Sustainable Development Methodology

PART VI: DECISION-MAKING AND USING RESULTS

ICAT INITIATIVE FOR Climate Action Transparency

Overview of ICAT

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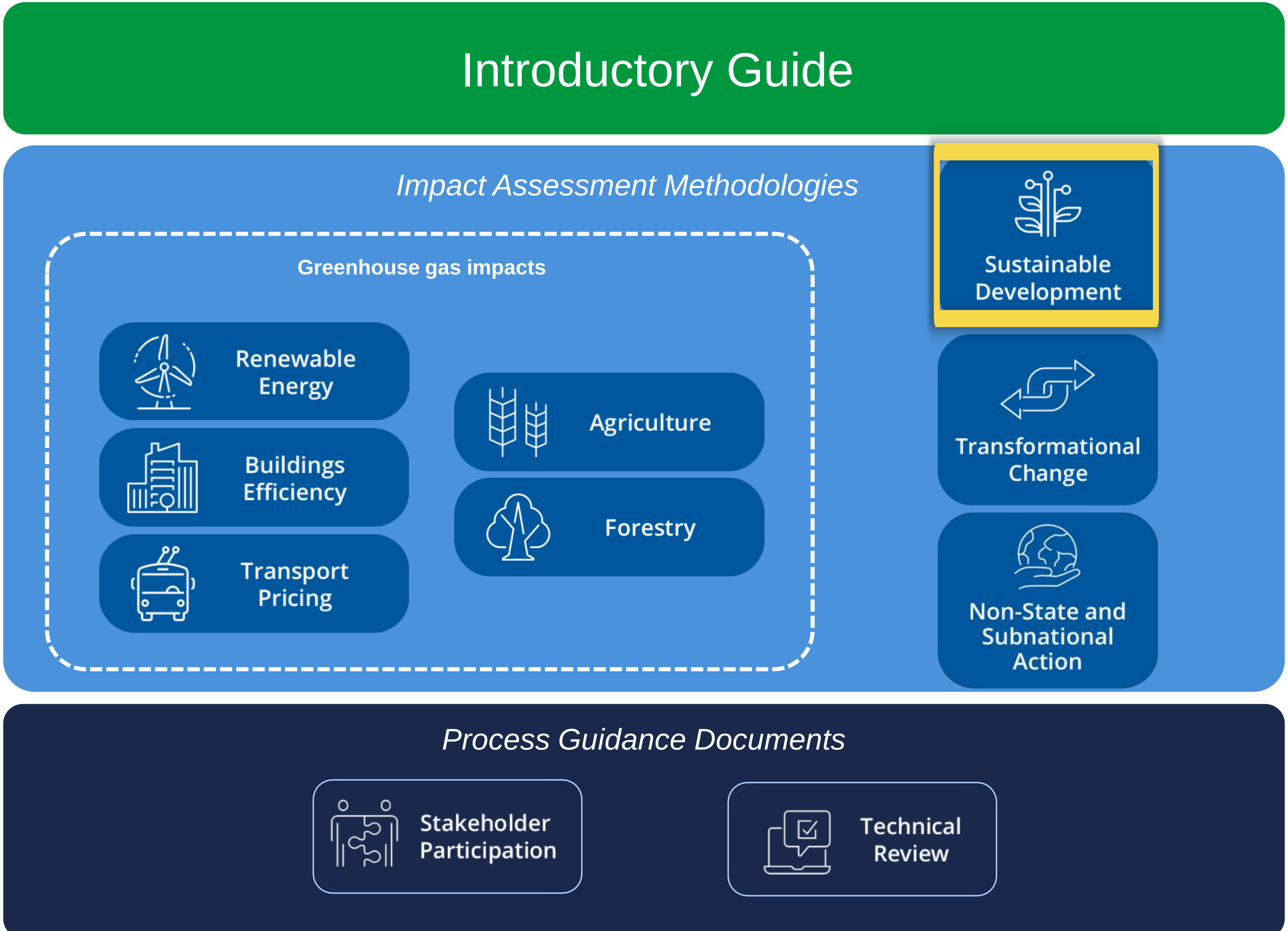

