

10 Monitoring performance over time

Monitoring serves two objectives: evaluation of the policy's performance (monitor trends in performance parameters to understand whether the policy is on track and being implemented as planned) and estimation of the policy's GHG impacts. This chapter provides guidance on monitoring the performance of policies during the implementation period, and collecting data for estimating RE addition and GHG impacts ex-post. Users estimating GHG impacts ex-ante without monitoring performance can skip this chapter.

Checklist of key recommendations

- Identify the key performance indicators that will be used to track performance of the policy over time and define the parameters necessary to estimate GHG emissions ex-post
- Create a plan for monitoring key performance indicators and parameters
- Monitor each of the indicators and parameters over time, in accordance with the monitoring plan

10.1 Identify key performance indicators and parameters

To estimate RE addition and GHG impacts ex-post, users collect data on a broad range of indicators and parameters to be monitored during the implementation period. A key performance indicator is a metric that helps track the performance of the policy. A parameter is a variable such as activity data or an emission factor that is needed to estimate emissions.

It is a *key recommendation* to identify the key performance indicators that will be used to track performance of the policy over time and define the parameters necessary to estimate GHG emissions ex-post. The selection of indicators and parameters should be tailored to the policy, the needs of stakeholders, the availability of existing data and the cost of collecting data. [Table 10.1](#) provides example key performance indicators for the types of policies covered by this methodology, and [Table 10.2](#) provides example parameters. Users should adapt the indicators and parameters as needed for the specific policies being assessed. Some of the indicators and parameters listed in the tables can also serve as inputs to monitoring progress towards implementation and achievement of NDCs, and meeting the reporting requirements of the enhanced transparency framework under the Paris Agreement.

FIGURE 10.1

Overview of steps in the chapter

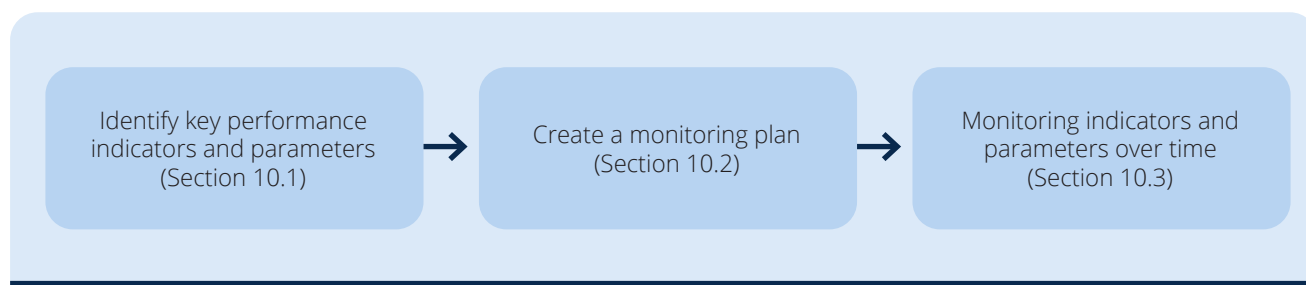


TABLE 10.1

Example key performance indicators for renewable energy policies

Key performance indicator	Definition	Examples
Inputs	Resources that go into implementing a policy	<ul style="list-style-type: none"> Financial resources for implementing and administering the policy
Activities	Administrative activities involved in implementing the policy	<ul style="list-style-type: none"> Level of tariff or premium by technology or installation (feed-in tariff policy, auction policy) Sum of tariff or premium payments (feed-in tariff policy, auction policy) Sum of tax deductions given to end user (tax incentive policy) Funds collected (tax incentive policy)
Intermediate effects	Changes in behaviour, technology, processes or practices	<ul style="list-style-type: none"> Amount of capacity auctioned versus installed (auctions) Share of installations that achieve tax breaks (tax incentive policy) Capacity utilization factor of RE installations (all policies) Number of RE plants by stage: planned, under construction, operational (all policies)
Sustainable development impacts	Changes in relevant environmental, social or economic conditions that result from the policy	<ul style="list-style-type: none"> Cost savings achieved (all policies) Employment generated (all policies) Number of households with reduced energy costs (all policies) Number of new business and/or investment opportunities (all policies) Air quality (all policies)

Source: Adapted from WRI (2014).

TABLE 10.2

Example parameters for estimating the GHG impacts of renewable energy policies

Parameter and unit	Potential sources of data	Parameter type	Suggested monitoring frequency
General			
Installed RE capacity (MW)	Monitoring reports and surveys, installation registers by federal energy agencies	Measured	Monthly or annual
Net electricity supplied to the electricity grid from RE (GWh)	Meter readings taken jointly by grid utility and power producer representatives	Calculated as the difference between quantity of electricity exported to the grid and quantity of electricity imported from the grid, as measured by electronic energy meters at the grid delivery point	Continuous measurement; monthly recording
Emissions trajectory method			
Electricity mix (GWh per technology)	Monitoring reports and surveys, installation registers by federal energy agencies, electricity market regulator	Measured	Monthly or annual
Technology-specific emission factors	National studies or other relevant sources	Calculated for each fuel source and/or type of technology	Annual
Grid emission factor method			
Grid emission factor (tCO ₂ e/MWh)	National statistics for grid-connected power plants	Calculated as the combination of operating and build margin by applying suitable weights	Most recent three years of data are used to recalculate operating margin every year
Operating margin (tCO ₂ e/MWh)	National statistics for grid-connected power plants	Calculated using methods specified in tools such as the CDM Tool to Calculate the Emission Factor for an Electricity System	Most recent three years of data are used to recalculate operating margin every year
Build margin (tCO ₂ e/MWh)	National energy strategies, national energy modelling, utility investment plans/permitting documents	Calculated using methods specified in tools such as the CDM Tool to Calculate the Emission Factor for an Electricity System	Most recent year data are used to recalculate build margin every year

