United Nations Framework Convention on Climate Change

COMPENDIUM ON GHG BASELINES AND MONITORING

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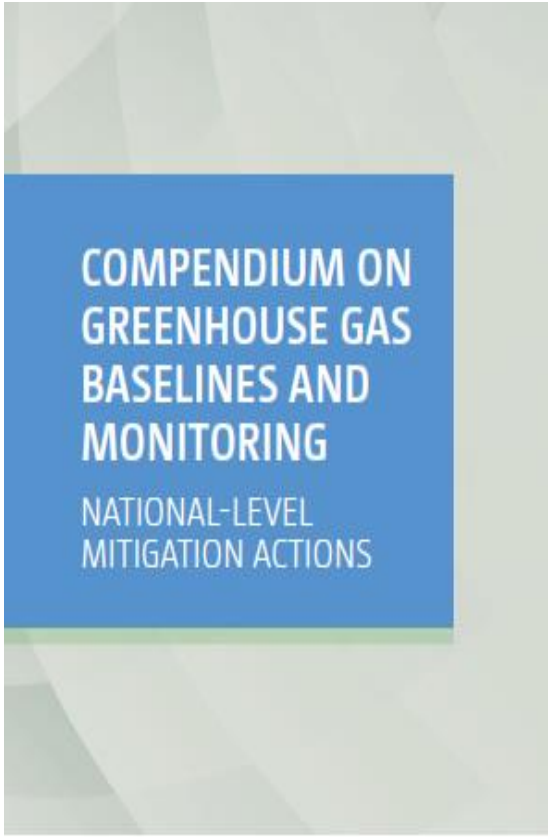
Compendium

National level mitigation actions volume of the Compendium

Our partners: GIZ; FAO; IRENA;World Bank; WRI; INFRAS; Szent István University; Integral-Egypt; UNDP; Swedish Energy Agency; and IEA.

- Introduction
- Methodological aspects of GHG emissions scenarios
- Modelling GHG emission scenarios
- Comparison of top-down and bottom-up approaches
- References
- Annexes



Aim

This volume covers:

- Guidance on the steps required to develop national-level baseline and mitigation scenarios using top-down approaches.
- Overview of key preparatory steps for developing national-level baseline and mitigation scenarios.
- Information on key aspects that need to be considered in order to select the most appropriate modelling approach.
- Guidance on conducting the stocktaking of available resources in order to identify relevant data needed for scenario building and data gaps that may need to be bridged in order to reach set objectives.
- Using this information as the basis for baseline and mitigation scenario building, the volume provides guidance on the methodological steps of the process and introduces key methodological issues of scenario building, the key drivers of GHG emissions, and considerations related to accounting for policies and measures in baselines.