Overview of the SD methodology

Part I: Introduction, objectives and key concepts

Understand the purpose and applicability of the methodology (Chapter 1)
Determine the objectives of the assessment (Chapter 2)
Understand key concepts and steps, and plan the assessment (Chapter 3)

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Part II: Defining the assessment

Clearly define the policy to be assessed (Chapter 4)
Choose which impact categories and indicators to assess (Chapter 5)

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Part III: Qualitative approach to impact assessment

Identify specific impacts of the policy within chosen impact categories (Chapter 6)
Qualitatively assess each specific impact (Chapter 7)

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Part IV: Quantitative approach to impact assessment

Estimate baseline values for impacts included in the quantitative assessment boundary (Chapter 8)
Estimate policy scenario values for the same impacts (ex-ante) (Chapter 9)
Estimate policy scenario values for the same impacts (ex-post) (Chapter 10)
Assess uncertainty (Chapter 11)

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Part V: Monitoring and reporting

Monitor the performance of indicators over time (Chapter 12)
Report the results and methodology used (Chapter 13)

↓

Part VI: Decision-making and using results

Evaluate synergies and trade-offs, and decice which policies to implement (Chapter 14)

Part VI: Overview

Part VI: Decision-making and using results

Evaluate synergies and trade-offs, and decide which policies to implement (Chapter 14)

This button indicates a key recommendation

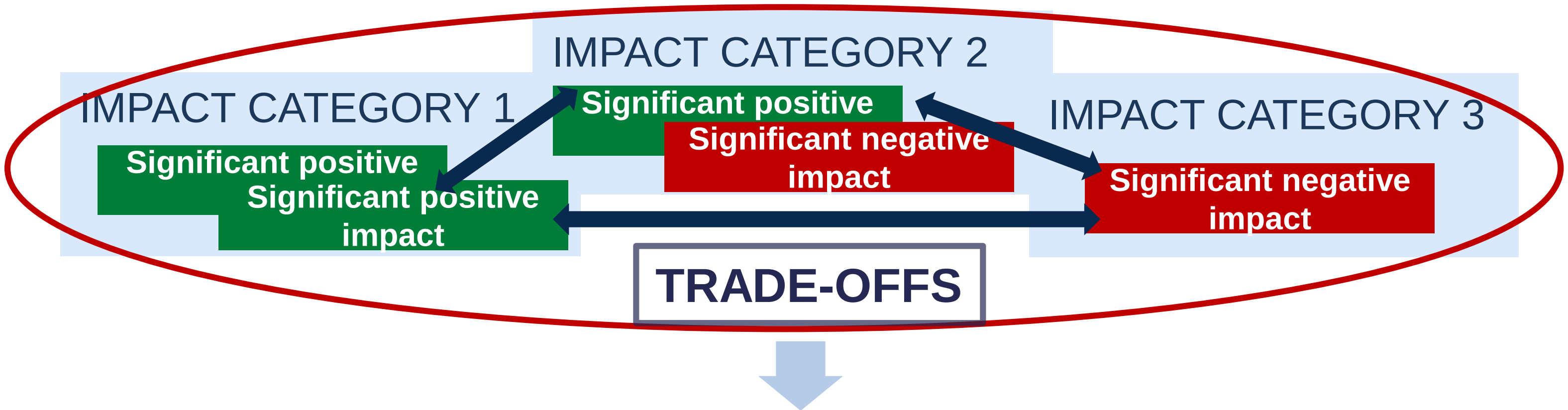
This is an interactive panel: navigate by clicking on a particular step

Chapter 14. Evaluate synergies and trade-offs, and decide which policies to implement

Overview of approaches for understanding and evaluating the results and possible trade-offs across multiple impact categories included in the assessment, and making decisions based on the results.