Source: Adapted from WRI (2014).

10.2 Create a monitoring plan

A monitoring plan is the system for obtaining, recording, compiling and analysing data and information important for tracking performance and estimating GHG impacts. A monitoring plan is important to ensure that the necessary data are collected and analysed. It is a *key recommendation* to create a plan for monitoring key performance indicators and parameters. Where feasible, users should develop the monitoring plan during the policy design phase (before implementation), rather than after the policy has been designed and implemented.

10.2.1 Monitoring period

The policy implementation period is the time period during which the policy is in effect. The assessment period is the time period over which the GHG impacts resulting from the policy are assessed. The monitoring period is the time period over which the policy is monitored. There can be multiple monitoring periods within the assessment period.

At a minimum, the monitoring period should include the policy implementation period. It is useful if the monitoring period also covers pre-policy monitoring of relevant activities before implementation of the policy and post-policy monitoring of relevant activities after the implementation period. Depending on the indicators being monitored, it may be necessary to monitor some indicators over different time periods than others.

Users should strive to align the monitoring period with those of other assessments being conducted using other ICAT assessment guides. For example, if assessing sustainable development impacts using the ICAT Sustainable Development Methodology in addition to assessing GHG impacts, the monitoring periods should be the same.

10.2.2 Institutional arrangements for coordinated monitoring

Information on key performance indicators and parameters can be dispersed among a number of institutions. Given the wide variety of data needed for impact assessment and the range of stakeholders involved, strong institutional arrangements serve an important function. They play a central role in coordinating monitoring. A technical coordinator, coordinating team or body is often assigned to lead monitoring, reporting and verification (MRV) processes in which responsibilities have been

delegated to different institutions. Since data can be widely dispersed between institutions, the coordinating body oversees the procedures for data collection, management and reporting.

Countries may already have institutions in place as part of a national MRV system. In this case, users can consider expanding the national MRV system to also monitor the impact of the policy. Where strong institutional arrangements do not yet exist, countries can determine the governmental body with the adequate capacity and authority to be responsible for the MRV system and to establish the necessary legal arrangements. Institutional mandates help to strengthen the procedures and the system, and may also help secure funding from the government to ensure the continuity of the process. Users can refer to the United Nations Framework Convention on Climate Change (UNFCCC) *Toolkit for Non-Annex 1 Parties on Establishing and Maintaining Institutional Arrangements for Preparing National Communications and Biennial Update Reports*, as well as other sources, for support on establishing or improving the institutional arrangements for a robust MRV system.⁵⁶

10.2.3 Considerations for a robust monitoring plan

To ensure that the monitoring plan is robust, consider including the following elements in the plan:

- **Roles and responsibilities.** Identify the entity or person that is responsible for monitoring key performance indicators and parameters, and clarify the roles and responsibilities of the personnel conducting the monitoring.
- **Competencies.** Include information about any required competencies and any training needed to ensure that personnel have necessary skills.
- **Methods.** Explain the methods for generating, storing, collating and reporting data on monitored parameters.
- **Frequency.** Key performance indicators and parameters can be monitored at various frequencies, such as monthly, quarterly or annually. Determine the appropriate frequency of monitoring based on the needs

⁵⁶ Available at: http://unfccc.int/files/national_reports/non-annex_1_natcom/training_material/methodological_documents/application/pdf/unfccc_mda-toolkit_131108_ly.pdf.

of decision makers and stakeholders, cost and data availability. In general, the more frequently data are collected, the more robust the assessment will be. Frequency of monitoring can be consistent with measurement conducted under the national MRV system.

- **Collecting and managing data.** Identify the databases, tools or software systems that are used for collecting and managing data and information.
- **Quality assurance and quality control (QA/QC).** Define the methods for QA/QC to ensure that the quality of data leads to confidence in the assessment results. QA is a planned review process conducted by personnel who are not directly involved in data collection and processing. QC is a procedure or routine set of steps performed by the personnel compiling the data to ensure the quality of the data.
- **Record keeping and internal documentation.** Define procedures for clearly documenting the procedures and approaches for data collection, as well as the data and information collected. This information is beneficial for improving the availability of information for subsequent monitoring events, documenting improvements over time and creating a robust historical record for archiving.
- **Continual improvement.** Include a process for improving the methods for collecting data, taking measurements, running surveys, monitoring impacts, and modelling or analysing data. Continual improvement of monitoring can help reduce uncertainty in GHG estimates over time.
- **Financial resources.** Identify the cost of monitoring and sources of funds.

