hand are less flexible than average or cumulative multi-year goals but allow users to know the expected annual emissions level for each year of the target period. This information can be a useful input into decision-making and planning processes.

Users with a multi-year goal shall report whether their goal is an average, annual, or cumulative multi-year goal.

5.10. Choose a base year or develop baseline scenario

Users with base year goals and intensity goals are required to choose a base year and calculate base year emissions or emissions intensity, according to goal type. Users with baseline scenario goals are required to develop a baseline scenario and estimate baseline scenario emissions. See Chapter 6 for guidance and reporting requirements related to base year or baseline scenario emissions.

5.11. Choose a target year or target period

An important next step in designing the goal is identifying the goal period, which is the time over which the user commits to achieving the goal. This will require the choice of a target year (the year in which the goal is achieved, or the last year of the goal period) or target period (the period of consecutive years over which the goal is achieved, corresponding to the last several years of the goal period).

The goal period is accordingly the time over which the user commits to achieving the goal, which is typically between the base year and the target year/target period. However, not all goal types have a base year, and, therefore, the definition of the goal period depends on the goal type:

- <u>Base year goal</u>: Goal period is the time between the base year and the target year/period.

- Intensity goal: Goal period is the time between the base year and the target year/period.
- Baseline scenario goal**:** Goal period is the time between the start year of the baseline scenario and target year/period.
- Fixed level goal: Goal period is the time between the year in which the goal is adopted and the target year/period.

When defining the length of the goal period, users may choose to set short-term goals, long-term goals, or a combination of both. A short-term goal is generally considered any goal that will be achieved in the near term (typically a matter of years rather than decades). A long-term goal has a longer timeframe, e.g., greater than 10 years. Users setting long-term goals often choose more aggressive goal levels than those associated with short-term goals because a longer time frame offers more flexibility to meeting ambitious goals. When choosing a goal length, users should consider their objectives, the level of ambition required by climate science to avoid dangerous anthropogenic climate change, and the feasibility of emissions reductions based on mitigation assessment, cost, and national/subnational circumstances.

In general, longer goal periods facilitate long-term planning and provide more certainty and flexibility for decision makers and stakeholders to make investment choices during the goal period. Longer goal periods can also be used to moderate the risk of unpredictable events that may temporarily increase emissions. Short-term goals can mobilize investment and planning for emission reductions more quickly and encourage quicker phase-out of inefficient practices and technologies. Since both short-term and long-term goals offer advantages, users should adopt both short- and long-term goals. For example, a user could adopt a short-term goal for the next 10 years coupled with a long-term goal for the next 30 years. Coupled short- and long-term goals can help ensure a decreasing emissions pathway that leads to significant cumulative reductions.

Users with single year goals shall report their choice of a target year. Users with multi-year goals shall report their choice of target period (i.e., a period of one or more consecutive years). All users shall report the length of their goal period. Users with short-term and long-term goal shall separately report the length of the goal period for each goal and treat them as separate goals for the purposes of this standard.

5.12. Consider the use of transferable emissions units

Users may meet their goals using any combination of emissions reductions from within the goal boundary and transfers of emissions units from outside of the goal boundary. Transferable emissions units include offset credits generated from emissions reduction projects and programs and tradable allowances. See Chapter 8 for accounting and reporting guidance and requirements related to transferable emissions units. As part of the goal design process, users should consider the potential role of transferable emissions units in meeting their goal.

5.13. Define the goal level

Defining the goal level is the final step in the goal design process. The goal level represents the quantity of emissions or emissions reductions that the user commits to achieving, and signifies the overall ambition of the goal (although ambition will be dictated by the size of the goal boundary as well). Regardless of goal type, users should set an ambitious goal level that reduces emissions significantly below the jurisdiction's business-as-usual emissions trajectory. When choosing a goal level users should consider: their objectives; the level of ambition required by climate science to avoid dangerous anthropogenic climate change; and the feasibility of emissions reductions based on mitigation assessment, cost, and national/subnational circumstances.

The user will next define their goal level as a single numerical value. Depending on goal type, the goal level will represent:

- Base year goal: a single percent value defining emissions reductions to be achieved relative to a base year
- Intensity goal: a single percent value defining emissions intensity reductions to be achieved relative to base year emissions intensity
- Baseline scenario goal: a single percent value defining emissions reductions to be achieved relative to a baseline scenario
- Fixed level goal: a single value defining absolute quantity of emissions to be achieved

A single numerical value increases certainty of the emissions level at the end of the goal period, assuming the goal is met.

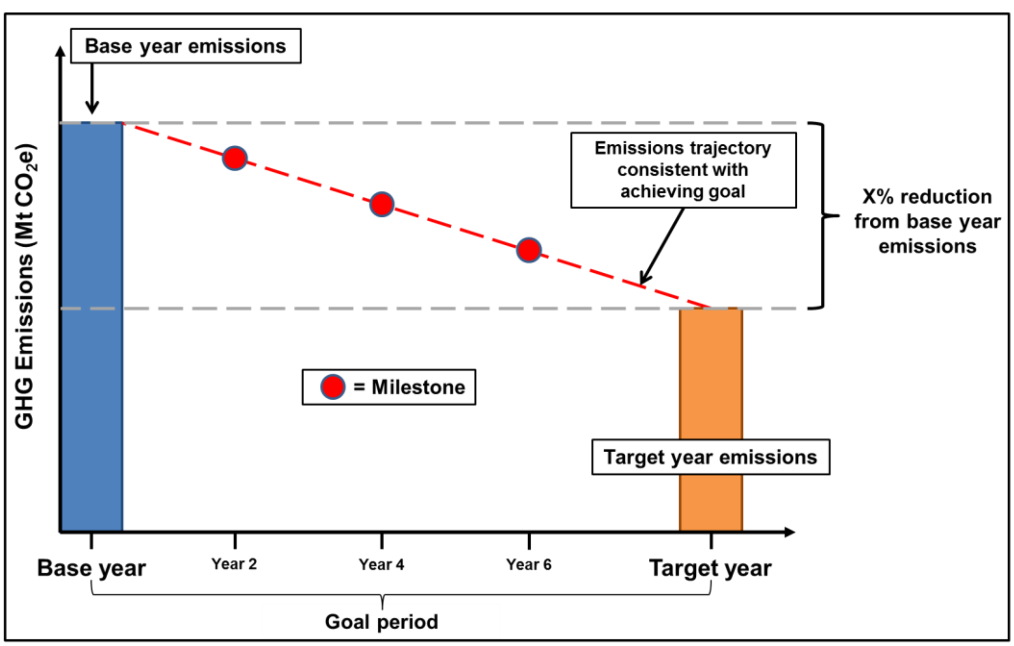
Users shall report a single numerical value as their goal level. The goal level shall be applied to all emissions and removals inside the goal boundary and be expressed in terms of carbon dioxide equivalent (CO_2e). Users also may have separate goal levels by individual gas as well, or a combination of a single goal across all greenhouse gases, as well as separate goals by individual gas.

Users with separate scopes goals and a combination of single and separate goals for scopes shall report their goal level by scope. For example, a user with a separate scopes goal shall separately report a goal level for each individual scope included in the goal (see Section 5.6 and Box 5.2).

5.14. Set milestones (optional)

Once the mitigation goal has been designed, users should set milestones at regular intervals throughout the goal period as a way to track and evaluate progress. Milestones are informal targets set during the goal period that align with an emissions trajectory consistent with achieving the goal (see Figure 5.15). Milestones can simply be along a linear emissions trajectory from the start of the goal period to the target year, or they may also align with political goals, such as the timing of future policy implementation, and/or users' planned frequency for assessing progress during the goal period (see Chapter 10). Milestones can help users to stay on track toward achieving their goal, inform policy-making, and respond to stakeholder demand.

Figure 5.15. Example of milestones for a base year goal



5.15. Goal revision

Where possible, users should increase the ambition of mitigation goals over time by expanding the goal boundary, changing the goal type to ensure that absolute emissions reductions are achieved, and raising the ambition of the goal level.

If users make significant revisions to the goal boundary or change the goal boundary during the goal period (e.g., add sectors or gases), they shall make the following recalculations:

- Recalculate base year or baseline scenario emissions, if applicable (see Chapter 6 for more information). Before making revisions to the goal boundary, users with base year and intensity goals should make sure that sufficient data (quality and quantity) exists in the base year for any sectors, gases, geographic territory, and/or direct/indirect emissions they wish to add. The goal boundary should only be expanded if sufficient base year data exist.
- Recalculate emissions levels and emissions reductions associated with meeting the goal (see Chapter 9 for more information)
- Recalculate emissions for all previous years in the goal period (see Chapter 10 for more information)

Significance of a revision to the goal boundary shall be determined using a significance threshold. A significance threshold is a quantitative or qualitative criterion used to determine whether changes in parameters are significant enough to trigger a recalculation. Users may define the significance threshold used (for more information see Box 6.1). Users shall disclose and justify the significance threshold used for any goal boundary revisions.

If revisions to the goal boundary result in very significant changes to the emissions sources covered by the goal, for example increase or decrease the emissions covered by the goal by 50%, users should consider eliminating the existing goal and establishing a new goal.

If users change their goal type, change from a single year to a multi-year goal, or change the goal level during the goal period assessing progress towards the existing goal shall stop and a new goal shall be established.

Chapter 6: Estimating base year or baseline scenario emissions

This chapter guides users in (1) choosing a base year and estimating base year emissions, or (2) developing a baseline scenario and estimating baseline scenario emissions, as relevant to their goal type. Section 6.1 provides guidance on base year emissions and is intended for users with base year goals or intensity goals that have not already chosen a base year and calculated base year emissions or emissions intensity. Section 6.2 provides guidance on baseline scenarios and is primarily intended for users with baseline scenario goals that have not developed a baseline scenario and estimated baseline scenario emissions. However, Section 6.2 is also applicable to all users interested in developing an informational baseline scenario. The reporting requirements of this chapter are applicable to all users.

Accounting requirements in this chapter[24]

Users with base year goals and intensity goals shall:

Section 6.1.2
- Establish a single base year or base period for all sectors and gases included in the goal boundary to enable comprehensive and consistent tracking of emissions over time.

Section 6.1.2
- Calculate base year emissions for all sectors, gases, and scopes covered by the goal (if relevant)
- Apply GWP values provided by the IPCC based on a 100-year time horizon

Section 6.1.3
- Calculate base year emissions intensity (only for users with intensity goals)

Section 6.1.4
- Develop a base year emissions recalculation policy and recalculate base year emissions when significant changes in key parameters occur
- Develop a significance threshold to determine whether changes in parameters are significant.
- Apply recalculation policy in a consistent manner
- Recalculate base year emissions if GWP values are updated during the goal period

Users with baseline scenario goals shall:

Section 6.2
- Develop a goal baseline scenario that covers the same sectors and gases as the goal and estimate baseline scenario emissions (by scope, if relevant)
- Use metric tons carbon dioxide equivalent as the goal baseline scenario metric
- Base baseline scenario inputs on the principles of relevance, accuracy, completeness, consistency, and transparency
- Develop the goal baseline scenario in a relevant, complete, consistent, transparent, and accurate manner, so that it represents a conservative emissions pathway.

Section 6.2.1
- If applicable, choose a third party baseline scenario for the goal baseline scenario that covers the same sectors and gases as the goal. If a jurisdiction's goal and the third party baseline scenario cover different sectors and gases, the third party baseline scenario shall not be used without necessary modifications.

Section 6.2.2
- Establish a timeframe for the goal baseline scenario that matches the goal period, at a minimum

[24] This table lists the accounting requirements in the chapter. Reporting requirements for this chapter are listed in Chapter 12 and are not listed below. While some sections in this chapter do not have requirements, each section in the chapter contains recommendations.

- Develop, at the start of the goal period, a goal baseline scenario emissions recalculation policy and define a recalculation significance threshold

Section 6.2.6

- Recalculate goal baseline scenario emissions if it becomes evident that a key parameter is no longer valid
- Use a significance threshold to determine the significance of GHG effects associated with a policy or measure

Section 6.2.9

- Users that develop a range of baseline scenarios shall define a single baseline scenario for setting the goal.

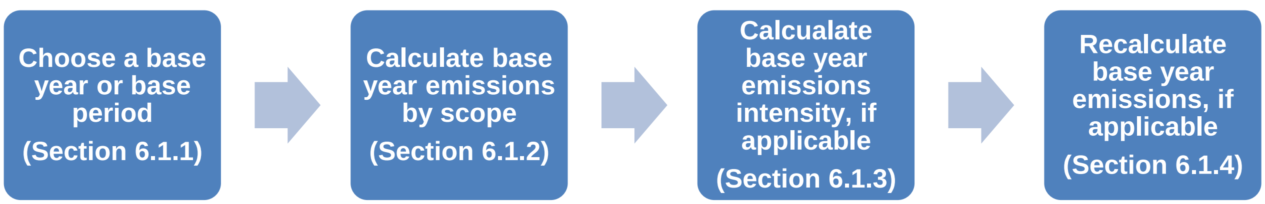
In addition to the requirements above, users with dynamic baseline scenario goals shall:

Section 6.2.7

- Develop, at the start of the goal period, a goal baseline scenario emissions update policy and define a update significance threshold
- Use defined significant threshold to determine whether changes in emissions drivers are significant
- Update goal baseline scenario emissions if changes in emissions drivers are significant
- Apply the update policy in a consistent manner

6.1. Estimating base year emissions (for base year goals and intensity goals)

Figure 6.1 Overview of steps for estimating base year emissions



6.1.1. Choose a base year or base period

For users with base year and intensity goals, a meaningful and consistent comparison of emissions over time requires that they establish a base year and estimate base year emissions. A base year is a specific year – or in the case of a base period, years – of historical emissions data against which a jurisdiction's current emissions are compared. The comparison of historical and current emissions enables users to track and evaluate progress during and after the goal period.

Users may define the base year as a single specific year of historical data (i.e., base year) or as an average of multiple years (i.e., base period). When deciding between a base year or base period, users should consider:

- Emissions data quality and availability
- Year-to-year fluctuations of emissions
- Objectives of the user: for example, a base year or base period could be chosen in order to align with related goals (e.g., a city may choose to have the same base year as that of the state in which it is located)

Users that choose a single year as their base year should choose a relevant point in time for which they have reliable, representative data. For those users with base year goals the base year should be the earliest point in time for which such data exist. However, users may wait until a later year of emissions reporting to set the base year, when the emissions inventory is sufficiently complete and reliable. Users should choose a base year that is representative of their average emissions in order to avoid cherry picking a year with uncharacteristically high or low emissions. Users may want to choose a base year that aligns with existing mitigation goals, such as the Kyoto Protocol for example (e.g., 1990 for developed countries).

Users in jurisdictions where emissions fluctuate significantly from year to year should choose a base period in order to smooth out fluctuations and develop a representative emissions level against which to track progress. Users that choose a base period should choose a sequence of years that are representative of their average emissions in order to avoid cherry picking years with uncharacteristically high or low emissions.

Users with base year goals and intensity goals shall report either a base year or base period and specify their reasons for choosing that particular year or years. Users shall establish a single base year or base period for all sectors and gases included in the goal boundary to enable comprehensive and consistent tracking of emissions over time. Users should choose a base year or base period for which representative, reliable, and verifiable emissions data are available.

Throughout the rest of this standard, the term “base year” is used as shorthand to mean base year or base period.

6.1.2. Calculate base year emissions by scope

Once a base year is selected, users shall calculate base year emissions for all sectors, gases, and scopes covered by the goal. In order to ensure consistency with the jurisdiction’s GHG inventory, users should use base year GHG inventory data to calculate base year emissions. For information on developing a GHG inventory, see Chapter 5, Section 5.1. If necessary, users may use non-inventory data to calculate base year emissions. Any non-inventory data used should be high-quality, peer-reviewed, and from recognized, credible sources, when available. Users shall report the method (e.g., IPCC’s *2006 Guidelines for National Greenhouse Gas Inventories*) used to calculate base year emissions.

Calculating base year emissions by scope

As described in Chapter 5, users may define single goals that cover multiple scopes (e.g., scope 1 + 2 + 3) or set separate goals for scope 1, 2, and/or 3. Users shall calculate and report base year emissions according to how their goal is defined.

- Users with combined scopes goals shall calculate and report base year emissions for combined scope 1 + 2 + 3 emissions, as relevant.
- Users with separate scopes goals shall separately calculate and report base year emissions for each relevant scope.
- Users with a combination of separate and single goals for scopes shall separately calculate and report base year emissions for combined scope 1 + 2 + 3 emissions (as relevant) and for each scope covered by a sub-goal.

Global warming potential values

Users shall apply global warming potential (GWP) values provided by the IPCC based on a 100-year time horizon. Users should use the most recent IPCC GWP values for the GHGs included in the goal boundary, as these values reflect the most recent scientific consensus. Users should use the same GWP values throughout the goal period in order to enable consistent performance tracking over time. If users update GWP values during the goal period, base year emissions shall be recalculated (see Section 6.1.5). Users shall disclose the GWP values used to estimate emissions.

6.1.3. Calculate base year emissions intensity (if applicable)

Users with intensity goals shall calculate and report base year emissions intensity. To do this, users should divide base year emissions by the units of output in the base year (see Equation 6.1). Data for the unit of output should be reliable, verifiable, and gathered from an official source. Users with intensity goals shall disclose and justify the methodology and data sources used to determine base year emissions intensity for both emissions and the unit of output.

Equation 6.1. Method for calculating base year emissions intensity

$$\textbf{Base year emissions intensity} = \frac{\text{Base year emissions (Mt CO2e)}}{\text{Unit of output (e.g., GDP)}}$$

6.1.4. Recalculate base year emissions (if applicable)

To maintain consistency and enable meaningful comparisons of emissions over time, users with base year and intensity goals shall recalculate base year emissions when significant changes in key parameters occur. Examples of relevant changes include:

- Structural changes in the jurisdiction that have a significant impact on its base year emissions, including, for example, changes in the geopolitical boundary of the jurisdiction (see Section 5.15)
- Changes in calculation methodologies, including:
  - updated inventory calculation method
  - improvements in the accuracy of emission factors or activity data
  - changes in GWP values
- Changes in goal boundary, including sectors, gases, or geographic area (see Section 5.15)
- Discovery of significant error(s) in original calculations

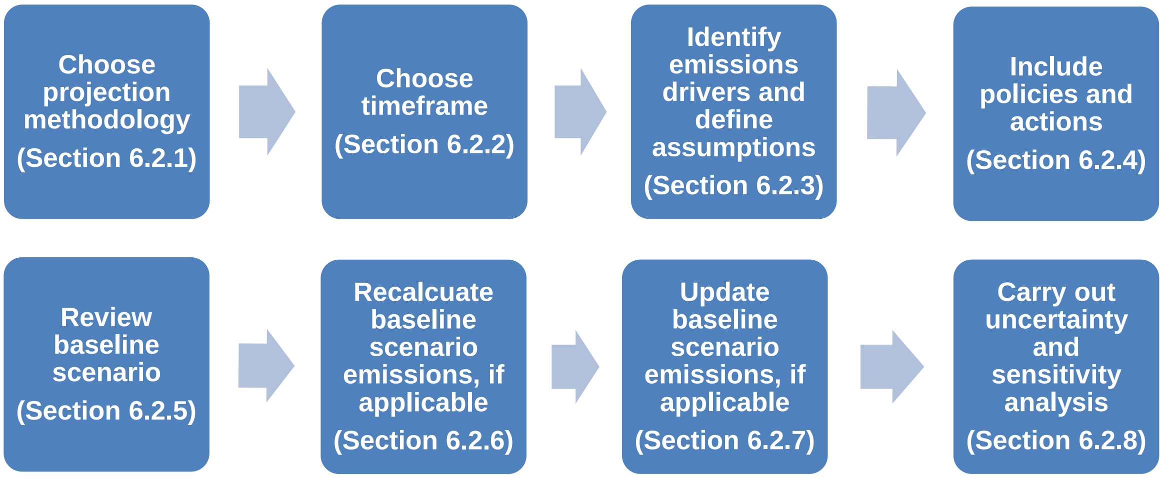
When setting a base year, users with base year and intensity goals shall develop a base year emissions recalculation policy and disclose and justify the basis and context for any recalculations. A significance threshold shall be used to determine whether changes in parameters are significant. See Box 6.1. Users with base year and intensity goals shall apply their recalculation policy in a consistent manner and disclose and justify the significance threshold used.

Box 6.1. Significance threshold

A significance threshold is a quantitative or qualitative criterion used to determine whether changes in parameters such as data, methods, or emissions drivers are significant enough to trigger a recalculation or update of base year and/or baseline scenario emissions (see Sections 6.1.4, 6.2.5, and 6.2.6). Users may define the significance threshold used. The determination of significance requires taking into account the cumulative effect on base year and/or baseline scenario emissions of changes in key parameters. For example, a significance threshold of 5% would mean that any change in a parameter that results in a 5% cumulative change in base year or baseline scenario emissions would trigger a recalculation or update.

6.2. Estimating baseline scenario emissions (for baseline scenario goals)

Figure 6.2. Overview of steps for estimating baseline scenario emissions[25]



A baseline scenario is a reference case that represents the events or conditions most likely to occur in the absence of activities taken to meet the mitigation goal. It is a plausible description of a possible future state of the world given pre-established assumptions and methodological choices; it is not a statement or prediction about what will actually happen in the future (see Box 6.2).[26]

Baseline scenarios can serve a variety of purposes, including:

- **Setting a goal**: A baseline scenario can be used as a reference point against which the ambition of a mitigation goal (i.e., goal level) is set.
- **Assessing progress toward a goal:** For baseline scenario goals, a baseline scenario is necessary to assess progress toward the goal's achievement by serving as a reference case against which progress is measured. (For further information on assessing progress see Chapter 11.)
- **Reporting:** Emissions projections are required by some reporting regimes. For example, under the UNFCCC, Annex I Parties are required to outline emissions projections for a number of different scenarios, including with and without policies and measures.
- **Mitigation assessment:** As described in Chapter 5, mitigation assessments are a means of determining, selecting, and analyzing mitigation options and strategies based on the specific needs, conditions, and objectives of a user. One critical element of carrying out a mitigation assessment is the development of a baseline scenario. This standard does not provide detailed guidance on mitigation assessments; however such guidance can be obtained from the IPCC[27] and the UNFCCC,[28] among others.[29]

[25] This sequence of steps is illustrative. Users may follow a different sequence.
[26] Based on Jacob K Søbygaard et al., "National greenhouse gas emissions baseline scenarios: Learning from experiences in developing countries," Danish Energy Agency, OECD, and UNEP Risø Centre, 2013, http://www.uneprisoe.org/upload/unep%20ris%C3%B8/pdf%20files/news%20items/national%20greenhouse%20gas%20emissions%20baseline%20scenarios%20-%20web.pdf
[27] Dennis Tirpak et al., "Chapter 27: Methods for assessment of mitigation options," in *Climate Change 1995: The IPCC Second Assessment Report: Scientific-technical analyses of impacts, adaptations, and mitigation of climate change*, eds. Robert T. Watson, M.C. Zinyowera, and Richard H. Moss, Cambridge, UK: Cambridge University Press 1995, http://www.ipcc-wg2.gov/publications/SAR/SAR_Chapter%2027.pdf.
[28] "Mitigation Assessments," UNFCCC, accessed November 12, 2012, http://unfccc.int/resource/cd_roms/na1/mitigation/index.htm.

The guidance offered in this chapter is applicable to two types of baseline scenarios – goal baseline scenarios and informational baseline scenarios, described below.

Goal baseline scenario: A goal baseline scenario is a reference case against which a baseline scenario goal is set and evaluated. Goal baseline scenarios may be static or dynamic (see Chapter 5). Static goal baseline scenarios are not updated over time, while dynamic baselines scenarios are updated based on changes in emissions drivers (see Section 6.2.6). Users with baseline scenario goals shall develop a goal baseline scenario and estimate goal baseline scenario emissions.

Informational baseline scenario: Informational baseline scenarios are used for informational purposes, for example to understand mitigation effort relative to a hypothetical business-as-usual (BAU) trajectory and to inform decision-making and mitigation strategies, rather than to evaluate progress in meeting a goal. Informational baseline scenarios may be useful to all users regardless of goal type.

The process of developing a baseline scenario involves a large number of inputs, including historical activity and emissions data, key drivers, and methodological choices about assumptions for key drivers and included policies and actions. How these inputs are defined depend on users' objectives, resources, and circumstances and can have a significant effect on resulting baseline scenario emissions.

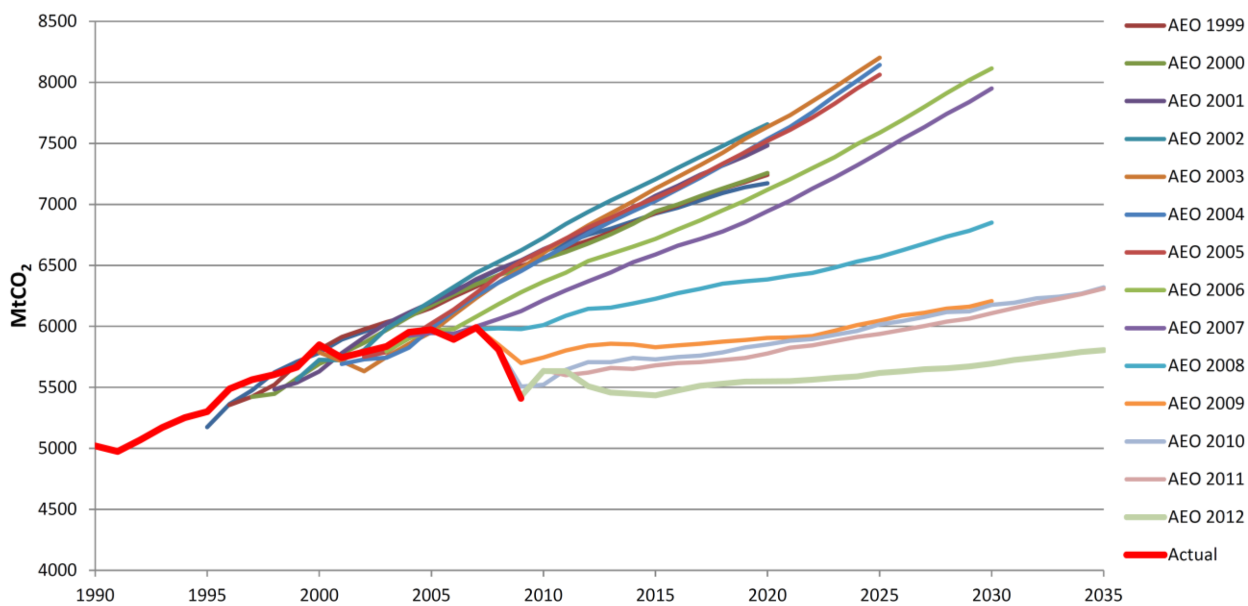
For users with baseline scenario goals in particular, the baseline scenario itself will have a significant impact on the ambition of the goal. For example, an over-estimated baseline scenario could allow a user to meet the goal without additional effort. In order to ensure environmental integrity, goal baseline scenarios shall be developed in a relevant, complete, consistent, transparent, and accurate manner, and represent a conservative emissions pathway (see Section 6.2.7). Furthermore, in order to enable comprehensive and consistent tracking of progress toward the goal, goal baseline scenarios shall cover the same sectors and gases as the goal boundary and be expressed as metric tons of carbon dioxide equivalent. Users with baseline scenario goals shall report the sectors and gases covered by the goal baseline scenario.

Box 6.2. Comparison of baseline scenario emissions over time

The U.S. Energy Information Administration (EIA) develops annual baseline scenarios (reference case scenarios) for U.S. energy-related CO_2 emissions as part of the Annual Energy Outlook (AEO). Figure 6.3 shows AEO projections for each year between 1998 and 2012. Note how dramatically projected emissions levels change from one year's scenario to the next. Such changes are due in part to updated information about key drivers (see Section 6.2.3) and updates to included policies and actions (see Section 6.2.4). The figure illustrates how a baseline scenario is not a statement or prediction about what will actually happen in the future, but rather a plausible description of a possible future state of the world given pre-established assumptions and methodological choices.

[29] For example, see Sathaye et al., *Greenhouse Gas Mitigation Assessment: A guidebook*, prepared by Countries Studies Management Team and Lawrence Berkeley Laboratory, 1995, http://ies.lbl.gov/iespubs/ggma/ghgcontents.html.

Figure 6.3. U.S. Energy Information Administration Annual Energy Outlook (AEO) Reference Case Scenarios for energy-related CO_2 emissions (1998- 2012)[30]



Estimating baseline scenario emissions by scope

As described in Chapter 5, users may define single goals that cover multiple scopes (e.g., scope 1 + 2 + 3) or set separate goals for scope 1, 2, and/or 3. Users shall calculate and report baseline scenario emissions according to how their goal is defined.

- Users with a single goal for all scopes shall calculate and report baseline scenario emissions for combined scope 1 + 2 + 3 emissions, as relevant.
- Users with separate goals for scopes shall separately calculate and report baseline scenario emissions for each relevant scope.
- Users with a combination of single and separate goals for scopes shall separately calculate and report baseline scenario emissions for combined scope 1 + 2 + 3 emissions (as relevant) and for each scope covered by a sub-goal.

6.2.1. Choose a projection methodology

All emissions projections are modeled in some way. Models can be complex systems that develop baseline scenarios based on projections of sectoral or economy-wide activity data and assumptions about future changes in emissions drivers. Less accurate approaches include simple extrapolations of historical trends in emissions, emissions intensity, and/or key drivers such as gross domestic product (GDP), energy prices, and population. In all cases, models require input data and assumptions and provide users with projections of future activity data and associated emissions. See Box 6.3 for general algorithms for modeling baseline scenario emissions.

[30] From Maurice N. LeFranc, Jr., "Crafting national baselines: What do different approaches tell us and are there 'best practices'?," Presentation to OECD Climate Change Expert Group Seminar, March 19-20 2012, http://www.oecd.org/env/cc/50024950.pdf.

Box 6.3. General algorithms for modeling baseline scenario emissions

In its simplest form, a baseline scenario is an emissions inventory for future years that uses projected instead of historical values for activity data and emissions factors. General algorithms for baseline scenarios include:

$$\textbf{Baseline Scenario Emissions} = \text{Projected activity data} \times \text{Projected emission factor}$$

$$\textbf{Baseline Scenario Emissions} =$$

$$\text{Projected energy consumption} \times \text{Projected energy efficiency} \times \text{Projected GHG intensity of energy generation} + \text{Projected non energy emissions} - \text{Projected GHG removals}$$

Baseline scenario emissions from the energy sector can also be expressed as a Kaya identity:

$$\textbf{Baseline scenario emissions from the energy sector} =$$

$$(\text{Projected population}) \text{ X } \left(\frac{\text{Projected GDP}}{\text{Projected population}}\right) \times \left(\frac{\text{Projected gross energy consumption}}{\text{Projected GDP}}\right) \times \left(\frac{\text{Projected emissions}}{\text{Projected gross energy consumption}}\right)$$

These algorithms are not sufficient on their own to develop baseline scenarios, but are shown to illustrate the underlying logic of how emissions projections may be created.

Choosing a model

The type of model used will depend on user objectives, data availability, and financial and technical resources. Two major categories of models exist: top-down and bottom-up. In general, top-down models focus on macroeconomic processes and linkages while bottom-up models typically assess distinct sectors and technologies, including costs and emissions reduction capabilities. Top-down models can be sub-divided into simple extrapolation models, which project emissions based on forecasts of economic output and associated emissions intensity, and more complex computable general equilibrium models, which simulate macroeconomic interactions between sectors.

Bottom-up models can be sub-divided into accounting models, which project changes based on assumptions about structural and/or policy development in each sector, and optimization models, which are based on assumptions about optimal behavior for economic agents.[31] Hybrid models are a third class, which combine elements from both the top-down and bottom-up approaches.[32] See Table 6.1 for an overview of modeling approaches.

[31] Based on Søbygaard et al. (2013).
[32] For further information on differences among models see: Christa Clapp and Andrew Prag, "Emissions baselines for national climate policy: Options for improving transparency and consistency," OECD, 2012, http://www.oecd.org/env/cc/CCXG%20(2012)3%20National%20Baselines.pdf; Christa Clapp, et al., "National and sectoral GHG mitigation potential: A comparison across models," OECD, 2009, http://www.oecd.org/env/cc/44050733.pdf; and Søbygaard et al. (2013).