Introduction to approaches → Apply CEA, CBA and/or MCA → Assess uncertainty and sensitivity → Use results to make decisions

14.1 Introduction to approaches



Evaluation of results across all impact categories based on

POSSIBLE **METHODS**

COST-EFFECTIVENESS ANALYSIS (CEA)	• Relevant to quantitative impact assessments • Suitable for policies with one primary objective
COST-BENEFIT ANALYSIS (CBA)	• Relevant to quantitative impact assessments • Suitable for assessing multiple impact categories • Enables monetizing impacts
MULTI-CRITERIA ANALYSIS (MCA)	• Either qualitative or quantitative impact assessment • Suitable for assessing multiple impact categories

14.2 Cost-effectiveness analysis (CEA)

Objective: Comparing different policy options based on their cost in achieving a single desired objective.

Output: Ratio of costs to effectiveness for a given policy option

STEP 1

Estimate the **cost** of each policy option

PV_c = present value of costs, C_t = costs in a particular year, r = discount rate, t = number of years from present, n = number of years

$$PVc = \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$$

STEP 2

Estimate the **effectiveness** of each policy for relevant impact categories

Effectiveness determined from quantitative assessment results (change in indicator value attributed to the policy)

STEP 3

Calculate the **cost-effectiveness** of each policy for relevant impact categories

Balance trade-offs based on which impact categories are most important and choose which policy option to implement

$$Cost\ effectiveness = \frac{PV_c}{impact}$$

14.3 Cost-benefit analysis (CBA)

Objective: Quantifying the various benefits and costs of a policy and using valuation methods to express non-monetary impacts in monetary terms

Output: Calculated value representing the present value of net benefits of the policy to society.

STEP 1 Quantify all relevant social, environmental and economical **costs** and **benefits** of the policy

STEP 2 Express non-monetary costs and benefits in **monetary terms** using valuation methods

STEP 3 Calculate the present value of all costs and benefits, and calculate the net present value for each policy option

Benefits → positive impacts of avoided negative impacts
Costs → negative impacts
X = Benefits or Costs

NP_v = Net Present Value

$$PV_X = \sum_{t=0}^{n} \frac{X_t}{(1+r)t}$$

$$NPV = PV_B - PV_C$$

Chapter 14

Example

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14.3 Multi-criteria analysis

Objective: Allowing stakeholders to determine the overall preference among alternative options, where the options accomplish multiple goals.

Output:

STEP 1

Identify decision-context, policy options, assessment objectives and criteria

Review assessment steps of Chapters 2, 4 and 5 to determine whether they are appropriate for the MCA.

STEP 2

Score each policy option's **performance** for each criterion

Criteria assessed either qualitatively or quantitatively

Performance assessed against baseline scenario and normalised into scores (performance matrix)

Ranking policy's options based on performance scores

STEP 3

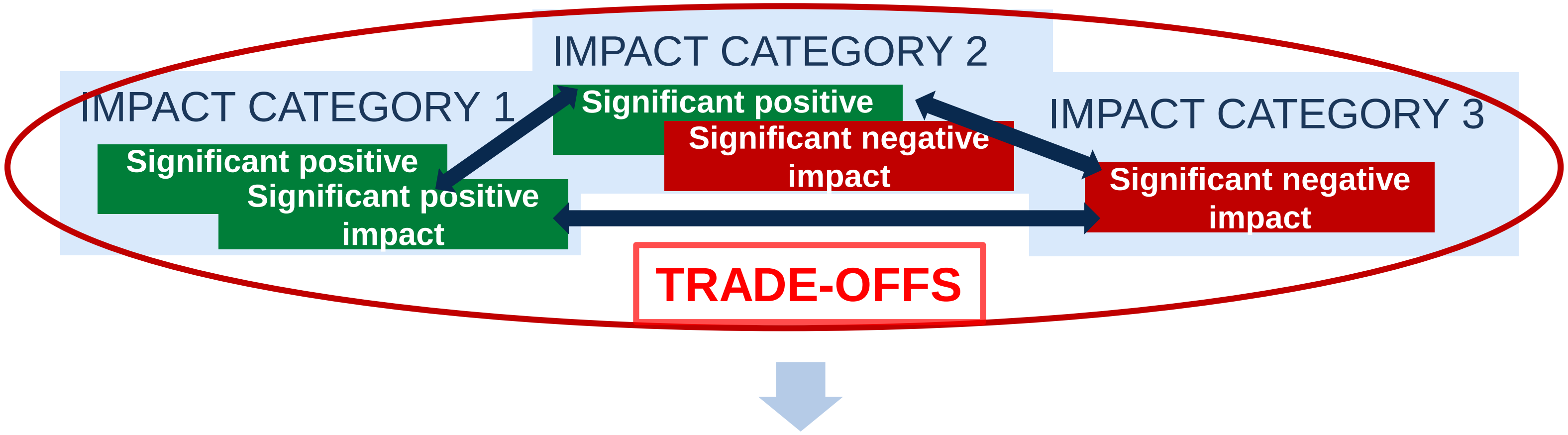
Assign a **weight** for each criterion and calculate an **overall score** and/or benefit score ratio for each option