Some key aspects of this volume

Section 2.1 Preparation for scenario building

Figure 1

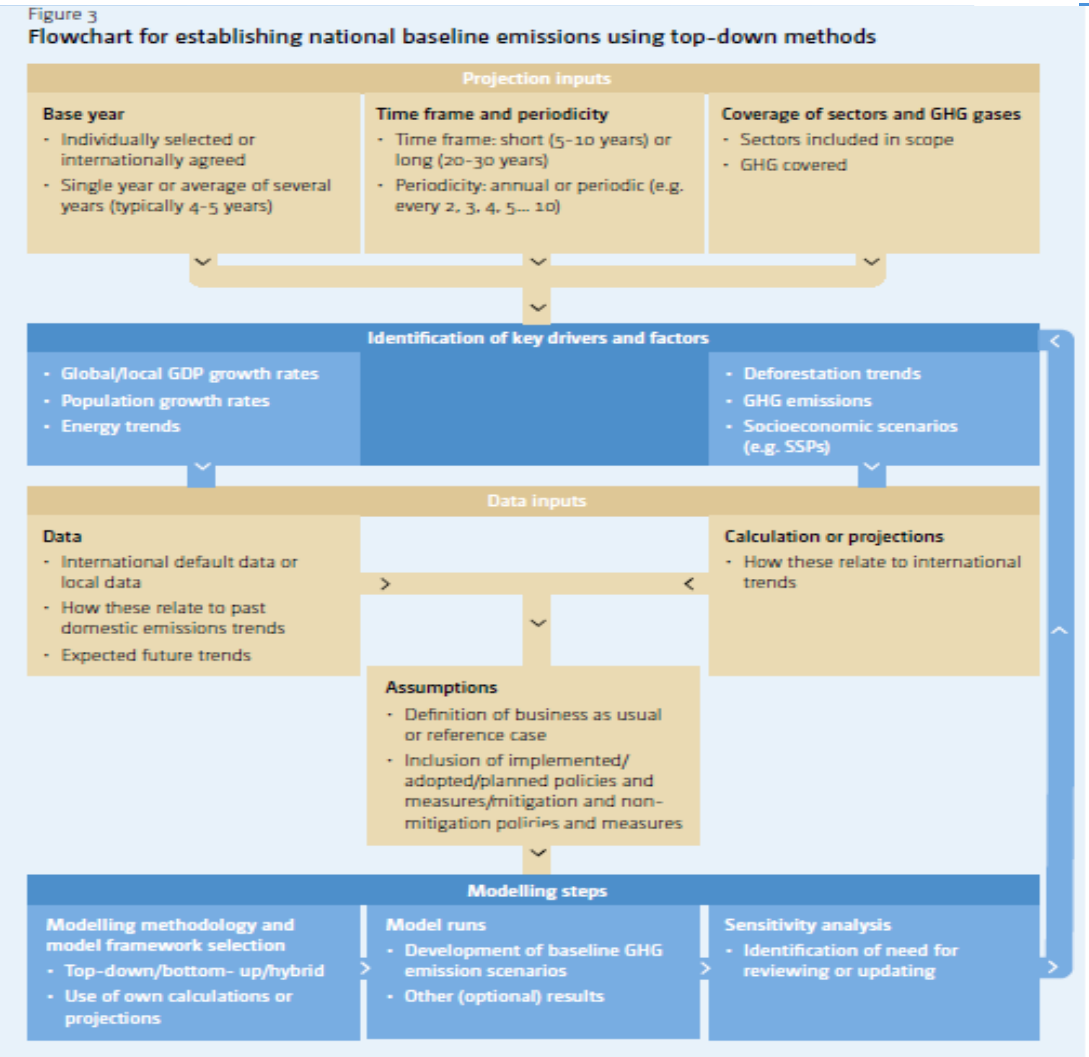
Assessment of modelling needs

Objetive of baseline setting	What is the intended use of the national-level baseline emissions? Example: Setting national emission reduction targets or domestic mitigation policy planning
Sectoral coverage	Which are the most important sectors to target with mitigation actions and include in the mitigation assessment? Example: Those sectors of the economy that are responsible for the largest shares of total national GHG emissions
Time frame	What time period needs to be considered in the mitigation assessment? This information is relevant for the selection of the base year and the projection period
Accuracy	What level of accuracy, conservativeness and detail is necessary? This information is relevant for the selection of the tier

Some key aspects of this volume

Section 2.2 Key methodological issues:

Flowchart for establishing national baseline emissions using top-down methods



Some key aspects of this volume

Section 2.3 Drivers and impacts: Overview of the primary drivers of emissions at the national level

Table 1
Overview of the primary drivers of emissions at the national level

Primary drivers	Examples of sources of data[a]
Population growth	United Nations and government agencies
Economic growth, activity	National statistics, OECD, World Bank, CIA The World Fact Book and IIASA
Structural changes in the economy	National statistics, OECD, World Bank and IIASA
Technological advancement	IIASA and national agencies
Modalities of transportation, infrastructure	National agencies
Efficiency of energy use	IEA, EPA and IIASA
Emission intensity	IEA, EPA and FAO
Intrinsic fossil fuel supplies	BP and Shell reports
Energy prices, energy demand and supply, price and income elasticity of energy demand	National statistics, Bloomberg, IEA and IRENA
Tax system, government policies (climate and non-climate policies)	Government agencies, OECD, IRENA and IEA

Some key aspects of this volume

Section 2.4 Accounting for policies and measures in nationa baselines: Overview of approaches to taking national policies into account in establishing baselines

Overview of approaches to taking national policies into account in establishing baselines