Table 6.1. Overview of modeling approaches[33]

	Top-down		Bottom-up		Hybrid
	Simple extrapolation	**Computable general equilibrium**	**Accounting**	**Optimization**	
Data	Use aggregated macroeconomic data		Use detailed sector-specific data on fuels, technologies, and policies		Uses top-down and bottom-up data
Strengths	Ease of use and potentially small data needs	Captures feedback effects on macroeconomic variables	Ease of use and potentially small data needs	Captures technological detail and offers least-cost projections	Captures technological detail and macroeconomic linkages
Weaknesses	Lack of technological detail		Does not capture linkages with broader macroeconomic developments		Can be very resource intensive
Examples	Spreadsheet models	ENV-Linkages (OECD), SGM, and CETA	LEAP, MEDEE, and MAED	MARKAL/TIMES, POLES, RESGEN, and EFOM	WEM, NEMS, MARKAL-MACRO, and IPAC

Models can be jurisdiction-specific or generic. Jurisdiction-specific models are purpose-made models developed by individual jurisdictions and designed to reflect their particular circumstances. Examples of jurisdiction-specific models include the U.S.'s National Energy Modeling System (NEMS) model, Canada's Energy-Economy-Environment Model for Canada (E3MC) model, and the United Kingdom's Dynamic Dispatch Model (DDM). Generic models are not designed to fit the specifications of any one jurisdiction, but instead developed to fit the needs of multiple users. Examples of generic models include the Long-range Energy Alternatives Planning System (LEAP) and the Market Allocation (MARKAL) model. Generic models can also be customized by users to fit their specific needs.[34] For users with limited capacity[35], generic models can provide a more convenient solution than jurisdiction-specific models for homogenous sectors like electricity generation, cement, and iron and steel. However, for uncommon or diverse sectors, a jurisdiction-specific or customized generic model may be needed, since off-the-shelf generic models are not typically available for these types of sectors.[36]

Users with baseline scenario goals should develop a goal baseline scenario using a jurisdiction-specific model. If a jurisdiction-specific model is not available, users should use a generic model customized to fit their jurisdiction. If a customized generic model cannot be used, users should use a generic model. If a generic model cannot be used, then users may choose an existing baseline scenario that has been developed for their jurisdiction by a third party as their goal baseline scenario. Examples include emissions projections developed by the International Energy Agency (IEA) and the U.S. Energy Information Administration (EIA) (see Table 6.2 for more examples).

Any third party baseline scenario used as a goal baseline scenario shall cover the same sectors and gases as the goal. If a jurisdiction's goal and the third party baseline scenario cover different sectors and gases, the third party baseline scenario shall not be used without necessary modifications.

[33] Adapted from Søbygaard et al. (2013).
[34] For examples of national experiences in customizing models see Søbygaard et al. (2013).
[35] For capacity building information related to baseline scenarios see Søbygaard et al. (2013) and "Modelling Methodologies", Mitigation Action Plans & Scenarios (MAPS), accessed July 24, 2013, http://www.mapsprogramme.org/category/themes/modelling-methodologies/.
[36] For more information see Søbygaard et al. (2013).

Users with baseline scenario goals shall disclose and justify the projection method used for developing the goal baseline scenario and estimating associated goal baseline scenario emissions.

Table 6.2. Examples of existing projections

Publication	Methodology	Country/regional scope	Coverage
IEA World Energy Outlook	World Energy Model	World; OECD; OECD Americas; USA; OECD Europe; EU; OECD Asia Oceana; Japan; Non-OECD; Eastern Europe/ Eurasia; Russia; non-OECD Asia; China; India; Middle East; Africa; Latin America; Brazil	Energy demand, gross electricity generation, electricity capacity, and CO_2 emissions from fuel combustion
United States EIA International Energy Outlook	WEPS+ Model	World; OECD; USA; Canada; Mexico and Chile; OECD Europe; Japan; South Korea; Australia/New Zealand; non-OECD; Russia; non-OECD Europe and Eurasia; China; India; non-OECD Asia; Middle East; Africa; Brazil; Other Central and South America	Energy consumption by end-use sector and fuel; Electricity capacity and generation by fuel; Population; GDP; Energy intensity; CO_2 intensity
IPCC Fifth Assessment Report (*forthcoming*)[37]	Shared socioeconomic pathways (SSPs)	Almost all countries	Combination of qualitative information related to country development and quantitative information on emissions and socioeconomic drivers such as population and per capita income.
United States EPA - Draft Global Non-CO_2 Emissions Projections Report: 1990-2030	In general, projections are based on countries' National Communications	Data are available for virtually all countries[38]	Methane (CH_4), nitrous oxide (N_2O), and the high global warming potential (high GWP) gases. The high GWP gases include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

6.2.2. Choose a timeframe for the baseline scenario

The timeframe for the baseline scenario refers to the period over which emissions are projected. Users with baseline scenario goals shall use a timeframe for their baseline scenario that matches the goal period, at a minimum. For example, for a user with a goal period of 2010 – 2030, the timeframe for the goal baseline scenario is 2010 – 2030, at a minimum. For planning purposes, users may project emissions farther into the future beyond the goal period. The selected timeframe shall be reported.

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[37] For more information see Clapp and Prag (2012), and Nigel Arnell et al.. "A framework for a new generation of socioeconomic scenarios for climate change impact, adaptation, vulnerability, and mitigation research," http://www.isp.ucar.edu/sites/default/files/Scenario_FrameworkPaper_15aug11_0.pdf

[38] U.S. Environmental Protection Agency (U.S. EPA), "Global anthropogenic non-CO_2 greenhouse gas emissions: 1990-2030," Washington, 2012, http://www.epa.gov/climatechange/Downloads/EPAactivities/EPA_Global_NonCO2_Projections_Dec2012.pdf.

Historical emissions data form the starting point for the timeframe of the baseline scenario. Baseline scenarios can be based on a single historical year of emissions inventory data or trends across a historical period of data. The choice of year or years depends on the availability of recent, representative, reliable, and verifiable data. As the starting point for their baseline scenario, users should choose the most recent year or years for which emissions inventory data is available. However, if inventory data of sufficient quality are not available for recent years, users may choose an earlier year or years. Historical emissions data for the baseline scenario should be collected from jurisdictions' inventory for the selected historical year or period.

If a single year is chosen as the starting point for the baseline scenario, the choice of year can have a significant effect on resulting baseline scenario emissions, especially if emissions in the chosen year are uncharacteristically high or low. If quality data are available, users should choose an historical emissions period as the basis of their baseline scenario. This approach provides an average emissions level over multiple years and helps to smooth year-to-year fluctuations in emissions, which creates a more representative and reliable starting point for the projection.

Users with baseline scenario goals shall report either a historical emissions year or period for which representative, reliable, and verifiable emissions data are available and specify their reasons for choosing that particular year or years. Users shall report the source of the historical emissions data used to develop the baseline scenario.

6.2.3. Identify emissions drivers and assumptions

Identifying emissions drivers

All baseline scenarios are based on assumptions about future changes in emissions drivers. A necessary and important step, therefore, in developing any baseline scenario is identifying relevant emissions drivers and deriving assumptions about how those drivers are most likely to change during the timeframe of the scenario. Emissions drivers are socioeconomic parameters that are closely linked to the growth and decline of GHG emissions via changes in activities. For example, the growth rate of GDP typically has a significant effect on jurisdictions' emissions. Examples of emissions drivers include (see Table 6.7 for further examples):

- Economic activity (e.g., GDP and sectoral composition of GDP)
- Structural changes in economic sectors (e.g., shifts from manufacturing to service sector jobs, shifts of industrial production between countries)
- Energy prices by fuel type
- Energy demand by fuel type
- Energy supply by fuel type
- Emissions intensity by fuel type
- Population and degree of urbanization
- Technological development
- Land use practices

Users should identify emissions drivers for each sector and gas covered by the goal based on their particular circumstances and projection methodology. In most cases, key drivers used as inputs to models will include GDP, energy prices, and population. GDP is typically the single most important determinant of baseline scenario emissions. An increase or decrease in projected GDP growth rates typically results in an increase or decrease in baseline scenario emissions.[39] Users shall disclose and justify all emissions drivers included in the baseline scenario. At the end of the goal period, users shall report the projected

[39] See Søbygaard et al. (2013).

trends in emissions drivers (developed at the start of the goal period) alongside the actual trend in those same emissions drivers (compiled at the end of the goal period).

Defining assumptions

Once drivers have been identified, the next step is to define assumptions about how those drivers are most likely to change during the timeframe of the baseline scenario. Assumptions will differ by driver and may be based on national, international, or local projections and estimates. See Box 6.4 for examples of drivers and assumptions for the U.S. Annual Energy Outlook 2013 Reference Case Scenario.

Users should base assumptions on official sources that are reliable, verifiable, and representative of their jurisdiction. Assumptions should be chosen based on the user's assessment of what is most likely to occur. When users have official targets (e.g., a government target for economic growth) for key drivers, they should reflect upon whether they will likely be met. If not, then the most likely assumption should be used in lieu of an official target. When choosing assumptions, users should conduct a stakeholder review process (see Section 6.2.5). Users with baseline scenario goals shall disclose and justify all assumptions related to emissions drivers used to develop the baseline scenario.

Box 6.4. Examples of drivers and assumptions for U.S. Annual Energy Outlook 2013 Reference Case Scenario[40]

The U.S. Energy Information Administration (EIA) develops emissions projections for the U.S. energy sector as part of the Annual Energy Outlook using the National Energy Modeling System (NEMS), a U.S.-specific hybrid model. Below are assumptions for three drivers – GDP, oil prices, and energy consumption – for the 'Reference Case Scenario'.

Table 6.3. Average annual percentage growth rate assumptions

	2011-2015	2011-2025	2025-2040	2011-2040
AEO2013 (Reference Case)	2.5	2.6	2.4	2.5

Table 6.4. Oil price assumptions for West Texas Intermediate (WTI) and Brent Crude (2011 dollars per barrel)

	2011		2025		2035		2040	
	WTI	Brent	WTI	Brent	WTI	Brent	WTI	Brent
AEO2013 (Reference Case)	94.86	111.26	115.36	117.36	143.41	145.41	160.68	162.68

Table 6.5. Projected energy consumption for select sectors (quadrillion Btu)

Sector	2011	2025	2035	2040
Residential	11.3	11	11.4	11.6
Commercial	8.6	9.2	9.9	10.2
Buildings	19.9	20.3	21.2	21.8
Industrial	24	27.5	27.8	28.7
Transportation	27.1	26.7	25.9	27.1

[40] For more information see U.S. Energy Information Administration, "Annual Energy Outlook 2013: With projections to 2040," U.S. Department of Energy, 2013, http://www.eia.gov/forecasts/aeo/pdf/0383(2013).pdf.

Collecting data

Specific data needs related to developing the baseline scenario will depend on the projection methodology used, but will include data for drivers, assumptions, and emissions factors. Some methods or models may require both historical activity data for drivers and assumptions about future changes, while others may require only projected activity data for each driver. Historical and projected data may be collected from existing sources or may be generated using models, surveys, or other relevant methods (see Table 6.7 for examples of common baseline scenario data types and sources.)

Users should establish formal procedures for collecting, compiling, and storing data from existing sources and for generating new data, based on the circumstances of their jurisdiction. Good practice data collection principles include:[41]

- Focus on collecting and improving data for the most significant emissions sources and drivers
- Establish data collection procedures (resource prioritization, planning, implementation, and documentation) that lead to continuous improvement of data quality
- Collect data at the level of detail appropriate for the projection methodology used
- Establish data sharing agreements with data suppliers to ensure consistent and continuous information flows
- Regularly review data collection procedures and data needs to guide continuous improvement of data collection activities

<u>Collecting data from existing sources</u>

In some cases, existing data sources of sufficient quality may be available to determine values for drivers and assumptions. Historical and projected data may be collected from:

- National, regional, state, city, and/or sector-level sources specific to the jurisdiction, such as departments or ministries of environment, energy, economics, transportation, and industry, and national statistics offices.
- International sources like the International Energy Agency (IEA), United Nations (UN), International Monetary Fund (IMF), and World Bank.
- Peer-reviewed literature

Users should use high-quality, peer-reviewed data from recognized, credible sources when available. Sources of data can vary in quality. When selecting data sources, users should apply the data quality indicators in Table 6.6 as a guide to obtaining the highest quality data available. The data quality indicators describe the representativeness of data (in terms of technology, time, and geography) and the quality of data measurements (i.e., completeness and reliability of data). Users should select data that are the most representative in terms of technology, time, and geography; most complete; and most reliable. When uncertainty is high, users should choose conservative values. Conservative values are those that are more likely to underestimate, rather than overestimate, baseline scenario emissions. Users shall document and report all sources of data used to develop the baseline scenario, including activity data, emission factors, and assumptions.

[41] Based on European Commission, "Draft GHG Projection Guidelines, Part A: General Guidance," CLIMA.A.3./SER/2010/0004, 2012, http://ec.europa.eu/clima/policies/g-gas/monitoring/docs/ghg_projection_guidelines_a_en.pdf

Table 6.6. Data quality indicators

Indicator	Description
Technological representativeness	The degree to which the data set reflects the relevant technology(ies)
Temporal representativeness	The degree to which the data set reflects the relevant time period
Geographical representativeness	The degree to which the data set reflects the relevant geographic location (e.g., country, city, or site)
Completeness	The degree to which the data is statistically representative of the relevant activity. Completeness includes the percentage of locations for which data is available and used out of the total number that relate to a specific activity. Completeness also addresses seasonal and other normal fluctuations in data.
Reliability	The degree to which the sources, data collection methods and verification procedures used to obtain the data are dependable.

<u>Generating new data</u>

In cases where no published data are available (historical or projected), or the existing data are incomplete, of poor quality, or in need of supplementation or further disaggregation, users should generate new data and assumptions. Users shall report a detailed description of the methodology used to develop new baseline scenario data and assumptions.

To develop new baseline values, users should:

1. Collect historical data for the driver going back to the earliest date for which data are available. Users should collect data with as high a frequency as is available (e.g., monthly data should be preferred over quarterly data, which should be preferred over annual data).
2. Derive assumptions about how the driver will change based on published sources.
3. Determine parameter values for each driver.

Users shall disclose and justify all new data used to develop their baseline scenario and the methodology used to generate new data.

Table 6.7. Examples of data types and sources for various drivers[42]

Category	Types of Data	Common Data Sources
Macroeconomic Variables		
Sectoral driving variables	GDP/value added, population, household size	National statistics and plans; macroeconomic studies; World Bank, GDP data, UN Population data, World Resources Institute.
More detailed driving variables	Physical production for energy intensive materials; transportation requirements (pass-km/year); agricultural production and irrigated area; commercial floor space, etc.	Macroeconomic studies; national sectoral studies, household surveys, UN FAO Agrostat database; etc.
Energy Demand		
Sector and subsector totals	Fuel use by sector/subsector	National energy statistics, national energy balance, energy sector yearbooks (oil, electricity, coal, etc.), International Energy Agency statistics.
End-use and technology characteristics	Energy consumption by end-use and device: e.g. new vs. existing building stock; vehicle stock; breakdown by type, vintage, and efficiencies; or simpler breakdowns.	Local energy studies; surveys and audits; studies in similar countries; general rules of thumb from end-use literature.
Response to price and income changes	Price and income elasticities	Econometric analyses of time-series or cross-sectional data.
Energy Supply		
Technical characteristics	Capital and O&M costs, performance, efficiencies, capacity factors, etc.	Local data, project engineering estimates, EPRI Technical Assessment Guide,
Energy prices		Local utility or Govt projections. IEA World Energy Outlook and fuel price projections.
Energy supply plans	New capacity on-line dates, costs, characteristics.	National or electric utility plans & projections; other energy sector industries.
Energy resources	Estimated recoverable reserves of fossil fuels; estimated costs and potential for renewable resources	Local energy studies; World Energy Council Survey of Energy Resources.
Technology Options		
Costs and performance	Capital and O&M costs, performance (efficiencies, unit intensities, capacity factors, etc.)	Local energy studies and project engineering estimates; technology suppliers; other mitigation studies,
Penetration rates	Percent of new or existing stock replaced per year; overall limits to achievable potential	Extrapolation of trends & expert judgment, optimizing or simulation models.
Administrative and program costs	For efficiency investment, often expressed in cost per unit energy saved.	Local and international studies.
Emission Factors	Kg GHG emitted per unit of energy consumed, produced, or transported.	National inventory assessments; IPCC Revised Inventory Guidelines (IPCC, 1996); CORINAIR; CO2DB, GEMIS, AIR CHIEF; IPCC Technology Characterization Inventory (US DOE, 1993); TED

[42] UNFCCC, "Mitigation Assessments: Module 5.1, Mitigation assessment tools in the energy sector," accessed June 20, 2013, http://unfccc.int/resource/cd_roms/na1/mitigation/Module_5/Module_5_1/a_Mitigation_assessment_tools_energy/Module5_1.ppt

6.2.4. Include policies and actions in the baseline scenario

Future emissions within a jurisdiction will be affected by policies and actions implemented by that jurisdiction, including policies and actions designed to reduce emissions as well as those designed to meet other goals.[43] The assumptions made about the likely GHG effects of policies and actions in the baseline scenario can have a significant effect on resulting baseline scenario emissions. Therefore, it is critical that policies and actions are accounted for in the baseline scenario in a relevant, complete, consistent, transparent, and accurate manner.

Baseline scenarios should include all policies and actions that have a significant effect on GHG emissions (either increasing or decreasing) that are implemented or adopted in the year the baseline scenario is developed. See Box 6.5 for definitions of implemented, adopted, and planned policies and actions. If the baseline scenario does not include all policies and actions with a significant effect on emissions, it will not reflect the most likely future emissions trajectory.

Box 6.5. Adopted, implemented, and planned policies and actions[44]

Implemented policies and actions are those that are currently in effect, as evidenced by one or more of the following: (a) relevant legislation or regulation is in force; (b) one or more voluntary agreements have been established; (c) financial resources have been allocated; or (d) human resources have been mobilized.

Adopted policies and actions are those for which an official government decision has been made and there is a clear commitment to proceed with implementation, but that have not yet been implemented.

Planned policies and actions are options under discussion and having a realistic chance of being adopted and implemented in future, but that have not yet been adopted or implemented.

Users should not include adopted policies in the baseline scenario if there is reason to believe the adopted policy will not be implemented (e.g., due to litigation or other reasons). Users may optionally include planned policies and actions in the baseline scenario but shall disclose these policies and actions as being "planned only" and distinguish planned policies from adopted policies. Users should be aware of the risks of double counting the GHG effects of overlapping policies and actions in the baseline scenario and work to prevent such double counting. For more information on quantifying the GHG effects of policies and actions, see the *GHG Protocol Policy and Action Standard*.

Users should define a significance threshold to determine whether a policy or action has a significant effect on emissions. See Box 6.1 for a description of significance thresholds. Users with baseline scenario goals shall disclose and justify the significance threshold used and apply it in a consistent manner across all relevant policies. Users with baseline scenario goals shall disclose which policies with significant effects on GHG emissions are included in the baseline scenario, and disclose and justify the exclusion of any significant policies. In addition, users with baseline scenario goals shall disclose and justify the cut off year for the baseline scenario, or the year after which no new policies or actions are included in the baseline scenario.

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[43] For the purposed of this standard, policies and measures refers to interventions taken or mandated by a government and may include laws, regulations and standards; taxes, charges, subsidies and incentives; information instruments; voluntary agreements; implementation of new technologies, processes, or practices; and public or private sector financing and investment, among others. 'Policies' is used as shorthand for policies and measures.

[44] Based on UNFCCC, "Review of implementation of the commitments and of other provisions of the Convention: UNFCCC guidelines on reporting and review," FCCC/CP/1999/7, 2000, http://unfccc.int/files/national_reports/annex_i_natcom/_guidelines_for_ai_nat_comm/application/pdf/01_unfccc_reporting_guidelines_pg_80-100.pdf.

Users with baseline scenario goals shall report the assumptions and methodologies used to estimate the effects of included policies and actions included in the baseline scenario.

Users may develop additional scenarios according to other approaches as a means for comparing a variety of plausible emissions trajectories for informational purposes. For example, users may develop scenarios that include no policies or that include all adopted, implemented, and planned policies and actions.

In addition to policies and actions, users may seek to include the effects of anticipated emissions reductions from projects (e.g., offset credits). However, there is a risk that if they are included in the baseline and also are considered in adjustments ex-ante and ex-post accounting, the emissions reductions will be accounted for twice. Therefore, instead of building the effects of projects into their baseline, users should adjust for project level emissions reductions ex-ante and ex-post (see Chapters 9 and 10). However, if the baseline does include emissions reductions for projects, adjustments can be made to accommodate this (see Section 9.4, 10.6, and 10.7).

6.2.5. Stakeholder consultation and review

The development of a baseline scenario should include stakeholder review processes, which allow relevant stakeholders (e.g., technical experts, government officials, and representatives from civil society and industry) to share, discuss, and compare their views on whether projected data for GHG emissions, emissions drivers, and assumptions are believed to be realistic or unrealistic. These views should be used to decide on the robustness of projected emissions and make necessary revisions to input data.[45]

Users should also compare baseline scenario data and projections with other similar emissions projections at the subnational, national, and/or international level. At the national or subnational level, projected baseline scenario data can be compared with data from projections developed by other in-country organizations, such as other government agencies, research institutes, or private sector institutions. At the international level, projected data can be compared with data from other organizations, such as the International Energy Agency (IEA) or U.S. Energy Information Administration (EIA). Projected socioeconomic data in particular should be directly compared to projected data from other organizations. For example, projections of national GDP used to develop a baseline scenario should be compared to national GDP projections from international organizations, such as the International Monetary Fund (IMF).

6.2.6. Recalculating baseline scenarios

During the goal period users with baseline scenario goals may discover significant and unexpected changes or errors in original data, methods, or other parameters. If by monitoring baseline scenario parameters it becomes evident that a key parameter is no longer valid, then all users with baseline scenario goals shall recalculate the goal baseline scenario and associated emissions estimates. In such cases, recalculating baseline scenario emissions is necessary to correct errors, maintain consistency, and enable meaningful comparisons of emissions over time. All users, regardless of goal type, should also recalculate any informational baseline scenario they develop if significant and unexpected changes or errors are discovered.

[45] For an example of baseline reviews for various developing countries see Søbygaard et al. (2013).

Examples of changes that would require recalculation include:

- Structural changes in the jurisdiction that have a significant impact on its baseline scenario emissions, including, for example, changes in the geopolitical boundary of the jurisdiction (see Section 5.15)
- Changes in calculation methods, including;
  - change in projection method, including change of model
  - updated inventory calculation method
  - improvements in the accuracy of emission factors or activity data
  - changes in GWP values
- Changes in goal boundary, including sectors, gases, or geographic area (see Section 5.15)
- Discovery of significant error(s) in original calculations
- Any other significant changes in the jurisdiction that would otherwise compromise the consistency and relevance of the reported GHG emissions information

When developing a goal baseline scenario, users shall develop and report a baseline scenario recalculation policy at the start of the goal period. A significance threshold shall be used to determine whether changes are significant. (See Box 6.1 for a description of significance thresholds.) Users with baseline scenario goals shall apply their recalculation policy in a consistent manner and disclose and justify the significance threshold used.

If a user chooses to use a goal baseline scenario developed by a third party, recalculating baseline scenario emissions will be difficult without modifying the third-party model. As a result, users should use a model to develop their own goal baseline scenario. If this is not possible, users shall disclose which errors or other changes to parameters were discovered and justify why the baseline scenario could not be recalculated.

Users with baseline scenarios goals shall disclose and justify any baseline scenario recalculations made during the goal period. At the end of the goal period, users with baseline scenario goals shall report recalculated baseline scenario emissions alongside the original baseline scenario emissions (associated with the baseline scenario developed at the beginning of the goal period).

6.2.7. Updating dynamic baseline scenarios for changes in emissions drivers

While all users with a baseline scenario goal – both static and dynamic (see Section 5.8) – are required to recalculate the baseline scenario if a key parameter is no longer valid, only dynamic baseline scenario goals shall be updated. In contrast to baseline recalculation, which is performed when there are changes in calculation methods or there is a discovery of an error, baseline updates are performed when there are observed changes in emissions drivers (e.g., GDP, energy prices, population) during or after the goal period that cause significant deviations from previous assumptions. Updating a dynamic baseline scenario allows users to isolate changes in emissions resulting from mitigation efforts as compared to changes in GDP, energy prices, or other exogenous factors (for more information see Chapter 5). All users, regardless of goal type, should update informational baseline scenarios.

Users with dynamic baseline scenario goals shall develop and report a baseline scenario update policy at the start of the goal period. Whether baseline scenario emissions are updated depends on the significance of changes. A significance threshold shall be used to determine whether changes in emissions drivers are significant (see Box 6.1 for a description of significance thresholds). Users with dynamic baseline scenario goals shall apply their update policy in a consistent manner and disclose and justify the significance threshold used.

At the end of the goal period users with dynamic baseline scenario goals shall review baseline scenario assumptions to determine whether they are still valid. If by reviewing baseline scenario assumptions it becomes evident that one or more of the assumptions have changed in a way that significantly affects baseline scenario emissions, users with dynamic baseline scenario goals shall update baseline scenario emissions for the target year or each year in the target period. These users shall report updated baseline scenario emissions alongside the original baseline scenario emissions (associated with the baseline scenario developed at the beginning of the goal period).

In order to consistently track progress during the goal period, users with dynamic baseline scenario goals should regularly review baseline scenario assumptions and update baseline scenario emissions according. Users with multi-year dynamic baseline scenario goals in particular should update their baseline scenario annually during the goal period. Users with single year goals dynamic baseline scenario goals may update their baseline scenario annually or at a different frequency. Users with dynamic baseline scenario goals shall disclose and justify any baseline scenario updates made during the goal period.

6.2.8. Uncertainty and sensitivity analysis

Since all baseline scenarios are descriptions of future events, it is unlikely that they will be completely accurate. As mentioned, baseline scenarios are not predictions of the future but rather estimated emissions pathways given certain assumptions and methodologies. Therefore, the development of baseline scenarios is subject to large uncertainties, especially related to future changes in emissions drivers.

Uncertainty is a lack of knowledge of the true value of a variable and depends on the quality and quantity of relevant data and quality of assessment methods. Understanding uncertainty is crucial for properly developing and interpreting baseline scenario emissions. Identifying and documenting sources of uncertainty through an uncertainty analysis can assist users in understanding the steps required to help improve the robustness of their baseline scenario and increase the level of confidence users and stakeholders have in it.

An uncertainty analysis is a systematic procedure to quantify and/or qualify sources of uncertainty. Uncertainty analyses can be used within the baseline scenario development process as a tool for guiding data quality improvements, as well as a tool for reporting uncertainty results. Users should identify and track key uncertainty sources throughout the process and iteratively check whether the confidence level of the results is adequate for the stated objectives. Users may choose a qualitative and/or quantitative approach to uncertainty analysis. Quantitative uncertainty analysis can provide more robust results than a qualitative assessment and better assist users in prioritizing data improvement efforts. Including quantitative uncertainty results in the GHG assessment report also adds clarity and transparency to users of the report. Users should report both qualitative and quantitative (if completed) uncertainty information. Users should also report their efforts to reduce uncertainty in future revisions of the assessment, if applicable.

Types of uncertainty

Uncertainty can be divided into three categories: parameter uncertainty; scenario uncertainty; and model uncertainty. The categories are not mutually exclusive, but they can be evaluated and reported in different ways. Table 6.8 illustrates these types of uncertainties and corresponding sources.

Table 6.8. Types of uncertainties and corresponding sources

Types of uncertainty	Sources
Parameter uncertainty	Historical emissions data
	Historical activity data for emissions drivers
	Historical emissions factors
	Projected emissions data
	Projected activity data for emissions drivers
	Projected emissions factors
	Assumptions about future changes in drivers and emissions factors
Scenario uncertainty	Methodological choices (e.g., inclusion of policies)
Model uncertainty	Model limitations

Parameter uncertainty

Parameter uncertainty refers to whether a value used in the development of the baseline scenario accurately represents its true value. Measurement errors, inaccurate approximation, unreliable projections, and low quality data sources influence parameter uncertainty. If parameter uncertainty can be determined, it can typically be represented as a probability distribution of possible values that includes the chosen value used in the baseline scenario. Parameter uncertainty can be for a single parameter (e.g., emissions factor) or for multiple parameters. To identify the influence of parameter values on resulting baseline scenario emissions, users should undertake sensitivity analysis (see below). In addition, for understanding the combined uncertainty of multiple parameters, random sampling (such as in the Monte Carlo method) and analytical formulas (such as in the Taylor Series expansion method) can be used.

Scenario uncertainty

While parameter uncertainty is a measure of how close the data used to calculate baseline scenario emissions are to the true (though unknown) values, scenario uncertainty refers to variation in baseline scenario emissions due to methodological choices. When there are multiple methodological choices available in the standard (e.g., the inclusion of policies), scenario uncertainty is created. The use of standards results in a reduction in scenario uncertainty by constraining choices the user may make in their methodology. To identify the influence of the methodological choices on resulting baseline scenario emissions, users should undertake sensitivity analysis (see below).

Model uncertainty

Model uncertainty arises from limitations in the ability of modeling approaches used to reflect the real world. Simplifying the real world into a numeric model always introduces some inaccuracies, especially when projecting future events. In many cases, model uncertainties can be represented, at least in part, through the parameter or scenario approaches described above. However, some aspects of model uncertainty might not be captured by those classifications and are otherwise very difficult to quantify.

Reporting uncertainty

Users should report uncertainty estimates for their baseline scenarios. Uncertainty estimates may be reported in many ways, including qualitative descriptions of uncertainty sources, and quantitative representations, such as error bars, histograms, probability density functions, among others. It is useful to provide as complete a disclosure of uncertainty information as is possible. Users of the information may then weigh the total set of information provided in judging their confidence in the information.

Sensitivity analysis

Sensitivity analysis assesses the extent to which the outputs of the modeling approach (e.g., projected activity data, projected emissions factors, and projected emissions) vary according to model inputs (e.g., assumptions, projected values for key emissions drivers, and methodological choices). It can be used to explore model sensitivity to inputs and the uncertainty associated with model outputs. In practice, sensitivity analysis involves testing a range of values for key parameters (or combination of parameters) that are known to be uncertain or subject to judgment. Typically, sensitivity analysis is conducted for one parameter at a time. The aim is to quantify the effect that changes in a parameter value has on the relevant model output. For example, assessing the sensitivity of baseline scenario emissions to changes in GDP may involve testing a range of possible GDP growth rates and analyzing how changes in the growth rate affects emissions. Changes that fall within plausible ranges generally suggest that the baseline scenario may be robust.

When developing a baseline scenario, users should identify key parameters that are most relevant for affecting overall baseline scenario emissions and conduct sensitivity analysis on them. Since baseline scenario emissions are often sensitive to changes in GDP, energy intensity of GDP, and energy prices, sensitivity analysis should, at a minimum, be conducted on these parameters.[46] Users should also use sensitivity analysis to develop a range of plausible baseline scenarios (see below). Users should report the results of sensitivity analyses.

6.2.9. Developing a range of plausible baseline scenarios

In order to reflect the range of plausible assumptions about future changes in key drivers and the uncertainty associated with any one assumption or parameter, users with baseline scenario goals should develop a range of plausible baseline scenarios, instead of a single scenario. Because baseline scenarios are generally very sensitive to key drivers, assessing the baseline scenario against a number of other plausible emissions pathways will help to ensure that the scenario is robust. A range can reflect the upper and lower bounds of plausible emissions pathways associated with a range of values for key emissions drivers like GDP, energy prices, population, and technological change. Furthermore, each baseline scenario in the range can reflect a different storyline about future events (e.g., high GDP growth scenario, low GDP scenario, etc.). The presentation of multiple baseline scenarios provides users and stakeholders with information on the sensitivity of baseline scenario emissions to changes in key drivers and methodological choices such as the inclusion of policies. This information enables a better understanding of likely baseline scenario emissions, which can build confidence among stakeholders in the chosen scenario. Developing a baseline scenario range can also help to guide baseline scenario updates, if relevant, by providing a transparent means to switch among scenarios, for example based on changes in GDP growth, without having to rerun the model.[47]

Once a range of plausible baseline scenarios has been developed, users with baseline scenario goals shall define a single baseline scenario pathway for setting the goal, such as the average baseline scenario of the range or the most conservative baseline scenario (see Figure 6.4). To ensure environmental integrity, users should set their goal against a conservative baseline scenario, i.e., an emissions pathway within the lower bound of the range. If a range of scenarios was created, users should report the range of plausible baseline scenarios and where their goal baseline scenario is located with the range.