Weighting reflects value assumptions and policy priorities

Calculating an overall score for each policy's option:

$$S_i = \frac{1}{100} * \sum_{j=1}^{n} w_j s_{ij}$$

14.5 Assess uncertainty and sensitivity



Sensitivity and uncertainty analysis useful for evaluating trade-offs

Type of analysis	Key parameters for sensitivity analysis
Cost-effectiveness analysis	Discount rate
Cost–benefit analysis	Discount rate; monetary value of non-monetary costs and benefits
Multi-criteria analysis	Criteria weights; performance scores for qualitatively assessed criteria

14.6 Using results to make decisions

CEA, CBA, CMA and further inputs and perspectives on the best course of action

CHOOSING A POLICY OPTION

- Policies without positive impacts should be eliminated

- In case minimisation of negative impacts is sought, trade-offs evaluated based on:

  Minimum requirements,
  Irreversibility
  Precaution

IMPROVING POLICY DESIGN

- How different policy implementation specifications can mitigate any negative impacts
- Establishing safeguards to minimize the likelihood of negative impacts
- Developing measures to offset any negative impacts

Case Studies using this Methodology

- Sustainable Development Impact of the Cities Footprint Project on the Sustainable Development Goals in Five Cities of Bolivia

- An Assessment of the Sustainable Development Impact of Biodiversity Policy in South Africa through the ICAT SD Guidance

Thank You

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Insights from Bolivia

- As a result of this assessment, the cities should follow these steps towards SDG implementation, reporting and monitoring:
  - Initiate an inclusive and participatory process: Raising awareness of the SDGs and engaging stakeholder collaboration to achieve the goals and targets.
  - Set the local SDG agenda: Translating the global SDGs into an ambitious yet realistic agenda that is tailored to the local development context.
  - Planning for SDG implementation: Deploying goal-based planning principles and mechanisms for more sustainable social, economic and environmental outcomes.
  - Monitoring and evaluation: Ensuring that SDG implementation remains on track, and developing local capacity for more responsive and accountable governance.

See Chapter 7 in: Sustainable Development Impact of the Cities Footprint Project on the Sustainable Development Goals in Five Cities of Bolivia (Arteaga Valdivia 2019)

14.1 Summary of methods to evaluate results

Method	Description	Advantages	Disadvantages
Cost-effectiveness analysis (CEA)	• Determines the ratio of costs to effectiveness for a given impact category • Can be used to compare policy options to determine which is most effective in achieving a given objective for the least cost	Simple approach; does not require that non-monetary benefits be quantified in monetary terms; fewer subjective elements	Results in multiple indicators when assessing more than one impact category; requires discount rates
Cost–benefit analysis (CBA)	• Determines the net benefits to society (the difference between total social benefits and total social costs) of policy options • Can be used to compare policy options to determine which has the greatest net benefit to society, or to analyse a single policy to determine whether its total benefits to society exceed its costs	Assesses aggregated benefits (across the environmental, social and economic dimensions) of policy options with one single indicator	Complex approach that requires monetizing non-monetary costs and benefits, and requires discount rates; can underestimate non-monetary benefits
Multi-criteria analysis (MCA)	• Compares the favourability of policy options based on multiple criteria • Can be used to determine the most preferred policy option	Assesses aggregated benefits (across the environmental, social and economic dimensions) of policy options with one single indicator; does not require that non-monetary benefits be quantified in monetary terms; does not require discount rate	Has significant subjective elements

