

# 4 Defining the assessment boundary

*This chapter provides steps for defining the assessment boundary in terms of sectors, GHGs, actor groups, action types and indirect emissions included in the analysis.*

## Checklist of key recommendations

- Specify which sectors and subsectors, actor groups, action types, GHGs, and types of indirect emissions are included in the assessment
- Specify the assessment period

It is a *key recommendation* to specify which sectors and subsectors, actor groups, action types, GHGs, and types of indirect emissions are included in the assessment.

## 4.1 Choose which sectors and subsectors to include

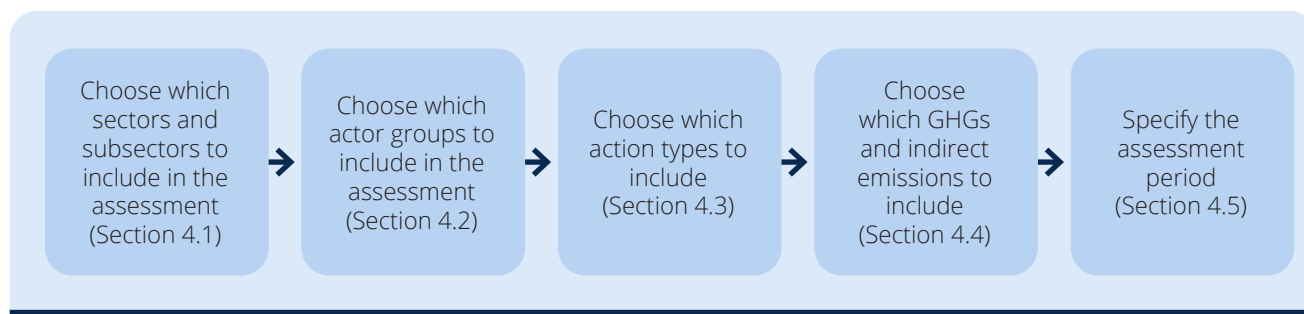
Users should identify whether the assessment is economy-wide or applicable to specific sectors (Figure 4.2). Economy-wide assessments also include sector-specific actions. Users can consider

defining sectors and subsectors according to Intergovernmental Panel on Climate Change (IPCC) categories (Figure 4.3), or follow the categorization used in country-specific models or tools. Users wishing to carry out an economy-wide assessment should cover sectors and subsectors contributing to at least 95% of total national emissions or removals, or 95% of projected national emissions or removals.<sup>33</sup> This will ensure that the coverage can truly be considered economy-wide.

This guide considers agriculture, forestry and other land use (AFOLU); energy-related emissions by sector and subsector; industrial processes and product use; and waste, in line with the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. However, the organization of subsectors throughout this guide differs from the IPCC guidelines and is more closely aligned with the kind of subnational actions that exist, to make it easier to apply. If the assessment requires closer alignment with national GHG inventories, users should consider the IPCC guidelines and the national GHG inventory process while aggregating impacts of non-state and subnational actions.<sup>34</sup>

FIGURE 4.1

## Overview of steps in the chapter



<sup>33</sup> This relates to the concept of “key source analysis” in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, which identifies sources that contribute to 95% of the total emissions or 95% of the trend of the inventory in absolute terms.

<sup>34</sup> For a complete list of subsectors, refer to the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

## 4.2 Choose which actor groups to include

Users should identify which actor groups to include in the assessment. The assessment can include actions taken by all or a subset of the following types of actors:

- cities
- states, provinces and regions

- companies
- investors
- civil society organizations
- others.

Users may choose to focus on one group of actors, such as cities, states or businesses. Alternatively, users may wish to focus more broadly on all actor