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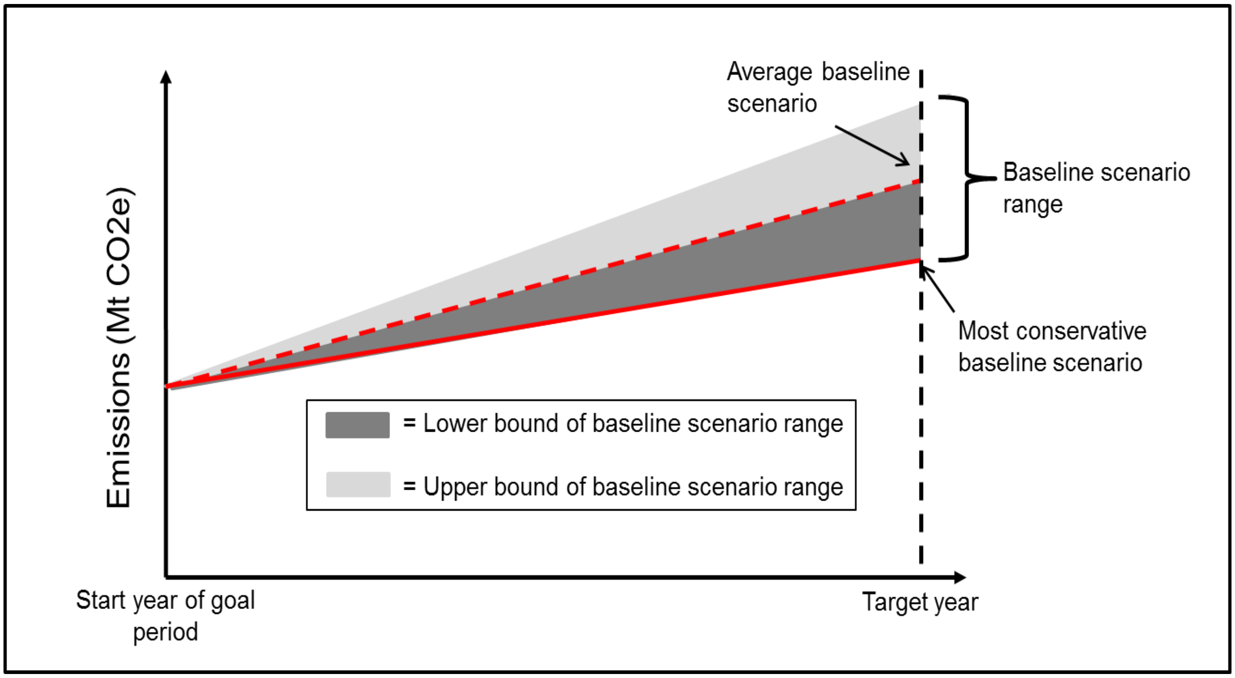
[46] For more information see Geoffrey Blanford, et al., "Baseline projections of energy and emissions in Asia," *Energy Economics* 34 (2012), S284-S292, http://www.sciencedirect.com/science/article/pii/S0140988312001764 and Søbygaard et al. (2013).
[47] Clapp and Prag (2012).

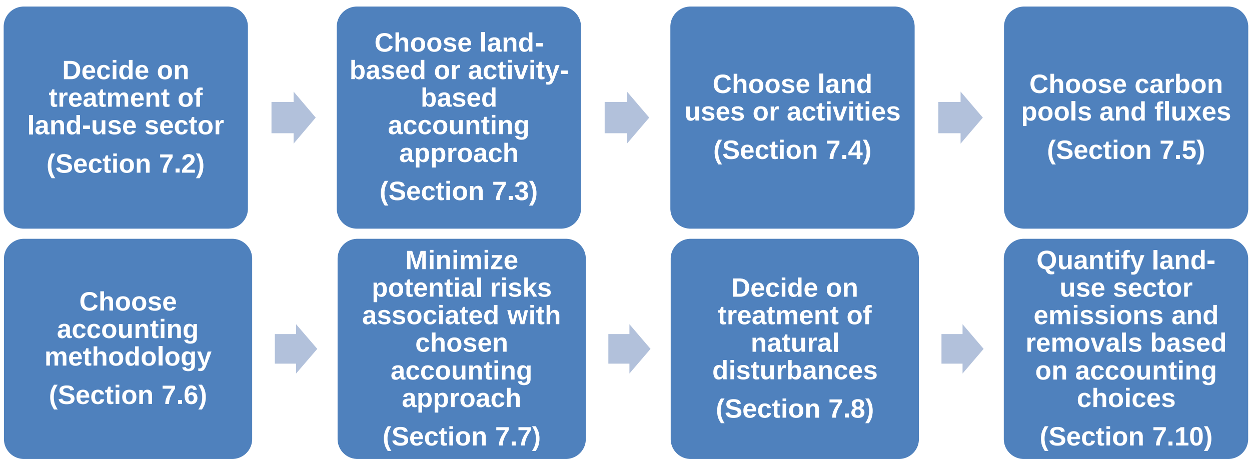
Figure 6.4. Average versus conservative baseline scenarios



Chapter 7: Accounting for the land-use sector

This chapter provides guidance on accounting for emissions and removals from the land-use sector. In most sectors, tracking progress toward a mitigation goal can generally be accomplished by comparing GHG inventory emissions; however, this type of accounting may not be appropriate for the land-use sector, given the significant role of non-anthropogenic emissions. Accordingly, the sector is treated separately in this chapter and users can adopt a method that differs from an inventory approach to track changes in the sector.

Figure 7.1 Overview of steps in this chapter



Accounting requirements in this chapter[48]

Section 7.4
• Users shall account for the land-use sector using one of the following approaches:
    ○ Include the land-use sector in the boundary of the mitigation goal
    ○ Separately account for the land-use sector as a sectoral goal
    ○ Use the land-use sector as an offset for the mitigation goal
    ○ Do not account for the land-use sector
• Users shall not change the land-use sector approach during the goal period. If a user changes the way in which the land-use sector in treated in the goal during the goal period, the existing mitigation goal shall be set aside and a new goal shall be established, for which the accounting starts over again.
Section 7.5
• Within elected land-use categories or activities, users shall account for emissions and removals arising from land use as well as land-use change.
Section 7.6
• Users shall account for all significant pools, fluxes, and activities within elected land-use categories or suites of activities
Section 7.8
• Users including the land-use sector within the goal boundary shall use the same accounting methodology as is used for the goal type.

48 This table lists the accounting requirements in the chapter. Reporting requirements for this chapter are listed in Chapter 12 and are not listed below. While some sections in this chapter do not have requirements, each section in the chapter contains recommendations.

- Users shall account for all elected land-use categories/activities using the same methodology.

Section 7.10

- Users applying base year or forward-looking baseline accounting approaches that invoke a natural disturbance mechanism during the goal period shall ensure consistency with the treatment of natural disturbances in the base year/period or baseline scenario.
- If a natural disturbance mechanism is used, the user shall do the following:
    - Not exclude any removals on lands affected by a natural disturbance event/circumstance from accounting until they have balanced the quantity of emissions removed from accounting.
    - Account for emissions associated with salvage logging.
    - Not exclude emissions from natural disturbances on those lands that are subject to land-use change following the disturbance.

7.1. Introduction

How land-based emissions and removals are incorporated into the mitigation goal can have a significant impact on the overall reductions achieved as a result of the goal. Users should consider their objectives, circumstances, and capacities when making policy and methodological choices about the treatment of the land-use sector.

Existing frameworks for the treatment of land-based emissions and removals generally provide guidance for accounting in either developing or developed country contexts. However, the guidance contained in this standard is applicable to all jurisdictions. The rules and recommendations contained herein are designed to work both in conjunction with existing accounting frameworks such as those under the United Nations Framework Convention on Climate Change (UNFCCC), as well as national strategies and voluntary mechanisms.

The guidance for GHG accounting in the land-use sector established under the UNFCCC's Kyoto Protocol and the good practice guidance developed by the Intergovernmental Panel on Climate Change for accounting under that process are the most immediately relevant examples of land-use accounting.[49] However, accounting under the Kyoto Protocol is highly tailored to the specific circumstances of Annex I countries participating in a compliance regime. Therefore, while portions of this standard build upon the technical recommendations and practices contained in the Kyoto Protocol and its supporting documents, users should remain aware that the principles underlying the GHG Protocol differ from those of the Kyoto Protocol's accounting mechanism.

Specifically, the focus of accounting for the land-use sector under the Kyoto Protocol is to incentivize greenhouse gas mitigation and to allow Annex I countries to use the land-use sector to offset a portion of their emission reduction requirements in other sectors. This has resulted in a number of accounting mechanisms, including exemptions from accounting, that are uniquely tailored to the Kyoto Protocol context. In contrast, the primary purpose of this standard is to help users quantify, track, and report mitigation in the land-use sector in an accurate, consistent, transparent, complete, and relevant manner. Accordingly, users should therefore assess and report all emissions and removals that affect the atmosphere, but users may remove non-anthropogenic emissions and removals (e.g., in an effort to be consistent with the UNFCCC). [50]

[49] The IPCC's guidance for accounting under the Kyoto Protocol is contained in the 2003 publication, *Good Practice Guidance for Land Use, Land-Use Change and Forestry,* at http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf. html. The IPCC's guidelines on greenhouse gas inventories, including those for the land-use sector, are distinct from the Good Practice Guidance.

[50] The GHG Protocol acknowledges that users may require flexibility in accounting for the land-use sector in particular.

Definition of the land-use sector

Use of the term "land-use sector" in this guidance applies to accounting for land-based emissions and removals and is based on the IPCC's land-use categories as contained in Volume 4 of the *2006 Guidelines for National Greenhouse Gas Inventories*.[51] This chapter references the following land-use categories: forest land, cropland, grassland, wetland, and settlement. However, accounting for the land-use sector does not require a user to account for all land-use categories, as discussed below.

This chapter covers emissions and removals of greenhouse gases from land, including land in agricultural production and grazing lands/grasslands. However, it does not cover accounting for GHG fluxes from on-farm agricultural activities, such as manure management or fossil fuel-based emissions from on-farm use of electricity, heat, or vehicles. These and other such emissions should be accounted for under their corresponding sectors or categories, for example energy and transportation.

Difference between the land-use sector and other sectors

In most sectors, tracking progress toward a mitigation goal can generally be accomplished by comparing GHG inventory emissions for covered gases during or after the goal period with base year or baseline scenario emissions (see Chapter 10 for more information). However, this type of accounting may not be appropriate for the land-use sector, especially since a GHG inventory may contain GHG fluxes that may not be desirable to include in accounting.

Land-use sector accounting methods described in this chapter presuppose that a user has established an inventory consistent with the principles and guidance contained in the IPCC *Guidelines for National Greenhouse Gas Inventories*.[52] Users should use the most recently adopted IPCC guidance, including any supplementary methodologies, in establishing and maintaining their GHG inventories for the land-use sector.

What makes the land-use sector unique?

Unlike other sectors, the emissions included in a GHG inventory for the land-use sector includes fluxes of both anthropogenic and non-anthropogenic origin. The two dominant sources of non-anthropogenic fluxes are (1) natural disturbances, which may include discrete events such as fires, windstorms, hurricanes, landslides, and tsunamis, or more continuous disturbances such as a pest outbreak or prolonged drought; and (2) pre-mitigation land-use management that continues to influence emissions and removals during the goal period.[53] While in certain instances fluxes arising from either or both of these categories may have an anthropogenic component (e.g., the ignition of a forest fire may have been human-caused or an aging forest was established through direct human intervention at some point in the past) determining the ultimate origin of these circumstances is beyond the scope of this guidance.[54] The treatment of anthropogenic versus non-anthropogenic fluxes in the land-use sector has fundamental implications for mitigation accounting. Users may choose to include or exclude non-anthropogenic fluxes in their mitigation accounting, as discussed further in this chapter.

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[51] IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

[52] The 2006 IPCC Guidelines combine agriculture, forestry, and other land use in Volume 4. Users should keep agriculture separate from forestry and other land use for the purpose of mitigation accounting. However, the principles and inventory methodologies for individual land uses prescribed in the 2006 Guidelines are applicable for this standard.

[53] The most common instance of this phenomenon is forest age-class structure. Although it is relevant specifically for forest land, the analogous issue of sink saturation may be relevant for the croplands, grasslands, and wetlands.

[54] Reporting for the land-use sector should include information on the criteria used to distinguish anthropogenic from non-anthropogenic fluxes, including the justification for doing so.

Why does it matter if land-use accounting includes non-anthropogenic fluxes?

This standard offers a flexible approach to accounting for the land-use sector that is relevant to a broad range of jurisdictions and circumstances. For some users, non-anthropogenic fluxes will not significantly affect overall emissions. For example, users with intensively managed land-use sectors from which all emissions and removals may be directly or indirectly attributed to human management, or users that experience very few major natural disturbances, may not require specialized land-use accounting mechanisms. These users may choose to account for the land-use sector as they would for other sectors included in the goal boundary. However, other users may decide that this approach does not capture the relevant emissions and removals for their mitigation goal. For example, the GHG inventory of a user that experiences frequent, large natural disturbance events may be dominated by non-anthropogenic emissions and removals. In this instance, inventory-based accounting would reflect changes in natural disturbance events from year to year, rather than efforts to mitigate GHG emissions. Alternatively, a user that has undertaken large-scale land-use management projects or programs in the past, such as wetlands drainage or reforestation, might find that an inventory-based approach reflects predominantly the continuing impacts of past management practices, rather than present mitigation.[55] These issues might be of particular concern to users accounting for GHG mitigation in compliance regimes; such users may therefore choose to invoke additional land-use sector accounting mechanisms to minimize the impacts of non-anthropogenic and/or non-additional fluxes on its mitigation accounting. The guidance that follows is designed to capture the full scope of anthropogenic emissions and removals from the land-use sector. However, the guidance also points to accounting mechanisms and options that will allow users to remove or lessen the impacts of non-anthropogenic fluxes or non-additional emissions/removals on accounting.

7.2. Decide on the treatment of the land-use sector

Users shall account for the land-use sector using one of the following approaches:

- Include the land-use sector in the boundary of the mitigation goal
- Separately account for the land-use sector as a sectoral goal
- Use the land-use sector as an offset for the mitigation goal
- Do not account for the land-use sector

See Table 7.1 for an explanation of each of the four approaches, including an overview of advantages and disadvantages.

When choosing how to treat the land-use sector, users should consider:

- Provision of incentives to mitigate emissions in the land-use sector
- Consistency with the overall mitigation goal type
- Ease and cost of land-use accounting, including issues related to data availability
- Consistency with any existing land-use sector accounting mechanisms in which the user is participating
- Avoidance of risks in accounting framework

Users should include the land-use sector in their goal boundary for several reasons, including: as a signal that land use should be included in economy-wide greenhouse gas mitigation strategies, to minimize the potential for leakage of emissions from covered sectors, such as energy and industry, to the land-use sector; and to avoid weakening the mitigation goal, which may occur if the land-use sector is treated as an offset. However, there may be some users for which including the land-use sector in the mitigation

[55] This issue will be explored more fully in sections 7.9 and 7.10.

goal boundary is not appropriate. Such instances may arise when a chosen mitigation goal type (e.g., base year goal or intensity goal), would result in perverse incentives for the land-use sector or would result in non-additional accounting, i.e., “unearned,” debits or “free” credits that would count against a mitigation goal in a compliance regime. While there are accounting techniques that can minimize these impacts, users may alternatively choose to remove the land-use sector from the goal boundary and treat it separately, either under its own mitigation goal or as an offset, using a more appropriate accounting methodology. These options are discussed later in this chapter.

Removing the land-use sector from the goal boundary does not necessarily mean that a user would not account for the sector. While not accounting for the land-use sector altogether is one option, a user may alternatively account for emissions/removals in relation to a separate land-use sectoral goal, or it could use GHG fluxes to offset its mitigation goal, i.e., use emission reductions from the land-use sector to offset emissions in the sectors and gases covered by the goal.

Users shall disclose and justify the adopted land-use sector approach. Users not including the land-use sector within the goal boundary shall disclose and justify their rationale. Users shall report the mitigation goal level both with and without the impact of land-use sector accounting. In other words, users shall report what the mitigation goal level is for the non-land-use sectors, in addition to what it is with the effect of the land-use sector. This is especially relevant if the land-use sector is used as an offset.

Table 7.1. Overview of possible interactions between land-use sector and mitigation goal

	Land use sector is included in the mitigation goal				Separate land use sector goal	Use land use sector as an offset	Do not account for land use sector
	Base year goal	**Baseline scenario goal**	**Intensity goal**	**Fixed level goal**			
Description	Compares net emissions during the goal period to those represented in base year that is included in a goal	Compares net emissions during the goal period to those in a forward-looking baseline that is included in a goal	Net emissions measured and integrated into calculation of a goal	Net emissions from the sector tallied with other sectors and compared to the goal	Sector has a separate goal that does not interact with goal	Credits/debits from accounting added to/subtracted from the inventory and used toward mitigation goal	User does not account for land-use sector
Pros	Consistent with mitigation goal; strong signal to reduce emissions relative to historical emissions	Consistent with mitigation goal; marginal incentive to improve land-use practices; factors out fluxes from age-class legacy	Consistent with mitigation goal; creates signal to increase the efficiency of land-based production	Consistent with mitigation goal; closest to "what the atmosphere sees;" relatively easy to account	Good when goal type creates risks for land-use sector; allows user to tailor accounting approach	Brings land-use sector into mitigation framework; allows user to tailor accounting approach	Good for users with insignificant land-use emissions or lack of capacity
Cons	May result in non-additional accounting; requires historical data	Difficult to accurately project business-as-usual emissions; emissions can increase relative to historical with no penalty	Not intuitive way to measure fluxes or incentivize mitigation in the land-use sector	May result in non-additional accounting	Depending on accounting methodology chosen; may not have strong mitigation signal	May not have strong mitigation signal; risks in land-use sector accounting may result in non-additional accounting	No mitigation signal
Accounting approach	"Net-Net" accounting using historical base year	Accounting using forward-looking baseline	"Net-Net" accounting using historical base year	"Gross-Net" accounting	Can use any accounting methodology	Can use any accounting methodology	None

7.3. Choose land-based or activity-based accounting approach

After deciding on an approach to the land-use sector, the next step is to choose a land-based or activity-based accounting approach. Land-based accounting tracks performance on the basis of land-use categories while an activity-based accounting tracks performance of land-use activities. The underlying purpose of both approaches is the same: to delineate the geographic areas, pools, and fluxes to be contained within the accounting framework. Whether a user chooses land-based or activity-based accounting, the most critical consideration is the comprehensiveness of accounting, or how completely the accounting framework captures emissions and removals generated in the land-use sector.

Land-based accounting

The land-based approach determines the scope of accounting based on five land-use categories: forest land, cropland, grassland, wetland, and settlement.[56] The categories used for land-based accounting should correspond to the reporting categories in a jurisdiction's GHG inventory.[57] Accounting should cover all lands within the category of interest; for example, net emissions from all lands classified in the GHG inventory as croplands are accounted for if the land-use category of cropland is elected (see Section 7.4) for the election of land-use categories or land-use activities). Lands subject to land-use change should be accounted for under the land-use category to which they are converted. If accounting for the converted-to land use is not elected, the net emissions should be accounted for under the converted-from land use.[58]

In some instances, users may wish to use the managed land proxy in conjunction with land-based accounting to mask out non-anthropogenic fluxes from accounting. Under the managed land proxy, identified areas of land that are "unmanaged" are excluded from accounting on the assumption that any fluxes occurring on those lands are not directly attributable to human influence.[59] Users choosing to use the managed land proxy should ensure that include all lands subject to direct human intervention, as well as lands on which any identifiable portion of emissions or removals result directly or indirectly from anthropogenic activity, remain in accounting. Users shall report their use of the managed land proxy, including, the definition of "managed land," if adopted, and the geographic locations of managed and unmanaged lands.

Activity-based accounting

Activity-based accounting defines the scope of accounting on the basis of a pre-determined set of land-use practices. For example, a user may decide that the lands, pools, and fluxes to be included in accounting for the activity "grazing land management" are those impacted by livestock ranching, fire prevention, and activities related to savannah restoration. The theory underlying activity-based accounting is similar to that of the managed land proxy—to limit accounting to those lands subject to direct human influence and thereby exclude non-anthropogenic fluxes from accounting.[60]

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[56] "Other" is also used as a land-use category, but it is generally regarded as a balancing term rather than its own land use type.

[57] Except in the case of "other land use", which is typically included in national inventories submitted to the UNFCCC, but not included in this chapter.

[58] See 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 2, http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf

[59] See Chapter 3 of IPCC *Good Practice Guidance for Land use, Land-use Change, and Forestry.*

[60] Accounting for the land use, land-use change and forestry sector under the Kyoto Protocol uses an activity-based framework; other land-use mechanisms currently under development under the UNFCCC have not yet reached the point at which this determination could be made.

Activity definitions are jurisdiction-specific. In order to uphold the environmental integrity of the accounting mechanism, users that choose activity-based accounting should include all anthropogenic activities that result in changes in carbon pools and/or fluxes. Emissions resulting from land-use change activities should be accounted for. The land-use activities and sub-categories listed below are for illustrative purposes only and do not represent the complete list of activities for which users may account:

- Forest Management
    - Afforestation/Reforestation, Deforestation, Community forestry, Sustainable forest management, Protected area management
- Cropland management
    - Soil carbon management, Fertilizer/Manure management, Agroforestry, Controlled burning, Vegetation management
- Grassland management
    - Soil carbon management, Controlled burning, Vegetation management, Protected area management
- Wetland management
    - Wetland drainage, Wetland rewetting, Vegetation management, Protected area management

To some extent, a user's decision regarding whether to use land-based or activity-based accounting will be determined by the existing structure and scope of its inventory and its capacities, priorities, and goals. Regardless of the framework adopted, users should aim for comprehensive coverage of all fluxes of greenhouse gases within each elected land-use category or suite of activities. Users should also aim to include all land uses and activities in the accounting (see Section 7.4). Users utilizing the managed land proxy should include all lands subject to direct human intervention, as well as lands on which an identifiable portion of emissions or removals result directly or indirectly from anthropogenic activity. Users that have adopted activity-based accounting should aim to include all activities within a suite of activities that result in changes in carbon pools and/or fluxes. Within elected land-use categories or activities, users shall account for emissions and removals arising from land use as well as land-use change.

7.4. Choose land-use categories or activities

Users shall account for all significant pools, fluxes, and activities within elected land-use categories or suites of activities.[61] Users should aim for comprehensive coverage of all anthropogenic emissions and removals within each elected land-use category or suite of activities. As far as practicable, users should aim to include all land-use categories or suites of activities in accounting. If necessary, users may adopt a step-wise approach to accounting for additional land-use categories or activities based on data availability and capacity, contribution of additional categories to total emissions and trends. Land-use accounting should not include agricultural activities involving fossil fuel use or livestock management**.**

7.5. Choose carbon pools and GHG fluxes

Users should account for all significant land-based carbon pools and greenhouse gas fluxes within their chosen land-use categories or suites of activities. Volume 4 of the 2006 IPCC *Guidelines for National Greenhouse Gas Inventories*[62] provides technical and methodological guidance on the inclusion of carbon pools and fluxes in inventories; this guidance should inform the accounting decision made when using this standard.

[61] Significance may be defined in terms of contribution to sectoral or economy-wide emissions, short- or long-term trend, and/or mitigation potential. Emissions and subsequent removals from unforeseen, non-anthropogenic disturbances may be removed from accounting as explained in Section 7.8.
[62] http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

7.6. Choose an accounting methodology

An accounting methodology is used to assess emissions reductions within each land-use category or activity. The methodology chosen has a potentially large impact on accounting not only within the elected land-use categories/activities, but also on the mitigation goal.

Users shall use the same accounting methodology as is used for the goal type:

- **Base year goal**: Use net-net accounting methodology
- **Intensity goal**: Use net-net accounting methodology
- **Baseline scenario goal**: Use forward-looking baseline accounting methodology
- **Fixed level goal**: Use gross-net accounting methodology

Users shall account for all elected land-use categories/activities using the same methodology. Net emissions from each elected land-use category/activity shall be assessed, reported, and accounted for as separate line items in the assessment report.

A brief overview of several types of accounting methodologies is contained in Table 7.1; a more thorough explanation of those methodologies is below.

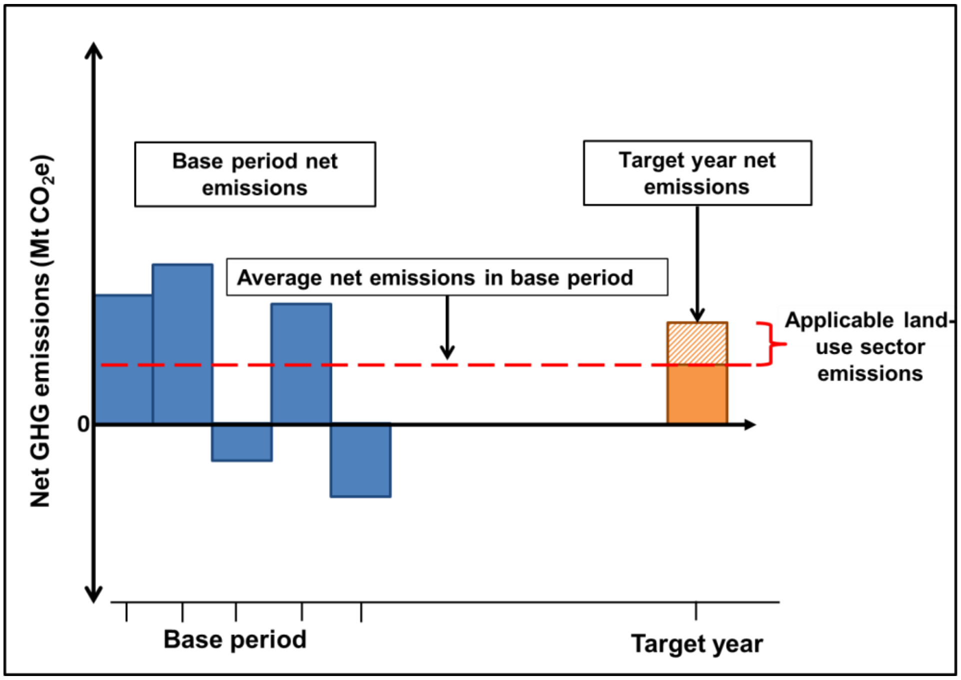
Net-net accounting approach

Relevant for: Included in goal boundary of base year goals; Included in goal boundary of intensity goals; Sectoral accounting using base year; Offset accounting using base year

Net-net is so called because it compares the net emissions (emissions + removals) in the goal period with net emissions from a historical base year or period (see Figure 7.2). Accounting under this approach reflects changes in a jurisdiction's emissions relative to past performance. Because emissions and removals in the land-use sector can be highly variable due to both anthropogenic and non-anthropogenic factors, users using a single base year risk adopting an unrepresentative value as a benchmark and thus creating an inaccurate and perverse accounting system. Adopting a 5 to 10 year base period for the land-use sector, rather than a base year, may help to minimize the effects of both inter-annual variability and long-term trends on accounting.[63] Users should use a base period rather than a base year when accounting for land use using the net-net methodology. When the mitigation goal is framed in terms of base year emissions, the base period may be formulated to span an equal number of years on either side of the base year (e.g., the base period for a 1990 base year would be 1988-1992).

[63] Throughout this standard 'base year' is used as shorthand to mean base year or base period.

Figure 7.2. Net-net accounting using a base period[64]



Users with base year goals that include the land-use sector in the goal boundary shall use net-net accounting with a historical base year. Users accounting for the land-use sector under a separate sectoral goal or using the sector as an offset should use net-net accounting with a historical base year.

Advantages

- Creates a signal for mitigation relative to historical emissions
- Consistent with mitigation goals based on historical base years or periods

Disadvantages

- Long-term trends in non-anthropogenic emissions may obscure impacts of anthropogenic mitigation and result in risks in accounting
- Emissions reductions may not be additional to what would have occurred in the absence of a mitigation goal
- Requires historical data

[64] Applicable land-use sector emissions or removals are the quantity of emissions or removals that is used to assess and report progress toward mitigation goals (see Chapter 10). The quantity of applicable land-use sector emissions or removals will vary by accounting approach.

Box 7.1. Example of net-net accounting in the land-use sector

Government A has chosen to use net-net accounting for the land-use sector. The base year is 2000, and Government A wishes to calculate emissions reductions for the cropland category of land use for the year 2020. Total emissions from croplands in Government A in 2000 were 40 Mt $CO_2$2e, and total removals were 20 Mt CO_2e. Net emissions in the base year were therefore 20 Mt CO_2e. In 2020, total emissions were 30 Mt CO_2e, and total removals were 25 Mt CO_2e. Therefore, net emissions in 2020 were 5 MtCO_2e. To calculate emissions reductions, subtract net emissions in the reporting year (5 Mt CO_2e) from net emissions in the base year (20 Mt CO_2e). In this example, Government A would be able to account for 15 Mt CO_2e of emission reductions from croplands relative to its base year.

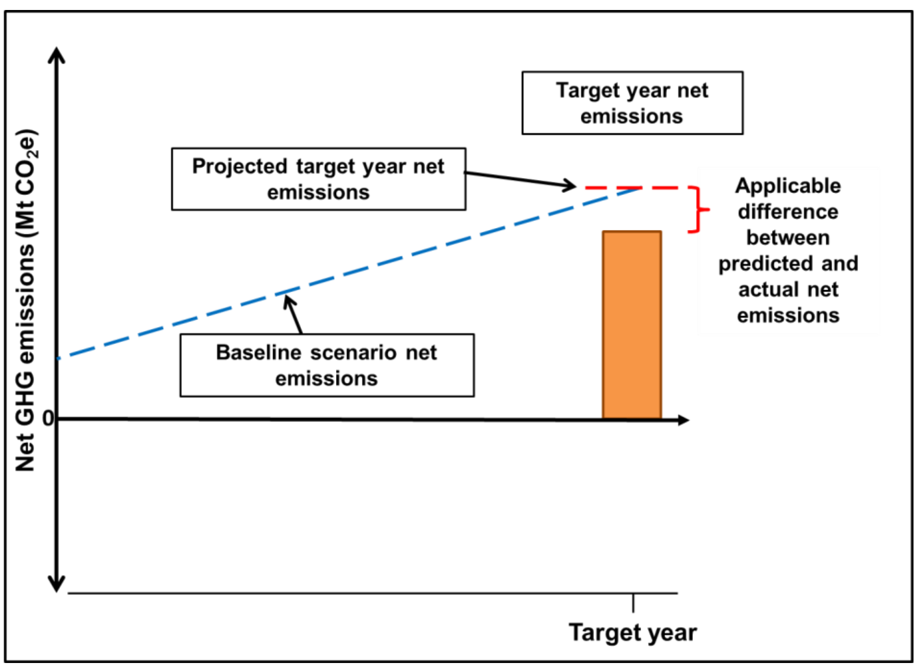
If Government A was using a base period, it would replace the value of net emissions in 2000 with the average annual net emissions from croplands for a period of several years, using 2000 as a mid-point. For example, the base period value could be the average annual net emissions for the period 1998–2002 or could be 1996–2005.

Forward-looking baseline accounting approach

<u>Relevant for</u>**:** Included in goal boundary of baseline scenario goals; Sectoral accounting using baseline; Offset accounting using baseline

A forward-looking baseline compares net emissions in the goal period with a projection of net baseline scenario emissions (see Figure 7.3). Forward-looking baseline accounting (hereafter referred to as baseline accounting) is also a form of net-net accounting, but is distinguished here on the basis of using a baseline scenario projection as the benchmark, rather than a base year or period. Users with baseline scenario goals that include the land-use sector in the goal boundary shall use a baseline accounting.