14.2 Example of using a CEA

STEP 1

$$PVc = \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$$

Policy options	Discount rate	Costs in each year (million $)					Discounted costs (million $)					Present value (million $)
		Year 1	Year 2	…	Year 9	Year 10	Year 1	Year 2	…	Year 9	Year 10	
Solar PV incentive policy	3%	1	1	…	1	1	0.97	0.94	…	0.77	0.74	8.53
Energy efficiency policy		0.4	0.4	…	0.4	0.4	0.39	0.38	…	0.31	0.30	3.41

STEP 2

Policy options	GHG reduction	Air pollution reduction	Job creation
Solar PV incentive policy	50,000 tCO_2e per year for 10 years	1,000 t $PM_{2.5}$ per year for 10 years	200 jobs created in the first year, which last for 10 years
Energy efficiency policy	30,000 tCO_2e per year for 10 years	600 t $PM_{2.5}$ per year for 10 years	50 jobs created in the first year, which last for 10 years

STEP 3

Policy option	GHG reduction	Air pollution reduction	Job creation
Solar PV incentive policy	$17 per tCO_2e reduced	$853 per t $PM_{2.5}$ reduced	$42,651 per job created
Energy efficiency policy	$11 per tCO_2e reduced	$568 per t $PM_{2.5}$ reduced	$68,241 per job created

$$Cost\ effectiveness = \frac{PV_c}{impact}$$

Previous slide

14.3 Example of using a CBA

STEP 1

Policy option	Costs	Benefits		
		GHG reduction	Air pollution reduction	Job creation
Solar PV incentive policy	$1,000,000 each year for 10 years	50,000 tCO_2e per year for 10 years	1,000 t $PM_{2.5}$ per year for 10 years	200 jobs created in the first year, which last for 10 years
Energy efficiency policy	$400,000 each year for 10 years	30,000 tCO_2e per year for 10 years	600 t $PM_{2.5}$ per year for 10 years	50 jobs created in the first year, which last for 10 years

STEP 2

In the case of the solar PV incentive policy, the monetary values for GHG reduction, air pollution reduction and job creation are assumed to be \$41/tCO_2e, \$140,000/t $PM_{2.5}$, and \$293,330/job, respectively, based on relevant literature. These values are illustrative and represent one of multiple ways of assigning monetary values to benefits (e.g. estimating economic impacts of job creation).

STEP 3

Policy option		Annual costs/benefits	Discount rate	Duration	Present value of costs/benefits
Solar PV incentive policy	Costs	$1,000,000	3%	10 years	$\sum_{t=1}^{10} \$1,000,000 / (1+0.03)^t$ = $8,530,203
	Benefits	(50,000 × $41) + (1,000 × $140,000) + (200 × $293,330) = $200,716,000			$\sum_{t=1}^{10} \$200,716,000/(1+0.03)^t$ = $1,712,148,193
	Net benefits	$199,716,000			$1,712,148,193 – $8,530,203 =$1,703,617,990
Energy efficiency policy	Costs	$400,000	3%	10 years	$\sum_{t=1}^{10} \$400,000 / (1+0.03)^t$ = $3,412,081
	Benefits	(30,000 × $41) + (600 × $140,000) + (50 × $293,330) = $99,896,500			$\sum_{t=1}^{10} \$99,896,500/ (1+0.03)^t$ = $852,137,408
	Net benefits	$99,496,500			$852,137,408 – $3,412,081 = $848,725,327

14.3 Example of using a MCA

STEP 1

In the case of a solar PV incentive policy, the reason for the assessment is to support the government's efforts to pursue multiple policy objectives, such as addressing climate change, improving health from improved air quality, creating jobs, improving energy independence and reducing budget deficits. Within that context, three policy options are identified: enact a solar PV incentive policy, enact an energy efficiency policy, or take no action. These policy objectives translate into five criteria for the MCA: GHG reduction, air pollution reduction, job creation, energy independence and direct costs.