Aspect	National Communications	Mitigation Goal Standard[a]
Objective of baseline	Communication of national progress in climate change mitigation	Development of baseline scenarios for national or subnational greenhouse gas (GHG) emission reduction goals
Types of policies to be taken into account in baselines	• Policies that are planned, adopted and/or implemented by governments at the national, state, provincial, regional and local levels • 'With existing measures' (WEM) scenario includes adopted and implemented policies • 'With additional measures' (WAM) scenario includes planned policies over WEM scenario policies • Policies may also include those adopted in the context of regional or international efforts	To reflect the most likely future emission pathway under a baseline scenario, users should include all policies and actions that • Have a significant effect on GHG emissions, either increasing or decreasing them; and • Are implemented or adopted in the year in which the baseline scenario is developed
Baseline scenario	Includes all policies and measures planned, adopted or implemented after the year chosen as the starting year for the projections ('without measures' scenario)	Relevant for baseline scenario goals; users shall report: • The cut-off year for the inclusion of policies; that is, the year after which no new policies or actions are included in the baseline scenario • Key policies and actions included in the baseline scenario • Any additional methods and assumptions used to estimate the effects on GHG emissions of key included policies and actions • Any significant policies excluded from the baseline scenario, with justification
Mitigation Scenario	• WEM scenario projections shall encompass currently implemented and adopted policies and measures	This is determined by calculating the allowable emissions in the target year, based on the specifics of the goal

Some key aspects of this volume

Section 3.1 Overview of top-down models

Overview of top-down models

Model type	Key features[a]/range of time periods considered	Example of applications and models used	Advantages	Disadvantages
Trend analysis	Extrapolates past trends, has less stringent data requirements than other model types listed below **Short or medium term (1–10 years)**	Intended nationally determined contributions (INDCs) of Benin, Djibouti and Gabon[b]	Requires highly aggregated data, and thus is less demanding to use	• Limited application to policy analysis • Interactions between energy use and economic sectors cannot be modelled
Macroeconomic models	Macroeconomic models focus on the entire economy and on the interaction between the sectors. Often, macroeconomic models do not concentrate on energy specifically, but on the economy as a whole, of which energy is only a (small) part **Short or medium term (1–10 years)**	INDC of Trinidad and Tobago (MACRO)	Good forecasting potential, and good linkage to the sectors of the economy	• Lack of technology representation • Requires high expertise to use • Provides a static representation of the economy • Typically provides an indirect connection to energy use and emissions

Some key aspects of this volume

Section 3.3 Selection of an appropriate model: Examples of model choices suitable for different national circumstances

Examples of model choices suitable for different national circumstances

National circumstances	Suitable models	Main sources of data*	Costs of input data and time required for data collection
Developing country with low carbon intensity (low GDP/capita and high share of agriculture)	• Trend analysis (simple models)	• United Nations agencies, World Bank, IEA and OECD • National statistics	Low (3–6 months)
Developing country with growing carbon intensity of economy (low–medium GDP/capita, growing share of industry or services sector, e.g. tourism)	• Trend analysis • Macroeconomic models	• United Nations agencies, World Bank, IEA and OECD • National statistics • National data development (measurements and modelling)	Low to medium (3–12 months)

Accessing UNFCCC tools and training materials

Tools and Training Materials for non-Annex I Reporting are available on UNFCCC webpages:

1. **Tools and Training Materials Click here**
2. **e-Network Click here**

Outline

1. Objective
2. Definition of baselines
3. Types of baselines
4. Tools to establish national baselines
5. Key drivers
6. Elements to consider for baseline setting

Baseline in the context of mitigation actions: Objective

Objective of the presentation: To introduce the concept of national-baseline estimation as a key element of climate change policymaking

The presentation is based on:

- CGE material, and in particular the ‘Compendium on GHG baselines and monitoring: national-level mitigation actions’
- The Mitigation Goal Standard: an accounting and reporting standard for national and subnational GHG reduction goals, by the GHG Protocol and the World Resources Institute (WRI)

Definition of ‘baseline’ and the link to national mitigation goals

- ‘Baseline scenarios’ are in general defined as scenarios that describe future GHG emissions in the absence of defined mitigation efforts and policies

- The term ‘baseline’ is often used to mean ‘business as usual’ (BAU) and ‘reference’. However, baseline scenarios may deviate from the expected emissions under BAU in order to evaluate the impact of a specific policy