Figure 7.3. Forward-looking baseline accounting



Advantages

- Allows a user to remove anticipated non-anthropogenic emissions and removals from accounting
- Creates a strong marginal signal for changes inland-use management that reduce emissions relative to BAU
- Maximizes the likelihood that emissions reductions are additional to those that would have occurred without a mitigation goal

Disadvantages

- Highly complex and data-intensive to calculate
- High uncertainty and variability in land-use sector emissions may lead to baselines that are not accurate representations of business-as-usual, resulting in non-additional accounting
- Users may claim credit for emissions reductions even when net emissions increase relative to historical levels

An important consideration for users applying the baseline accounting methodology for the land-use sector is how to determine which emissions are non-anthropogenic and thus eligible to be excluded from the baseline scenario. Users should exclude anticipated net emissions that may reasonably be mitigated from the baseline scenario in order to create a robust incentive for their reduction.

Due to the high uncertainty inherent in projecting net emissions and the resulting potential for non-additional credits, users employing the baseline accounting methodology for the land-use sector should use conservative methods and values to maximize accuracy and promote the environmental integrity of accounting.

Users should follow the guidance in Chapter 6 for estimating baseline scenario emissions. However, there are several additional recommendations and/or qualifications that are relevant to this calculation for the land-use sector.

- Use of an extrapolation based economic forecasts (type of top-down model) or optimization (type of bottom-up) model is not recommended for the land-use sector. Most users will likely utilize an accounting model or a hybrid accounting/computable general equilibrium model.
- There are relatively few generic models or existing projections available to estimate future emissions and removals for the land-use sector. Due to the wide range of circumstances present in the land-use sector, users should not use non-jurisdiction specific generic models for estimating baseline scenario emissions or removals from the land-use sector.[65]
- Users will likely need to model each suite of activities/land-use category separately and then aggregate the net emissions from each to obtain the baseline scenario emissions/removals for the land-use sector.
- Drivers of emissions and removals in the land-use sector are likely to include past, present, and future land-use change; policies and measures affecting, either directly or indirectly, land and natural resource management; structural changes in the land-use sector; population and demographic trends; technological development; and natural disturbance events.
- Existing sources of historical data include IPCC default emission factors, field/inventory data, biomass/carbon density maps derived from remote sensing and field data, industry data (e.g., activity data derived from reported agricultural output or forest harvests), and academic research.

[65] This recommendation does not apply to accounting frameworks/guidance such as IPCC Guidelines or Good Practice Guidance, the GHG Protocol, and other technical resources.

Box 7.2. Example of baseline accounting in the land-use sector

Government B has chosen to use a baseline accounting methodology and wishes to calculate emissions reductions from croplands for the year 2020. Government B's baseline scenario emissions for croplands in 2020 are 30 Mt CO_2e and baseline scenario removals are 10 Mt CO_2e. Net baseline scenario emissions in 2020 are therefore 20 Mt CO_2e. Reporting in 2020, Government B's actual emissions are 25 Mt CO_2e and actual removals are 10 Mt CO_2e. Therefore, actual net emissions in 2020 are 15 Mt CO_2e. Emission reductions are calculated by subtracting the actual net emissions (15 Mt CO2e) from the baseline scenario net emissions (20 Mt CO_2e). In this example, Government B would account for 5 Mt CO_2e of emission reductions from croplands relative to net baseline scenario emissions.

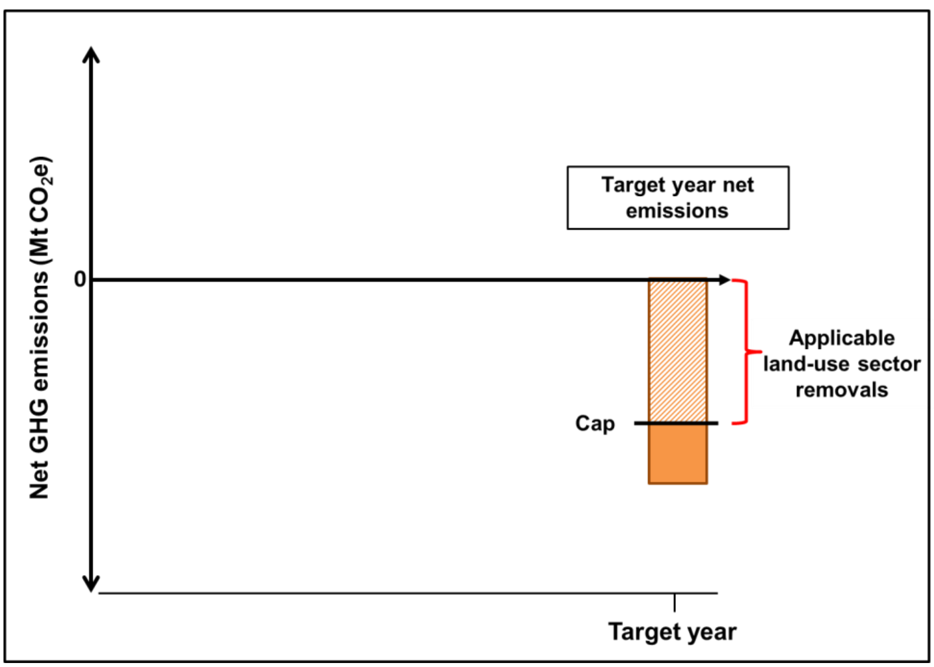
Gross-net accounting approach

Relevant for: Included in goal boundary of fixed level goals; Sectoral accounting for fixed level goals; Offset accounting for fixed level goals

Gross-net accounting is similar to net-net accounting in that it measures the net emissions (emissions + removals) over the goal period. However, unlike net-net accounting, gross-net accounting does not compare emissions and removals to a reference level, for example a base year or baseline scenario. Instead, accounting encompasses the total value of net emissions in the target year/period. Users with fixed level goals that include the land-use sector in the goal boundary shall use gross-net accounting for this sector.

This approach creates the potential for relatively large quantities of non-additional credits in certain circumstances. Users applying the gross-net methodology should therefore consider exploring accounting options to maximize additionality, or using a cap on the quantity of credits in order to limit perverse impacts on the mitigation goal (see Figure 7.4).

Figure 7.4. Gross-net accounting using a cap



Advantages

- Net emissions are “what the atmosphere sees”
- Relatively easy to calculate

Disadvantages

- Users may earn credits for non-additional mitigation that would have occurred in the absence of a mitigation goal
- Depending on the size of the sink, accounting in the land-use sector could overwhelm the mitigation goal

Box 7.3. Example of gross-net accounting approach in the land-use sector

Government D has chosen to use gross-net accounting for the land-use sector to align with its fixed level goal, and wishes to calculate net emissions for the year 2020. Total gross emissions in 2020 were 40 Mt CO_2e and total removals were 30 Mt CO_2e. Net emissions in 2020 were therefore 10 Mt CO_2e. Government D would account for 10 Mt CO_2e of net emissions from croplands in 2020.

Users shall not change their accounting approach during the goal period. If very significant effects result, the user should start again with this standard and treat the altered goal as a new goal (see Section 5.15). Users shall report and justify any changes to the accounting approach, including their quantitative and qualitative effects.

7.7. Minimize potential risks associated with the chosen accounting approach

After the accounting method is chosen, it is important to minimize risks associated with the chosen accounting approach. The following considerations will not be relevant to all users.

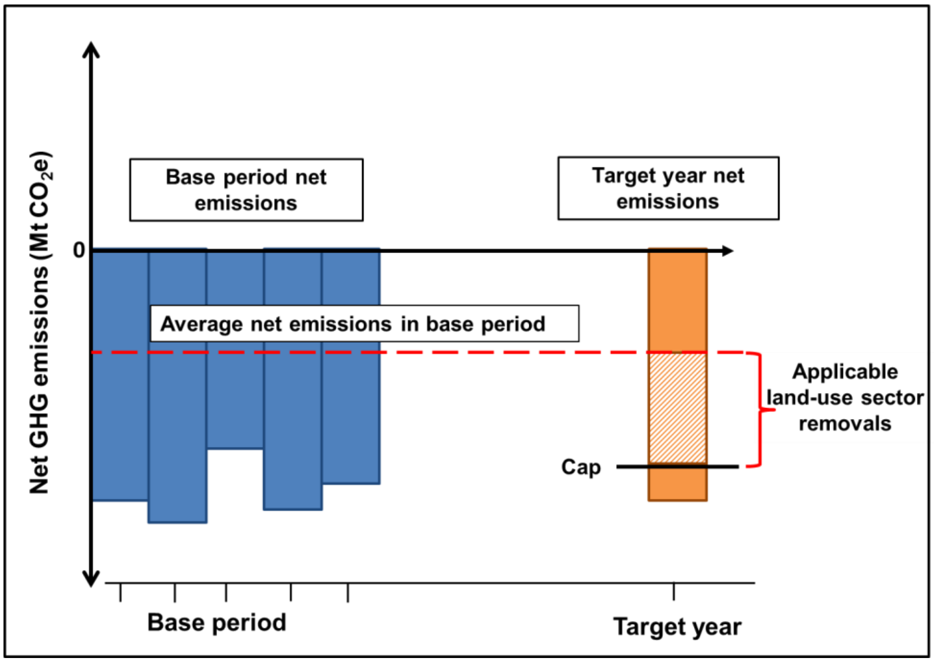
Net-net

Land-use sector accounting using a base year (net-net accounting) can result in non-additional credits or debits when non-anthropogenic emissions/removals cycles or trends (e.g., natural disturbances or age-class structure) obscure the impacts of land-use mitigation efforts during the goal period. This consideration is relevant only for users that are dependent upon a marginal incentive for mitigation in the land-use sector, and/or are participants in a compliance regime. There are three options to correct this potential perversity: 1) remove the land-use category/activity from the mitigation goal and account for it under a separate, category- or activity-specific goal, 2) apply a cap to credits and/or debits (discussed below), or, 3) adjust the mitigation goal either up or down to compensate for the non-additional credits or debits arising from the land-use accounting.[66] If this latter approach is adopted, then the user should start with the standard again from the beginning and treat the goal as a new goal because the goal level would be changed.

[66] For example, a user in a compliance regime using historical base period desires to account for changes in emissions relative to past performance. However, if emissions from the land-use sector in the base period were particularly high because its forest plantations reached maturity at that time and were harvested, net-net accounting for the land-use sector would result in credits for emissions reductions during the goal period that would have occurred in the absence of mitigation. A user may therefore wish to adjust its mitigation goal downward during the goal period to compensate for the effect of non-additional emissions reductions (“free” emission reductions) from the land-use sector. If this approach is adopted, then the user should start with the standard again from the beginning and treat the goal as a new goal because the goal level would be changed. As noted above, however, this consideration is not relevant for all users, particularly those not involved in a compliance regime. Additionally, all users should report all emissions and removals in their greenhouse gas inventories.

The issue of non-additional accounting when using a base year can also affect mitigation accounting when the land-use sector is used as an offset. In this instance, the potential perversity can be minimized by 1) putting a cap on the quantity of credits and/or debits a user can account toward its goal (see Figure 7.5), or 2) adjusting the mitigation goal either up or down to compensate for the non-additional credits or debits. If this latter approach is adopted, then the user should start with the standard again from the beginning and treat the goal as a new goal because the goal level would be changed.

Figure 7.5. Net-net accounting using a cap



When the land-use sector is included in the goal boundary or used as an offset and the chosen accounting methodology would result in non-additional credits or debits, users should adjust the overall mitigation goal up or down to compensate for those credits/debits in order to preserve the environmental integrity of the mitigation goal. If this latter approach is adopted, then the user should start with the standard again from the beginning and treat the goal as a new goal because the goal level would be changed.

Forward-looking baseline

There are two potential weaknesses of using a baseline scenario for land-use accounting: 1) difficulty in determining which anticipated emissions and removals are non-anthropogenic and should thus be excluded from accounting; and 2) difficulty in accurately predicting baseline scenario emissions and removals for the sector. Both can result in inaccurate baseline scenarios that erode the environmental integrity of accounting, and therefore of mitigation. To ameliorate these effects, users should employ a conservative approach to developing a baseline scenario for the land-use sector.

There are two additional methodological means of mitigating the likelihood that inaccurate baselines will perversely impact accounting, which users should consider: ex-post updates of the baseline scenario (see Chapter 6) and use of a cap on credits to limit the impact that land-use sector accounting can have on the mitigation goal (relevant if land-use sector is included in the mitigation goal or used as an offset).

Gross-net

Due to the potential risks associated with non-additional accounting using the gross-net methodology described above, users should apply a cap on the quantity of credits resulting from land-use categories/activities that are a net sink when using gross-net accounting (see Figure 7.4). This is relevant when the land-use sector is included in the boundary of the mitigation goal, when it is accounted for as a separate sectoral goal, and when it is used as an offset. If the land-use category/activity is included in the goal boundary, users should consider adjusting the mitigation goal up or down to compensate for the impacts of non-additional credits/debits. If this approach is adopted, then the user should start with the standard again from the beginning and treat the goal as a new goal because the goal level would be changed.

The issue of non-additional credits is especially relevant for forest land, as the age-class structure of a jurisdiction's forests and the resulting removals from the atmosphere may not represent mitigation that is additional to that which would have occurred in the absence of a mitigation goal.

Caps

As mentioned above, a user may consider a cap when the accounting methodology used for the land-use sector is likely to result in inclusion of emissions and/or removals that would erode the integrity of the goal. Such fluxes might include emissions or removals that have been "locked in" by previous events and do not reflect current mitigation efforts,[67] or apparent changes in emissions or removals that are more likely attributable to uncertainty in methodologies or data than to actual mitigation. Whether a user should address such non-additional emissions or removals, either with a cap or some other measure, will depend on the treatment of the land-use sector in relation to the jurisdiction-wide goal and to the accounting methodology chosen (see above).

Caps are blunt instruments that may limit users' incentives to mitigate net emissions in the land-use sector. Instead of using caps, users should when possible, apply alternative techniques, such as jurisdiction-specific practices for maximizing additionality, conservative methodologies and data, and/or adjusting the mitigation goal up or down to counteract the effects of non-additional accounting (which would require starting with the standard again from the beginning and treating the goal as a new goal because the goal level would be changed). Users that are unable to use these approaches may choose to use a cap on accounting in the land-use sector as a last resort.

7.8. Decide on treatment of natural disturbances

Natural disturbances are non-anthropogenic events or circumstances (e.g., severe drought) that cause significant land-based emissions and are beyond the control of, and not materially influenced by, a user.[68] Where natural disturbances have the potential to significantly impact greenhouse gas accounting, users may elect to establish mechanisms to factor the non-anthropogenic emissions out of their accounts. Factoring out natural disturbances is a highly complex and data-intensive process.

There are four primary technical considerations associated with factoring out the impacts of natural disturbances.

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[67] As stated above, this consideration is only relevant for users dependent upon a marginal incentive for mitigation in the land-use sector or that are participants in a compliance regime.

[68] Adapted from the definition of natural disturbance contained in United Nations Framework Convention on Climate Change (UNFCCC), "Decision 2/CMP.7: Land use, land-use change, and forestry," FCCC/KP/CMP/2011/10/Add.1, 2012, http://unfccc.int/resource/docs/2011/cmp7/eng/10a01.pdf.

1. How to determine when the emissions from a natural disturbance event or circumstance are: a) truly non-anthropogenic, and b) significant enough to warrant factoring out.

2. How to separate the emissions resulting from the actual disturbance, which may be factored out, from emissions stemming from subsequent anthropogenic activities that generate emissions (e.g., salvage logging) or subsequent changes in land-use, which should be accounted for.

3. A natural disturbance mechanism should factor out not only the emissions, but also the subsequent removals resulting from the recovery of carbon stocks after the disturbance event or circumstance.[69] The land subject to the natural disturbance provision should remain out of accounting until the quantity of removals on that land has balanced the quantity of emissions that were factored out. The lands subjected to natural disturbances should be georeferenced and the fluxes tracked over time in order to determine when removals have balanced emissions.

4. Users applying base year or forward-looking baseline accounting approaches that invoke a natural disturbance mechanism during the goal period shall ensure consistency with the treatment of natural disturbances in the base year or baseline scenario.

The following requirements for addressing natural disturbances have been adapted from the Annex to UNFCCC decision 2/CMP.7 on Land Use, Land-Use Change and Forestry.[70]

- Any removals on lands affected by a natural disturbance event/circumstance shall be excluded from accounting until they have balanced the quantity of emissions removed from accounting.[71]
- Users shall account for emissions associated with salvage logging.
- Users shall not exclude emissions from natural disturbances on those lands that are subject to land-use change following the disturbance.
- Users shall provide transparent information:
    - Showing that all lands subject to the natural disturbance mechanism are identified, including their georeferenced location, year and types of disturbances;
    - Showing how annual emissions resulting from disturbances and the subsequent removals in those areas are estimated;
    - Showing that no land-use change has occurred on lands for which the mechanism is applied and explaining the methods and criteria for identifying any future land-use changes on those land areas during the goal period;
    - That demonstrates that the occurrences were beyond the control of, and not materially influenced by, the user during the goal period, by demonstrating practicable efforts to prevent, manage or control the occurrences that led to the application of the mechanism;
    - That demonstrates efforts taken to rehabilitate, where practicable, the land for which the mechanism applied; and
    - Showing that emissions associated with salvage logging on forest land subject to natural disturbance were not excluded from accounting.

[69] This is to prevent a user from getting the benefit of a natural disturbance while avoiding the cost, and is as such necessary to upholding environmental integrity.
[70] http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/awgkp_lulucf.pdf
[71] In order to exclude emissions from a natural disturbance event, the land area subject to the disturbance is first georeferenced and the emissions (removed from the land-use accounting) are quantified. After the event, the land will begin the process of recovery, which will generally include rebuilding soil carbon, vegetation, etc. These phenomena will likely result in net removals on the area of recovering land. This accounting requirement ensures that users cannot factor out the emissions from a natural disturbance on the one hand and also take credit for the resulting removals on the other. The identified piece of land must remain out of land-use accounting until the emissions and removals have netted each other out.

The additional burden associated with a natural disturbance mechanism means that users will need to weigh the potential for large emissions impacts from natural disturbances against the costs of establishing and implementing a mechanism to address those emissions. Although mechanisms to factor out emissions and removals from natural disturbances may be used in conjunction with any accounting framework or methodology, users should consider the necessity of such a provision given their specific circumstances and the potential impacts of natural disturbances given their chosen accounting approaches. Due to the different characteristics of land-use categories/suites of activities, users may elect to use a natural disturbance mechanism for individual categories/activities, rather than for the sector as whole. For example, a user may employ a natural disturbance mechanism for forest land/forest management activities, but not for grassland/grazing management activities.

7.9. Revising land-use sector accounting

Users shall not change the land-use sector approach during the goal period. If a user changes the way in which the land-use sector in treated in the goal during the goal period, the existing mitigation goal shall be set aside and a new goal shall be established, for which the accounting starts over again (see Section 5.15).

During the goal period users should not change the accounting approach, land-use categories or activities, or carbon pools and GHG fluxes. If any are changed during the goal period and significant effects result, users should start again with this standard and treat the altered goal as a new goal (see Section 5.15). Users shall use a significance threshold to determine the significance of effects (see Box 6.1). Users shall disclose and justify any changes, including their quantitative and qualitative effects, and the significance threshold used.

7.10. Quantify land-use sector emissions and removals based on accounting choices

Users should follow the quantification steps below to calculate historical net land-use emissions and applicable land-use emissions in the reporting year. Both of these numbers are necessary to assess and report progress toward mitigation goals and are inputs into the equations that are used for ex-ante and ex-post assessment, as described in Chapters 9 and 10.

If the land use sector is included in the goal boundary or the land use sector is treated as a sectoral goal:

Step 1: Calculate historical net land-use emissions based on chosen accounting approach and selected land-use categories/activities and pools and fluxes, if applicable

Users with base year goals should use Equation 7.1 to calculate net base year or base period emissions from the land-use sector. This sum shall be added to base year or base period emissions for all other sectors and gases covered by the goal (see Section 6.1) to calculate base year or base period emissions for the goal.

This step is not relevant for users with baseline scenario goals and fixed level goals.

Equation 7.1. Method for calculating net base year or base period land-use emissions

$$\textbf{Net base year or base period land use emissions} = \\ (\text{Emissions from selected land use categories, activities, pools, fluxes in base year or base period}) \\ + (\text{Removals from selected land use categories, activities, pools, fluxes in base year or base period})$$

Step 2: Calculate applicable land-use emissions in the reporting year based on chosen accounting approach and selected land-use categories/activities and pools and fluxes

Users with base year goals should use Equation 7.2 to calculate net applicable reporting year emissions from the land-use sector. This sum shall be added to reporting year emissions from all other sectors and gases covered by the goal to calculate adjusted reporting year emissions within the goal boundary, both during and after the goal period (see Sections 10.6 and 10.7).

Equation 7.2. Method for calculating net applicable reporting year land-use emissions (net-net)

$$\begin{aligned}&\textbf{Net applicable reporting year land use emissions} =\\&[(\text{Emissions from selected land use categories, activities, pools, fluxes in the reporting year}) +\\&(\text{Removals from selected land use categories, activities, pools, fluxes in the reporting year})] -\\&(\text{Net base year or base period land use emissions}) -\\&(\text{Cap on removals (expressed as a negative integer), if applicable})\end{aligned}$$

Users with baseline scenario goals should use Equation 7.3 to calculate net applicable reporting year land-use emissions relative to a baseline scenario. This sum shall be added to reporting year emissions from all other sectors and gases covered by the goal to calculate adjusted reporting year emissions within the goal boundary, both during and after the goal period (see Sections 10.6 and 10.7).

Equation 7.3. Method for calculating net applicable land-use emissions relative to baseline scenario (net-net)

$$\begin{aligned}&\textbf{Net applicable reporting year land use emissions relative to baseline scenario} =\\&(\text{Net baseline scenario land use emissions in the reporing year})\\&- [(\text{Emissions from selected land use categories, activities, pools, fluxes in the reporting year})\\&+ (\text{Removals from selected land use categories, activities, pools, fluxes in the reporting year})]\end{aligned}$$

Users with fixed level goals should use Equation 7.4 to calculate net applicable land use emissions in the reporting year. This sum shall be added to reporting year emissions from all other sectors and gases covered by the goal to calculate adjusted reporting year emissions within the goal boundary, both during and after the goal period (see Sections 10.6 and 10.7).

Equation 7.4. Method for calculating net applicable land-use emissions (gross-net)

$$\begin{aligned}&\textbf{Net applicable reporting year land use emissions} =\\&[(\text{Emissions from selected land use categories, activities, pools, fluxes in the reporting year}) +\\&(\text{Removals from selected land use categories, activities, pools, fluxes in the reporting year})] -\\&(\text{Cap on removals (expressed as a negative integer), if applicable})\end{aligned}$$

Step 3: Adjust the accounting methodology to contend with risks (see Section 7.7)

Step 4: Determine whether to use a natural disturbance mechanism and adjust accordingly (see Section 7.8)

If the land-use sector is treated as an offset:

Step 1: Calculate emissions reductions

To calculate emissions reductions using net-net accounting and historical base year or base period

1. Calculate historical net land-use emissions in base year or base period using Equation 7.1
2. Calculate net land-use emissions in reporting year using Equation 7.2
3. Subtract reporting year emissions from base year emissions
4. Above quantity = offset

To calculate emissions reductions using net-net accounting with a forward-looking baseline scenario

1. Estimate baseline scenario net land use emissions (see Sections 7.8, 7.9, and 6.2)
2. Calculate net land-use emissions in reporting year using Equation 7.3
3. Subtract reporting year emissions from land-use baseline scenario emissions
4. Above quantity = offset

To calculate emissions reductions using gross-net accounting

1. Calculate net emissions in reporting year using Equation 7.4
2. Above quantity = offset

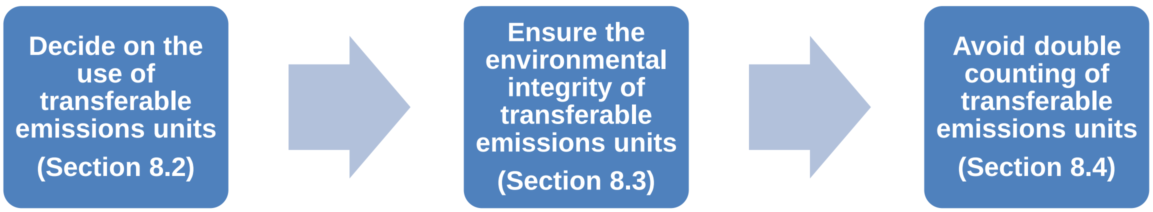
Step 2: Adjust the accounting methodology to contend with risks (see Section 7.7)

Step 3: Determine whether to use a natural disturbance mechanism and adjust accordingly (see Section 7.8)

Chapter 8: Accounting for transferable emissions units

This chapter provides guidance on how to account for transferable emissions units and avoid double counting of transferable emissions units between jurisdictions.

Figure 8.1. Overview of steps in this chapter



Accounting requirements in this chapter[72]

Section 8.2
- Users shall set a threshold that defines the extent to which transferable emissions units will be used to meet their goal.

Section 8.3
- Offset credits that are used towards the goal shall be real, additional, permanent, transparent, verified, owned unambiguously, and address leakage.
- Allowances from emissions trading programs outside the goal boundary that are used towards the goal shall come from programs that have rigorous monitoring and verification protocols; transparent reporting and tracking of units; and stringent caps.

Section 8.4
- Users shall not double count, double sell, or double claim transferable emissions units.
- To prevent double counting, users shall adjust reporting year emissions by adding sold emissions units to GHG inventory emissions and subtracting purchased units that are retired in the reporting year from GHG inventory emissions.

8.1 Introduction

GHG mitigation goals can be met entirely from internal GHG reductions from within the goal boundary (e.g., within a jurisdiction's geopolitical boundary). In addition to GHG reductions from within the goal boundary, jurisdictions may also use transferable emissions units from outside of the goal boundary to meet their goals. Two types of transferable emissions units may be used:

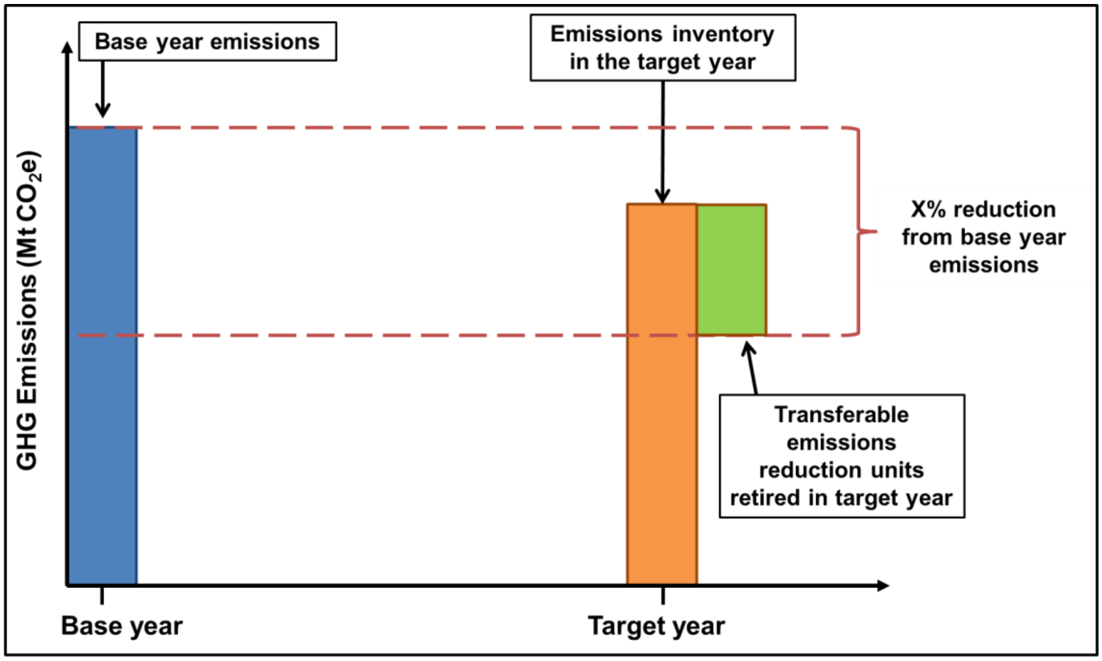
- Emissions **allowances** from emissions trading programs, issued ex-ante with respect to emission budgets to participants in an emission trading regime; and
- **Offset credits** generated from emission reduction (or removal enhancing) projects or programs, and issued with respect to ex-post verified emission reductions relative to an approved baseline.

This chapter uses the term "transferable emissions units"[73] to refer to both allowances and offset credits from outside the goal boundary that are used toward meeting a mitigation goal. Transferable emissions

[72] This table lists the accounting requirements in the chapter. Reporting requirements for this chapter are listed in Chapter 12 and are not listed below. While some sections in this chapter do not have requirements, each section in the chapter contains recommendations.

units can be generated beyond the jurisdictional boundary (e.g., in a neighboring country) or within the boundaries of the jurisdiction, but in sectors not covered by the mitigation goal. See Figure 8.2 for an illustration of using transferable emissions units toward meeting a goal. In the figure, the emissions in the target year exceed the level of emissions needed to meet the goal, so transferable emissions units are used to meet the goal.

Figure 8.2. Use of transferable emissions units towards a goal



This chapter provides guidance on three main accounting decisions related to the use of transferable emissions units:

1. The quantity of units, if any, that will be used (Section 8.2)
2. The quality of units that will be used (Section 8.3)
3. Avoiding double counting of units between jurisdictions (Section 8.4)

8.2. Decide on the use of transferable emissions units

Using transferable emissions units to achieve a mitigation goal has both advantages and disadvantages. Access to a wider pool of emission reduction opportunities may increase ambition of mitigation goals; may lead to more cost-effective mitigation efforts; and may increase technology transfer and build technical capacity in jurisdictions where offset credits are generated.

On the other hand, relying on transferable emissions units to achieve mitigation goals may lead to fewer domestic mitigation actions, which may limit co-benefits of GHG mitigation that would accrue to the purchasing jurisdiction. In addition, if the units used toward the goal are of low quality (e.g., if they do not represent additional emissions reductions), their use may compromise the environmental integrity of the system, and lead to increased emissions globally than would be achieved through domestic mitigation.

[73] Andrew Prag et al., "Made to measure: Options for emissions accounting under the UNFCCC," Climate Change Expert Group Paper No. 2013(1), OECD, 2013, http://www.oecd.org/env/cc/Made%20to%20Measure_Final.pdf

Based on these tradeoffs, some jurisdictions have set thresholds that define the extent to which transferable emissions unit may be used to meet their mitigation goals.

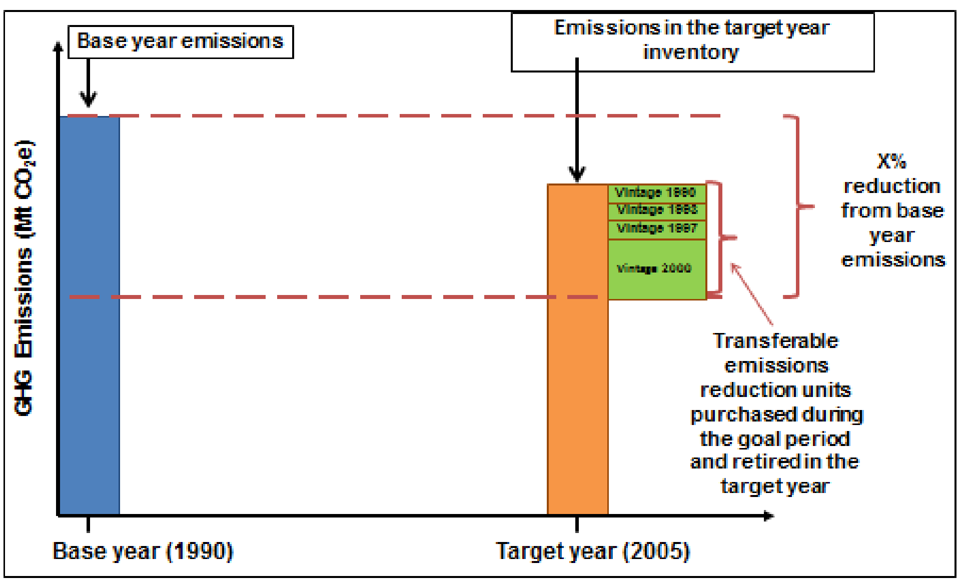
Users shall set a threshold that defines the extent to which transferable emissions units will be used to meet their goal. Users may choose a qualitative or quantitative threshold. Users shall disclose and justify the chosen threshold.

Vintage of units

Users should also consider the time dimension of transferable emissions units used toward goals. In most emission trading systems market-based units sourced from a predefined number of years (known as "vintages," or the year in which the unit was generated) are eligible to be counted towards emission reduction commitments.

