9 Estimating transformational impacts ex-post

This chapter explains the steps for conducting an ex-post assessment of a policy to understand the extent of transformation achieved. The steps are almost the same as for an ex-ante assessment. The ex-post assessment includes collecting data for indicators that are most relevant to assessment of impacts achieved.

Checklist of key recommendations

- Collect data for selected indicators
- Assess characteristics using indicators to assess the extent of transformation achieved by the policy Aggregate the results for all characteristics to the process and outcome levels, and describe the overall assessment

9.1 Collect data

Ex-post assessment is a backward-looking qualitative and/or quantitative assessment of indicators. This is important to measure the extent to which a policy – including unintentional changes[20] – contributes to transformational change to low-carbon and sustainable development. The assessment provides users with observed information about the implementation process to understand whether and how policies have been transformational relative to the starting situation (as described in Chapter 7).

The transformation achieved is the change between the current situation and the starting situation (described in Chapter 7). Selected indicators are used to assess specific changes in characteristics impacted by the policy. It is a *key recommendation* to collect data for selected indicators. Tables 9.2 and 9.3 provide templates for collecting data. Refer to Section 7.1 for information on selection of indicators and to Appendix A for examples of indicators.

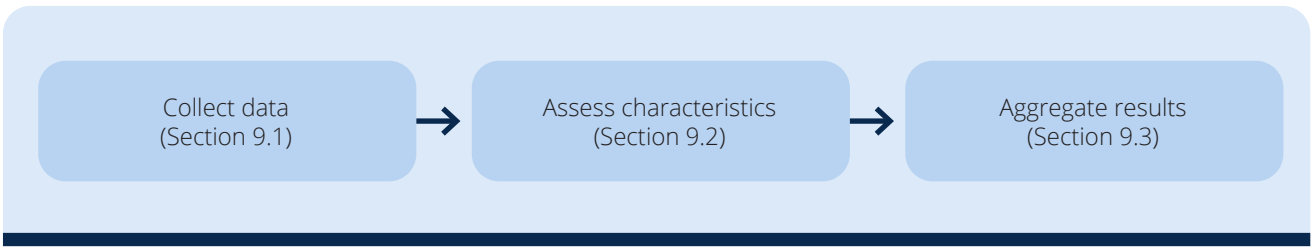
The nature of an indicator determines the method of assessment and whether the value of the indicator is better assessed quantitatively or qualitatively. Qualitative indicators enable descriptive and narrative data for characteristics, whereas quantitative indicators are estimated or measured to demonstrate the transformational extent of a policy on the characteristics.

A specific method of assessment is determined for each indicator, as appropriate. Methods of assessment can be classified as either bottom-up or top-down methods. Top-down methods are often appropriate for a large number of affected actors, whereas bottom-up methods are more appropriate for a smaller number of affected actors or entities, where data are available and feasible to collect.

[20] Transformational change is highly uncertain and may not unfold as planned, although managed transition is the focus of this assessment. To include unintentional changes in the assessment, a broad approach is taken to monitor all characteristics of a system that could be relevant to the policy (see Chapter 7). Users can choose to monitor indicators for characteristics that are judged to be "not relevant", to take a comprehensive approach.

FIGURE **9.1**

Overview of steps in the chapter



Examples of bottom-up methods are direct data collection from affected stakeholders, facilities or entities through monitoring of indicators (such as energy consumption and costs per kilowatt hour), sampling or use of default values from similar policies, to estimate effects (such as the average reduction in grid-connected electricity use per building that installs solar PV). Examples of top-down methods are use of existing data at sector or subsector level, and energy or transport modelling using statistically collected data, to assess changes in indicator values.

For further guidance on data-collection methods and monitoring of performance over time based on indicators, refer to Chapter 10 and Appendix A, which provide examples of indicators of transformational change characteristics.

9.2 Assess characteristics

The next step is to assess the policy's impact on process and outcome characteristics by comparing indicator values for the starting situation with value for the ex-post situation.