- How are national baselines used?
  - ✓ Support national climate change policy preparation
  - ✓ Set national targets and goals
  - ✓ Provide a benchmark for mitigation targets
  - ✓ Estimate the mitigation impact and assess progress in implementation

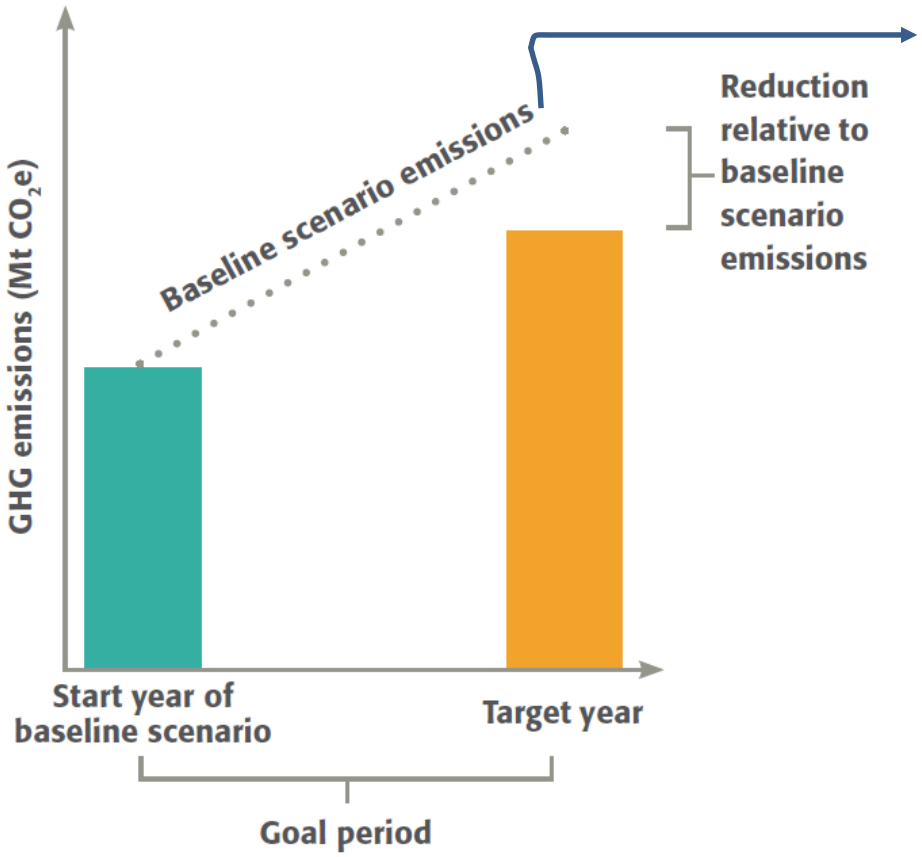
- Baselines are constructed and/or depend on the type of mitigation goals

Different types of mitigation goals=different types of baselines

Goal Type	Description	Reductions in what?	Reductions relative to what?
Base year emissions goal	Reduce, or control the increase of, emissions by a specified quantity relative to a base year. For example, a 25% reduction from 1990 levels by 2020.	Emissions	Historical base year emissions
Fixed-level goal	Reduce, or control the increase of, emissions to an absolute emissions level in a target year. One type of fixed-level goal is a carbon neutrality goal, which is designed to reach zero net emissions by a certain date.	Emissions	No reference level
Base year intensity goal	Reduce emissions intensity (emissions per unit of another variable, typically GDP) by a specified quantity relative to a base year. For example, a 40% reduction from 1990 base year intensity by 2020.	Emissions intensity	Historical base year emissions
Baseline scenario goal	Reduce emissions by a specified quantity relative to a projected emissions baseline scenario. A baseline scenario is a reference case that represents future events or conditions most likely to occur in the absence of activities taken to meet the mitigation goal. For example, a 30% reduction from baseline scenario emissions in 2020.	Emissions	Projected baseline scenario emissions

Source: Mitigation Goal Standard (GHG Protocol)