There is an important interplay between the timing of the creation of transferable units, which is reflected in GHG inventories, and their eventual use towards the goal. In particular, whether the user has a single year or multi-year target has important implications.[74] With single year targets, it is conceivable that purchasers of units collect vintages of offset credits and retire them only in the target year in an effort to meet the target (see Figure 8.3). The same could be done with banking and borrowing of units. While from an accounting perspective it is easy to adjust for such units in the evaluation of meeting the goal, from an ambition perspective this is very problematic because the user could engage in very minimal amount of mitigation within its boundary by choosing instead to retire a large volume of units in the final target year. While it is possible that the same problem could surface with multi-year goals, the volume of units that would have to be retired would be so large that it may not occur as often (see Figure 8.4).

Figure 8.3. Retirement of older vintage units in the target year of a single year goal



[74] Andrew Prag et al., "Made to measure: Options for emissions accounting under the UNFCCC," Climate Change Expert Group Paper No. 2013(1), OECD, 2013, http://www.oecd.org/env/cc/Made%20to%20Measure_Final.pdf

Figure 8.4. Retirement of older vintage units in the target period of a multi-year goal

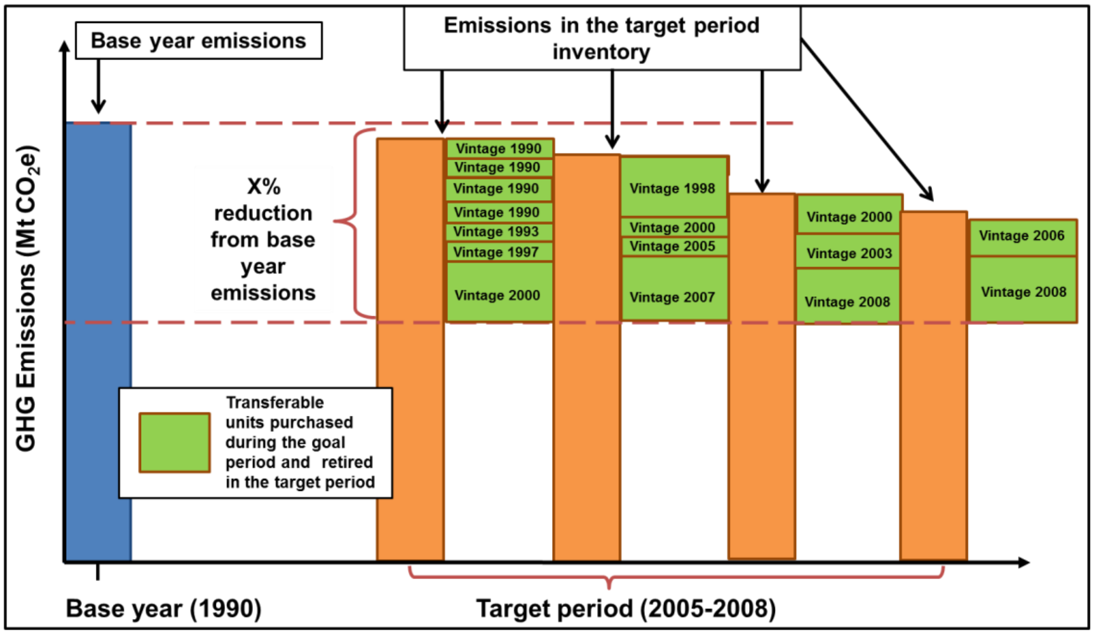


Figure 8.3 and Figure 8.4 indicate that, while it is possible to account for multiple vintage years of offset credits to be applied to the target year/target period, it may result in less clear accounting results. Accordingly:

a) Users should adopt multi-year targets given that single year targets can more easily accommodate a build-up of emissions and their cumulative impact on the atmosphere (see Chapter 5 for more information).
b) Users should retire only target year or target period vintages to meet their goals in order to maximize ambition. However, if non-target year/target period vintages are used, their use should be time-bound in order to maximize ambition and avoid the build-up and use of emissions units over short goal periods.

Ex-ante, users shall report on their estimated use of units. Ex-post, users shall report on the actual quantity of transferable emissions units counted towards the goal, their source, and vintage year.

8.3. Ensure the environmental integrity of transferable emissions units

To safeguard the environmental integrity of mitigation goals, it is critical that transferable emissions units generated outside of the goal boundary that are counted towards the mitigation goal are equivalent to emissions units within the goal boundary. To demonstrate this equivalency, i.e., “a tonne is a tonne”, quality principles for offset credits and emission allowances (from cap and trade schemes) are set out separately below.

Offsets used towards goals shall meet the quality principles outlined below.[75] Users shall report how the following quality principles were met for offset credits:

[75] Based on Offset Quality Initiative, “Ensuring offset quality: Integrating high quality greenhouse gas offsets into North American cap-and-trade policy,” July 2008, http://www.offsetqualityinitiative.org/pdfs/OQI_Ensuring_Offset_Quality_7_08.pdf; World Wildlife Fund, “WWF guidelines on the key principles required for robust voluntary carbon offset project standards: A paper to accompany the report ‘*Making sense of the voluntary carbon market – A*

- **Real**: Emissions reductions or removals should represent actual emission reductions.[76]
- **Additional**: Emissions reductions or removals should be surplus to regulation and beyond what would have happened in the absence of the incentive provided by the offset credit program or project. A range of approaches may be used to assess the additionality of activities that generate offset credits. Offset credits quantified using a project vs. performance standard methodology may establish slightly different requirements for demonstrating additionally. Units that are additional represent an emission reduction from a counterfactual scenario without the existence of the pricing induced by a particular carbon finance instrument. In the absence of such additionality, a net increase of emissions will result from the use of any units (allowances or offset credits) towards their goal. This points to the critical role that the design of the counterfactual scenario – the baseline – has in ensuring environmental integrity of any crediting scheme. Internationally accepted baseline methodologies (e.g., the GHG Protocol's *Project Protocol*) that underlie the generation of emissions reductions outside of the goal boundary are, therefore, critical to ensure the quality of the offset credit.
- **Permanent**: The emissions reductions or removals should be permanent or have guarantees to ensure that any losses are replaced in the future, which may include legal guarantees, insurance, or buffer pools (i.e., mechanisms that set aside a portion of the earned offset credits to compensate for any potential future carbon sequestration reversal).
- **Transparent:** Offset credits must be publicly and transparently registered to clearly document offset credit generation, transfers, and ownership. Crediting programs must also be transparent regarding rules and procedures for monitoring, reporting, and verification, quantifying GHG reductions, and enforcement.
- **Verified**: The emissions reductions or removals must result from projects whose performance has been appropriately validated and verified to a standard that ensures reproducible results by an independent third party that is subject to a viable and trustworthy accreditation system.
- **Owned unambiguously:** There should be clarity in ownership of GHG reductions or removals such that one Party can reasonably claim ownership or two Parties (buyer and seller) split ownership (and receive a predetermined percentage of the associated credits).
- **Addresses leakage**: The emissions reductions or removals that result from the transferable emissions units do not lead to increase in emissions or decrease in removals that occur elsewhere. The market mechanism that generates the transferable emissions units should be designed and operated in a way that minimizes the risk of leakage and accounts for any unavoidable leakage.

Allowances from emissions trading programs outside the goal boundary shall also conform to basic quality principles, which partly overlap with those for offset credits. Allowances shall come from emissions trading systems with the quality features outlined below. Users shall report how any emissions trading system used conforms to these quality features:

- **Rigorous monitoring and verification protocols**: In most existing emissions trading programs, there are a number of approved methods for measurement of emissions from different types of sources, which are necessary to ensure the quality and comparability of underlying emissions data.
- **Transparent reporting and tracking of units**: Allowances should be publicly and transparently registered to clearly document their generation, transfer, and ownership. Emissions trading programs should also be transparent regarding rules and procedures for monitoring, reporting, and verification, as well as compliance and enforcement.

comparison of carbon offset standards," March 2008; and The Climate Registry, *General Reporting Protocol: Version 2.0*, 2013, http://www.theclimateregistry.org/downloads/2013/03/TCR_GRP_Version_2.0.pdf.

[76] As Gillenwater (2012) notes, the concept of real suggests that fraudulent behavior did not ensue and embraces several principles, including accuracy and comprehensiveness.

- **Stringent caps**: Emissions trading programs should have stringent caps that limit the amount of emissions in a given time period to a level lower than would be expected in a business-as-usual scenario. Allowing the use of allowance units from emissions trading programs with overly high caps (i.e., beyond realistic business as usual projections) would compromise the environmental benefit of purchasing the units, since they may not represent real reductions. Doing so may also negatively impact any domestic emissions trading programs by lowering prevailing prices. Assessing the stringency of the cap involves an assessment of the quality of the linked system, which involves a political judgment. Such judgment should be made explicit and the decision to allow an import of units should be made with awareness of potential negative impacts on the mitigation goal.

Table 8.1 provides examples of crediting and trading programs currently in operation.

Table 8.1. Overview of selected crediting and trading schemes

Crediting/Trading	System	Origin	Unit	Use/recognition in other schemes	More information
Trading programs	Australia Emissions Trading Scheme	Australian law	Australian Carbon Unit (ACU)	Linked to JI, CDM, and Australia's CFI. To be linked to the EU ETS	http://www.cleanenergyregulator.gov.au/Carbon-Pricing-Mechanism/Pages/default.aspx
	European Union Emission Trading System (EU ETS)	European Union law, Directive 2003/87, subsequently amended	European Union Allowance (EUA)	Linked to JI, CDM, and Swiss ETS. To be linked to the Australian CPM	http://ec.europa.eu/clima/policies/ets/index_en.htm
	International Emission Trading	Kyoto Protocol article 17	AAU (Assigned Amount Unit)	Not used outside the Kyoto Protocol	http://unfccc.int/kyoto_protocol/mechanisms/emissions_trading/items/2731.php
	New Zealand ETS	New Zealand law	NZU (New Zealand Units)	Linked to CDM and to IET	http://www.climatechange.govt.nz/emissions-trading-scheme/
	Regional Greenhouse Gas Initiative (RGGI)	Mandates from different Northeastern US states			http://www.rggi.org/
Crediting programs	American Carbon Registry	Voluntary initiative			www.americancarbonregistry.org
	Australia Carbon Farming Initiative (CFI)	Australian law	Australian Carbon Credit Units (ACCUs)	Linked to Australia's ETS	http://www.cleanenergyfuture.gov.au/carbon-farming-initiative/
	Clean Development Mechanism (CDM)	Kyoto Protocol article 17	Certified Emission Reduction (CER)	Widely used across most official emission trading schemes to date	www.cdm.unfcccc.int
	Joint Implementation (JI)	Kyoto Protocol article 6	Emission Reduction Units (ERU)	Widely used across most official emission trading schemes to date	www.ji.unfccc.int
	Verified Carbon Standard	Voluntary initiative	VER (Verified Emission Reduction)	Used mostly in the voluntary market	www.v-c-s.org

8.4. Avoid double counting of purchased and sold transferable emissions units

Double counting of transferable emissions units occurs when the same transferable emissions unit is counted toward the mitigation goal of two different jurisdictions. Avoiding double counting between the jurisdiction that purchases units (i.e., the purchasing jurisdiction) and the jurisdiction that sells units (i.e., the host jurisdiction) is necessary to ensure the environmental integrity of the respective mitigation goals.

Scenarios for double counting[77]

Double counting refers to both double selling and double claiming. *Double selling* occurs when credit from a single emission reduction is sold twice. *Double claiming* occurs when credit from an emissions reduction is claimed by two different parties, which may occur under various scenarios:

- <u>In the case of purchased units</u>: Buyer claims units and credits them toward their goal. Double counting will occur if seller credits the same units toward their goal.
- <u>In the case of sold units</u>: Seller sells units and claims units toward their goal. Double counting will occur if purchaser credits the same units toward their goal.
- <u>In the case of shared units</u>: Both buyer and seller claim a proportion of the emissions units and credit them toward their goals. Double counting will occur if there is overlap in the proportion of the units that the buyer and seller claim (e.g., 60% each).

There is also the possibility for double issuance, in which more than one credit is generated for one unit of emissions reduction. Double issuance increases the risk that emissions reductions will be counted towards mitigation goals twice if a purchaser relies on the integrity of a market mechanism's design to ensure that the emissions unit is real instead of the purchaser doing their own due diligence on each unit purchased.

All of these scenarios are applicable to both allowances and credits and pose a problem for the purposes of the accounting of tradable emissions units towards mitigation goals.

Avoiding double counting

Double claiming of the same units by both seller and buyer undermines the environmental integrity of the system(s), leading to a mismatch between what the accounting system(s) reflect and what the atmosphere observes.[78]

Users shall not double count, double sell, or double claim GHG reductions. To prevent double counting, users shall adjust reporting year emissions levels by adding sold emissions units to GHG inventory emissions and subtracting purchased units that are retired in the reporting year from GHG inventory emissions (see Equation 8.1). Users should utilize the GHG balance sheets provided in Appendix A to track annual sales and purchases of transferable units and adjust emissions levels accordingly.

[77] Based on Andrew Prag, "Overlap of carbon market mechanisms," Presentation given at CEPS Carbon Market Forum, 3rd meeting of the Task Force on New Market Mechanisms under the AWG-LCA, July 2012

[78] It is conceivable that the inventory does not reflect retired or sold transferable emissions units (e.g., because inventories are put together with a methodology that differs from a project-level methodology in terms of resolution and/or accuracy). For this reason, it is important that the user reports the inventory and use of units separately. http://www.oecd.org/env/cc/Made%20to%20Measure_Final.pdf

Equation 8.1. Adjusting for transferable emissions units

$$\textbf{Adjusted reporting year emissions within the goal boundary for transferable emissions units} = \text{(Emissions level in the goal boundary in the reporting year}^{*}\text{)} + \text{(Transferable emissions units sold in the reporting year)} - \text{(Transferable emissions units purchased and retired in the reporting year)}$$

*Including net emissions from the land-use sector if applicable, which can be determined with Chapter 7.

Users should institute or promote mechanisms to avoid double counting. To ensure that double counting does not occur, a variety of mechanisms may be used, including:[79]

- **Legal mandates** that disallow double counting and are underpinned by effective penalty and enforcement systems
- **Registries** that lists the quantity and other characteristics of transferable emissions units held by a jurisdiction
- **A transaction log** that records the details of each transaction between registry accounts, including the issuance, holding, transfer, and acquisition of transferable emissions units
- **Agreements** between buyers and sellers that specify which party has the exclusive right to claim any transferred and specifies what percentage, if any, are shared

Double issuance can be prevented by sharing information to identify already registered transferable emissions units in schemes. Transaction logs and registries are useful in avoiding double trading and claiming, and enhancing transparency and confidence in the use of markets to support mitigation outcomes. More specifically, they can:

- Recognize the identity/attributes of units provided at the issuance stage (e.g., vintage, origin);
- Track ownership and location of units;
- Track transfers of units between accounts within a registry and between registries; and
- Track the status of units (e.g., cancellation, retirement, banking).

Under any such mechanisms, it is essential, that any transferable unit be uniquely identified at least in two different points in time:

- At the point of issuance/generation, e.g., when a unit in a cap-and-trade system is issued into a system registry; and
- At the point of compliance with the mitigation goal, i.e., when it is permanently retired.

The critical functions that transaction logs and registries must fulfill could be implemented at a subnational, national or international level, or through a combination of domestic and international transaction logs and registries. Arguably, more complete solutions would entail the creation of standardized protocols for issuance of units, serialization of units from different systems using the same type of serial unit, and the use of a centralized transaction log, but minimum requirements may be established through a simple centralized notification protocol with different systems. Table 8.2 provides examples of existing mechanisms currently being used in different contexts, by way of example/illustration.

In the event that, despite preventative measures, double counting is observed, users shall correct relevant registries and accounts. Apportionment of liability for rectifying double counting (either by the seller or buyer) should be incorporated into offset contracts.

[79] These are not mutually exclusive and a user could employ a combination or all of them.

Table 8.2. Examples of mechanisms for tracking transferable emissions units

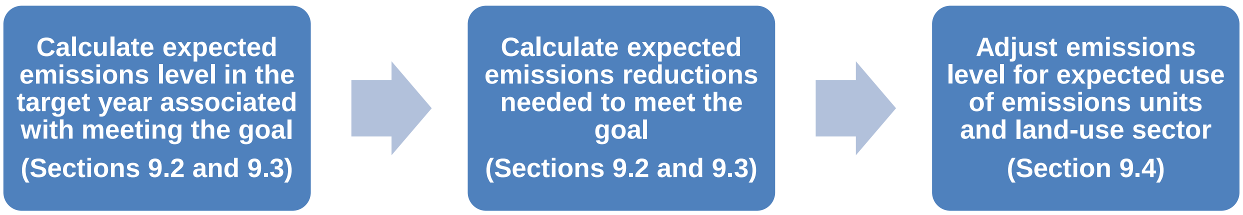
Regime	Mechanism	Name	Purpose
Australian Carbon Pricing Mechanism (CPM)	Registry	Australian National Registry of Emissions Units (ANREU)	Track allowances and offset credits
California Cap-and-Trade Program	Transaction log	Compliance Instrument Tracking System Service (CITSS)	Track allowances and offset credits
	Registry	American Carbon Registry	Track offset projects and issue offset credits
	Registry	Climate Action Reserve	Track offset projects and issue offset credits
EU Emissions Trading Scheme (ETS)	Transaction log	Community Independent Transaction Log (CITL)	Track allowances and offset credits
Kyoto Protocol	Transaction log	International Transaction Log (ITL)	Track allowances and offset credits
	Registry	CDM Registry	Track offset projects and issue offset credits

Under some mechanisms, situations may arise in which different parties to a contract may believe they have legitimate claim to the same emissions reduction. Such situations may well be prevented under some mechanisms (such as with a transaction log and registry system that covers all admissible units under both jurisdictions), but not in others (as in other, more loose types of agreements or mandates). In most cases, these mechanisms will put the liability on either the seller (in seller liability regimes) or the buyer (in buyer beware or “caveat emptor” regimes). This standard cannot prevent such situations altogether, and it also does not intend to mandate specific liability provisions or any commercial law issues. Users must however endeavor to avoid any such situation (e.g., through arbitration or agreement) and be transparent about whether any offset credit being claimed is potentially or actually subject to dispute for breach of contract or disagreement between parties (i.e., that one party claims the reductions despite agreeing not to, or that a national government claims the reductions even though a subnational entity has agreed to sell the rights). Users shall report the provisions in place to ensure that emission reductions were not double claimed by multiple entities.

Chapter 9: Calculating expected emissions in the target year and emissions reductions needed to meet the goal

This chapter provides guidance on: 1) calculating the emissions level in the target year if the goal is met, and 2) calculating emissions reductions needed to meet the mitigation goal ex-ante. Users that are designing, or have recently designed, a mitigation goal should use this chapter. Alternatively if a user has established a mitigation goal and has already started to implement it, this chapter can be skipped and the user can begin to assess progress towards meeting the goal (see Chapter 10).

Figure 9.1. Overview of steps in this chapter



Accounting requirements in this chapter[80]

- Users shall calculate the expected emissions level (or emissions intensity level) in the target year associated with meeting their goal and emissions reductions (or reductions in emissions intensity) needed to meet their goal, according to goal type.

9.1 Introduction

Users shall calculate the expected target year/period emissions level (or emissions intensity level) and emissions reductions (or reductions in emissions intensity) associated with meeting the goal. The target year/period emissions level associated with meeting the goal is an ex-ante calculation of the future emissions level within the goal boundary that would be achieved if the goal were met. Emissions reductions needed to meet the goal are the quantity of reductions that would need to be achieved by the end of the goal period to meet the goal. This chapter does not address how the goal is to be met; users may meet their goals using any combination of reductions within the goal boundary and transfers of emissions units**.**

Calculating the expected emissions level and emissions reductions associated with meeting the goal provides users with important information that should be used for internal decision making, the design of mitigation strategies, and evaluation at the end of the goal period of whether the goal has been met.[81]

In general, the calculations in this chapter follow a similar three step procedure:

Step 1: Estimate base year emissions, base year emissions intensity, or baseline scenario emissions (see Chapter 7)

[80] This table lists the accounting requirements in the chapter. Reporting requirements for this chapter are listed in Chapter 12 and are not listed below. While some sections in this chapter do not have requirements, each section in the chapter contains recommendations.
[81] The forecast here is a projection, and made using GHG inventory methods at the time the goal is set. In some cases, minor GHG inventory procedures (e.g., input factors) may change, suggesting that this forecast could also change. Accordingly, the exact target emissions level may in some cases change. For further details, see Chapter 11.

Step 2: Calculate the emissions level or emissions intensity level in the target year associated with meeting the goal. For single year goals see Equation 9.1 and 9.3. For multi-year goals see Equation 9.4.

Step 3: Calculate emissions reductions relative to a base year or baseline scenario needed to meet the goal. For single year goals see Equation 9.2 and 9.3. For multi-year goals see Equation 9.5.

Users should keep in mind that, as described in Chapter 5, some goals will be differentiated by scope. If the user has separate goals for each scope or a combination of single and separate goals for scopes, the user shall perform the below calculations for each scope separately, as well as report separately by scope.

9.2 Calculating expected emissions and emissions reductions for single year goals

Users with single year goals shall calculate the expected target year emissions level (or emissions intensity level) in the target year and emissions reductions (or reductions in emissions intensity) associated with meeting their goal. Calculation methods for each goal type are presented below (see Equation 9.1 and 9.2). To complete these calculations users will need data for base year emissions, base year emissions intensity, or baseline scenario emissions in the target year.

While intensity goals will be evaluated on the final intensity achieved, it is also helpful for decision makers and other stakeholders to understand emissions levels associated with intensity goals in the target year, as well as the emissions reductions that need to be achieved by the target year. Accordingly, users with single year intensity goals shall also estimate the target year emissions level and emissions reductions associated with meeting the goal (see Equation 9.1 and 9.2). Converting an emissions intensity level to an emissions level requires an assumption about future change of an output metric in the target year, typically in units of economic output (e.g., GDP). The ex-ante estimation of emissions levels and emissions reduction associated with intensity goals is inherently uncertain given that it is difficult to know with any certainty how the unit of output will change. Projections of output metrics such as GDP should be gathered from international data sources like the International Monetary Fund (IMF), World Bank, or Organisation for Economic Co-operation and Development (OECD), or from relevant government bodies. Modeling techniques may also be used to calculate projections for relevant output metrics.

Equation 9.1. Calculating target year emissions level for single year goals

Single year goal type	Calculation method: Target year emissions level associated with meeting the goal
Base year goal	**Target year emissions level** = (Base year emissions) − [(Base year emissions) × (Percent reduction)]
Intensity goal[82]	**Estimated target year emissions level** = [(Base year emissions intensity) − (Base year emissions intensity) × (Percent reduction)] × (Projected quantity of output in the target year)
Static and dynamic baseline scenario goal[83]	**Target year emissions level** = (Baseline scenario emissions in the target year) − [(Baseline scenario emissions in the target year) × (Percent reduction)]
Fixed level goal	**Target year emissions level** = Specified target year emissions level associated with meeting the goal

[82] As noted above, this calculated value is subject to change, depending on actual units of output in the target year.
[83] While users with single year dynamic baseline scenario goals can calculate the expected target year emissions level and emissions reductions needed, they are subject to change during the goal period due to baseline scenario updates (see Chapter 6).

Equation 9.2. Calculating emissions reductions for single year goals

Single year goal type	Calculation method: Emissions reductions needed to meet the goal compared to the base year/baseline scenario
Base year goal	$\textbf{Emissions reductions needed} = (\text{Base year emissions}) \times (\text{Percent reduction})$
Intensity goal[84]	$\textbf{Emissions reductions needed} = (\text{Estimated target year emissions level (see Equation 9.1)}) - (\text{Base year emissions})$
Static and dynamic[85] **baseline scenario goal**	$\textbf{Emissions reductions needed} = (\text{Baseline scenario emissions in the target year}) \times (\text{Percent reduction})$
Fixed level goal	N/A[86]

Equation 9.3. Calculating emissions intensity and reductions in emissions intensity for single year goals

Single year goal type	Calculation method
Target emissions intensity level associated with meeting the goal	
Emissions intensity goal	$\textbf{Target year emissions intensity level} = (\text{Base year emissions intensity}) - [(\text{Base year emissions intensity}) \text{ X } (\text{Percent reduction})]$
Reduction in emissions intensity needed to meet the goal	
Emissions intensity goal	$\textbf{Reduction in emissions intensity} = (\text{Base year emissions intensity}) \text{ X } (\text{Percent reduction})$

Users with single year goals shall calculate and report:

- Target year emissions level associated with meeting the goal, by scope (see Equation 9.1)
- Emissions reductions needed to meet the goal, by scope (see Equation 9.2)

In addition, users with single year intensity goals shall calculate and report:

- Target year emissions intensity level associated with meeting the goal by scope (see Equation 9.3)
- Reduction in emissions intensity needed to meet the goal by scope (see Equation 9.3)
- Disclose and justify data sources for projected output metrics and/or any projection methodology used.

For dynamic baseline scenario goals, the emissions level and emissions reductions calculated will be subject to change later in the goal period due to baseline scenario updates (see Chapter 6).

Users with baseline scenario goals should also report the emissions level for the start year of the baseline scenario (see Section 6.2.2). Knowing the relationship ex-ante between the emissions level at the start of the goal period and in the target year enables decision makers and stakeholders to understand the likely trajectory of emissions levels over the goal period.

[84] As noted above, this calculated value is subject to change, depending on actual units of output in the target year.
[85] While users with single year dynamic baseline scenario goals can calculate the expected target year emissions level and emissions reductions needed, they are subject to change during the goal period due to baseline scenario updates (see Chapter 6).
[86] Fixed level single year goals are not relative to a base year or baseline and therefore necessary emissions reductions cannot be calculated.

Users with base year goals and fixed level goals may develop an informational baseline scenario (corresponding to a business-as-usual projection) and report baseline scenario emissions in the target year. Comparing emission levels against a baseline scenario can offer decision makers and stakeholders insight into the level of effort associated with meeting their goal by illustrate what emissions levels would have most likely been in the absence of the goal. Refer to Chapter 6 for guidance on developing informational baselines.

9.3 Calculating expected emissions level and emissions reductions for multi-year goals

Users with multi-year goals shall calculate and report the expected emissions levels in the target year, as well as the emissions reductions needed to meet the goal, according to their multi-year goal type (see Chapter 5 for a description of different types of multi-year goals). Calculation methods for each multi-year goal type are provided in Equation 9.4 and Equation 9.5. To complete these calculations users will need data for base year emissions or baseline scenario emissions throughout the target period.

Equation 9.4. Calculating annual emissions levels over the target period for multi-year goals

Multi-year goal type	Calculation method: Emissions levels over the target period for multi-year goals
Base year goal	
Average	**Average annual emissions during the target period** = (Base year emissions) − [(Base year emissions) X (Average annual percent reduction)]
Annual	**Annual emissions for each year during the target period** = (Base year emissions) −[(Base year emissions) × (Percent reduction for each year in the target period)]]
Intensity goal	
Average	**Average annual emissions during the target period** = (Average target year emissions intensity level associated with meeting the goal [e.g., t CO_2e / GDP] × (Projected output metric for each year in the target period [e.g., GDP])
Annual	**Annual emissions during the target period** = (Target year emissions intensity level associated with meeting the goal for each year in the target period [e.g., g CO_2e/ GDP]) × (Projected output metric for each year in the target period [e.g., GDP])
Static and dynamic[87] baseline scenario goal	
Average	**Average annual emissions during the target period** = (Baseline scenario emissions in each year) − ([Baseline scenario emissions in each year) × (Average annual percent reduction)]
Annual	**Annual emissions during the goal period associated with meeting the goal** = (Baseline scenario emissions in eachyear) − [(Baseline scenario emissions in each year) X (Percent reduction for each year in the target period)]
Fixed level goal	
Cumulative	**Average annual emissions during the target period** = (Cumulative goal for goal period) / (Number of years in goal period)
	Cumulative emissions over the goal period associated with meeting the goal = Cumulative goal for the goal period
Average	**Average annual emissions during the target period** = Average annual goal
Annual	**Annual emissions during the goal period associated with meeting the goal** = Annual goal for each year in the target period

[87] While users with dynamic baseline scenario goals can calculate the expected target year emissions level and emissions reductions needed, they are subject to change during the goal period due to baseline scenario updates (see Chapter 6).

Equation 9.5. Calculating emissions reductions for multi-year goals

Multi-year goal type	Calculation method: Emissions reductions over the target period for multi-year goals
Base year goal	
Average	**Difference between base year emissions and average annual emissions during the target period** = (Base year emissions) X (Average annual percent reduction)
Annual	**Difference between base year emissions and annual emissions during the target period** = (Bbase year emissions in each year in the target period*) X (Percent reduction for year) *This can be calculated for each year in the target period
Intensity goal	
Average	**Difference between base year emissions and average annual emissions during the target period** = (Average annual emissions during the target period (see Equation 9.4)) −(Base year emissions)
Annual	**Difference between base year emissions and annual emissions during the target period** = (Annual emissions for each year of the target period* (see Equation 9.4)) − (Base year emissions) *This can be calculated for each year in the target period
Static or dynamic[88] baseline scenario goal	
Average	**Average annual emissions reductions (compared to a baseline scenario) during the target period needed to meet the goal** = (Baseline scenario emissions in year) X (Average annual percent reduction)
Annual	**Annual emissions reductions (compared to a baseline scenario) during the target period needed to meet the goal** = (Baseline scenario emissions in year) X (Percent reduction for year)
Fixed level goal	
N/A[89]	

Users with average multi-year goals shall calculate and report:

- Average annual emissions level during the target period associated with meeting the goal, by scope (see Equation 9.4)
- Average annual emissions reductions during the target period needed to meet the goal, by scope (see Equation 9.5)

Users with annual multi-year goals shall calculate and report:

- Annual emissions level associated with meeting the goal for each year during the target period, by scope (see Equation 9.4)
- Annual emissions reductions needed to meet the goal for each year during the target period, by scope (see Equation 9.5)

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[88] While users with single year dynamic baseline scenario goals can calculate the expected target year emissions level and emissions reductions needed, they are subject to change during the goal period due to baseline scenario updates (see Chapter 6).

[89] Calculating emissions reductions is not relevant for fixed level goals because these goals don't specify a base year or baseline scenario against which to measure reductions.

Users with cumulative multi-year goals shall calculate and report:

- Average annual emissions during the target period associated with meeting the goal by scope (see Equation 9.4)
- Cumulative emissions over the target period associated with meeting the goal by scope (see Equation 9.4)

Box 9.1. Cumulative emissions over the goal period associated with meeting a cumulative multi-year goal: UK case study

The UK Climate Change Act of 2008 requires that the UK's GHG emissions are reduced by at least 80% by 2050 below 2010 base year levels. Four five-year carbon budgets were developed to set the trajectory for achieving the goal. Each carbon budget limits cumulative GHG emissions for a specified five-year period.[90]

The UK's carbon budgets limit aggregate GHG emissions over each of the five-year goal periods to:

- 3,018 Mt CO_2e between 2008 - 2012
- 2,782 Mt CO_2e between 2013 - 2017
- 2,544 Mt CO_2e between 2018 - 2022
- 1,950 Mt CO_2e between 2023 - 2027

In the case of the UK, cumulative emissions over the goal period associated with meeting the goal equal the carbon budget for the particular goal period. For example, cumulative emissions over the goal period 2013 – 2017 associated with meeting the goal are 2,782 Mt CO_2e.

9.4 Adjusting emissions levels for expected use of transferrable emissions units and land-use sector emissions

Users may choose to meet their goals by using emissions units (e.g., offset credits and allowances) purchased from outside the goal boundary. Similarly, users may generate emissions units within the goal boundary that are sold and counted toward the goals of other jurisdictions. Furthermore, if the land-use sector is not covered by the goal boundary, users may utilize GHG removals from the land-use sector to offset emissions from covered sectors and gases.