FIGURE 4.2

### Defining the assessment boundary

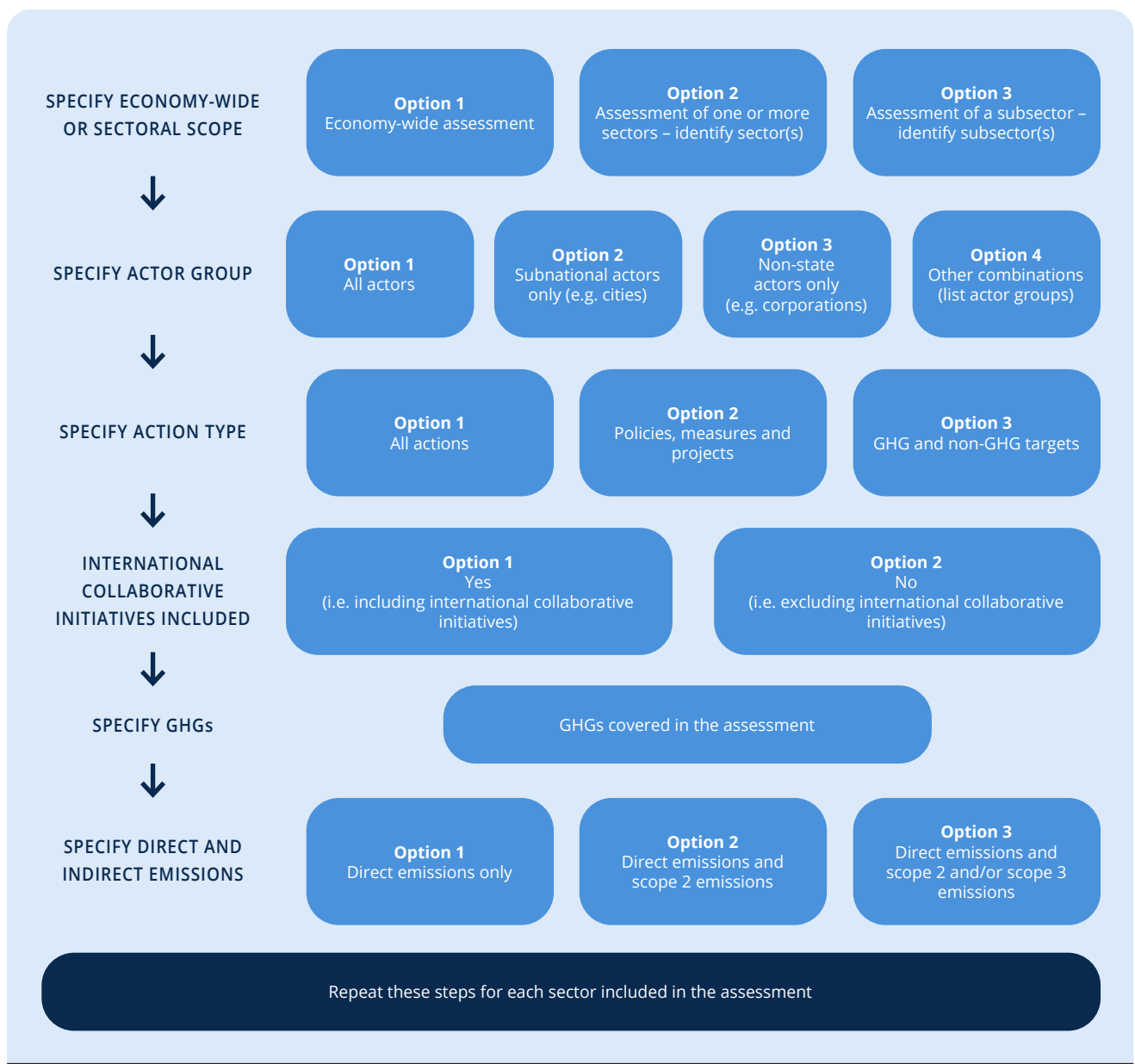
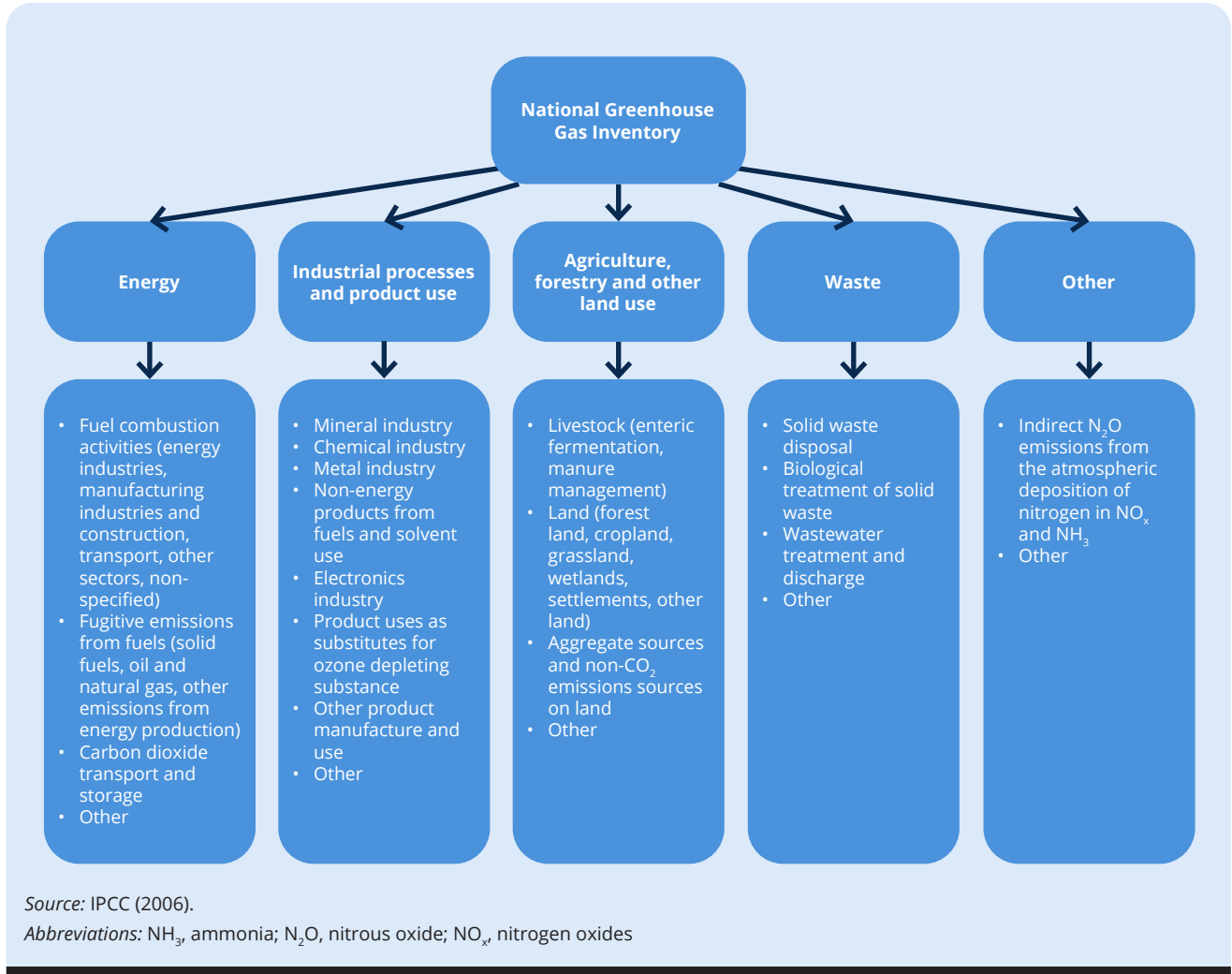