Example of a baseline-scenario goal



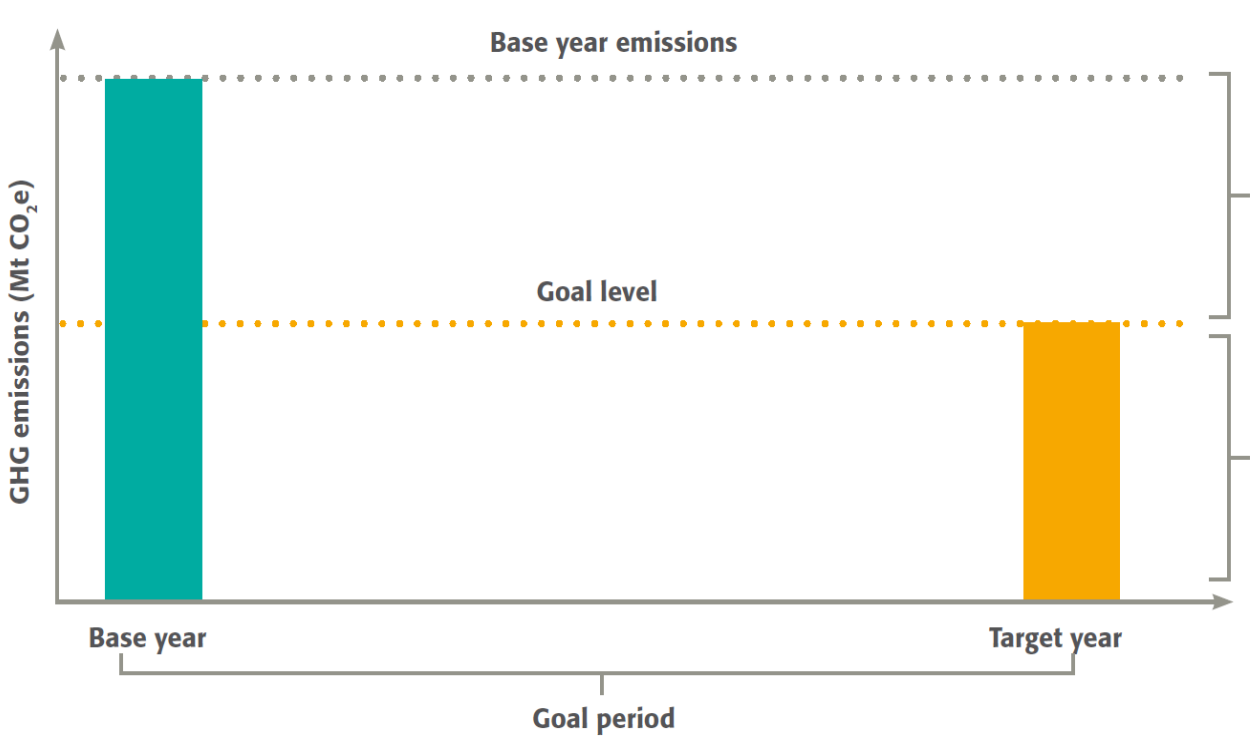
The ex-ante baseline scenario: Most likely to occur in the absence of actions, policies or measures taken to meet a mitigation goal.

The asssumptions regarding which policies are included or excluded (e.g. existing vs approved but not fully implemented) should be as transparent as possible

The baseline also depends on data-availability and emission drivers as well as on the national-specific modelling appraoch

Source: WRI (World Resource Institute). 2014. Mitigation Goal Standard: An Accounting and Reporting Standard for National and Subnational Greenhouse Gas Reduction Goals.

Example of a base-year emissions goal



For example, ~50% reduction compared to base year

Maximum quantity to be emitted in the target year or period to achieve the mitigation goal

Source: WRI (World Resource Institute). 2014. Mitigation Goal Standard: An Accounting and Reporting Standard for National and Subnational Greenhouse Gas Reduction Goals.