In order to account for the expected use of transferable emissions units ex-ante, users should adjust the emissions level associated with meeting their goal if they have knowledge on the expected use of transferable emissions units (e.g., they have agreements with other jurisdictions on the future sale/purchase of units) and land-use the sector. In general, to adjust the emissions level associated with meeting the goal, users should**:**

- Subtract emissions units expected to be retired during the target year/target period and/or expected GHG removals from the land-use sector, and/or
- Add emissions units expected to be sold during the target year/target period (see Equation 9.6)
- Adjust for the expected use of the land-use sector, to the extent known

[90] UK Department of Energy and Climate Change, "UK greenhouse gas emissions: Performance against emissions reduction targets – 2011 provisional figures," 2012, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48643/2351-uk-greenhouse-gas-emissions-performance.pdf

Users that set goals relative to a baseline scenario that already includes the expected purchase and sale of transferable emissions units should not use Equation 9.6 to adjust for the expected use of transferable emissions units. Doing so would lead to the double counting of emissions units.

Equation 9.6. Ex-ante adjustment for expected use of emissions units and treatment of the land use sector

Calculation method
$\textbf{Adjusted target year emissions level} =$ $(\text{Target year emissions level associated with meeting the goal}^{*})$ $-\ (\text{Emissions units expected to be retired in the target year})$ $+\ (\text{Emissions units expected to be sold to other entities in the target year})$ *This should include expected net emissions from the land-use sector if applicable and known, which can be determined with Chapter 7. This is a sample equation for a single year target, For multi-year target, the user would adjust target period emissions (annual, average or cumulative) with expected use of emissions units (annual, average or cumulative respectively).

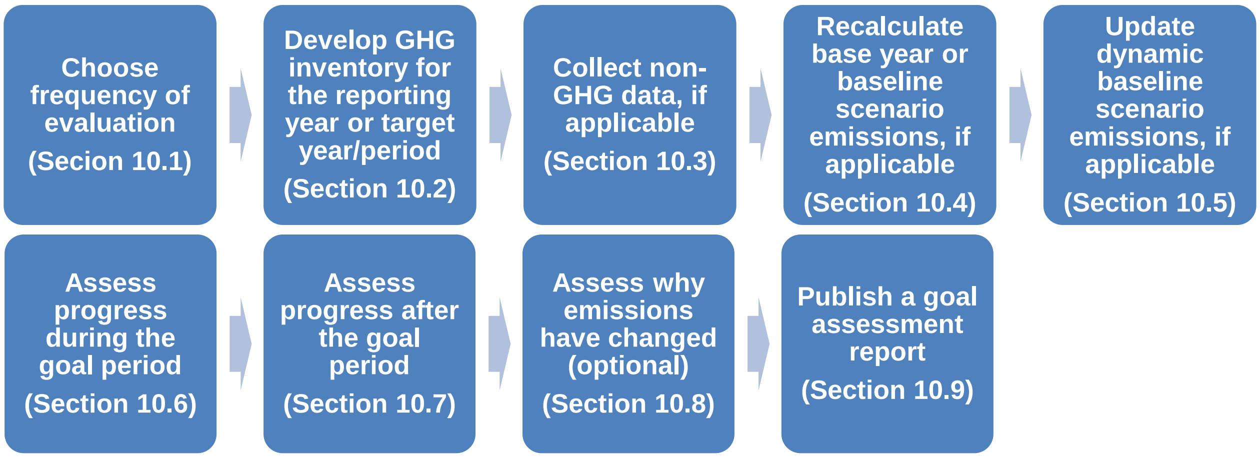
If a user is expected to be a net purchaser of emissions units, this adjustment would raise target year/period emissions associated with meeting the goal. If a user is expected to be a net seller of emissions units, the adjustment would lower target year/period emissions associated with meeting the goal.

Adjusting the emissions level associated with meeting the goal ex-ante based on expected use of emissions units is inherently uncertain since actual use of emissions units over the goal period may change. Only users that have predetermined their transferable emissions units use during the target year/target period should carry out an adjustment. Users shall disclose any ex-ante adjustments for the expected use of emissions units (purchased and sold) and for the expected use of the land-use sector made to the emissions level associated with meeting the goal.

Chapter 10: Assessing progress during and after the goal period

This chapter provides guidance on: 1) assessing and reporting progress toward the mitigation goal during the goal period, and 2): assessing and reporting achievement of the goal at the end of the goal period.

Figure 10.1. Overview of steps in this chapter



Accounting requirements in this chapter[91]

Section 10.1

- At the end of the goal period, users shall evaluate whether the mitigation goal has been achieved
- Users with multi-year goals shall evaluate progress on an annual basis throughout the target period.

Section 10.2

- Emissions data for the evaluation shall come from official inventories that have been reviewed by third parties and are publicly available.
- National jurisdictions shall apply IPCC methods to develop a GHG inventory.
- If users update inventory methods or GWP values during the goal period, emissions for all previous years in the goal period, including the base year, shall be recalculated
- Once emissions data are collected from the inventory, users shall adjust the inventory to the goal boundary (e.g., select only those covered sectors and greenhouse gases) to estimate the reporting year or target year/period's emissions level.

Section 10.3

- For the land-use sector, uncertainty shall be addressed using the IPCC *Good Practice Guidance for LULUCF* (and any updates)
- Uncertainty related to baseline drivers and assumptions shall be addressed in a consistent manner.

Section 10.4

- Before evaluating progress at the end of the goal period, base year and baseline scenario emissions shall be recalculated based on any significant changes to methodology, goal boundary, and discovery of significant errors (as outlined in Chapter 6) and in accordance with users' recalculation policy.

[91] This table lists the accounting requirements in the chapter. Reporting requirements for this chapter are listed in Chapter 12 and are not listed below. While some sections in this chapter do not have requirements, each section in the chapter contains recommendations.

Section 10.5

- Before evaluating progress at the end of the goal period, users with dynamic baseline scenarios shall update their baseline scenarios based on any significant changes in emissions drivers and users' update policy
- Users with fixed baseline scenario goals shall not update their baseline scenario

Section 10.6

- If evaluating progress during the goal period, users shall first adjust inventory emissions within the goal boundary in the reporting year to account for land-use sector emissions and for transferable emissions units retired or sold in the reporting year.

Section 10.7

- At the end of the goal period, users shall evaluate whether they have achieved their goal.
- Users shall adjust target year inventory emissions to account for land-use sector emissions and for transferable emissions units that are retired or sold in the target year.
- For all goal types, including single year goals, users shall quantify the cumulative change in emissions over the goal period.
- If users make any significant changes to the goal boundary, goal type, or goal level during the goal period they shall make the required recalculations.
- The goal assessment report shall be completed as soon as possible after the end of the goal period (considering the availability of data to produce a quality inventory for the target year).

Section 10.9

- At the end of the goal period, users shall develop and make publically available a final goal assessment report that provides evidence of whether the mitigation goal was achieved, including all relevant methodological choices, subsequent recalculations or revisions, and all reporting requirements listed in Chapter 12.
- Final goal assessment reports shall be publically available in a timely manner at the end of the goal period
- If an interim assessment report is produced, it shall be made publically available in a timely manner after completion
- Users shall specify when and where reports are published and how the public can obtain copies.

10.1. Choose frequency of evaluation

This chapter focuses its attention on how to evaluate progress during the goal period – to understand to what extent users are on track in meeting its goal – as well as at the end of the goal period – to understand if the goal has been met.

At the end of the goal period, users shall evaluate whether the goal has been achieved. Users with multi-year goals shall evaluate and report progress on an annual basis throughout the target period because an annual reporting frequency will be necessary for understanding whether the goal has been met. This final stage of evaluation can assist in the design of new goals and mitigation programs.

During the goal period, users should regularly evaluate and report progress toward meeting their goal. Evaluating progress during the goal period aids in the understanding of whether a jurisdiction's emissions have changed. This will clarify overall progress toward the goal and the likelihood of success in achieving the goal. This information can be used to modify mitigation strategies to ensure goals are met. The frequency of evaluation will depend on a range of factors, including users' objectives, decision-making needs, data availability, cost, capacity, and stakeholder demand. As a general rule, in approaching the target year or target period the selected reporting frequency should allow decision makers and other affected stakeholders to gain a solid understanding of the latest trends in emissions and how much further emissions have to be reduced if the goal is to be achieved. Annual reporting will produce the timeliest and consistent reports and most effectively track progress. Once a reporting frequency is established, the same frequency should be used throughout the goal period. Consistent frequency of reporting helps ensure a common basis for performance tracking over time.

10.2. Develop a GHG inventory for the reporting year or target year/period

The first step in assessing progress is to develop a GHG inventory for the reporting year (for assessing progress during the goal period) or for the target year/period (for ex-post assessment). Emissions data for the assessment shall come from official inventories that have been reviewed by third parties and are publicly available. As described in Chapter 5, national jurisdictions shall apply IPCC methods to develop a GHG inventory. Subnational jurisdictions should apply internationally accepted guideline such as C40/ICLEI/WRI *Global Protocol for Community Emissions* (GPC). Users shall disclose and justify all data sources used for evaluating progress. Uncertainty and quality assurance/quality control procedures should follow the same methodologies as that used for the inventory in the base year. For more information, see Chapter 5, Section 5.1.

Gaps in past inventory data should be filled using estimations according to methodologies clearly specified in the progress evaluation plan. The results of any interpolated or extrapolated data shall be clearly reported and differentiated from actual reported data. Missing data for current year(s) may be approximated from the most recently available published inventory report or any other method that is clearly specified in the progress evaluation plan. Methods for interpolation or extrapolation shall be reported, applied consistently, and accompanied by estimates of uncertainty introduced in the resulting figures. The results shall be clearly reported and differentiated from actual reported data.

Since inventory methods and GWP values are updated over time by the IPCC, an important consideration for users is how and when inventory methods and/or GWP values used to track progress are updated. Users should apply the same inventory methods and GWP values for evaluating progress during and after the goal period in order to have a consistent time series and enable performance tracking over time on a common basis. If users update inventory methods or GWP values during the goal period, emissions for all previous years in the goal period, including the base year, shall be recalculated.

Once emissions data are collected from the inventory, users shall adjust the inventory to the goal boundary (e.g., select only those covered sectors and greenhouse gases) to estimate the reporting year or target year/period's emissions level. This will provide the basis for evaluating progress.

10.3. Collect non-GHG data (if relevant)

Other data sources in addition to emissions data may also be relevant. For example, for intensity goals, data are required for devising the unit of output (e.g., GDP). Data sources for units of output for emissions intensity goals should come from official, peer-reviewed sources that are publicly available. Additionally, data related to offset credits (purchased, sold, or shared), baseline scenarios, and emissions and removals in the land-use sector will be relevant. Users shall disclose and justify all data sources that are being used for evaluating progress.

QA/QC of updates to non-GHG data should be done in a consistent manner as the base year inputs. Users should make every effort to assure the integrity of data used for reports completed under this standard. Such assurances may benefit from external (third party) experts and reviewers that should evaluate the quality of data and tracking systems and the accuracy of reports. Users shall disclose data QA/QC procedures for both GHG emissions data and non-GHG emissions data (as relevant) that are collected for the reporting year and/or target year/period.

For the land-use sector, uncertainty shall be addressed using the IPCC *Good Practice Guidance for LULUCF* (and any updates).[92] Uncertainty related to baseline drivers and assumptions is addressed in

[92] IPCC, *Good Practice Guidance for Land-use, Land-use Change and Forestry*, 2003, http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html.

Chapter 6 and shall be addressed in a consistent manner. Users shall disclose and justify how data uncertainty is addressed.

10.4. Recalculate base year or baseline scenario emissions

Before evaluating progress at the end of the goal period, base year and baseline scenario emissions shall be recalculated based on any significant changes to methods, the goal boundary, and discovery of significant errors (as outlined in Chapter 6) and in accordance with the user's recalculation policy. Any recalculations to base year or baseline scenario values shall be reported with a statement whether these changes could materially affect the likelihood of achieving the emission goal and why recalculations occurred.

10.5. Update dynamic baseline scenarios

Before evaluating progress at the end of the goal period, users with dynamic baseline scenarios shall update their baseline scenarios based on any significant changes in emissions drivers and the user's update policy (see Chapter 6). During the goal period, users with dynamic baseline scenario goals should regularly update their baseline scenarios in order to ensure consistent tracking over time. Updated dynamic baseline scenarios shall be reported alongside the original baseline so that a comparison can be made. Users with fixed baseline scenario goals shall not update their baseline scenario.

10.6. Assess progress during the goal period

During the goal period, users should regularly evaluate and report progress toward achieving their goal. Information gained from regular progress evaluations can be used to gauge likelihood of success in achieving the goal, modify existing mitigation policies, inform the design of new policies, and respond to stakeholder demand. To evaluate progress during the goal period users shall first adjust inventory emissions within the goal boundary in the reporting year to account for transferable emissions units and the treatment of the land-use sector (see Equation 10.1). Users shall adjust only for transferable emissions units that are retired or sold in the reporting year. Users should utilize the GHG balance sheets provided in Appendix A to track land-use emissions and annual sales and purchases of transferable units and adjust emissions accordingly.

For users with baseline scenario goals that have already included expected transfers of emissions units (retirement and sales) in the baseline scenario (see Chapter 9), only the difference between expected transfers and actual transfers (in the reporting year) should be used to adjust the reporting year's emissions. Otherwise there will be double counting of such units. See Section 6.2.4 for further information.

Equation 10.1. Adjusting reporting year emissions for transferable emissions units and LULUCF

$$\begin{aligned}&\textbf{Adjusted reporting year emissions within the goal boundary} =\\&(\text{Emissions level in the goal boundary in the reporting year}^{*})\\&+ (\text{Transferable emissions units sold in the reporting year})\\&- (\text{Transferable emissions units purchased and retired in the reporting year})\end{aligned}$$

*Including net emissions from the land-use sector if applicable, which can be determined with Chapter 7.

Next, users should calculate and report changes in emissions since the start of the goal period. Equation 10.2 demonstrates how this calculation can be carried out.

Equation 10.2. Quantifying the change in emissions between the reporting year and the base year

$$\textbf{Change in emissions between reporting year and base year} = \left(\text{Adjusted reporting year emissions within goal boundary (see Equation 10.1)}\right) - \left(\text{Base year emissions within goal boundary (see Chapter 6)}\right)$$

While baseline scenario goals and fixed level goals do not have base years, users can still evaluate progress since an earlier date. For those that have baseline scenario goals, emissions in the start year of the projection can be used instead of base year emissions in this calculation. For those with fixed level goals, emissions in the year the goal was adopted can be used instead of base year emissions in this calculation.

Users should then calculate and report the additional quantity of emissions reductions needed to meet the goal (see Equation 10.3). To do so, for a single year goal, users compare emissions in the reporting year with the target year/target period emissions level. This step will provide an indication of how users are progressing towards the target year or the start of the target period (see Equation 10.3).

Users that have multi-year cumulative goals should use a different calculation because an additional step is required to translate the cumulative goal into an average annual level of emissions for each year in the target period (see second equation in Equation 10.3). This calculation will provide users with an emissions level for the start of the target period and then enable a comparison with reporting year emissions.[93]

Emission reductions needed to meet the goal should be reported in both absolute and percentage terms.

Equation 10.3. Quantifying the additional emissions reductions needed to meet the goal

For all goal types except multi-year cumulative goals:

$$\textbf{Additional emissions reductions needed to meet the goal} = \left(\text{Adjusted reporting year emissions within the goal boundary (see Equation 10.1)}\right) - \left(\text{Target year or target period emissions level associated with meeting the goal}^*\right)$$

For multi-year cumulative goals:

$$\textbf{Additional emissions reductions needed to meet the goal} = \left(\text{Adjusted reporting year emissions within the goal boundary (see Equation 10.1)}\right) - \left(\text{Cumulative emissions level associated with meeting the goal / number of years in the target period}^*\right)$$

*See Chapter 9 for calculating target year/target period emissions levels associated with all goal types.

Users may evaluate whether the emissions level in the reporting year is in reach of meeting the goal, consistent with reductions planned for the remainder of the goal period within the margin of error of the data. Such assessment can be done by projecting reductions achieved out to the end of the goal period, or comparison to interim goals established ex-ante. In the case of the former method, the uncertainties associated with such projections are likely to be large and may greatly reduce the value of such comparisons. Because of such statistical issues, comparison to ex-ante interim goals is recommended.

[93] This is one approach for quantifying additional emissions reductions needed to meet a multi-year cumulative goal. Another approach is to assume a linear rate of decline in emissions over the goal period where emissions reductions needed to meet the goal increase each year.

Statistical methods like those to be applied to ex-post evaluations are likely to be useful in making and interpreting assessments of interim progress.

During the goal period, users should evaluate and report interim progress made toward meeting their goals and the calculation methodologies used in interim goal assessment reports (see Section 10.9). If users choose to evaluate progress during the goal period, they shall report the following information:

- Total emissions and removals within the goal boundary in the reporting year (before any adjustments for transferable emissions units and land-use sector) by gas, carbon dioxide equivalent (CO_2e), and scope (if relevant)
- Adjusted reporting year emissions by gas, carbon dioxide equivalent (CO_2e), and scope (if relevant).
- Emissions reductions or reductions in emissions intensity achieved relative to base year or baseline scenario emissions, according to goal type
- Emissions reductions achieved relative to an informational baseline scenario, if developed
- Cumulative change in emissions between the base year and reporting year
- In cases where a jurisdiction's mitigation goal does not cover all the sectors and gases in its GHG inventory, users shall report total GHG inventory emissions. This information helps stakeholders compare emissions from sectors and gases covered by the goal to those left out of the goal boundary.

Equation 10.4. Quantifying the cumulative change in emissions between the base year and reporting year

$$\textbf{Sum of emissions since the base year} = \text{Sum of each year's adjusted emissions levels (see Equation 10.1) during the goal period}$$

10.7. Assess progress at the end of the goal period

At the end of the goal period, users shall evaluate and report whether they have achieved their goal. Similar to tracking emissions reductions during the goal period, the first step is to adjust the emissions level for the target year/target period (see Equation 10.5). Users shall adjust only for transferable emissions units that are retired or sold in the reporting year. Users should utilize the GHG balance sheets provided in Appendix A to track land-use emissions and annual sales and purchases of transferable units and adjust emissions accordingly. See Figure 10.2 for an illustration of adjusted target year emissions.

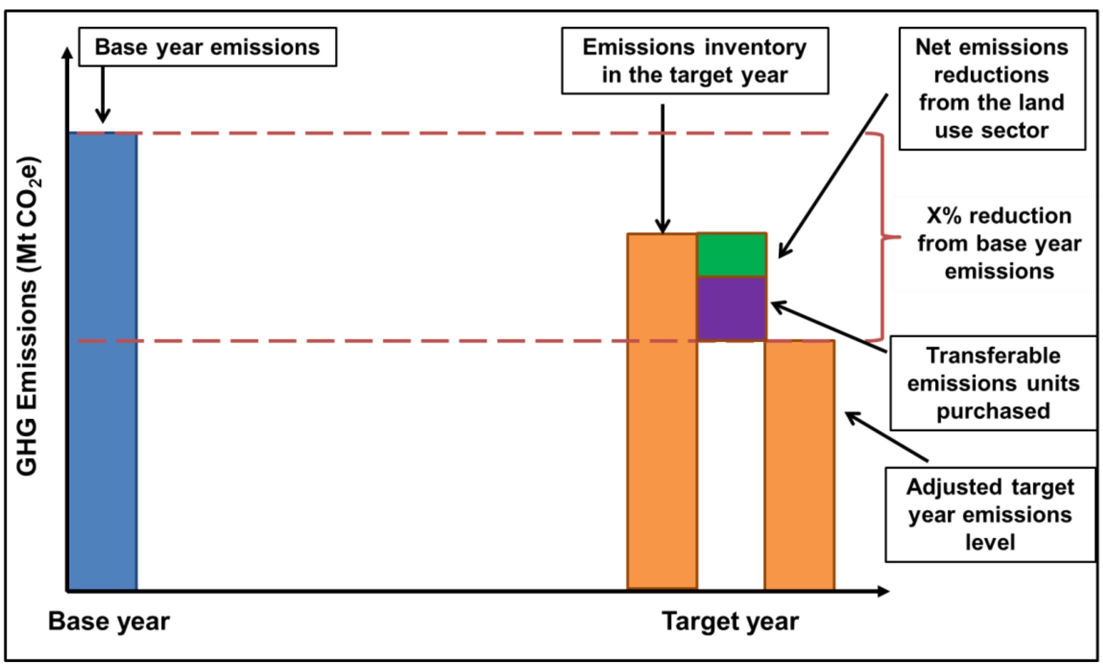
For users with baseline scenario goals that have included expected transfers of emissions units (purchases and sales) in the baseline scenario (see Chapter 9), only the difference between expected transfers and actual transfers (in the target year/period) should be used to adjust inventory emissions. Otherwise there will be double counting of such units. See Section 6.2.4 for further information.

Equation 10.5. Adjusting target year/target period emissions

Goal	Calculation method
Single year goals	$\textbf{Adjusted target year emissions in the goal boundary} = (\text{Emissions level in the goal boundary in the target year}^{*}) + (\text{Transferable emissions units sold in the target year}) - (\text{Transferable emissions units retired in the target year})$ *This shall include net emissions from the land-use sector if applicable, which can be determined with Chapter 7. Also, see Chapter 9 for equations related to target level emissions

Multi-year goals: Average	**Adjusted average emissions over the target period*** = (Average annual emissions over the target period**) + (Average transferable emissions units sold during the target period) − (Average transferable emissions units retired over the target period) **This shall include net emissions from the land-use sector if applicable, which can be determined with Chapter 7. Also, see Chapter 9 for equations related to target period emissions levels.
Multi-year goals: Annual	**Adjusted annual emissions over the target period*** = (Annual emissions in the goal boundary for each year during the target period **) + (Transferable emissions units sold for each year of the target period) − (Transferable emissions units retired for each year of the target period) * This shall be calculated for every year of the target period, as each target period year's emissions levels are needed to determine whether the goal has been achieved. ** This shall include net emissions from the land-use sector if applicable, which can be determined with Chapter 7. Also, see Chapter 9 for equations related to target period emissions levels.
Multi-year goals: Cumulative	**Adjusted cumulative emissions over the target period associated with meeting the goal** = (Cumulative emissions in the goal boundary over target period*) + (Emissions units sold during the target period) − (Emissions units retired over the target period) *This shall include net emissions from the land-use sector if applicable, which can be determined with Chapter 7. Also, see Chapter 9 for equations related to target period emissions levels.

Figure 10.2. Adjusted target year emissions level



After the emissions level in the target year/target period is adjusted, the next step is to evaluate whether the jurisdiction has achieved the goal (see Equation 10.6).

Equation 10.6. Determining whether the goal has been achieved

Single year base year, baseline scenario and fixed level goals

$$(\text{Adjusted target year emissions (see Equation 10.5)}) - (\text{Target year emissions level associated with meeting the goal})$$

To determine "target year emissions level associated with meeting the goal," see Chapter 9.

If the goal has been achieved, the result will be zero (or less than zero if the goal is exceeded).

Single year or multi-year intensity goal

$$[(\text{Adjusted target year or target period emissions (see Equation 10.5)}) / \text{Quantity of output in the target year or target period}] - (\text{Target year or target period emissions intensity associated with meeting the goal})$$

To determine "target year emissions intensity associated with meeting the goal," see Chapter 9.

If the goal has been achieved, the result will be zero (or less than zero if the goal is exceeded).

Multi-year average goal

$$(\text{Adjusted average emissions over the target period (see Equation 10.5)} - (\text{Average emissions over the target period associated with meeting the goal})$$

To determine "average emissions over the target period associated with meeting the goal," see Chapter 10.

If the goal has been achieved, the result will be zero (or less than zero if the goal is exceeded).

Multi-year annual goal

$$(\text{Adjusted annual emissions for each year of the target period (see Equation 10.5)} - (\text{Annual emissions for each year of the target period associated with meeting the goal})$$

To determine "annual emissions over the target period associated with meeting the goal," see Chapter 9.

If the goal has been achieved, the result will be zero (or less than zero if the goal is exceeded). This calculation should be carried out for each individual year of the target period.

Multi-year cumulative goal

$$(\text{Adjusted cumulative emissions over the target period (see Equation 10.5)} - (\text{Cumulative emissions over the target period associated with meeting the goal})$$

To determine "cumulative emissions over the target period associated with meeting the goal," see Chapter 9.

If the goal has been achieved, the result will be zero (or less than zero if the goal is exceeded).

For multi-year cumulative goals, if the target period has yet to be completed but the reporting year falls within the target period, it is possible to also perform a calculation to understand the level of additional emissions reductions needed to meet the goal.

$$\textbf{Additional emissions reductions needed to meet the goal} = \text{(Sum of adjusted emissions within the goal boundary (see Equation 10.1) for each individual year that has occurred in the target period)} - \text{(Cumulative emissions level associated with meeting the goal)}$$

For all goal types, including single year goals, users shall quantify the cumulative level of emissions over the goal period.

Equation 10.7. Quantifying the cumulative level of emissions between the base year and target period

$$\textbf{Sum of emissions since the base year}^{*} = \text{Sum of each year's adjusted emissions levels during the goal period}$$

* In advance of reaching the target year or target period, if annual series of emission data are not reported, users can interpolate or extrapolate as needed. Methods for such interpolation or extrapolation shall be reported, applied consistently, and accompanied by estimates of uncertainty introduced in the resulting figures.

At the end of the goal period:

- Users shall report whether the mitigation goal has been achieved and the calculation methodologies used. Based on the uncertainty related to the emissions estimation, users may evaluate whether the emissions level at the end of the goal period is consistent with the goal level within the margin of error of the data. In the event that the goal has not been achieved, users should provide a qualitative explanation of why the goal was not achieved.
- All users shall report total emissions and removals within the goal boundary in the target year or target period (before any adjustments for transferable emissions units and land-use sector) by gas, carbon dioxide equivalent (CO_2e), and scope (if relevant)
- All users shall report adjusted target year or target period emissions by gas, carbon dioxide equivalent (CO_2e), and scope (if relevant).
- All users shall report the difference between the emissions levels associated with meeting the goal (calculated ex-ante in Chapter 9) with the adjusted emissions level in the target year or period.
- All users shall report cumulative change in emissions over the goal period.
- Users with base year goals shall report emissions reductions achieved relative to base year emissions.
- Users with intensity goals shall report reductions in emissions intensity relative to base year emissions intensity.
- Users with baseline scenario goals shall report emissions reductions achieved relative to baseline scenario emissions in the target year.
- Users with base year goals and emissions intensity goals should report emissions reductions achieved relative to an informational baseline scenario, if developed.
- In cases where a jurisdiction's mitigation goal does not cover all the sectors and gases in its GHG inventory, users shall report total GHG inventory emissions. This information helps stakeholders compare emissions from sectors and gases covered by the goal to those left out of the goal boundary.

If users make any significant changes to the goal boundary, goal type, or goal level during the goal period they shall make the required recalculations. For guidance and requirements on recalculations for goal revisions see Section 5.15.

The goal assessment report shall be completed as soon as possible after the end of the goal period (considering the availability of data to produce a quality inventory for the target year). If users intend to enter another goal period and there is a review procedure between goal periods, the report should be produced as soon as possible so that it can inform plans for the next goal period.

10.8. Assess why emissions have changed (optional)

At the end of the goal period, users should assess why emissions in the jurisdiction have changed using qualitative and quantitative methods. Examples of methods include regression analysis and decomposition analysis. Decomposition analysis is commonly used to determine the effect of changes in various emissions drivers (e.g., economic activity, population, energy prices, and GHG intensity of energy) on overall emissions levels within the goal boundary during the goal period. In general, the first step of decomposition analysis is to identify relevant emissions drivers for the sectors or subsectors being analyzed. The second step is to disaggregate changes in emissions (within the goal boundary and during the goal period) into a sum of individual changes that can be attributed to each of the previously identified emissions drivers (see Box 10.1 for an example of decomposition analysis of CO_2 emissions trends from passenger cars in the EU).[94]

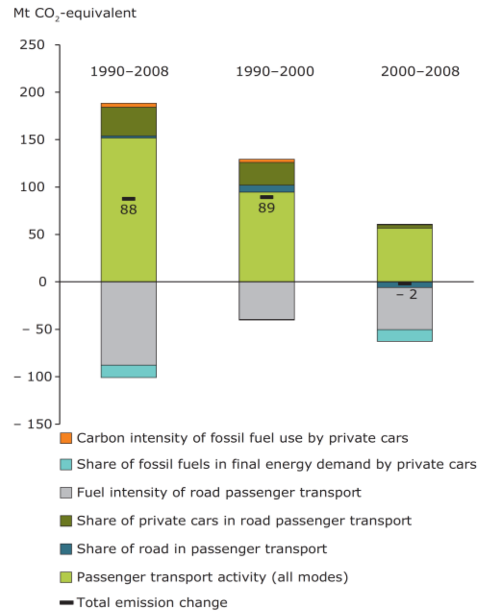
Employing decomposition analysis can help users understand why emissions have changed during the goal period and determine whether changes were the result of mitigation efforts (e.g., mitigation policies, actions, programs, and projects) or other factors (e.g., changes in economic activity). Information gained from decomposition analysis should be used to inform the design of future mitigation goals and strategies.

Box 10.1. Example of decomposition analysis of CO_2 emissions trends from passenger cars in the EU

Figure 10.3 shows the effect of different emissions drivers (listed below the graph) on emissions from passenger cars in the EU for the periods 1990-2008, 1990-2000, and 2000-2008. Based on this decomposition analysis, decision makers are able to understand why emissions have changed during each period. Increased passenger transport activity caused the largest increase in emissions from 1990-2008, increasing emissions by approximately 150 Mt CO_2; while changes in fuel intensity caused the largest decrease in emissions during the same period, reducing emissions by approximately 75 Mt CO_2e. If mitigation policies to reduce fuel intensity were implemented during the period 1990-2008, decision makers could have an indication that these policies helped to reduce emissions relative to what would have happened otherwise (though further assessment would be needed, such as using the GHG Protocol *Policy and Action Standard*). However, they would also be able to see that the positive effects of these policies were overwhelmed by emissions increases from people driving cars more (i.e., increases in passenger transport activity). Knowing this, policy-makers might next design policies that aim to reduce passenger transport activity.

[94] For additional examples of decomposition analyses see: Schleich, et al., “Greenhouse gas reductions in Germany – lucky strike or hard work?,” *Climate Policy* 1(3), 2001, 363-380; Mishina, Y. and Muromachi, Y. “Revisiting Decomposition Analysis for Carbon Dioxide Emissions from Car Travel: Introduction of Modified Laspeyres Index Method,” *Transportation Research Record*, 2012, 171-179; Sun, W., et al., “Decomposition analysis of energy-related carbon dioxide emissions in the iron and steel industry in China,” *Frontiers of Environmental Science & Engineering*, 6, 2012, 265-270; and Feng, K, et al., “Analyzing Drivers of Regional Carbon Dioxide Emissions for China: A Structural Decomposition Analysis,” *Journal of Industrial Ecology*, 16, 2012, 600-611.

Figure 10.3. Decomposition analysis of CO_2 emissions trends from passenger cars in the EU, 1990-2008[95]



Note: Each bar shows the contribution of a single driver to GHG emission trends during a determined period. The thick short black lines indicate the combined effect of all emission drivers, i.e. the overall GHG emission trend during the period considered.
Different data sources have been used for the calculation of carbon intensity, which may result in a relatively high uncertainty of the results for this driver.

Source: Own calculations, based on EEA, 2010a; European Commission, 2010a; Eurostat, 2011b.

One simplified approach for beginning to understand why energy-related emissions have changed in a sector or subsector is to populate a Kaya identity with relevant data from the goal period (see Equation 10.8). Once populated, the Kaya identity can help users identify which emissions drivers have changed during the goal period and the approximate effect those changes had on overall energy-related GHG emissions. For example, users can isolate changes in GHG intensity of energy (emissions / gross energy consumption) and then trace how these changes affect overall energy-related emissions in a sector or subsector. If GHG intensity of energy decreases over time, users can then try to determine whether those decreases are the result of mitigation policies or other factors.

Equation 10.8. Kaya identity for decomposing changes in energy-related emissions

$$\textbf{Energy related GHG emissions} =$$

$$(\text{Population}) \text{ X } \left(\frac{\text{GDP}}{\text{Population}}\right) \text{X} \left(\frac{\text{Gross energy consumption}}{\text{GDP}}\right) \text{X} \left(\frac{\text{GHG emissions}}{\text{Gross energy consumption}}\right)$$

To estimate the GHG effects of individual mitigation policies and actions (or packages of policies and actions), users should refer to the *GHG Protocol Policy and Action Standard*.