It is a *key recommendation* to assess characteristics using indicators to assess the extent of transformation achieved by the policy (using the scale in Table 9.1, and templates in Tables 9.2 and 9.3). The ex-post indicator value is based on observed data and shows the extent to which the policy has influenced the characteristic relative to the starting situation. Users are encouraged to identify multiple indicators for each characteristic in their assessments. Only one indicator per characteristic has been chosen here, for illustration purposes.

A qualitative scale is used for scoring transformational characteristics based on the indicator values. Table 9.1 provides scales for scoring process and outcome characteristics. Assessing outcome characteristics helps users understand the degree of transformational change achieved. Ex-post assessment of process characteristics gives insights into the drivers that helped achieve the outcome and can be used to improve policy design or inform new policies. It shows whether barriers were overcome, and to what extent and how, which can also help in future policymaking.

Engaging stakeholders in scoring characteristics and determining relative importance can bring new insights and lend credibility to the process. Refer to the ICAT *Stakeholder Participation Guide* (Chapter 8) for information on designing and conducting consultations.

TABLE **9.1**

Scale for scoring characteristics

Score[a]	Description
Process characteristics	
4	It is very likely (e.g. a probability of 90–100%) that the policy had a significant positive impact on this characteristic over the assessment period.
3	It is likely (e.g. a probability of 66–90%) that the policy had a significant positive impact on this characteristic over the assessment period.
2	It is possible (e.g. a probability of 33–66%) that the policy had a significant positive impact on this characteristic over the assessment period. Instances where the likelihood is unknown or cannot be determined should be considered possible.
1	It is unlikely (e.g. a probability of 10–33%) that the policy had a significant positive impact on this characteristic over the assessment period.
0	It is very unlikely (e.g. a probability of 0–10%) that the policy had a significant positive impact on this characteristic over the assessment period.

TABLE **9.1,** continued

Scale for scoring characteristics

Score[a]	Description
Outcome characteristics – scale (for GHG and sustainable development impacts)	
3	The policy resulted in GHG impacts that represent large emissions reductions, relative to the starting situation, at the level of assessment targeted. The policy resulted in significant positive sustainable development impacts, relative to the starting situation, at the level of assessment targeted.
2	The policy resulted in GHG impacts that represent moderate emissions reductions, relative to the starting situation, at the level of assessment targeted. The policy resulted in moderate positive sustainable development impacts, relative to the starting situation, at the level of assessment targeted.
1	The policy resulted in GHG impacts that represent minor emissions reductions, relative to the starting situation, at the level of assessment targeted. The policy resulted in minor positive sustainable development impacts, relative to the starting situation, at the level of assessment targeted.
0	The policy did not result in GHG impacts, relative to the starting situation, at the level of assessment targeted. The policy did not result in sustainable development impacts, relative to the starting situation, at the level of assessment targeted.
–1	The policy resulted in GHG impacts that represent a net increase in emissions, relative to the starting situation, at the level of assessment targeted. The policy resulted in negative sustainable development impacts, relative to the starting situation, at the level of assessment targeted.
Outcome characteristics – time for which outcome is sustained (for GHG and sustainable development impacts)	
3	The policy resulted in GHG impacts that are very likely (e.g. a probability of 90–100%) to be sustained over the assessment period. The policy resulted in sustainable development impacts that are very likely (e.g. a probability of 90–100%) to be sustained over the assessment period.
2	The policy resulted in GHG impacts that are likely (e.g. a probability of 66–90%) to be sustained over the assessment period. The policy resulted in sustainable development impacts that are likely (e.g. a probability of 66–90%) to be sustained over the assessment period.
1	The policy resulted in GHG impacts that will possibly (e.g. a probability of 33–66%) be sustained over the assessment period. Instances where the likelihood is unknown or cannot be determined should be considered possible. The policy resulted in sustainable development impacts that will possibly (e.g. a probability of 33–66%) be sustained over the assessment period. Instances where the likelihood is unknown or cannot be determined should be considered possible.
0	The policy resulted in GHG impacts that are less likely (e.g. a probability of 10–33%) to be sustained over the assessment period. The policy resulted in sustainable development impacts that are less likely (e.g. a probability of 10–33%) to be sustained over the assessment period.
–1	The policy resulted in GHG impacts that are unlikely (e.g. a probability of 0–10%) to be sustained over the assessment period and risk being reversed to negative impacts. The policy resulted in sustainable development impacts that are unlikely (e.g. a probability of 0–10%) to be sustained over the assessment period and risk being reversed to negative impacts.