STEP 2

Performance matrix

Policy option	GHG reduction	Air pollution reduction	Job creation	Energy independence	Monetary costs ($)
Solar PV incentive policy	50,000 tCO_2e	10,000 t $PM_{2.5}$	200	Major positive impact	8,530,203
Energy efficiency policy	30,000 tCO_2e	6,000 t $PM_{2.5}$	50	Moderate positive impact	3,412,081
No action	0	0	0	No impact	0

STEP 3

Policy option	GHG reduction	Air pollution reduction	Job creation	Energy independence	Direct monetary costs	Overall score
Criteria weights	30	30	5	5	30	-
Solar PV incentive policy	100	100	100	100	0	70
Energy efficiency policy	60	60	25	50	60	57.75
No action	0	0	0	0	100	30

14.3 Step 2 : How to score policy's options performance

STEP 2

Performance matrix can be used to summarize and to present the performance of options.

- Qualitative criteria: Value can be used directly
- Quantitative criteria : A description of the result needs to be provided

Policy option	GHG reduction	Air pollution reduction	Job creation	Energy independence	Monetary costs ($)
Solar PV incentive policy	50,000 tCO_2e	10,000 t $PM_{2.5}$	200	Major positive impact	8,530,203
Energy efficiency policy	30,000 tCO_2e	6,000 t $PM_{2.5}$	50	Moderate positive impact	3,412,081
No action	0	0	0	No impact	0

After producing the performance matrix, users should rank the performance for each criterion. For criteria that are quantitatively assessed, the user should assign 100 to the best option and 0 to the worst option. All others should be scaled between these limits in proportion to their quantitative impacts.

For criteria that are assessed qualitatively, users can directly assign scores to each option's performance for each criterion, giving the best performance a score of 100 and the worst performance a score of 0, and score everything else in between. This may require making difficult judgments about the degree of difference between each option's qualitative performance. However, such judgments are required to conduct an MCA for qualitatively assessed criteria.

14.3 Step 3 : How to weight each criterion

STEP 3

One approach is to allocate a total of 100 points among all criteria, with more points meaning that the criterion is more important. When allocating the points, users should take into account the importance of each criterion, and also the size of the difference between the least and most preferred options. For example, the user may decide that job creation is important, but, in the illustrative case of the solar PV incentive and energy efficiency policies, the difference between the best- and worst-performing options is only 100 jobs, which is insignificant in the broader context of total jobs in a country. That criterion should receive a low weight because the difference between the highest and lowest options is small.

Once the weights are determined, the user should determine an overall score for each option by calculating the weighted average of its scores on all the criteria. Equation 14.4 shows how to calculate the result.

Another useful approach is to calculate the benefits score without including monetary costs. To do so, users should classify all criteria into two categories – costs and benefits – assign weights to criteria in the benefits category only, and then calculate the weighted-average performance scores for each option. By separating performance scores and costs, users can calculate the cost–benefit ratios for each option.

14.3 Example of a sensitivity analysis

Sensitivity scenario	Cost-effectiveness analysis	Cost–benefit analysis		Multi-criteria analysis	
	Discount rate (%)	Discount rate (%)	Monetary value of CO_2 emission reduction ($)	Criteria weights (GHG reduction : air pollution reduction : job creation : energy independence : monetary costs)	Performance scores for energy independence (Solar PV policy : energy efficiency policy)
Primary scenario	3	3	41	30:30:5:5:30	100:50
Alternative scenario 1	1.4	1.4	13	10:40:5:5:40	100:20
Alternative scenario 2	6	6	120	20:20:15:15:30	100:80

Sensitivity scenario	Policy option	GHG reduction ($ per tCO_2e)	Air pollution reduction ($ per t $PM_{2.5}$)	Job creation ($ per job)
Primary scenario: discount rate 3%	Solar PV incentive policy	17	853	42,651
	Energy efficiency policy	11	568	68,241
Alternative scenario 1: discount rate 1.4%	Solar PV incentive policy	19	927	46,356
	Energy efficiency policy	12	618	74,170
Alternative scenario 2: discount rate 6%	Solar PV incentive policy	15	736	36,800
	Energy efficiency policy	10	491	58,881