Sustainable Development Methodology

PART VI: DECISION-MAKING AND USING RESULTS
Overview of ICAT

Introductory Guide

Impact Assessment Methodologies

- Greenhouse gas impacts
- Sustainable Development
- Transformational Change
- Non-State and Subnational Action

Process Guidance Documents

- Stakeholder Participation
- Technical Review
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)

Part II: Defining the assessment
- Clearly define the policy to be assessed (Chapter 4)
- Choose which impact categories and indicators to assess (Chapter 5)

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)

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)

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 decide which policies to implement (Chapter 14)
Part VI: Decision-making and using results

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

**IMPACT CATEGORY 1**
- Significant positive impact

**IMPACT CATEGORY 2**
- Significant positive impact
- Significant negative impact

**IMPACT CATEGORY 3**
- Significant negative impact

**TRADE-OFFS**

**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

\[ PV_c = \sum_{t=0}^{n} \frac{C_t}{(1 + r)^t} \]

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

**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
- $X = \text{Benefits or Costs}$
- $NP_v = \text{Net Present Value}$

\[
P_{VX} = \sum_{t=0}^{n} \frac{X_t}{(1+r)^t}
\]

\[
NPV = PV_B - PV_C
\]
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

<table>
<thead>
<tr>
<th>Type of analysis</th>
<th>Key parameters for sensitivity analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-effectiveness analysis</td>
<td>Discount rate</td>
</tr>
<tr>
<td>Cost–benefit analysis</td>
<td>Discount rate; monetary value of non-monetary costs and benefits</td>
</tr>
<tr>
<td>Multi-criteria analysis</td>
<td>Criteria weights; performance scores for qualitatively assessed criteria</td>
</tr>
</tbody>
</table>
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

Contacts:
David Rich, WRI
drich@wri.org

Karen Holm Olsen, UNEP DTU
kaol@dtu.dk

www.climateactiontransparency.org
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                                                                                                                                                                                                                                                                                                                                 | Example |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| **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

**Policy options**

<table>
<thead>
<tr>
<th>Discount rate</th>
<th>Costs in each year (million $)</th>
<th>Discounted costs (million $)</th>
<th>Present value (million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 1</td>
<td>Year 2</td>
<td>...</td>
</tr>
<tr>
<td>Solar PV incentive policy</td>
<td>3%</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Energy efficiency policy</td>
<td>0.4</td>
<td>0.4</td>
<td>...</td>
</tr>
</tbody>
</table>

**Policy options**

<table>
<thead>
<tr>
<th>GHG reduction</th>
<th>Air pollution reduction</th>
<th>Job creation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV incentive policy</td>
<td>50,000 tCO₂e per year for 10 years</td>
<td>1,000 t PM₂.₅ per year for 10 years</td>
</tr>
<tr>
<td>Energy efficiency policy</td>
<td>30,000 tCO₂e per year for 10 years</td>
<td>600 t PM₂.₅ per year for 10 years</td>
</tr>
</tbody>
</table>

**Policy option**

<table>
<thead>
<tr>
<th>GHG reduction</th>
<th>Air pollution reduction</th>
<th>Job creation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV incentive policy</td>
<td>$17 per tCO₂e reduced</td>
<td>$853 per t PM₂.₅ reduced</td>
</tr>
<tr>
<td>Energy efficiency policy</td>
<td>$11 per tCO₂e reduced</td>
<td>$568 per t PM₂.₅ reduced</td>
</tr>
</tbody>
</table>

**Cost effectiveness**

\[
Cost \text{ effectiveness} = \frac{PV_c}{\text{impact}}
\]
14.3 Example of using a CBA

<table>
<thead>
<tr>
<th>Policy option</th>
<th>Costs</th>
<th>Benefits</th>
<th>Discount rate</th>
<th>Duration</th>
<th>Present value of costs/benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solar PV incentive policy</strong></td>
<td>$1,000,000 each year for 10 years</td>
<td>GHG reduction: 50,000 tCO₂e per year for 10 years, Air pollution reduction: 1,000 t PM₂.₅ per year for 10 years, Job creation: 200 jobs created in the first year, which last for 10 years</td>
<td>3%</td>
<td>10 years</td>
<td>$8,530,203</td>
</tr>
<tr>
<td><strong>Energy efficiency policy</strong></td>
<td>$400,000 each year for 10 years</td>
<td>GHG reduction: 30,000 tCO₂e per year for 10 years, Air pollution reduction: 600 t PM₂.₅ per year for 10 years, Job creation: 50 jobs created in the first year, which last for 10 years</td>
<td>3%</td>
<td>10 years</td>
<td>$852,137,408</td>
</tr>
</tbody>
</table>

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/tCO₂e, $140,000/t PM₂.₅, 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).
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.