FIGURE 4.3

Main sectors and subsectors defined by the IPCC for national inventories



groups. Depending on the objectives and data availability, specific subgroups may be targeted, such as cities of a certain size or businesses within a specific economic sector (Figure 4.2).

### 4.3 Choose which action types to include

Users should determine which types of actions by the selected actor groups are to be included in the analysis (Figure 4.2). Non-state and subnational actions can encompass a large number of actions and targets of actors such as businesses, cities, states, provinces and investors across all sectors,

sometimes transcending national boundaries. Climate action plans from individual actor groups such as cities may contain mitigation targets, along with specific policies and measures to realize the targets. Some actors, such as investors, may be participating in cooperative initiatives or taking individual action, such as issuing green bonds for clean energy projects. Table 4.1 illustrates the variety of non-state and subnational actions in the United States as an example. Users can adopt a similar table to organize their actions.

TABLE 4.1

## Examples of targets and actions adopted by United States states, cities and businesses

States	Cities	Businesses
<b>GHG target/cap</b>		
Legally binding GHG emissions targets	Climate change goal formally adopted or in progress	Science-based GHG reduction target
Carbon pricing		Internal carbon price
<b>Renewable/CCS/nuclear</b>		
Renewable energy portfolio standards or goals	Committed to 100% renewable energy	Companies with renewable targets such as 100% renewable energy
Property Assessed Clean Energy (PACE) financing to facilitate clean energy investments	Power purchase agreements	Power purchase agreements
Financial incentives for CCS		
Zero-emission credits for nuclear		
<b>Energy efficiency</b>		
Combined heat and power financing and incentives	Energy savings goal formally adopted or in progress	Corporate energy efficiency improvements through Better Buildings Challenge
Energy efficiency resource standard or goals	Energy efficiency procurement policy	Industrial energy efficiency improvements through Better Plants Program
Adoption of "best-in-class" building energy codes	Adoption of the 2015 IECC building code or stretch code	
Appliance and equipment energy efficiency standards	Green building requirements for some private buildings	
	Required building retrofit or retro commissioning	
<b>Transport</b>		
Freight plan with multimodal freight strategies	Car-sharing programme	Emissions reductions from transportation and distribution
Efficient vehicle requirement for public fleet procurement	Bike-sharing programme	Efficient routing efforts
Integration of transport and land use in comprehensive plans	Sustainable transportation plan	Backhauling practices by logistics companies
Dedicated funding streams for public transit	Fuel efficiency requirement for public fleets	
Financial incentives for high-efficiency vehicles	Codified VMT/transportation-related GHG targets	

TABLE 4.1, continued

## Examples of targets and actions adopted by United States states, cities and businesses

States	Cities	Businesses
Clean streets legislation	Codified travel mode target	
California's vehicle emission standards	Vehicle infrastructure incentives	
Zero Emission Vehicle mandate	Vehicle purchase incentives	
Low-carbon-fuel standard	No minimum parking requirements for new developments	
Freight-specific energy efficiency performance metrics	Efficient freight strategy	
	Adoption of technologies to help coordinate freight transport	
<b>Forestry and land use</b>		
Property tax programmes to support sustainable forests	Urban heat island goals	Soil sequestration by food companies
Conservation easement tax credits	Green infrastructure targets and policies	Biogas generation from manure
Cost-sharing programmes to improve forest systems		
Wildfire protection incentives		
<b>Methane</b>		
Landfill gas energy project incentive	Zero-waste goal	Joining EPA's Natural Gas STAR programme
Rules and incentives to reduce food waste		Joining EPA's Methane Challenge
Coal mine methane standards		Actions that reduce food waste by 50%
Methane standards for existing oil and natural gas facilities		
Methane emissions reduction targets		
<b>HFCs</b>		
HFC management programme (stronger than EPA)		Supermarkets committing to reduce HFC emissions and use

Source: America's Pledge (2017).

Abbreviations: CCS, carbon capture and storage; EPA, Environmental Protection Agency; HFC, hydrofluorocarbon; IECC, International Energy Conservation Code; VMT, vehicle miles travelled

Non-state and subnational action types can be broadly categorized into:

- GHG reduction targets (absolute and intensity), which usually do not specify how emissions will be reduced
- sectoral (non-GHG) targets, such as targets for renewable energy or forests
- specific policies, measures and projects to reduce emissions.

Users may want to consider data availability and levels of uncertainty around different actions when deciding which action types to include. Quantitative reduction targets or commitments may have uncertainty relating to their likelihood of being achieved. On the other hand, specific policies, programmes and activities may be more difficult to convert into quantitative GHG reduction outcomes and therefore may involve higher uncertainty.

Actor groups may also differ in terms of the types of actions they undertake. For example, states and regions may have legally binding GHG emissions targets, whereas companies' targets are often not binding and carry more uncertainty. Users may wish to include all types of actions in their assessment, which may increase uncertainty but provide a more comprehensive indication of potential impact. On the other hand, a narrow selection of action types may

reduce uncertainty, but may not provide a full picture of the potential impacts.