[a] The scale uses numbers as a simple reference to qualitative scores explained in this table. When aggregating across characteristics, the number scores should not be used in a numerical way (e.g. they should not be averaged to obtain category-level scores).

TABLE **9.2**

Template for ex-post assessment for process characteristics (using hypothetical solar PV policy example)

Category	Characteristics	Score	Rationale for score	Indicator	Indicator value at starting situation (2015)[a]	Indicator value for expected transformation (2030)[a]
Technology	Research and development (R&D)	1	The policy did not channel resources into R&D. The investment in R&D increased slightly over the assessment period. It is largely directed at developing commercial energy storage solutions and enhancing grid flexibility.	Amount of related public and private R&D investment in the country	$100,000	$5 million
	Adoption	2	The financial subsidy and feed-in tariff have helped increase the adoption of clean technology and kick-started the local rooftop solar PV industry.	Number of demonstration projects for rooftop solar PV initiated (annual)	2	7
				% of annual electricity consumption supplied by rooftop solar PV	Less than 1%	Less than 5%
	Scale-up	2	The financial subsidy and feed-in tariff have facilitated the uptake of solar in the country over the assessment period, while enhancing the availability of skilled workforce for installation and maintenance. They have helped kick-start the local service industry. But the level of scale-up necessary to achieve systemic transition across the sector has not occurred because of the focus on rooftop solar PV alone. Advances in grid integration and energy storage that would help deploy solar at a larger scale across all forms of technologies and RE more broadly have not occurred.	Share of installed rooftop solar PV in the solar sector (nationwide or statewide)	5%	20%
				Share of solar power (utility scale, rooftop, off-grid) in the electricity sector	8%	33%
				Share of RE in the country as a percentage of electricity consumption	5%	20%

TABLE **9.2,** continued

Template for ex-post assessment for process characteristics (using hypothetical solar PV policy example)

Category	Charac-teristics	Score	Rationale for score	Indicator	Indicator value at starting situation (2015)[a]	Indicator value for expected transfor-mation (2030)[a]
Agents of change	Entrepre-neurs	2	The policy has triggered investments and entrepreneurship in solar-related businesses compared with the starting situation, when high upfront financial investment was a significant barrier. However, the broader solar sector has remain untapped in terms of receiving a similar influx of new investments and market interest.	Volume of venture capital investments	$100 million	$500 million
	Coalitions of advocates	1	The solar PV policy has not supported the creation of coalitions and networks.	Number of projects/ research centres involving university–industry collaboration	1	6
	Beneficiaries	-	Not relevant	-	-	-
Incentives	Economic and non-economic	3	The solar PV policy used subsidies and preferential tariffs to increase technology penetration. These incentives have promoted consumer demand, which in turn has promoted the local service industry. However, broader changes across the sector without policies for different kinds of solar technologies (e.g. utility scale, off-grid) are lacking.	Number of new economic incentives in place for grid rooftop solar	1	4
				Number of new incentives for solar (all kinds of technologies)	1	10
				Number of new incentives to promote different forms of RE	2	15

TABLE **9.2,** continued

Template for ex-post assessment for process characteristics (using hypothetical solar PV policy example)