[95] European Environment Agency, *Greenhouse gas emissions in Europe: A retrospective analysis for the period 1990-2008*, 2011, p39, Copenhagen, http://www.eea.europa.eu/publications/ghg-retrospective-trend-analysis-1990-2008.

Whether or not a user has achieved a mitigation goal is based on a comparison between actual emissions within the goal boundary in the target year/period and the target year/period emissions level associated with meeting the goal. This standard does not prescribe how goals are to be achieved, which can be a result of users' effort or other factors. Therefore, decomposition analysis should be seen as a way for users to understand emissions trends and make decisions about future policies and goals, not as a means to demonstrate why their goal was or was not achieved.

10.9. Goal assessment report

At the end of the goal period, users shall develop and make publically available a final goal assessment report that provides evidence of whether the mitigation goal was achieved, including all relevant methodological choices, subsequent recalculations or revisions, and all reporting requirements listed in Chapter 12. Final goal assessment reports shall be publically available in a timely manner at the end of the goal period. Users shall specify when and where reports are published and how the public can obtain copies.

During the goal period, users should regularly develop and make publically available interim goal assessment reports that contain all relevant methodological choices, subsequent recalculations or revisions, and all reporting requirements listed in Chapter 12. If an interim assessment report is produced, it shall be made publically available in a timely manner after completion.

To improve the transparency of the assessment report, users should consider presenting reports at multiple levels of detail and in several formats for a variety of audiences, while meeting the reporting requirements. High-level summaries may be appropriate for policy makers or the general public. Greater detail may be appropriate for more technical audiences and full detail is required for official reports and determination of achievement of goals. Greater public use and scrutiny of data is possible when data are readily available in downloadable forms such as spreadsheet-compatible files. Both graphical and tabular presentations may be valuable. Public venues where results are presented, explained, and available for examination and feedback can do much to improve data quality and transparency.[96]

Users should specify in the assessment report a schedule for evaluation of the plan itself. This should include identifications of needed revisions, controlling decisions on when and if updates will be made, and whether and under what circumstances improvements to the assessment reports will be allowed or required. Any revisions should include all reasonable efforts to improve data quality and ensure compliance with the five accounting principles outlined in Chapter 4.

[96] Adapted from "Tracking Emissions and Mitigation Actions: Evaluation of MRV Systems in China, Germany, Italy, and the United States" published by the Climate Policy Initiative, 2013, http://climatepolicyinitiative.org/wp-content/uploads/2012/05/Tracking-Emissions-and-Mitigation-Actions-Evaluation.pdf.

Chapter 11: Verification

This chapter provides guidance on how to carry out verification. While verification is not a requirement of this standard, carrying out verification of the mitigation goal assessment report is valuable for providing the implementing user and relevant stakeholders with confidence in the results of the report.

11.1 Introduction

Assurance is the level of confidence that the information reported is relevant, complete, accurate, consistent, transparent, and without material misstatements. Verification is the process for assessing the level of assurance. The verification process involves an evaluation of whether the principles of GHG accounting have been met and of users' justifications of chosen accounting methods and assumptions. Verification should be a cooperative, iterative process that provides feedback allowing users to improve accounting practices.

Although verification is not a requirement of this standard, this chapter offers guidance on, and an overview of the approach involved in providing assurance that a reported change in GHG emissions associated with a mitigation goal has been estimated and reported according to the *Mitigation Goals Standard*'s requirements. It is relevant to users that are planning on or considering obtaining an assurance statement on the change in GHG emissions associated with their goal. Assurance can be provided before or after the implementation of the goal, in terms of validating or verifying the change in GHG emissions, respectively. It can also be provided during the goal period, which has elements of both validation and verification as some reductions have already occurred while others have yet to occur. While the terminology differs, the approach for validation and verification is essentially the same. For the purposes of this standard, the term "verification" is used to refer to both "verification" and "validation."

- Validation: provides assurance of ex-ante estimates before the implementation of a goal (or if during the goal period, assurance of ex-ante reductions for the remainder of the goal period)
- Verification: provides assurance of ex-post estimates during or after the implementation of a goal (or if during the goal period, assurance of those reductions that have already occurred during the goal period)

While this chapter focuses on conducting verification on the use of the standard (i.e., ensuring that the standard was implemented in a reasonable way and all reporting requirements were fulfilled), conducting verification on data inputs is critical to ensuring the overall integrity of estimates of emissions and emissions reductions associated with a mitigation goal. Examples of data inputs include data related to GHG inventories, development of a baseline scenarios (if applicable), and transferable emissions units.

Users shall report whether the GHG assessment results were verified, and if so, the type of verification performed (first party or third party), the relevant competencies of the verifier(s), and the opinion issued by the verifier.

11.2 Benefits of verification

Obtaining assurance is valuable for reporting entities and others that make decisions informed by the results expected from or achieved by a goal. Assessing assurance of changes in GHG emissions associated with a goal can provide a variety of benefits, including:

- Increased confidence in the reported information as a basis for GHG mitigation strategies and related decisions before the implementation of the goal
- Increased confidence in the reported progress of a goal in meeting its expected outcome during implementation
- Increased confidence in the reported performance of a goal after implementation

- Enhanced internal accounting and reporting practices (e.g., data collection, estimation methods, and internal reporting systems), and facilitation of learning and knowledge transfer within the jurisdiction
- Improved efficiency in subsequent processes for updating GHG mitigation strategies and when planning or implementing further mitigation goals
- Increased confidence in the results reported by other entities using the *Mitigation Goals Standard*, promoting a credible representation of the relative efforts undertaken by different jurisdictions participating in a collective goal
- Greater stakeholder trust in the reported results

11.3 Key concepts in assurance

Materiality

Central to a verifier's activities is the assessment of the risks of material discrepancies in the change in GHG emissions reported by the user. Discrepancies are differences between reported information by the user and information that could result from the proper application of the *Mitigation Goals Standard*'s requirements and guidance. A material discrepancy, or materiality, occurs when individual or aggregate errors, omissions, and misrepresentations have an impact on the estimated change in GHG emissions significant enough that it could influence the user's decisions related to a goal. A materiality threshold is the quantitative level of material discrepancy above which an assertion is considered in non-conformity with a standard, a regulation or a benchmark, and is likely to result in a decision regarding a policy or action different from that taken in the absence of materiality.

Many other terms are used in assurance to describe various related concepts and processes. Though not comprehensive, Table 11.1 includes some of the key terms used that a user may encounter.

Table 11.1 Key assurance concepts

Concept	Description and Example
Assertion	A statement by the user on the results of a goal. The assertion is presented to the verifier performing assurance. Example of an assertion: "The studied goal's estimated reduction in greenhouse gas emissions from base year emissions is 10 Mt CO_2e. The reduction is calculated in conformity with the *GHG Protocol Mitigation Goals Accounting and Reporting Standard*, supplemented by our entity-specific methodologies described in the assessment report."
Subject matter	The subject matter of the verification is the accounting and reporting results and supporting information included in the assessment report. The type of verification performed will determine which subject matter(s) should be assessed. See paragraph below the table for further information.
Evidence	Data sources, estimation methods, and documentation used to calculate emissions reductions and that support the subject matter of the reporting entity's assertion. Evidence should be sufficient in quantity and appropriate in quality. Examples: Physical observations on the implementation of the goal; interviews with the planning, implementing, and enforcing authorities; documents prepared by an independent party and/or the reporting entity, such as goal evaluation reports; internal audit reports on the performance of the goal.
Assurance standards	Standards or requirements used by verifiers, which determine how the assurance process and the verification steps are performed to be able to formulate an assurance opinion. Example: ISO 14064-3 Specification with Guidance for the Validation and Verification of Greenhouse Gas Assertions.

***Mitigation Goals Standard* criteria**	Requirements and guidance of the *Mitigation Goals Standard* against which the reported results of the goal will be evaluated. Example: Table 3.2 of the *Mitigation Goals Standard* summarizes the main requirements of the standard.
Verification	Process that results in an assurance opinion on whether an assertion is in conformity with the *Mitigation Goals Standard*'s requirements.
Assurance opinion	The results of the verification of the user's assertion (i.e., estimated reduction in GHG emissions). If the verifier determines that a conclusion cannot be expressed, the opinion should cite the reason. See Table 11.3 for examples of assurance opinions.
Assessment report	An assessment report, completed by the user, documents all required accounting steps and reporting requirements are recorded.

Subject matters relevant to the Mitigation Goals Standard

The results of the mitigation goal (in terms of GHG emissions and emissions reductions) provided in the assessment report are the ultimate subject matter assessed in the assurance process. To verify that these results represent a true and fair account of GHG emissions associated with a goal in conformity with the *Mitigation Goals Standard*, the verifier assesses whether all the requirements of the standard are met. In the case of the *Mitigation Goals Standard*, there are several steps, and accompanying requirements, in designing the goal and evaluating progress towards achieving the goal. Each of these steps constitutes in itself a subject matter and the verifier needs to check that the information reported meets the requirements and that the methods and assumptions used are reasonable. A list of the main steps, or subject matters, in the *Mitigation Goals Standard* is included below. See Table 3.2 for the full list. For each of these subject matters, there will be several different aspects of accounting that will need to be verified. For example, see Box 11.1 for an illustration of the verification procedures for GHG accounting for the land-use sector.

- Definition of mitigation goal boundary
- GHG accounting for the land-use sector
- Selection of mitigation goal type
- Choice of base year and calculation of base year emissions and/or development of baseline scenario and estimation of baseline scenario emissions
- Use of transferable emissions units
- Selection of target year/target period
- Selection of goal level
- Calculation of expected GHG reductions associated with meeting the goal (ex-ante)
- Evaluation of progress during and after the goal period (ex-post)

Box 11.1. Example of verification of land-use sector accounting

GHG accounting methodologies for the land-use sector are often complex and include many different data inputs. This section illustrates how a verifier should carry out an assurance assessment of land-use sector accounting based on the requirements of this standard.

<u>Land-use accounting and the mitigation goal</u>: Verifiers should focus on whether the user has justified its treatment of the land-use sector vis-à-vis their mitigation goal. If the sector is being used as an offset, verification should establish whether the user has provided a qualitative and/or quantitative description of how land-use accounting is expected to impact the overall goal.

Land-based and activity-based accounting: Verifiers should determine whether a user has provided sufficient rationale for choosing land-based or activity-based accounting.

Inclusion of land uses and activities*:* The critical element here is completeness. Verifiers should focus on identification and minimization of anthropogenic fluxes not included in accounting.[97] This may be accomplished by comparing accounting data to the GHG inventory to determine what, if any, fluxes are included in the inventory but missing from accounting. Independent data (data not used to calculate land-use emissions) on anthropogenic emissions and removals, where available, may also be used to check the completeness of the accounting. Verification should highlight any potential inconsistencies between total anthropogenic fluxes (all anthropogenic fluxes "seen" by the atmosphere) and those included in land-use sector accounting.

Inclusion of pools and fluxes: Verifiers should focus on the completeness of accounting with regard to anthropogenic impacts on carbon pools and emissions and removals. Accounting data should be compared with GHG inventory data and any available independent sources of information to determine if all anthropogenic fluxes, to the extent possible, are included in accounting. Users should explain the reasons for omitting a pool or flux from accounting.

Land-use accounting methodology*:* Verifiers should address the accuracy, consistency, and transparency of the accounting methodology used for the land-use sector. As a first step, verification should establish that a user has provided a sufficient description and justification of its chosen methodology. For example, has the user included explanations of how the base year, baseline scenario, or emission intensity benchmark, was calculated, including the data, methods, models, and assumptions used? Verification should also determine whether the pools and fluxes included in the base year, baseline scenario, or emission intensity benchmark are consistent with (the same as) those included in the land-use accounting. For users using land-based accounting, verification should ensure that the lands included in the reference scenario are the same lands included in accounting, and that the managed land proxy, if used, is applied consistently. For activity-based accounting, verification should ensure that the activities included in the reference scenario are consistent with those included in accounting.

Verification should further assess whether the methodologies used achieve the stated objectives. For example, if a user has stated that it wishes to smooth out the effects of inter-annual variability on accounting, verification would check to see that a base period, rather than a base year, was used, and that it was of sufficient length. To the extent possible, verification should assess the accuracy of the calculations themselves. The more information a user provides regarding justification and calculations, the more verification can help to strengthen and streamline the accounting process.

Natural disturbance provision: Verification should focus on whether natural disturbances have been treated consistently in the base year, baseline, or intensity benchmark and accounting. Verification should also check that the requirements included in section 8.4.7 have been satisfied, including whether the entity had demonstrated that the disturbance was beyond the control of, and not materially influenced by, the entity; whether the lands subject to the disturbance have been identified, and whether removals from lands identified as have been subjected to a natural disturbance are excluded from accounting until they balance the excluded emissions.

11.4 Types of verification

Either first or third party verifiers may be used (see Table 11.2). Both first and third party verifiers should follow similar procedures and processes. Third party verification is likely to increase the credibility of the reported results to external stakeholders. However, first party verification can also provide confidence in

[97] Entities utilizing a step-wise approach in reaching full accounting for all anthropogenic fluxes should note this in their reporting.

the reliability of those results, and it can be a worthwhile learning experience for the user prior to commissioning third party verification.
Assurance provided by a third party verifiers offers a higher degree of objectivity and independence. Typical threats to independence may include allegiance to an employing entity, pending renewal of funding for a goal based on reported performance, promotion of an entity official conditional on performance, or political pressure and other conflicts of interest between the user and the verifier. These threats should be assessed throughout the verification process. Entities receiving first party verification should report how potential conflicts of interest were avoided during the verification process.

Table 11.2 Types of verification

Type of verification	*Description*
First party verification	Internal verification performed by independent person(s) from within the reporting entity. Example: person(s) from a different line of business in an entity not involved in the process of planning, implementing and reporting on a mitigation goal.
Third party verification	Assurance performed by person(s) from an independent entity. Examples: independent accounting, engineering, or analysis organization; accredited third-party verification body

11.5 Levels of assurance

The level of assurance refers to the degree of confidence that stakeholders can have in the information reported on the results of a goal. There are two levels of assurance: limited and reasonable. The thoroughness with which the assurance evidence is obtained is less rigorous in limited assurance. Limited assurance provides a “negative opinion” that states that no errors were detected. On the other hand, reasonable assurance provides a “positive opinion” that states that all assertions are valid. Table 11.3 provides examples of limited and reasonable assurance opinions. The level of assurance requested by the user will determine the rigor of the verification process and the amount of evidence required. The highest level of assurance that can be provided is a reasonable level of assurance. Absolute assurance is typically not provided since it is not feasible to test 100 percent of the inputs to the assessment.

Table 11.3 Levels of assurance

Assurance opinion	*Nature of opinion*
Limited assurance	Negative opinion Example: "Based on our verification, we are not aware of any material modifications that should be made to the entity’s assertion that the estimated reduction in greenhouse gas emissions from base year emissions is 10 Mt CO_2e and is in conformity with the *GHG Protocol Mitigation Goals Accounting and Reporting Standard*.”
Reasonable assurance	Positive opinion Example: “In our opinion the reporting entity’s assertion that the estimated reduction in greenhouse gas emissions from base year emissions is 10 Mt CO_2e is fairly stated, in all material respects, and is in conformity with the *GHG Protocol Mitigation Goals Accounting and Reporting Standard*.”

11.6 Competencies of verifiers

Selecting a competent verifier is important in order for the assurance opinion to have the credibility needed to support the user's and stakeholders' needs. A competent verifier of emissions and emissions reductions associated with a mitigation goal has the following characteristics:

- Assurance expertise and verification experience
- Knowledge and experience of GHG accounting and reporting, GHG inventory methods and assessments, and mitigation goal assessments, including baseline scenario development, accounting for transferable emissions units, and land-use sector accounting
- Knowledge of the user's activities and their relationship to other users' mitigation goals, as well as how this relationship could affect the expected results
- Ability to assess the emission sources included in the goal boundary and the magnitude of potential errors, omissions, and misrepresentations
- Ability to assess baseline scenario emissions (if relevant), including the selected modelling approach, drivers, and assumptions, as well as the magnitude of potential errors, omissions and misrepresentations
- Credibility, independence and the professional skepticism required to challenge data, methods, and other information

11.7 Verification process

Many elements have to be considered as part of the systematic process for providing assurance that an assertion of GHG emissions and emissions reductions is in conformity with the *Mitigation Goals Standard*. The following paragraphs describe the main elements of the verification process, assuming that the entity has already selected a type and a level of assurance that suit its needs and identified a competent verifier.

Timing of the verification

The timing of verification in the case of the *Mitigation Goals Standard* depends on the subject matter and needs of the user. For example, verification can be performed before the implementation of the goal when the user, as part of its planning activities and wants to obtain confidence that a goal is likely to achieve its expected reduction in GHG emissions (i.e., ex-ante assessment). Alternatively, assurance can be performed before a user's public release of an interim or final report to provide an update on progress and inform a potential adjustment of course or conclude on the final performance and effectiveness of a goal (i.e., ex-post assessment). This allows for any materiality to be corrected before the release of the assurance opinion (or revised opinion) and the assertion of GHG emissions and emissions reductions. Verification can also be performed during the goal period to assess achieved emissions reductions, as well as the expected reductions for the remainder of the goal period. The work should be initiated long enough before the planned date of implementation of the goal, or the release date of the assessment report, so that the verification is useful in improving the estimation of emissions and emissions reductions, when necessary. The time required for verification is dependent on the nature and complexity of the subject matter and the level of assurance selected.

Preparing for verification

Preparing for verification is a matter of ensuring that the evidence that the verifier needs is easily accessible. The type of evidence and documentation requested by the verifier depends on the subject matter, the type of goal considered, and the type and level of assurance being sought. Maintaining documentation of the process of estimating GHG emissions and emissions reductions in the assessment report is helpful for ensuring the assurance evidence is available.

Prior to initiating verification, the reporting entity should ensure that the following are prepared for, and available to, the verifier:

- The entity's written assertion (i.e., estimated GHG emissions and emissions reductions associated with the mitigation goal);
- The completed assessment report and a referenced description of the tools and methods used; and
- Access to sufficient and appropriate evidence (i.e., goal planning documentation, decisions and supporting rationales, interim monitoring reports, internal evaluations and performance reports, peer reviews, etc., much of which will be supplied in the assessment report).

Steps of verification

Verification, whether performed by a first or third party verifier providing limited or reasonable assurance, features several steps that are common to all approaches:

1. Planning and scoping: Planning involves the prioritization of effort by the verifier towards the data, methods, and information that is most likely to affect the reported GHG emissions and emissions reductions associated with a goal. In practice the verifier assesses the risks and the magnitude of potential errors, omissions and misrepresentations in the GHG assertion. The assurance plan is structured around the assurance standards. It identifies the level and objectives of the assurance; the criteria and scope (subject matter and materials to be verified); the materiality threshold and describes the activities and schedules the verifier implements to assess the assertion against the *Mitigation Goals Standard* criteria.
2. Identifying data, methods and assumptions: This step involves identifying GHG sources included in the goal boundary and the assumptions and methods used for estimating the GHG emissions and emissions reductions from those sources. If applicable, the internal controls and systems of the entity relevant to the goal are also identified (e.g., quality control and quality assurance activities, internal audits, etc.)
3. Verification: Carrying out the verification activities as planned in the schedule. The main steps of such a schedule consist in the collection and analysis of evidence, and the appraisal of the evidence against the *Mitigation Goals Standard*'s principles and requirements.
4. Assessing materiality: This consists in determining if the verification findings support the user's assertion on the GHG emissions and emissions reductions associated with its mitigation goal. Depending on the level of assurance and materiality threshold agreed, the verifier assesses if the information reported by the entity is in conformity with the *Mitigation Goals Standard* criteria or if there is any material discrepancy in the information reported.
5. Forming and reporting an assurance opinion: Once the verifier has concluded against the agreed objectives and criteria of the assurance plan, he/she next forms an assurance opinion, the nature of which depends on the level of assurance agreed (see Table 11.3). As part of his/her opinion, the verifier should report the following:

    - A description of the studied mitigation goal
    - A reference to the user's assertion included in the goal assessment report
    - A description of the assurance process
    - A list of the *Mitigation Goals Standard*'s principles and requirements
    - A description of user's and verifier's responsibilities
    - Whether the verification was performed by a first or third party
    - The verification standard used to perform the verification, for example ISO 14064-3: *Specification with Guidance for the Validation and Verification of Greenhouse Gas Assertions*
    - How any potential conflicts of interest were avoided in the case of first party assurance
    - A summary of the work performed

- The level of assurance achieved (limited or reasonable); if the verifier determines that an opinion cannot be expressed, a statement of the reason needs to be provided
- The materiality threshold, if set
- Any additional details regarding the verifier's conclusion, including details on any discrepancies noted or issues encountered in performing the verification
- Practical modifications to help rectifying any discrepancies

11.8 Challenges and other considerations

There are several challenges in verifying GHG emissions and emissions reductions associated with a mitigation goal. These challenges mainly relate to the fact that the estimation of GHG emissions and reductions may rely on a wide variety of data sources, assumptions, and methods and be considerably uncertain. In other words, the main challenge is to verify and provide assurance on a subject matter that may be largely uncertain. Given the uncertain nature of assertions, the verifier will need to exercise expert judgment and evaluate the reasonableness, credibility, and reliability of GHG emissions data.

As a result of these challenges, users should improve their data sources, assumptions and methods. For example, they could determine which entity has control over the data and obtain it from where possible. If there are confidentiality concerns, users could enter non-disclosure agreements. If data do not exist, users could prioritize new data collection methods to fill data gaps.

Chapter 12: Reporting

This chapter provides reporting requirements explaining what information shall be reported in order for a GHG assessment report to be in conformance with the GHG Protocol *Mitigation Goals Accounting and Reporting Standard*. It is broken into three parts: information on (1) the design of the goal; (2) ex-ante calculation of the emissions and emissions reductions associated with the goal; and (3) assessing progress during and after the goal period.

All users shall report the information in Part 1. Users that are either at the beginning of the goal period or are in the middle of the goal period shall report the information in Part 2. Users that are in the middle of the goal period should report the information in Part 3, as relevant. Users that have completed the goal period shall report the information in Part 3.

Part 1: Information on the design of the goal

GHG inventory

- How emissions data uncertainty is addressed and the justification for any procedures to handle uncertainty
- Data quality assurance and control procedures used for data collected
- The GWP values used for each greenhouse gas. If any GWP values change during the goal period, the recalculated GWP value

Goal boundary

- The geographic boundary of the goal, including any protectorates, departments, overseas territories, dependencies or other non-contiguous territories included or excluded from the goal boundary
- The justification of the choice of the geographic boundary
- Which sectors and subsectors are included in the goal boundary
- Any exclusions in the goal boundary and the justification for exclusions
- The definitions of sectors covered by the goal
- The justification of the definitions of sectors covered by the goal
- If sector definitions are used that deviate from the most recent IPCC guidelines, an explanation for why IPCC defined sectors were not used and information on the alternative sector definitions, including an explanation of how non-IPCC sector definitions map onto the IPCC sectors
- Which direct and indirect emissions sources are covered by the goal boundary, categorized by scope
- A justification for which direct and indirect emissions sources are covered by the goal.
- A definition of the goal by scope (single goal for scopes, separate goals for scopes, or a combination of single and separate goals for scopes)
- For those goals that cover indirect emissions (scope 2 or 3), users any risks of goal overlap that are known to them
- Which greenhouse gases are included within the goal boundary, and report them accordingly.
- If all seven Kyoto Protocol greenhouse gases are not covered by the goal, the excluded gases, a justification for exclusion, and the contribution of excluded gases to the overall inventory
- If multiple greenhouse gases are covered by the goal, an aggregation and translation of all included GHGs into units of carbon dioxide equivalent (CO_2e) using IPCC global warming potential values

Goal type

- The mitigation goal type
- Whether the goal is a single year goal or a multi-year goal
- If a single year goal, the target year
- If a multi-year goal, whether the goal is an average, annual or cumulative multi-year goal

- If a multi-year period, the target period
- The length of the goal period
- The goal level, expressed in terms of carbon dioxide equivalent (CO_2e). If separate goals for each scope or a combination of single and separate goals for scopes, define and report the goal level by scope
- The significance threshold for revision to a goal boundary, if relevant, as well as its justification

Additional information for base year goals

- The base year or base period
- The method (e.g., IPCC's *2006 Guidelines for National Greenhouse Gas Inventories*) used to calculate base year emissions
- The calculated base year emissions for all sectors, gases, and scopes covered by the goal, according to how the goal is defined (by scope as relevant)
- The base year emissions recalculation policy and the basis and context for any recalculations
- The significance threshold used for any recalculations, as well as the justification for the threshold

Additional information for intensity goals

- The base year or base period
- The method (e.g., IPCC's *2006 Guidelines for National Greenhouse Gas Inventories*) used to calculate base year emissions
- The calculated base year emissions for all sectors, gases, and scopes covered by the goal, according to how the goal is defined (by scope as relevant)
- The base year emissions recalculation policy and the basis and context for any recalculations
- The significance threshold used for any recalculations, as well as the justification for the threshold
- The unit of output
- Base year emissions intensity
- The methodology and data sources used to determine base year emissions intensity for both emissions and the unit of output

Additional information for baseline scenario goals

- Whether the goal baseline scenario is static or dynamic
- The estimated goal baseline scenario emissions, by scope as relevant
- The sectors and gases covered by the goal baseline scenario
- The projection method used for developing the goal baseline scenario and estimating associated goal baseline scenario emissions
- The justification for the chosen projection method
- The timeframe for the goal baseline scenario
- The year or period of years for historical emissions data used to develop the goal baseline scenario, and the source of the historical emissions data
- All emissions drivers included in the goal baseline scenario
- At the end of the goal period, the projected trends in emissions drivers alongside the actual trend in those same emissions drivers
- All assumptions related to emissions drivers used to develop the goal baseline scenario, as well as the justification for the choice of those assumptions
- All sources of data used to develop the goal baseline scenario, including activity data, emission factors, and assumptions
- A detailed description of the methodology used to develop new goal baseline scenario data and assumptions
- All new data used to develop the goal baseline scenario and the methodology used to generate new data, as well as the justification for the methodology
- Which policies and actions with significant GHG effects are included and excluded from the goal baseline scenario

- The significance threshold used to determine whether the GHG effects associated with a policy or action are significant, if applicable
- The justification for the significance threshold used to determine whether the GHG effects associated with a policy or action are significant, if applicable
- The assumptions and methodologies used to estimate the effects of included policies and actions included in the goal baseline scenario
- The cut off year for the goal baseline scenario, or the year after which no new policies or actions are included in the goal baseline scenario
- The justification for the choice of cut off year
- Any adopted policies not included in the goal baseline scenario
- Any planned policies and actions included in the goal baseline scenario. The goal baseline scenario recalculation policy at the start of the goal period
- The significance threshold used to determine whether changes are significant to recalculate the goal baseline scenario
- The justification of the choice of significance threshold used to determine whether changes are significant to recalculate the goal baseline scenario
- Which errors or other changes to parameters were discovered and justify why the goal baseline scenario could not be recalculated
- Any goal baseline scenario recalculations made during the goal period, and the justification
- Any goal baseline scenario recalculations made during the goal period, providing recalculated baseline scenario emissions
- The original goal baseline scenario emissions (associated with the goal baseline scenario developed at the beginning of the goal period)
- For those with dynamic goal baseline scenario goals, a goal baseline scenario update policy at the start of the goal period
- The significance threshold used to determine whether changes in emissions drivers are significant to update the goal baseline scenario
- The justification for the significance threshold used to determine whether changes in emissions drivers are significant to update the goal
- Any goal baseline scenario updates made during the goal period, providing updated goal baseline scenario emissions
- The justification for updating goal baseline scenario emissions
- The original goal baseline scenario emissions (associated with the goal baseline scenario developed at the beginning of the goal period)

The land-use sector

- The adopted land-use sector approach
- The justification for the adopted land-use sector approach
- Users not including the land-use sector within the goal boundary, the rationale for not doing so
- The mitigation goal level both with and without the impact of land-use sector accounting
- Any use of the managed land proxy, including, the definition of “managed land,” if adopted, and the geographic locations of managed and unmanaged lands
- Net emissions from each elected land-use category/activity
- Any significant changes to the accounting approach, land-use categories or activities, carbon pools and GHG fluxes, including the quantitative and qualitative effects
- The significance threshold used to determine whether any changes the accounting approach, land-use categories or activities, carbon pools and GHG fluxes are significant
- For those users that are using a natural disturbance mechanism, provide information that shows all lands subject to the natural disturbance mechanism are identified, including the georeferenced location, year and types of disturbances
- For those users that are using a natural disturbance mechanism, provide information that shows how annual emissions resulting from disturbances and the subsequent removals in those areas are estimated

- For those users that are using a natural disturbance mechanism, provide information that shows that no land-use change has occurred on lands for which the mechanism is applied and explain the methods and criteria for identifying any future land-use changes on those land areas during the goal period
- For those users that are using a natural disturbance mechanism, provide information that demonstrates that the occurrences were beyond the control of, and not materially influenced by, the user during the goal period, by demonstrating practicable efforts to prevent, manage or control the occurrences that led to the application of the mechanism
- For those users that are using a natural disturbance mechanism, provide information that demonstrates efforts taken to rehabilitate, where practicable, the land for which the mechanism applied
- For those users that are using a natural disturbance mechanism, provide information that shows that emissions associated with salvage logging on forest land subject to natural disturbance were not excluded from accounting

Use of transferable units

- A threshold that defines the extent to which transferable emissions units are used to meet the goal
- Justification for the design for the choice of a threshold to be applied to the use of transferable emissions units
- Ex-ante, the estimated use of transferable emissions units
- Ex-post, the actual quantity of transferable emissions units counted towards the goal
- Ex-post, the source of transferable emissions units counted towards the goal
- Ex-post, the vintage years of transferable units counted towards the goal
- How the quality principles were met for offset credits
- How the quality principles were met for allowances
- How emissions trading system used conforms to quality features
- The provisions in place to ensure that transferable emissions units were not double claimed by multiple entities

<u>Part 2: Ex-ante calculation of emissions and emission reductions associated with the goal</u>

For base year goals

- Target year emissions level associated with meeting the goal by scope
- Emissions reductions needed to meet the goal (compared to base year) by scope

For intensity goals

- Target year emissions intensity level associated with meeting the goal by scope
- Estimated target year emissions level associated with meeting the goal by scope
- Reduction in emissions intensity needed to meet the goal by scope
- Emissions reductions needed to meet the goal (compared to base year) by scope
- Data sources for projected output metrics and/or any projection methodology used
- Justification for data sources for projected output metrics and/or any projection methodology used

For baseline scenario goals

- Target year emissions level associated with meeting the goal by scope
- Emissions reductions needed to meet the goal (compared to baseline scenario) by scope

For fixed level goals

- Target year emissions level associated with meeting the goal by scope

For all multi-year goals

- The expected emissions levels in the target year, as well as the required emissions reductions associated with meeting the goal, according to the multi-year goal type

For multi-year base year goals

- *Average multi-year*: Average annual emissions level during the target period associated with meeting the goal by scope
- *Average multi-year*: Average annual emissions reductions (compared to a base year) during the target period needed to meet the goal by scope
- *Annual multi-year*: Annual emissions level associated with meeting the goal for each year during the target period by scope
- *Annual multi-year*: Annual emissions reductions (compared to a base year) needed to meet the goal for each year during the target period by scope

For multi-year intensity goals

- *Average multi-year*: Average annual emissions level during the target period associated with meeting the goal by scope
- *Average multi-year*: Average annual emissions reductions (compared to a base year) during the target period needed to meet the goal by scope
- *Annual multi-year*: Annual emissions level associated with meeting the goal for each year during the target period by scope
- *Annual multi-year*: Annual emissions reductions (compared to a base year) needed to meet the goal for each year during the target period by scope

For multi-year baseline scenario goals

- *Average multi-year*: Average annual emissions during the target period associated with meeting the goal by scope
- *Average multi-year*: Average annual emissions reductions (compared to a baseline scenario) needed to meet the goal for each year during the target period by scope
- *Annual multi-year*: Annual emissions during the target period associated with meeting the goal by scope
- *Annual multi-year*: Annual emissions reductions (compared to a baseline scenario) needed to meet the goal for each year during the target period by scope

For multi-year fixed level goals

- *Cumulative multi-year*: Cumulative emissions over the target period associated with meeting the goal by scope
- *Average multi-year*: Average annual emissions during the target period associated with meeting the goal by scope
- *Annual multi-year*: Annual emissions associated with meeting the goal for each year during the target period by scope

For all goals

- Any ex-ante adjustments for the expected use of emissions units (purchased and sold) and for the expected use of the land-use sector made to the emissions level associated with meeting the goal

Part 3: Assessing progress during and after the goal period

For assessing progress at all stages (during and after the goal period)

- All data sources used for evaluating progress
- Justification of all data sources used for evaluating progress

- If users update inventory methods or GWP values during the goal period, recalculated emissions for all previous years in the goal period, including the base year
- Data QA/QC procedures for both GHG emissions data and non-GHG emissions data (as relevant) that are collected for the reporting year and/or target year/period
- How data uncertainty is addressed
- Justification for how data uncertainty is addressed
- Any recalculations to base year or baseline scenario values, with a statement whether these changes could materially affect the likelihood of achieving the emission goal and why recalculations occurred
- For users with dynamic baseline scenarios, updated dynamic baseline scenarios
- For users with dynamic baseline scenarios, the original baseline

For assessing progress during the goal period

- Any interpolated or extrapolated data used for evaluating progress
- Methods for interpolation or extrapolation
- Total emissions and removals within the goal boundary in the reporting year (before any adjustments for transferable emissions units and land-use sector) by gas, carbon dioxide equivalent (CO_2e), and scope (if relevant)
- Adjusted reporting year emissions by gas, carbon dioxide equivalent (CO_2e), and scope (if relevant)
- Emissions reductions or reductions in emissions intensity achieved relative to base year or baseline scenario emissions, according to goal type
- Emissions reductions achieved relative to an informational baseline scenario, if developed.
- Cumulative change in emissions between the base year and reporting year
- In cases where a jurisdiction's mitigation goal does not cover all the sectors and gases in its GHG inventory, users shall report total GHG inventory emissions. This information helps stakeholders compare emissions from sectors and gases covered by the goal to those left out of the goal boundary

For assessing progress at the end of the goal period

- Whether the goal has been achieved and calculation methodologies used
- Total emissions and removals within the goal boundary in the target year/target period (before and adjustments for transferable emissions units and land-use sector) by gas, CO_2e and scope (if relevant)
- Adjusted target year/target period emissions by gas, carbon dioxide equivalent (CO_2e), and scope (if relevant)
- The difference between the emissions levels associated with meeting the goal (calculated ex-ante in Chapter 9) with the adjusted emissions level in the target year or period
- In cases where a jurisdiction's mitigation goal does not cover all the sectors and gases in its GHG inventory, the total GHG inventory emissions
- The cumulative level of emissions over the goal period
- If the user assessed progress during the goal period, the outcomes of those assessments
- For users with base year goals, the emissions reductions achieved relative to base year emissions
- For users with intensity goals, the reductions in emissions intensity relative to base year emissions intensity
- For users with baseline scenario goals, the emissions reductions achieved relative to baseline scenario emissions in the target year
- When and where assessment reports are published and how the public can obtain copies

Sample reporting template for GHG assessment of a goal

This sample reporting template includes all of the reporting requirements of the Greenhouse Gas Protocol *Mitigation Goal Standard*. This template illustrates one example of how the required information can be reported. Users of the standard may report the results in any format that is most useful to the intended audience, provided all the required information is reported.