Users should also decide whether to include commitments to develop targets in future (as opposed to actions that are already planned or under way). A conservative approach suggests that users should exclude these actions, since no target has been announced yet and it may be difficult to quantify the level of reductions targeted in future. When developing additional scenarios with higher ambition in non-state and subnational actions, users can assume these future targets to be consistent with the NDCs or with national GHG targets. This assumes that eventually all national government targets (including the NDC) would trickle down to the actors at different levels (e.g. cities, businesses). While this may mean a different degree of ambition or target for each actor, the NDC level can be assumed to be the average across all.

Users should also specify whether international cooperative initiatives are included in the assessment ([Figure 4.2](#)). [Table 4.2](#) provides some examples of cooperative initiatives, with their sector and geographic focus. Inclusion of international cooperative actions with commitments spanning geographical boundaries may prove challenging, because an accurate disaggregation of impacts by individual countries will depend on information availability. Users may want to include these initiatives for a comprehensive indication of potential

**TABLE 4.2**

### Examples of international cooperative actions

Initiative	Sector	Region
Building Efficiency Accelerator Platform	Buildings	Global
Transport Decarbonization Alliance	Transport	Global
Super-efficient Equipment and Appliance Deployment (SEAD) Initiative	Energy	Global
United for Efficiency (U4E)	Energy	Global, focus on developing countries
Africa Renewable Energy Initiative (AREI)	Energy	Africa
Bonn Challenge	Forestry	Global
New York Declaration on Forests	Forestry	Global
Global Methane Initiative	Non-CO <sub>2</sub>	Global

Source: Data-Driven Yale, NewClimate Institute and PBL (2018a).

impact, or exclude them to minimize uncertainty. Users also need to decide whether to include the overall target of the international cooperative initiative (which may involve ambitious membership goals of many initiatives) or evaluate the current contribution of an initiative (e.g. based on current membership numbers).

Users also need to decide whether to include actions to reduce emissions from sources that are excluded from national totals in inventories (e.g. emissions from international aviation and maritime transport). As these categories generally involve multiple countries, any analysis involving these sectors should be undertaken, and documented, separately from the main assessment.

#### 4.4 Choose which GHGs and indirect emissions to include

Users should also specify the GHGs and types of indirect emissions included within the identified (sub) sector(s) in the assessment (Figure 4.2). Specifying which direct and indirect emissions are included in the assessment is necessary to clearly define the scope of the assessment, and address possible double counting between multiple non-state and subnational actors.

GHGs include carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF<sub>6</sub>) and nitrogen trifluoride (NF<sub>3</sub>). Users can assess the impacts of non-state and subnational actions on all or a subset of GHGs, depending on data availability.

The definition of direct and indirect emissions is different for businesses and organizations versus cities and subnational regions. A corporate GHG inventory (which applies to organizations of any type, including businesses, government agencies and civil society organizations) classifies emissions according to scopes (scopes 1, 2, and 3):<sup>35</sup>

- Scope 1 (direct) emissions are emissions that occur from sources owned or controlled by the company – for example, emissions from stationary fuel combustion, mobile fuel combustion in company-owned vehicles, and process-related emissions such as from calcination in the cement industry.

Indirect emissions are a consequence of the company's activities but occur at sources not owned or controlled by the company. These are divided into scope 2 and scope 3 emissions:

- Scope 2 emissions are indirect emissions resulting from the use of purchased electricity, heat or steam.
- Scope 3 emissions are all other indirect emissions that occur in the company's value chain (e.g. purchased goods and services, outsourced transportation, use of sold products).

In the context of a city or subnational GHG inventory, the *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories* classifies emissions into scopes relative to the city or subnational geopolitical boundary:<sup>36</sup>

- Scope 1 emissions are emissions from sources located within the city or subnational boundary.
- Scope 2 emissions are emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city or subnational boundary.
- Scope 3 emissions are all other emissions that occur outside the city or subnational boundary as a result of activities taking place within the city or subnational boundary.

One company's scope 2 or 3 emissions are another company's scope 1 emissions, while one city's scope 2 or 3 emissions are another city's scope 1 emissions. Scope 1 emissions of a business located within a city are also the scope 1 emissions of that city. The Greenhouse Gas Protocol provides several resources on calculating sector-specific emissions and developing GHG emissions inventories for industries, as well as subnational entities such as cities.<sup>37</sup>

In contrast to non-state and subnational inventories, national GHG inventories categorize emissions by source. For example, emissions from fossil fuel combustion across sectors (e.g. the cement, iron

<sup>36</sup> Adapted from WRI, C40 and ICLEI (2014).