Category	Charac-teristics	Score	Rationale for score	Indicator	Indicator value at starting situation (2015)[a]	Indicator value for expected transfor-mation (2030)[a]
Incentives, continued	Disincentives	0	The solar PV policy did not use disincentives to achieve its goals. There is a growing recognition of a need for a comprehensive strategy, but no steps have been taken in this direction yet.	Number of new disincentives to discourage use of fossil fuels to generate electricity	1	1
				Size of fossil fuel subsidy	$10 million	$15 million
	Institutional and regulatory	2	The solar PV policy has led to the development of new agencies and regulations to promote solar in a few front-runner states. This experience, and creation of institutions and regulatory mechanisms can potentially be leveraged in future for broader sector-level changes.	Number of new regulations and institutions set up to promote solar	3	6
				Number of new regulations and institutions set up to promote RE	3	6
Norms	Awareness	-	Not relevant	-	-	-
	Behaviour	2	The solar PV policy has somewhat influenced consumer behaviour and shifted preferences away from carbon-intensive electricity, as a result of targeted financial incentives. However, in the absence of a strategy to discourage fossil fuel use and a broader solar/RE policy, a widespread change in behaviour has not occurred.	Number of new measures to influence consumer behaviour in favor of solar/RE	None	1
	Social norms	0	Although one or two states have emerged as leaders in the solar industry, a sustained change in societal norms favouring solar or RE in general has not been observed yet.	Number of emerging leaders/ role models favouring renewables (e.g. states leading the transition to RE)	0	1 or 2

Abbreviations: -, not applicable; RE, renewable energy

Note: The table builds on the information generated in the previous step, which is shown in the grey columns.

[a] It is assumed that the ex-post assessment is done after 2030. Indicator values are purely illustrative and only meant to show change over time.

TABLE **9.3**

Template for ex-post assessment for outcome characteristics (using hypothetical solar PV policy example)

Category	Charac-teristics	Score	Rationale for score	Indicator	Indicator value at starting situation (2015)[a]	Indicator value for expected transfor-mation (2030)[a]
Scale of outcome – GHGs	Macro level	-	Outside the assessment boundary	Users can choose to monitor characteristics outside the assessment boundary.	Indicator value if monitoring outside the assessment boundary	Indicator value if monitoring outside the assessment boundary
	Medium level	1	The policy achieved its 2022 rooftop solar target, but in 2030. The emissions reductions impacts are significant but are not sufficiently large to facilitate transformational change. Given the size of the electricity sector and the demand, far greater renewable energy, including solar, capacity can be deployed to replace fossil fuel–based power.	Installed capacity of grid-connected rooftop solar power plants (up to 500 kW) at national level	1 GW	20 GW
				GHG emissions avoided (annually) as a result of solar PV deployment (calculated assuming solar PV generation replaced a baseline scenario of fossil fuel mix generation)	50,000 tCO_2e	7 million tCO_2e
	Micro level	1	Although one state led in rooftop solar scale-up, achieving high levels of penetration, others showed moderate growth over the assessment period.	% of rooftop solar PV in the electricity mix at a subnational level	5% for state 1 10% for state 2	40% for state 1 20% for state 2
Scale of outcome – sustain-able develop-ment	Macro level	-	Outside the assessment boundary	Users can choose to monitor characteristics outside the assessment boundary	Indicator value if monitoring outside the assessment boundary	Indicator value if monitoring outside the assessment boundary
	Medium level	1	Growth in solar was accompanied by a minor boost in employment in this sector, but the growth was much smaller than anticipated.	Net employment generation in solar sector at national level (calculated assuming the employment created by alternative technology – fossil fuels – of same capacity)	10,000	190,000

TABLE **9.3,** continued

Template for ex-post assessment for outcome characteristics (using hypothetical solar PV policy example)

Category	Characte-ristics	Score	Rationale for score	Indicator	Indicator value at starting situation (2015)[a]	Indicator value for expected transfor-mation (2030)[a]
Scale of outcome – sustain-able develop-ment, continued	Micro level	2	A large part of the employment growth was concentrated in two states. Other regions were not able to reap the benefits as much.	New employment generation in solar sector in province X (calculated assuming the employment created by alternative technology – fossil fuels – of same capacity)	600 in state 1 1,000 in state 2	30,000 in state 1 15,000 in state 2
Time frame over which outcome is sustained – GHGs	Long term	-	Beyond the assessment period (2015–2030)	Users can choose to monitor characteristics beyond the assessment period	Indicator value if monitoring beyond the assessment period	Indicator value if monitoring beyond the assessment period
	Medium term	2	The policy made sustained gains over the assessment period, and no reversal of impacts is expected at the time of assessment. Financial incentives and feed-in tariff are expected to be phased out, but the penetration achieved is expected to continue.	Trend in installed capacity of grid-connected rooftop solar power plants (up to 500 kW)	-	Sustained growth during the assessment period
	Short term	2	In the short term, the policy did not result in sustained gains. There was a significant risk of policy reversal due to political changes in the first 5 years of policy implementation.	Trend in installed capacity of grid-connected rooftop solar power plants (up to 500 kW)	-	Sustained growth through 2022