To establish national baseline emissions: a) 'needs assessment'

Objetive of baseline setting	What is the intended use of the national-level baseline emissions? Example: Setting national emission reduction targets or domestic mitigation policy planning
Sectoral coverage	Which are the most important sectors to target with mitigation actions and include in the mitigation assessment? Example: Those sectors of the economy that are responsible for the largest shares of total national GHG emissions
Time frame	What time period needs to be considered in the mitigation assessment? This information is relevant for the selection of the base year and the projection period
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- The objective of the national baseline depends on national priorities and circumstances: e.g. nationally determined contributions (NDCs)
- GHG inventories are essential/very important towards establishing, monitoring and assessing the implementation of a GHG mitigation goal

Source: Compendium on Greenhouse Gas Baselines and Monitoring: National-Level Mitigation Actions

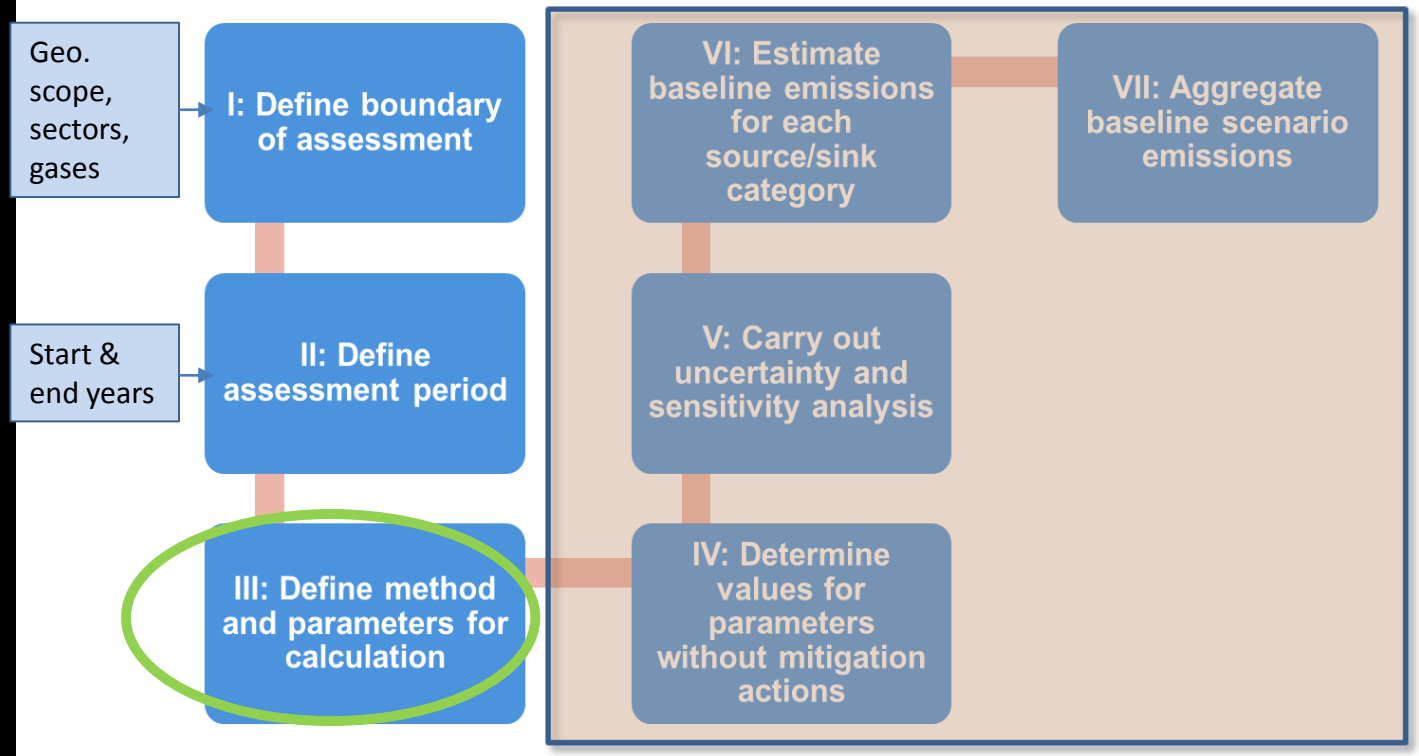
To establish national baseline emissions: b) 'stocktaking of info available'

Research capacity	Are there research institutions available with relevant modelling expertise that can support the GHG emission scenarios modelling? Example: Universities, government agencies, researchers and consultants
Data	What data are available? See section 3.2 for an overview of data sources and data requirements of data models
Models	What models are available? See section 3.1.1 and Annex 1 for an overview of models
Studies	What studies on national-level scenario building have been conducted? What can these studies bring in terms of useful information for the GHG emissions scenario modelling that can be used as indicators to the proposed effort? Example: Macroeconomic forecasts, population forecasts and outlined emission projections