<sup>37</sup> See the Greenhouse Gas Protocol website ([www.ghgprotocol.org](http://www.ghgprotocol.org)) for these resources. The website has relevant standards, guidance and sector-specific calculation tools, along with online training resources.

<sup>35</sup> WRI and WBCSD (2004).

and steel, and aluminium sectors) are listed under a single category. Similarly, industrial process emissions are aggregated and reported in a single category, although disaggregated totals are often available for process emissions from major emitting industries (e.g. cement, and iron and steel). Therefore, emissions from purchased electricity used in the iron and steel industry are accounted for under electricity generation in national inventories, whereas the iron and steel company will account for these as scope 2 emissions.

Actions can target direct emissions (e.g. targets for sources occurring within a city's geographic boundary) as well as indirect emissions (e.g. scope 2 emissions sources). Direct emissions are presumed to be accounted for, but users should specify whether and which indirect emissions will be included in the assessment. Where scope 2 emissions are targeted by chosen actions, users should include them in their assessment boundary (e.g. companies targeting their scope 2 emissions; cities and states aiming to increase the share of renewables in their jurisdictions, which would impact their scope 2 emissions). Inclusion of indirect emissions is likely to result in potential overlaps and double counting that should be carefully addressed when aggregating impacts. Accounting for these overlaps also requires reliable, geographically resolved data on baseline emissions or action-specific activity data (e.g. MWh of electricity consumption) for all actors included in the assessment. In general, users should be conservative and avoid overestimating the aggregated impacts from non-state and subnational actions, while accounting for overlaps and possible double counting by different actor groups. Users may decide whether to address scope 3 emissions depending on availability of data to estimate impact while taking account of overlaps.

The India corporate actions assessment included scope 1 and scope 2 emissions in the analysis. Relevant data were available because companies had annual data on scope 2 emissions in their inventories, and their GHG targets included both scopes.

Differences in emissions accounting across different actors (e.g. nations, cities, companies) also present a challenge. For the sake of simplicity, this guide suggests following the IPCC categories, which list GHG emissions by (direct) sources of emissions and removals by sinks (Figure 4.3),<sup>38</sup> but carefully considering the effect of mitigation actions on

reducing electricity use and related (indirect) emissions. For example, international cooperative initiatives from companies in the waste sector should be accounted for in the waste sector, while any effect these actions may have on electricity generation should be accounted for in the energy supply sector.

[Box 4.1](#) illustrates how to define the assessment boundary using some hypothetical examples.

## 4.5 Specify the assessment period

It is a *key recommendation* to specify the assessment period. If the objective is to understand the expected contribution of the policy or action towards achieving a country's NDC, it may be appropriate to align the assessment period with the NDC implementation period (e.g. ending in 2030). To align with longer-term trends and planning, users may select a longer assessment period, such as 2050, or consider aligning with the requirements for reporting GHG emissions and removals projections under the enhanced transparency framework of the Paris Agreement.<sup>39</sup> Users should also consider whether it will be useful to understand the assessment results only for the end year or also for interim years. For adequate comparison and aggregation, users will need to harmonize the time periods for assessment of non-state and subnational actions with the assessment period for national targets (further discussed in [Section 8.1](#)).

<sup>38</sup> IPCC (2006).