TABLE **9.3,** continued

Template for ex-post assessment for outcome characteristics (using hypothetical solar PV policy example)

Category	Characte-ristics	Score	Rationale for score	Indicator	Indicator value at starting situation (2015)[a]	Indicator value for expected transfor-mation (2030)[a]
Time frame over which outcome is sustained – sustainable develop-ment	Long term	-	Beyond the assessment period (2015–2030)	Users can choose to monitor characteristics beyond the assessment period	Indicator value if monitoring beyond the assessment period	Indicator value if monitoring beyond the assessment period
	Medium term	2	Employment generation was sustained and showed an increasing trend through the assessment period, with a steady increase in rooftop solar projects.	Trend in employment generation in solar sector	-	Sustained growth during the assessment period
	Short term	1	Employment generation in the beginning was not steady, as the risk of policy reversals affected investor confidence, and held back the growth in rooftop solar projects and consequently jobs.	Trend in employment generation in solar sector	-	Flat trend through 2022

Abbreviations: -, not applicable

Note: The table builds on the information generated in the previous step, which is shown in the grey columns.

[a] Indicator values are purely illustrative and only meant to show change over time.

9.3 Aggregate results

Once the characteristics have been assessed, the next step is to aggregate the analysis to understand the impact of the policy at the category level, then the process and outcome level, and finally use it to understand the extent of transformation achieved by the policy.

It is a *key recommendation* to aggregate the results for all characteristics to the process and outcome levels, and describe the overall assessment.

9.3.1 Aggregating to the category level

The assessment of process and outcome categories is based on the assessment of individual characteristics, which, in turn, is based on indicators (as described in Section 9.2). Process and outcome categories are scored taking into consideration the policy's impact on characteristics within each category, and using the same scale as in Table 9.1. When assigning a score to each category, it is important to consider the relative importance of categories of characteristics. Tables 9.4 and 9.5 provide templates to describe category-level qualitative scores. These do not assess or score how well the policy was implemented; rather, they

show the impact of implementation of the policy in achieving transformational change in a given context.

Table 9.4 asks users to note the relative importance of each process category expressed as a percentage, with the sum of all process categories adding to 100%. For instance, the technology (30%), agents of change (30%) and incentives (30%) categories are relatively more important than the norms category (10%) in the example shown in Tables 9.4 and 9.5. For outcomes, each category – scale of outcome and sustaining of outcome over time – is considered equally important for transformational change. Users should arrive at a score at the category level in Table 9.5 based on the individual scores for outcome characteristics in Table 9.3, and provide adequate justification.

Ex-post assessment focuses on observed indicator values. Barriers are inherent in these values, as they would have affected the performance of the policy, which is captured by the indicator in the assessment. Therefore, barriers are not assessed separately in ex-post assessment. Users can nevertheless choose to analyse barriers following the methodology in Section 8.2 – for example, to understand the underlying reasons for a policy's lack of significant impact on a characteristic or category. Users can also consult Chapter 12, which discusses how to use the assessment results for learning and policy improvement.