- The data availability and modelling approach depend on national circumtances and priorities as well as on institutional arrangements for data sharing
- Countries may use simple models like trend analysis and move to higher tier models to estimate baselines in line with improvements in the availability and quality of the data

Source: Compendium on Greenhouse Gas Baselines and Monitoring: National-Level Mitigation Actions

A simplified ‘good practice’ for baseline setting



Steps may not necessarily be carried out in this exact order

Depending on the situation individual steps may be more or less important and may require different levels of detail

More information on these steps for baseline setting - WRI (World Resource Institute). 2014. Mitigation Goal Standard: An Accounting and Reporting Standard for National and Subnational Greenhouse Gas Reduction Goals.

Available at http://www.wri.org/sites/default/files/Mitigation_Goal_Standard.pdf

Source: Based on WRI (2014).

Source: Compendium on Greenhouse Gas Baselines and Monitoring: National-Level Mitigation Actions

Need to understand what drives GHG emissions: Overview of some key emission drivers

The Kaya Identity is estimated as follows:

Population (N) × per capita income (PCI)= GDP

GDP × energy intensity (EI)=primary energy demand (ED)

Primary energy demand (ED)× carbon intensity (CI)= emissions (EM)

Overview of the primary drivers of emissions at the national level

Primary drivers	Examples of sources of data[a]
Population growth	United Nations and government agencies
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Structural changes in the economy	National statistics, OECD, World Bank and IIASA
Technological advancement	IIASA and national agencies
Modalities of transportation, infrastructure	National agencies
Efficiency of energy use	IEA, EPA and IIASA
Emission intensity	IEA, EPA and FAO
Intrinsic fossil fuel supplies	BP and Shell reports
Energy prices, energy demand and supply, price and income elasticity of energy demand	National statistics, Bloomberg, IEA and IRENA
Tax system, government policies (climate and non-climate policies)	Government agencies, OECD, IRENA and IEA

Abbreviations: CIA = Central Intelligence Agency, EPA = United States Environmental Protection Agency, FAO = Food and Agriculture Organization of the United Nations, IEA = International Energy Agency, IIASA = International Institute for Applied Systems Analysis, IRENA = International Renewable Energy Agency, OECD = Organisation for Economic Co-operation and Development.

Source: Compendium on Greenhouse Gas Baselines and Monitoring: National-Level Mitigation Actions

Some elements to consider regarding the methods and parameters for baseline setting

1. To estimate baseline emissions one should analyse the main drivers/factors underpinning the key emission sources in the country
2. There should be as much consistency as possible between the drivers/factors underpinning historical emissions and the baseline
3. There are several methods for estimating baselines:
   - There can be different methods to estimate baseline emissions by source (e.g. 'trend analysis' for one sector & econometric for another)
   - Complex methods do not always improve accuracy, particularly if data is not readily available, or may be too resource demanding
   - Simple, user-friendly, methods can sometimes be more suitable, both in terms of resources and communication
   - Countries can use with simple models and move to higher tier models to estimate baseline emissions in line with improvements in data availability, data collection and data quality as their institutional arrangements become more established

The Compendium provides examples of model choices suitable for different national circumstances and a decision tree for selecting the appropriate modelling approach

Some key elements to consider regarding policies for baseline setting

6. There are policy and non-policy drivers. It is not always easy to isolate/model the potential effects of a particular policy. One should acknowledge that baselines can contain a certain degree of subjectivity
7. Choices need to be made as to which existing policies are included in the baseline and which are part of the emission reduction scenarios. In general:
   - The baseline should include existing and implemented policies
   - The baseline may exclude planned policies that are approved and legally binding but are not yet fully implemented
   - Policy choices regarding the baseline should be transparent and justified
8. It is important to assess interactions to avoid over or underestimation of baseline emissions. An individual policy may interact with other policies to produce total effects that differ from the sum of individual effects.

The Compendium provides an overview of different approaches to talking national policies into account when establishing baselines

THANK YOU

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