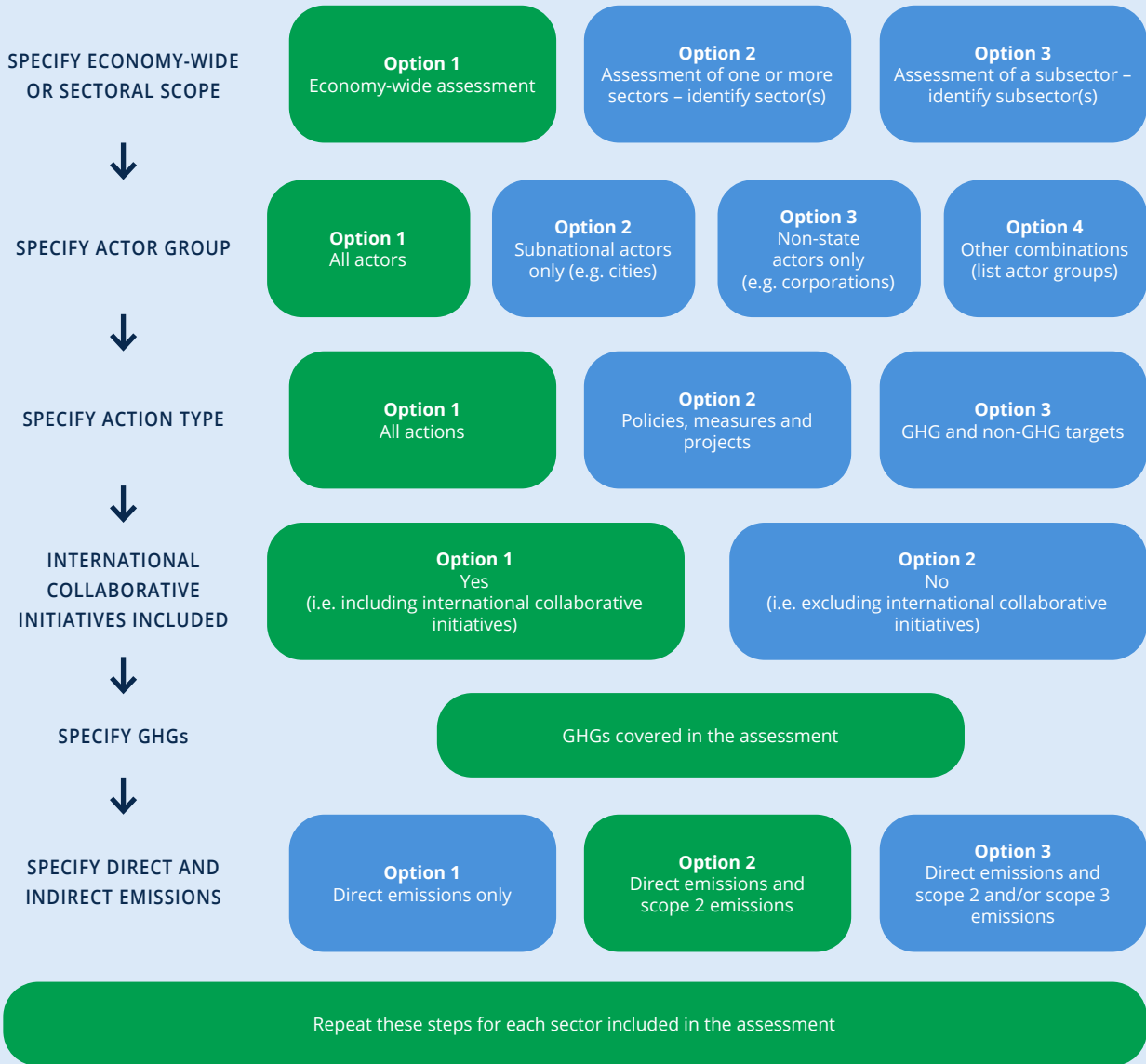
<sup>39</sup> Under the enhanced transparency framework, GHG emissions and removals projections are required to begin from the most recent year in the country's national inventory report and extend at least 15 years beyond the next year ending in zero or five (UNFCCC 2018).