### Performance matrix

<table>
<thead>
<tr>
<th>Policy option</th>
<th>GHG reduction</th>
<th>Air pollution reduction</th>
<th>Job creation</th>
<th>Energy independence</th>
<th>Monetary costs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV incentive policy</td>
<td>50,000 tCO₂e</td>
<td>10,000 t PM₂.₅</td>
<td>200</td>
<td>Major positive impact</td>
<td>8,530,203</td>
</tr>
<tr>
<td>Energy efficiency policy</td>
<td>30,000 tCO₂e</td>
<td>6,000 t PM₂.₅</td>
<td>50</td>
<td>Moderate positive impact</td>
<td>3,412,081</td>
</tr>
<tr>
<td>No action</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>No impact</td>
<td>0</td>
</tr>
</tbody>
</table>

### Criteria weights

<table>
<thead>
<tr>
<th>Policy option</th>
<th>GHG reduction</th>
<th>Air pollution reduction</th>
<th>Job creation</th>
<th>Energy independence</th>
<th>Direct monetary costs</th>
<th>Overall score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria weights</td>
<td>30</td>
<td>30</td>
<td>5</td>
<td>5</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>Solar PV incentive policy</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>70</td>
</tr>
<tr>
<td>Energy efficiency policy</td>
<td>60</td>
<td>60</td>
<td>25</td>
<td>50</td>
<td>60</td>
<td>57.75</td>
</tr>
<tr>
<td>No action</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>30</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Policy option</th>
<th>GHG reduction</th>
<th>Air pollution reduction</th>
<th>Job creation</th>
<th>Energy independence</th>
<th>Monetary costs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV incentive policy</td>
<td>50,000 tCO₂e</td>
<td>10,000 t PM₂.₅</td>
<td>200</td>
<td>Major positive impact</td>
<td>8,530,203</td>
</tr>
<tr>
<td>Energy efficiency policy</td>
<td>30,000 tCO₂e</td>
<td>6,000 t PM₂.₅</td>
<td>50</td>
<td>Moderate positive impact</td>
<td>3,412,081</td>
</tr>
<tr>
<td>No action</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>No impact</td>
<td>0</td>
</tr>
</tbody>
</table>

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.
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

<table>
<thead>
<tr>
<th>Sensitivity scenario</th>
<th>Cost-effectiveness analysis</th>
<th>Cost–benefit analysis</th>
<th>Multi-criteria analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Discount rate (%)</td>
<td>Discount rate (%)</td>
<td>Monetary value of CO₂ emission reduction ($)</td>
</tr>
<tr>
<td>Primary scenario</td>
<td>3</td>
<td>3</td>
<td>41</td>
</tr>
<tr>
<td>Alternative scenario 1</td>
<td>1.4</td>
<td>1.4</td>
<td>13</td>
</tr>
<tr>
<td>Alternative scenario 2</td>
<td>6</td>
<td>6</td>
<td>120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensitivity scenario</th>
<th>Policy option</th>
<th>GHG reduction ($ per tCO₂e)</th>
<th>Air pollution reduction ($ per t PM₂.₅)</th>
<th>Job creation ($ per job)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary scenario: discount rate 3%</td>
<td>Solar PV incentive policy</td>
<td>17</td>
<td>853</td>
<td>42,651</td>
</tr>
<tr>
<td></td>
<td>Energy efficiency policy</td>
<td>11</td>
<td>568</td>
<td>68,241</td>
</tr>
<tr>
<td>Alternative scenario 1: discount rate 1.4%</td>
<td>Solar PV incentive policy</td>
<td>19</td>
<td>927</td>
<td>46,356</td>
</tr>
<tr>
<td></td>
<td>Energy efficiency policy</td>
<td>12</td>
<td>618</td>
<td>74,170</td>
</tr>
<tr>
<td>Alternative scenario 2: discount rate 6%</td>
<td>Solar PV incentive policy</td>
<td>15</td>
<td>736</td>
<td>36,800</td>
</tr>
<tr>
<td></td>
<td>Energy efficiency policy</td>
<td>10</td>
<td>491</td>
<td>58,881</td>
</tr>
</tbody>
</table>