Part 1: The design of the goal

Reporting requirement	Response
GHG inventory	
How emissions data uncertainty is addressed and the justification for any procedures to handle uncertainty	
Data quality assurance and control procedures used for data collected	
The GWP values used for each greenhouse gas. If any GWP values change during the goal period, the recalculated GWP value	
Goal boundary	
The geographic boundary of the goal, including any protectorates, departments, overseas territories, dependencies or other non-contiguous territories included or excluded from the goal boundary	
The justification of the choice of the geographic boundary	
Which sectors and subsectors are included in the goal boundary	
Any exclusions in the goal boundary and the justification for exclusions	
The definitions of sectors covered by the goal	
The justification of the definitions of sectors covered by the goal	
If sector definitions are used that deviate from the most recent IPCC guidelines, an explanation for why IPCC defined sectors were not used and information on the alternative sector definitions, including an explanation of how non-IPCC sector definitions map onto the IPCC sectors	
Which direct and indirect emissions sources are covered by the goal boundary, categorized by scope	
A justification for which direct and indirect emissions sources are covered by the goal	
A definition of the goal by scope (single goal for each scope, separate goals for each scope, or a combination of single and separate goals for scopes)	
For those goals that cover indirect emissions (scope 2 or 3), users any risks of goal overlap that are known to them	
Which greenhouse gases are included within the goal boundary, and report them accordingly	
If all seven Kyoto Protocol greenhouse gases are not covered by the goal, the excluded gases, a justification for exclusion, and the contribution of excluded gases to the overall inventory	
If multiple greenhouse gases are covered by the goal, an aggregation and translation of all included GHGs into units of carbon dioxide equivalent (CO_2e) using IPCC global warming potential values	
Goal type	
The mitigation goal type	
If an intensity goal is chosen, the unit of output	
For users that choose a baseline scenario goal, whether the baseline	

scenario is static or dynamic	
Whether the goal is a single year goal or a multi-year goal	
If a single year goal, the target year	
If a multi-year goal, whether the goal is an average, annual or cumulative multi-year goal	
If a multi-year period, the target period	
The length of the goal period.	
The goal level, expressed in terms of carbon dioxide equivalent (CO_2e). If separate goals for each scope or a combination of single and separate goals for scopes, define and report the goal level by scope	
The significance threshold for revision to a goal boundary, if relevant, as well as its justification	
Additional information for base year goals	
The base year or base period	
The method (e.g., IPCC's *2006 Guidelines for National Greenhouse Gas Inventories*) used to calculate base year emissions	
The calculated base year emissions for all sectors, gases, and scopes covered by the goal, according to how the goal is defined (by scope as relevant)	
The base year emissions recalculation policy and the basis and context for any recalculations	
The significance threshold used for any recalculations, as well as the justification for the threshold	
Additional information for intensity goals	
The base year or base period	
The method (e.g., IPCC's *2006 Guidelines for National Greenhouse Gas Inventories*) used to calculate base year emissions	
The calculated base year emissions for all sectors, gases, and scopes covered by the goal, according to how the goal is defined (by scope as relevant)	
The base year emissions recalculation policy and the basis and context for any recalculations	
The significance threshold used for any recalculations, as well as the justification for the threshold	
The base year emissions intensity	
The methodology and data sources used to determine base year emissions intensity for both emissions and the unit of output	
Additional information for baseline scenario goals	
Whether the goal baseline scenario is static or dynamic	
The estimated goal baseline scenario emissions, by scope as relevant	
The sectors and gases covered by the goal baseline scenario	
The projection method used for developing the goal baseline scenario and estimating associated goal baseline scenario emissions	
The justification for the chosen projection method	
The timeframe for the goal baseline scenario	
The year or period of years for historical emissions data used to develop the goal baseline scenario, and the source of the historical emissions data	
All emissions drivers included in the goal baseline scenario	

At the end of the goal period, the projected trends in emissions drivers alongside the actual trend in those same emissions drivers	
All assumptions related to emissions drivers used to develop the goal baseline scenario, as well as the justification for the choice of those assumptions	
All sources of data used to develop the goal baseline scenario, including activity data, emission factors, and assumptions	
A detailed description of the methodology used to develop new goal baseline scenario data and assumptions	
All new data used to develop the goal baseline scenario and the methodology used to generate new data, as well as the justification for the methodology	
Which policies and actions with significant GHG effects are included and excluded from the goal baseline scenario	
The significance threshold used to determine whether the GHG effects associated with a policy or action are significant, if applicable	
The justification for the significance threshold used to determine whether the GHG effects associated with a policy or action are significant, if applicable	
The assumptions and methodologies used to estimate the effects of included policies and actions included in the goal baseline scenario	
The cut off year for the goal baseline scenario, or the year after which no new policies or actions are included in the goal baseline scenario	
The justification for the choice of cut off year	
Any adopted policies not included in the goal baseline scenario	
Any planned policies and actions included in the goal baseline scenario. The goal baseline scenario recalculation policy at the start of the goal period	
The significance threshold used to determine whether changes are significant to recalculate the goal baseline scenario	
The justification of the choice of significance threshold used to determine whether changes are significant to recalculate the goal baseline scenario	
Which errors or other changes to parameters were discovered and justify why the goal baseline scenario could not be recalculated	
Any goal baseline scenario recalculations made during the goal period, and the justification	
Any goal baseline scenario recalculations made during the goal period, providing recalculated baseline scenario emissions	
The original goal baseline scenario emissions (associated with the goal baseline scenario developed at the beginning of the goal period)	
For those with dynamic goal baseline scenario goals, a goal baseline scenario update policy at the start of the goal period	
The significance threshold used to determine whether changes in emissions drivers are significant to update the goal baseline scenario	
The justification for the significance threshold used to determine whether changes in emissions drivers are significant to update the goal	
Any goal baseline scenario updates made during the goal period, providing updated goal baseline scenario emissions	
The justification for updating goal baseline scenario emissions	

The original goal baseline scenario emissions (associated with the goal baseline scenario developed at the beginning of the goal period)	
The land-use sector	
The adopted land-use sector approach.	
The justification for the adopted land-use sector approach.	
The mitigation goal level both with and without the impact of land-use sector accounting.	
Any use of the managed land proxy, including, the definition of "managed land," if adopted, and the geographic locations of managed and unmanaged lands.	
Net emissions from each elected land-use category/activity.	
Any significant changes to the accounting approach, land-use categories or activities, carbon pools and GHG fluxes, including the quantitative and qualitative effects.	
The significance threshold used to determine whether any changes the accounting approach, land-use categories or activities, carbon pools and GHG fluxes are significant.	
For those users that are using a natural disturbance mechanism, provide information that shows all lands subject to the natural disturbance mechanism are identified, including the georeferenced location, year and types of disturbances.	
For those users that are using a natural disturbance mechanism, provide information that shows how annual emissions resulting from disturbances and the subsequent removals in those areas are estimated.	
For those users that are using a natural disturbance mechanism, provide information that shows that no land-use change has occurred on lands for which the mechanism is applied and explain the methods and criteria for identifying any future land-use changes on those land areas during the goal period.	
For those users that are using a natural disturbance mechanism, provide information that demonstrates that the occurrences were beyond the control of, and not materially influenced by, the user during the goal period, by demonstrating practicable efforts to prevent, manage or control the occurrences that led to the application of the mechanism.	
For those users that are using a natural disturbance mechanism, provide information that demonstrates efforts taken to rehabilitate, where practicable, the land for which the mechanism applied.	
For those users that are using a natural disturbance mechanism, provide information that shows that emissions associated with salvage logging on forest land subject to natural disturbance were not excluded from accounting.	
Use of transferable units	
A threshold that defines the extent to which transferable emissions units are used to meet the goal.	
Justification for the design for the choice of a threshold to be applied to the use of transferable emissions units.	
Ex-ante, the estimated use of transferable emissions units.	
Ex-post, the actual quantity of transferable emissions units counted towards the goal.	
Ex-post, the source of transferable emissions units counted towards the goal.	

Ex-post, the vintage years of transferable units counted towards the goal.	
How the quality principles were met for offset credits.	
How the quality principles were met for allowances.	
How emissions trading system used conforms to quality features.	
The provisions in place to ensure that transferable emissions units were not double claimed by multiple entities.	

Part 2: Ex-ante calculation of emissions and emission reductions

Information	Response
For base year goals	
Target year emissions level associated with meeting the goal by scope.	
Emissions reductions needed to meet the goal (compared to base year) by scope.	
For intensity goals	
Target year emissions intensity level associated with meeting the goal by scope.	
Estimated target year emissions level associated with meeting the goal by scope.	
Reduction in emissions intensity needed to meet the goal by scope.	
Emissions reductions needed to meet the goal (compared to base year) by scope.	
Data sources for projected output metrics and/or any projection methodology used.	
Justification for data sources for projected output metrics and/or any projection methodology used.	
For baseline scenario goals	
Target year emissions level associated with meeting the goal by scope.	
Emissions reductions needed to meet the goal (compared to baseline scenario) by scope.	
For fixed level goals	
Target year emissions level associated with meeting the goal by scope.	
For all multi-year goals	
The expected emissions levels in the target year, as well as the required emissions reductions associated with meeting the goal, according to the multi-year goal type.	
For multi-year base year goals	
Average multi-year: Average annual emissions level during the target period associated with meeting the goal by scope.	
Average multi-year: Average annual emissions reductions (compared to a base year) during the target period needed to meet the goal by scope.	
Annual multi-year: Annual emissions level associated with meeting the goal for each year during the target period by scope.	
Annual multi-year: Annual emissions reductions (compared to a base year) needed to meet the goal for each year during the target period by scope.	
For multi-year intensity goals	

Average multi-year: Average annual emissions level during the target period associated with meeting the goal by scope.	
Average multi-year: Average annual emissions reductions (compared to a base year) during the target period needed to meet the goal by scope.	
Annual multi-year: Annual emissions level associated with meeting the goal for each year during the target period by scope.	
Annual multi-year: Annual emissions reductions (compared to a base year) needed to meet the goal for each year during the target period by scope.	
For multi-year baseline scenario goals	
Average multi-year: Average annual emissions during the target period associated with meeting the goal by scope.	
Average multi-year: Average annual emissions reductions (compared to a baseline scenario) needed to meet the goal for each year during the target period by scope.	
Annual multi-year: Annual emissions during the target period associated with meeting the goal by scope.	
Annual multi-year: Annual emissions reductions (compared to a baseline scenario) needed to meet the goal for each year during the target period by scope.	
For multi-year fixed level goals	
Cumulative multi-year: Cumulative emissions over the target period associated with meeting the goal by scope.	
Average multi-year: Average annual emissions during the target period associated with meeting the goal by scope.	
Annual multi-year: Annual emissions associated with meeting the goal for each year during the target period by scope.	
For all goals	
Any ex-ante adjustments for the expected use of emissions units (purchased and sold) and for the expected use of the land-use sector made to the emissions level associated with meeting the goal.	

Part 3: Assessing progress during and after the goal period

Information	Response
For assessing progress at all stages (during and after the goal period)	
All data sources used for evaluating progress.	
Justification of all data sources used for evaluating progress.	
If users update inventory methods or GWP values during the goal period, recalculated emissions for all previous years in the goal period, including the base year.	
Data QA/QC procedures for both GHG emissions data and non-GHG emissions data (as relevant) that are collected for the reporting year and/or target year/period.	
How data uncertainty is addressed.	
Justification for how data uncertainty is addressed.	
Any recalculations to base year or baseline scenario values, with a statement whether these changes could materially affect the likelihood of achieving the emission goal and why recalculations occurred.	
For users with dynamic baseline scenarios, updated dynamic baseline scenarios.	
For users with dynamic baseline scenarios, the original baseline.	

For assessing progress during the goal period	
Any interpolated or extrapolated data used for evaluating progress.	
Methods for interpolation or extrapolation.	
Total emissions and removals within the goal boundary in the reporting year (before any adjustments for transferable emissions units and land-use sector) by gas, carbon dioxide equivalent (CO2e), and scope (if relevant).	
Adjusted reporting year emissions by gas, carbon dioxide equivalent (CO2e), and scope (if relevant).	
Emissions reductions or reductions in emissions intensity achieved relative to base year or baseline scenario emissions, according to goal type.	
Emissions reductions achieved relative to an informational baseline scenario, if developed.	
Cumulative change in emissions between the base year and reporting year.	
In cases where a jurisdiction's mitigation goal does not cover all the sectors and gases in its GHG inventory, users shall report total GHG inventory emissions. This information helps stakeholders compare emissions from sectors and gases covered by the goal to those left out of the goal boundary.	
For assessing progress at the end of the goal period	
Whether the goal has been achieved and calculation methodologies used.	
Total emissions and removals within the goal boundary in the target year/target period (before and adjustments for transferable emissions units and land-use sector) by gas, CO2e and scope (if relevant).	
Adjusted target year/target period emissions by gas, carbon dioxide equivalent (CO2e), and scope (if relevant).	
The difference between the emissions levels associated with meeting the goal (calculated ex-ante in Chapter 9) with the adjusted emissions level in the target year or period.	
In cases where a jurisdiction's mitigation goal does not cover all the sectors and gases in its GHG inventory, the total GHG inventory emissions.	
The cumulative level of emissions over the goal period.	
If the user assessed progress during the goal period, the outcomes of those assessments.	
For users with base year goals, the emissions reductions achieved relative to base year emissions.	
For users with intensity goals, the reductions in emissions intensity relative to base year emissions intensity.	
For users with baseline scenario goals, the emissions reductions achieved relative to baseline scenario emissions in the target year.	
When and where assessment reports are published and how the public can obtain copies.	

Appendix A: Sample GHG balance sheets

Table A.1. Sample GHG balance sheet for scope 1 emissions and removals

GHG balance sheet for scope 1 emissions and removals			1[98]	2	3	4	5	6
			Goal period					Cumulative emissions = (1) + (2) + (3) + (4) + (5)
			2015 (Base year)	2016	2017	2018	2019 (Target year)	
Scope 1 inventory emissions and removals (Mt CO_2e)								
A	**Total emissions**		1,000					
B	**Total removals**		200					
Scope 1 emissions and removals from sectors and gases covered by the goal (Mt CO_2e)								
C	**Total emissions**		1,000					
D	**Total removals (by category)**		150[99]					
	Type A (e.g., Forest management)		100					
	Type B (e.g., Grassland management)		50					
Transferable emissions units (Mt CO_2e)								
E	**Total credits retired (-)**		50					
	Credits retired by type	Type A (e.g., CDM)	30					
		Type B	20					
F	**Total credits sold (+)**		10					
	Credits sold by type	Type A (e.g., CDM)	5					
		Type B	5					
G	**Total allowances retired (-)**		10					
	Allowances retired by type	Type A (e.g., EUA)	5					
		Type B	5					
H	**Total allowances sold (+)**		5					
	Allowances sold by type	Type A (e.g., EUA)	3					
		Type B	2					
Adjusted net scope 1 emissions (Mt CO_2e)								
I	**Adjusted net scope 1 emissions = (C – D) – (E) + (F) – (G) + (H)**		805					

[98] Values in this column are provided as examples.
[99] Total removals within the goal boundary can differ from total removals in the inventory for a variety of reasons, e.g., due to the use different accounting approaches or different treatment of natural disturbances. See Chapter 7 for more information.

Table A.2. Sample GHG balance sheet for scope 2 emissions

GHG balance sheet for scope 2 emissions[100]			1[101]	2	3	4	5	6
			Goal period					Cumulative emissions = (1) + (2) + (3) + (4) + (5)
			2015 (Base year)	2016	2017	2018	2019 (Target year)	
Scope 2 inventory emissions (Mt CO_2e)								
A	**Total emissions**		500					
Scope 2 emissions from sectors and gases covered by the goal (Mt CO_2e)								
B	**Total emissions**		500					
Transferable emissions units (Mt CO_2e)								
C	**Total credits retired (-)**		30					
	Credits retired by type	Type A (e.g., CDM)	15					
		Type B	15					
D	**Total credits sold (+)**		10					
	Credits sold by type	Type A (e.g., CDM)	5					
		Type B	5					
E	**Total allowances retired (-)**		10					
	Allowances retired by type	Type A, (e.g., EUA)	5					
		Type B	5					
F	**Total allowances sold (+)**		5					
	Allowances sold by type	Type A, (e.g., EUA)	3					
		Type B	2					
Adjusted net scope 2 emissions (Mt CO_2e)								
G	**Adjusted net scope 2 emissions = (B) – (C) + (D) – (E) + (F)**		475					

[100] Removals are not included since scope 2 emissions are a result of imported energy (e.g., electricity, heating, and cooling).
[101] Values in this column are provided as examples.

Table A.3. Sample GHG balance sheet for scope 3 emissions and removals

GHG balance sheet for scope 3 emissions and removals			1[102]	2	3	4	5	6
			Goal period					Cumulative emissions = (1) + (2) + (3) + (4) + (5)
			2015 (Base year)	2016	2017	2018	2019 (Target year)	
Scope 3 inventory emissions and removals (Mt CO_2e)								
A	**Total emissions**		100					
B	**Total removals**		30					
Scope 3 emissions and removals from sectors and gases covered by the goal (Mt CO_2e)								
C	**Total emissions**		100					
D	**Total removals (by category)**		20[103]					
	Type A (e.g., Forest management)		15					
	Type B (e.g., Grassland management)		5					
Transferable emissions units (Mt CO_2e)								
E	**Total credits retired (-)**		1					
	Credits retired by type	Type A (e.g., CDM)	1					
		Type B	N/A					
F	**Total credits sold (+)**		0					
	Credits sold by type	Type A (e.g., CDM)	N/A					
		Type B	N/A					
G	**Total allowances retired (-)**		1					
	Allowances retired by type	Type A (e.g., EUA)	1					
		Type B	N/A					
H	**Total allowances sold (+)**		0					
	Allowances sold by type	Type A (e.g., EUA)	N/A					
		Type B	N/A					
Adjusted net scope 3 emissions (Mt CO_2e)								
I	**Adjusted net scope 3 emissions = (C – D) – (E) + (F) – (G) + (H)**		78					

[102] Values in this column are provided as examples.
[103] Total removals within the goal boundary can differ from total removals in the inventory for a variety of reasons, e.g., due to the use different accounting approaches or different treatment of natural disturbances. See Chapter 7 for more information.

Appendix B: Sample reporting template for gases and sectors

Table B.1. Sample reporting template for gases and sectors

Sectors	Total net GHG emissions	CO_2	CH_4		N_2O		HFCs		PFCs		SF_6		NF_3	
	(Mt CO_2e)	(Mt CO_2)	(Mt)	(Mt CO_2e)	(Mt)	(Mt CO_2e)	(Mt)	(Mt CO_2e)	(Mt)	(Mt CO_2e)	(Mt)	(Mt CO_2e)	(Mt)	(Mt CO_2e)
Total emissions and removals														
Energy														
Subsector A														
Industrial processes and Product Use (IPPU)														
Subsector A														
Agriculture, Forestry, and other Land Use (AFOLU)														
Subsector A														
Waste														
Subsector A														

Abbreviations

AFOLU	Agriculture, Forestry, and Other Land Use
BAU	Business-as-usual
C40	Cities Climate Leadership Group
CDM	Clean Development Mechanism
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
EIA	US Energy Information Agency
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPC	Global Protocol for Community-Scale Greenhouse Gas Emissions
GWP	Global warming potential
HFCs	Hydrofluorocarbons
ICLEI	International Council for Local Environmental Initiatives
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
LEAP	Long-range Energy Alternatives Planning System
LULUCF	Land Use, Land Use Change, and Forestry
MARKAL	Market Allocation Model
Mt CO_2e	Metric Tons of Carbon Dioxide Equivalent
NEMS	National Energy Modeling System
NF_3	Nitrogen Trifluoride
NGO	Non-Governmental Organization
N_2O	Nitrous Oxide
OECD	Organisation for Economic Co-operation Development
PFCs	Perfluorocarbons
QA	Quality Assurance
QC	Quality Control
SF_6	Sulfur Hexafluoride
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
WRI	World Resources Institute
WEPS+	World Energy Projection System Plus

Glossary

Activity data: A quantitative measure of a level of activity that results in GHG emissions. Activity data are multiplied by an emissions factor to derive the GHG emissions associated with a process or an operation. Examples of activity data include kilowatt-hours of electricity used, quantity of fuel used, output of a process, hours equipment is operated, distance traveled, and floor area of a building.

Adopted policies and actions: Policies and actions for which an official government decision has been made and there is a clear commitment to proceed with implementation, but that have not yet been implemented.

***Annual multi-year goa*l:** Mitigation goal that aims to reduce annual emissions by a specific amount each year over a target period relative to a base year or baseline scenario.

Average multi-year goal: Mitigation goal that aims to reduce annual emissions by an average amount over a target period relative to a base year or baseline scenario.

Base period: An average of multiple years of historic data against which emissions are tracked over time.

Base year: A specific year of historic data against which emissions are evaluated over time.

Base year emissions: GHG emissions and removals within the goal boundary in the base year.

Base year goal: Mitigation goal that aims to reduce emissions relative to an emissions level in a historical base year.

Baseline scenario: A reference case that represents the events or conditions most likely to occur in the absence of activities taken to meet the mitigation goal.

Baseline scenario assumptions: Numerical values that define how emissions drivers in a baseline scenario are most likely to change over a defined future time period.

Baseline scenario emissions: An estimate of GHG emissions, removals, or storage associated with a baseline scenario.

Baseline scenario goal: Mitigation goal that aims to reduce emissions relative to a baseline scenario emissions level.

CO_2 equivalent (CO_2e): The universal unit of measurement to indicate the global warming potential (GWP) of each greenhouse gas, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate releasing (or avoiding releasing) different greenhouse gases against a common basis.

Cumulative emissions: Sum of annual emissions over a defined time period.

Cumulative goal: Mitigation goal that aims to limit cumulative emissions over a target period to a fixed absolute amount

Decomposition analysis: Mathematical method for determining the effect of changes in various emissions drivers (e.g., economic activity, population, energy prices, and GHG intensity of energy) on overall emissions levels.

Direct emissions: Emissions from sources located within a jurisdiction’s geopolitical boundary.

Double counting: Occurs when the same emissions reductions or transferable emissions units are counted toward the mitigation goal of two different jurisdictions.

Drivers: Socioeconomic or other conditions or other policies that influence the level of emissions or removals. (E.g., economic growth is a driver of increased energy consumption.) Drivers that affect emissions activities are divided into two types: other policies and non-policy (e.g., socioeconomic) drivers.

Dynamic baseline scenario: Baseline scenario that is updated throughout the goal period based on changes in emissions drivers.

Dynamic baseline scenario goal: Mitigation goal that aims to reduce emissions relative to a dynamic baseline scenario emissions level.

***Emission factor*:** A factor that converts activity data into GHG emissions data (e.g., kg CO_2e emitted per liter of fuel consumed).

Emissions: The release of greenhouse gases into the atmosphere. For simplicity, this standard often uses the term “emissions” as short-hand for “emissions and removals.”

***Emissions estimation method**:* An equation, algorithm, or model that quantitatively estimates GHG emissions (e.g., a simple emissions estimation method is the following equation: GHG emissions = emission factor x activity data.) An emissions estimation method is comprised of parameters (e.g., emission factor, activity data).

Emissions intensity: Greenhouse gas emissions per unit of output (e.g., greenhouse emissions per unit of gross domestic product (GDP)).

Emissions level: The quantity of greenhouse emissions in a given year.

Emissions reduction: Reduction in greenhouse emissions relative to a base year, baseline scenario, or reporting year.

Emissions source: A point of origin for emissions (e.g., stationary fuel combustion is an emission source).

Ex-ante calculation: The calculation of expected future GHG emissions and emissions reductions associated with a mitigation goal.

Ex-post assessment: The evaluation of historical GHG effects of a mitigation goal after implementation.

Fixed level goal: Mitigation goal that aims to reduce emissions to an absolute emissions level.

Geopolitical boundary: The geographic demarcation over which political authority is exercised. Also known as “jurisdiction.”

Geographic coverage: The physical contiguous and non-contiguous territory or territories included in a goal boundary.

Global warming potential (GWP): A factor describing the radiative forcing impact (degree of harm to the atmosphere) of one unit of a given GHG relative to one unit of CO_2.

Goal assessment: The estimation of changes in GHG emissions and tracking of GHG emissions reductions achieved over the goal period. Goal assessments can be performed ex-ante or ex-post.

***Goal boundary**:* The greenhouse gases, sectors, geographic area, and direct and indirect emissions covered by a mitigation goal.

Goal level: Quantity of emissions or emissions reductions to be achieved by a mitigation goal.

Goal period: The definition of the goal period depends on the goal type. For base year goals and intensity goals, it is the period of time between the base year and the target year/period. For baseline scenario goals it is the time between the start year of the baseline scenario and target year/period. For fixed level goals it is the time between the year in which the goal is adopted and the target year/period.

Greenhouse gas inventory: A quantified list of a jurisdiction's GHG emissions and sources.

Greenhouse gases (GHGs): For the purposes of this standard, GHGs are the seven gases covered by the Kyoto Protocol: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); sulfur hexafluoride (SF_6); and NF_3.

***Greenhouse (GHG) gas coverage**:* The greenhouse gases (GHGs) included within the goal boundary.

Implemented policies and actions: Policies and actions that are currently in effect, as evidenced by one or more of the following: (a) relevant legislation or regulation is in force; (b) one or more voluntary agreements have been established; (c) financial resources have been allocated; (d) human resources have been mobilized.

Indirect emissions: Emissions that are a consequence of the activities of the reporting jurisdiction but occur at sources located outside that jurisdiction's geopolitical boundary.

Intensity goal: Intensity goals represent a reduction in emissions intensity relative to an emissions intensity level in a historical base year.

Jurisdiction: The geographic area within which an entity's (e.g., government's) authority is exercised. Also known as "geopolitical boundary."

Leakage: Increase in emissions outside of the mitigation goal boundary that results as a consequence of activities (e.g., policies, actions, and projects) implemented to achieve the goal.

Net GHG emissions: The aggregation of GHG emissions and removals.

Mitigation goal: A commitment to reduce GHG emissions by a defined amount over a defined time period.

Materiality: Concept that individual (or the aggregation of) errors, omissions, and/or misrepresentations could affect the GHG inventory and could influence the user's decisions.

***Offset credit**:* Represents the reduction, removal, or avoidance of GHG emissions from a specific project that is used to compensate for GHG emissions occurring elsewhere. One offset credit represents one metric ton of CO_2 equivalent.

Parameter: A variable (e.g., activity data, emission factor) that is part of an emissions estimation equation. E.g., "emissions per kWh of electricity", and "quantity of electricity supplied" are both parameters in the equation "0.5 kg CO_2e/kWh of electricity x 100 kWh of electricity supplied = 50 kg CO_2e".

Peer-reviewed: Literature (e.g., articles, studies, evaluations) that has been subject to independent evaluation by experts in the same field prior to publication.

Planned policies and actions: Policy or action options that are under discussion and have a realistic chance of being adopted and implemented in the future, but that have not yet been adopted or implemented.

Policy and action: An interventions taken or mandated by a government, institution, or other entity, which may include laws, regulations and standards; taxes, charges, subsidies and incentives; information instruments; voluntary agreements; implementation of new technologies, processes, or practices; public or private sector financing and investment, among others. For purposes of this standard, no further distinction is made between “policies” and “actions”.

Removal: Removal of GHG emissions from the atmosphere through sequestration or absorption (e.g., when carbon dioxide is absorbed by forests and other vegetation during photosynthesis).

Reporting year: The year in which a goal assessment is compiled and published.

Sectoral coverage*:* The sectors included in the goal boundary.

Sensitivity analysis: Sensitivity analysis assesses the extent to which the outputs of an emissions modeling approach (e.g., projected activity data, projected emissions factors, and projected emissions) vary according to model inputs (e.g., assumptions, projected values for key emissions drivers, parameters, and methodological choices). It can be used to explore model sensitivity to inputs and the uncertainty associated with model outputs.

Sink: Any process, activity or mechanism that removes a greenhouse gas from the atmosphere. Forests and other vegetation are considered sinks because they remove carbon dioxide through photosynthesis.

Source: Any process, activity or mechanism that releases a greenhouse gas into the atmosphere.

Static baseline scenario: Baseline scenario that is fixed throughout the goal period and not updated based on changes in emissions drivers.

Static baseline scenario goal: Mitigation goal that aims to reduce emissions relative to a static baseline scenario emissions level.

Target period*:* For multi-year goals, a span of several years, corresponding to the last years of the goal period, over which the goal is to be achieved.

Target year: For single-year goals, the last year of the goal period and the year by which the goal is to be achieved.

Target year/period emissions associated with meeting the goal: Ex-ante calculation of the future emissions level within the goal boundary in the target year/period that would be achieved if the goal were achieved.

Target year/period emissions reductions associated with meeting the goal: Ex-ante calculation of the future emissions reductions within the goal boundary in the target year/period that would be achieved if the goal were met.

Timeframe: The period over which baseline scenario emissions are projected.

Uncertainty: Can be defined quantitatively or qualitatively. 1. Quantitative definition: Measurement that characterizes the dispersion of values that could reasonably be attributed to a parameter. 2. Qualitative definition: A general and imprecise term that refers to the lack of certainty in data and methodology choices, such as the application of non-representative factors or methods, incomplete data on sources and sinks, lack of transparency etc.

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To be completed

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