**BOX 4.1**

**Hypothetical examples of determining assessment boundary based on objectives**

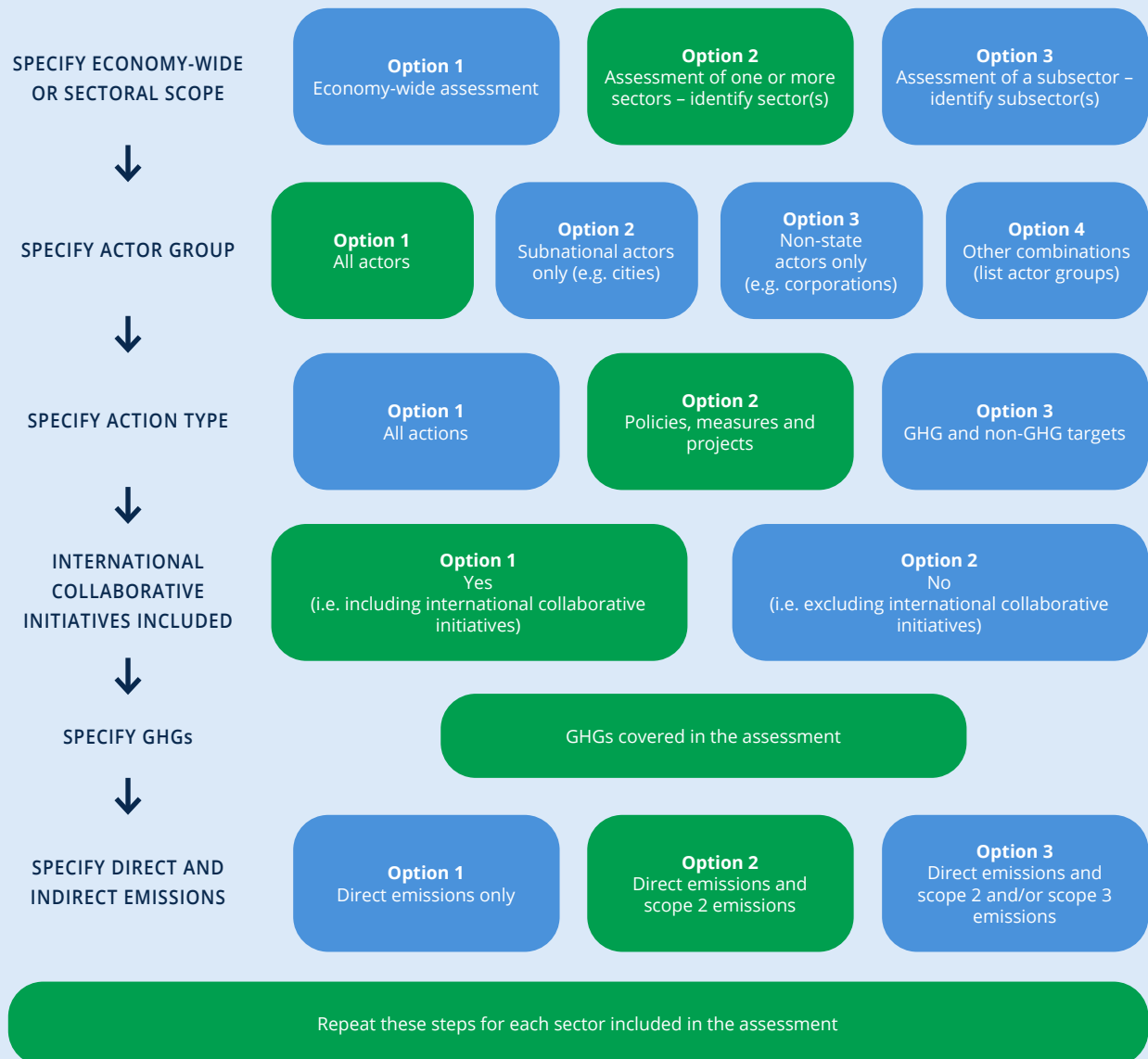
Example 1: The assessment objective is to identify, quantify and integrate the impact of non-state and subnational actions to revise overall national emissions projections for 2030. In this instance, users should go through the steps for all relevant sectors and subsectors identified in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. See the proposed stepwise approach marked in green below.



## BOX 4.1, continued

## Hypothetical examples of determining assessment boundary based on objectives

Example 2: The assessment objective is to identify, quantify and integrate the impact of non-state and subnational actions when designing a roadmap to decarbonize the national transport sector by 2050. Here, users should apply the steps for the transport sector (direct emissions) and the energy supply sector (indirect emissions resulting from the production of electricity consumed by electric vehicles). See the proposed stepwise approach marked in green below.



**BOX 4.1, continued**

**Hypothetical examples of determining assessment boundary based on objectives**

Example 3: The assessment objective is to identify, quantify and integrate the impact of non-state and subnational actions on energy efficiency of passenger cars sold nationally by 2030. In this instance, users should apply the steps only to this specific subsector (road transportation), as shown in the proposed stepwise approach marked in green below.