10.3 Monitor indicators and parameters over time

It is a *key recommendation* to monitor each of the indicators and parameters over time, in accordance with the monitoring plan. The frequency of monitoring is dependent on stakeholder resources, data availability, feasibility, and the uncertainty requirement of reporting (e.g. under the enhanced transparency framework, biennial transparency reports must be submitted every two years, as of 2024) or estimation needs. The monitoring plan should include an iterative process for balancing these dependencies. Where monitoring indicates that the assumptions used in the ex-ante assessment are no longer valid, users should document the difference and account for the monitored results when updating ex-ante estimates or when estimating ex-post GHG impacts.

11 Reporting

Reporting the results, methodology and assumptions used is important to ensure that the impact assessment is transparent, and gives decision makers and stakeholders the information they need to properly interpret the results. This chapter provides a list of information that is recommended for inclusion in an assessment report.

Checklist of key recommendations

- Report information about the assessment process and the GHG impacts resulting from the policy (including the information listed in [Section 11.1](#))

11.1 Recommended information to report

It is a *key recommendation* to report information about the assessment process and the GHG impacts resulting from the policy (including the information listed below⁵⁷). Where two or more assessment guides are applied to the policy, the general information and policy description only need to be reported once. For guidance on providing information to stakeholders, refer to the ICAT *Stakeholder Participation Guide* ([Chapter 7](#)).

General information

- The name of the policy assessed
- The person(s) or organization(s) that did the assessment
- The date of the assessment
- Whether the assessment is an update of a previous assessment and, if so, links to any previous assessments

⁵⁷ The list does not cover all chapters in this document because some chapters provide information or guidance that is not relevant to reporting.

Chapter 2: Objectives of assessing the GHG impacts of renewable energy policies

- The objective(s) and intended audience(s) of the assessment

Chapter 4: Using the methodology

- Opportunities for stakeholders to participate in the assessment

Chapter 5: Describing the policy

- A description of the policy, including the recommended information in [Table 5.1](#). Whether the assessment applies to an individual policy or a package of related policies; if a package is assessed, which policies are included in the package
- Whether the assessment is ex-ante, ex-post, or a combination of ex-ante and ex-post

Chapter 6: Identifying impacts: how renewable energy policies reduce GHG emissions

- If identifying GHG impacts ([Section 6.1](#)), a list of all GHG sources for the policy identified, using a causal chain, showing which impacts are included in the GHG assessment boundary
- A list of potential GHG impacts that are excluded from the GHG assessment boundary, with justification for their exclusion
- The assessment period

Chapter 7: Estimating renewable energy addition of the policy ex-ante

- An estimate of the technical potential for the assessment period that the policy is expected to achieve
- A refined estimate after accounting for policy design characteristics
- A refined estimate after accounting for factors that affect the financial feasibility of RE technologies
- A refined estimate after accounting for barriers ([Section 7.5](#) provides a sample template for the barrier analysis)

- The estimated RE addition of the policy upon completion of the steps in [Sections 7.1–7.5](#)
- The method or approach used to assess uncertainty
- An estimate or description of the uncertainty and/or sensitivity of the results, to help users of the information properly interpret the results

Chapter 8: Estimating GHG impacts of the policy ex-ante

- The method chosen (approach 1 or approach 2) for estimating GHG impacts based on the objectives of the assessment, and the policy's expected impact and time frame
- Where using approach 1
 - » An estimate of the emissions trajectory using an energy model or the method for limited data availability
 - » The calculated GHG emissions reductions (if relevant)
- Where using approach 2
 - » An estimate of the grid emission factor using the combined margin approach or emission factor modelling
 - » The calculated GHG emissions reductions
- Any methodologies and assumptions used to estimate GHG emissions reductions, including any models used
- All sources of data used to estimate GHG emissions reductions, including activity data, emission factors and assumptions
- The method or approach used to assess uncertainty
- An estimate or description of the uncertainty and/or sensitivity of the results, to help users of the information properly interpret the results

Chapter 9: Estimating GHG impacts of the policy ex-post

- An estimate of the achieved RE addition using monitored values for the indicators and parameters described in the monitoring plan

- Total annual and cumulative policy scenario emissions and removals over the GHG assessment period
- The methodology and assumptions used to estimate policy scenario emissions, including the emissions estimation methods (including any models) used
- The ex-post GHG impact estimate calculated using the emissions trajectory method or the grid emission factor method
- The method or approach used to assess uncertainty
- An estimate or description of the uncertainty and/or sensitivity of the results, to help users of the information properly interpret the results

Chapter 10: Monitoring performance over time

- A list of the key performance indicators used to track performance over time and the rationale for their selection
- Sources of key performance indicator data and monitoring frequency

Additional information (if relevant)

- How the policy is modifying longer-term trends in GHG emissions
- The economic, social and environmental (sustainable development), and transformational impacts of the policy.
- The type of technical review undertaken (first, second or third party), the qualifications of the reviewers and the review conclusions. More guidance on reporting information related to technical review is provided in Chapter 9 of the *Technical Review Guide*.