TABLE **9.4**

Template for describing results of the ex-post analysis at process category level (using hypothetical solar PV policy example)

Category	Score	Rationale for scoring	Relative importance of category and rationale
Technology	2	The policy possibly positively influenced the penetration of solar in the country. But, with its limited focus on rooftop solar, the policy does not facilitate adoption and scale-up of other forms of solar technologies, which are necessary to bring about a large-scale, systemic change in the sector. Further, issues relating to grid integration and energy storage are not addressed, thus preventing large-scale deployment of solar (and other RE technologies) in the country.	30% Given the starting situation, technology, incentives and agents are considered equally important to achieve transformational change in the solar sector.
Agents of change	1	Although the policy had a positive impact on businesses, and influenced entrepreneurs and investors, it did not leverage market forces and engage stakeholders to support the development of a strong constituency for large-scale solar deployment in the country.	30% Given the starting situation, technology, incentives and agents of change are considered equally important to achieve transformational change in the solar sector.
Incentives	2	The policy used financial incentives at its core, which led to the development of enabling institutions and regulations in a few front-runner states. However, it failed to spur new actions involving disincentives to discourage the use of fossil fuels or facilitate utility-scale solar, thus limiting its ability to cause transformational change.	30% Given the starting situation, technology, incentives and agents of change are considered equally important to achieve transformational change in the solar sector.
Norms	0	The policy did not bring about significant shifts in this category. Societal norms and behaviour continue to favour carbon-intensive forms of energy.	10% Changing norms in society is considered less important in the pre-development phase, until the technology has proved its benefits, given the costs, and is ready for take-off.

9.3.2 Aggregating to the impact level

The final ex-post assessment result is arrived at by aggregating the qualitative scores for process and outcome categories, while considering the relative importance of each category. The overall assessment indicates the extent and sustained nature of transformation achieved (outcome), and how this transformational outcome is realized (process), contributing to both the scale and entrenchment of the change achieved. Table 9.6 provides the scale for scoring outcome and process impacts.

Figure 9.2 illustrates the matrix of possible qualitative scores for process and outcome impacts. If the final result for the policy falls in the green area, the policy is transformational. If it is in the red area, the policy is not (yet) transformational. The colour gradient of the matrix reflects the qualitative nature of the analysis and the high uncertainty associated with the assessment.

Figure 9.2 illustrates the final result for the hypothetical solar PV policy. Based on Tables 9.4 and 9.5, the ex-post assessment for this hypothetical

TABLE **9.5**

Template for describing results of the ex-post analysis at outcome category level (using hypothetical solar PV policy example)

Category	Score	Rationale for scoring
Scale of outcome – GHGs	1	The policy achieved a minor change in GHG emissions reductions and sustainable development impacts, relative to the starting situation.
Scale of outcome – sustainable development	1	A large net increase in jobs was seen in some regions, but this was not distributed evenly across the country.
Time frame over which outcome is sustained – GHGs	2	The policy's GHG impacts were sustained over the assessment period. There is only a small risk that the gains made may be reversed by removal of the feed-in tariff and subsidies.
Time frame over which outcome is sustained – sustainable development	1	Sustained growth in employment was not seen across the country and was limited to a few pockets.

TABLE **9.6**

Scale for scoring outcome and process categories

Outcome – extent and sustained nature of transformation achieved	Score	Process – transformational outcome	Score
Major	3	Very likely	4
Moderate	2	Likely	3
Minor	1	Possible	2
None	0	Unlikely	1
Negative	–1	Very unlikely	0

policy concludes that the process has possibly supported transformation, but the extent of transformation achieved is minor. The policy has given a boost to rooftop solar PV in the country, particularly within the rooftop solar subsector, has been well implemented, and produced sustained results. The policy has built foundational institutional and regulatory structures to support renewables more broadly, contributed to energy access, engaged entrepreneurs and markets, developed relevant skills, generated jobs and made solar power more visible. However, it falls short of driving systemic transition across the solar or renewable energy sectors. Complementary policies that facilitate solar energy deployment at a utility scale, and technological advances in grid integration and energy storage to absorb increased amounts of intermittent renewable power are urgently needed to scale up the share of solar in the country – along with the focus on rooftop solar PV. The policy falls short of facilitating transformational change as a result of its limited focus on rooftop solar, which alone is not able to cause systemic shifts.

FIGURE **9.2**

Transformational impact matrix (using solar PV policy example)