



**COST ASSESSMENT FOR
SUSTAINABLE ENERGY SYSTEMS**

CASES is a Co-ordination Action funded by the European Commission under the Sixth Framework Programme, PRIORITY 6.1.3.2.5, Sustainable Energy Systems

Multi-Cases Tool

User Guide

Developed by the Laboratory of Industrial & Energy Economics, NTUA

ATTENTION: You should first allow MACROS to run in MS Excel

For Microsoft Office Excel 2003: Please follow the steps: *Tools* → *Macro* → *Security* → *Security Level* → *Low*.

For Microsoft Office Excel 2007: Please follow the steps: *Office Button* → *Excel Options* → *Trust Center* → *Trust Center Settings* → *Macro Settings* → *Enable all Macros*.

→ **The Multi-Cases Tool** always opens in the sheet “**Home**”.

Push the “**ENTER**” arrow and continue to the next sheet named “**Steps**”.

→ **The sheet “Steps”** provides an overview of the methodological steps to be followed.

It is important to complete all steps in order to obtain the full set of results.

In each step a hyperlink can lead you directly to the corresponding sheet.

NOTE: If you wish to stop working at any step, you can save the work already done and continue another time by directly clicking the corresponding step

NOTE: While in one step you can navigate through the sheets in the following way:



Guides you to the previous step



Guides you to the next step



Guides you to the sheet “**Steps**”

1. The sheet “**Criteria**” aims at the definition and ranking of the evaluation aspects you wish to take into account for the comparative assessment of your alternative options with the **Multi-Cases Tool**.

→ Insert criteria in any order you think appropriate and specify their acronyms.

→ The maximum number of criteria you can insert is 15. This limit has been chosen because it is widely acknowledged that for a greater number of criteria, the human mind can not easily perform the necessary comparisons and identify differences in relative importance.

→ Starting with the most important criterion, insert the number “1” in the column **Rank** and the corresponding line, continue with “2” for the second most important criterion, until all chosen criteria are assigned with their rank order.

→ Define the direction of preference in the evaluation scale of each criterion by choosing either **Max** or **Min** from the two options provided in the last column:

✓ select **Max** if greater values are preferred to smaller ones (e.g. profit values)

✓ select **Min** if smaller values are preferred to greater ones (e.g. cost values)

➔ Press the button **Sort Criteria** and the list of criteria will be rearranged according to the rank number you have specified. The new order will be automatically transferred to the sheet “**Performances**”, and to the sheets “**RATIO weights**” and “**LEVEL weights**”.

2. The sheet “**Alternatives**” aims at the definition of the alternative options you wish to comparatively assess with the **Multi-Cases Tool**.

➔ Insert alternatives in any order you think appropriate and specify their acronyms. Alternatives will be automatically numbered when inserted. The order you used will be transferred to the sheet “**Performances**”, to the choices presented in the sheets “**RATIO weights**” and “**LEVEL weights**”, and to the sheets “**RATIO results**” and “**LEVEL results**”.

➔ The maximum number of alternatives that can be specified and assessed with the **Multi-Cases Tool** is 100.

3. The sheet “**Performances**” asks you to fill an empty evaluation matrix constructed on the basis of the already specified criteria and alternatives.

➔ Consider each column separately and insert the performance of the alternatives for the respective criterion. According to the direction of preference, the best and worst performances appear in green and red colour respectively.

➔ Continue with other columns until the whole matrix is filled.

NOTE: You can use different evaluation scales for the considered criteria:

- Qualitative scales of various widths for ordinal criteria
- Quantitative scales of various units for cardinal criteria

All these scales will be automatically normalized through a linear transformation by assuming that a linear value function relates initial performances and relative scores.

NOTE: The Multi-Cases Tool provides two alternative weighting methods to help you articulate your judgments regarding the relative importance of criteria.

- a) The **RATIO** method
- b) The **LEVEL** method

You can implement both methods for checking the consistency of your judgments.

- Small differences in the resulting weights cannot be avoided. However, these differences are unlikely to influence your results.
- Large differences offer you an opportunity to rethink the preferential input you provided in the respective sheets and decide on your final judgment.

You can also implement only one method, the one that seems most convenient to your way of thinking.

4.a. The sheet “RATIO weights**” provides a rational framework to help you differentiate in quantitative terms the relative importance of the specified criteria.**

- ➔ Criteria appear in the order you have specified in step 1, with the most important criterion placed on the top and the least important on the bottom of the rank.
- ➔ By default the value 100 is assigned to the top ranked criterion. You are asked to assign a value less than 100 to the second ranked criterion (or equal to 100 in case you think the 2 first criteria are of the same importance). You continue by assigning a lower (or equal) value to the next most important criterion, until all criteria are characterized by a numerical value denoting their relative importance.
- ➔ If a higher value is assigned to a criterion that has been identified as less important than others, a red colour will indicate that this value has to be changed to a lower one.
- ➔ The tool automatically displays the normalised weights resulting from your values.

NOTE: Examine the weights and think if they adequately represent your preferences:

- The specified rank order can be changed by returning to the sheet “**Criteria**” so as to revise and sort again the criteria.
- The values of relative importance can be changed directly from this sheet.

4.b. The sheet “LEVEL weights**” provides an alternative rational framework to help you differentiate in quantitative terms the relative importance of the specified criteria.**

- ➔ Criteria appear in the order you have specified in step 1, with the most important criterion placed on the top and the least important on the bottom of the rank.
- ➔ Examine carefully the criteria in Table A and place each criterion in Table B in column 1, at the level that better reflects its importance. The highest level is appointed to the most important criterion. Place the second most important criterion at a lower level. Leave blank lines between two criteria in order to denote a greater difference in their relative importance. The more the blank lines left, the greater the difference in importance.
- ➔ In case you think two or three criteria are equally important, then place these criteria at the same level, by filling first column 1, next column 2, and finally column 3.
- ➔ Check in Table A that all criteria have been placed in Table B and no criterion has been placed in two levels. All values under column **Check** should be equal to 1.
- ➔ The tool automatically displays the normalised weights defined by your values.

NOTE: Examine the weights and think if they adequately represent your preferences:

- The specified rank order can be changed by returning to the sheet “**Criteria**” so as to revise and sort again the criteria.
- The position of criteria in Table B can be changed directly from this sheet.

5. The sheets “**RATIO results**” and “**LEVEL results**” display the final ranking of the examined alternatives resulting from their global score. The final ranking is calculated as the average of their performances in each single criterion, weighted according to “**RATIO weights**” and “**LEVEL weights**”, respectively.

→ Alternatives appear in the random order defined when completing the sheet “**Alternatives**”. In order to rank them according to their global score in a descending order of global preference, press the button **Sort Alternatives**.

NOTE: You can also perform a **sensitivity analysis** in order to check the robustness of the obtained results. Besides the basic scenario, it is possible to consider up to 3 additional scenarios by revising any of the subjective/preferential inputs (number of criteria, weights of criteria, performance of alternative(s) on criteria).

The results of any separate scenario can be stored as explained below, in order to be subsequently used for comparison and reporting.

→ Store the results of your basic scenario by pressing the button **Copy/Paste Results of Basic Scenario**. The results are stored on the right of the sheet “**RATIO results**” or “**LEVEL results**”.

→ Store the results of your additional scenarios by pressing the buttons **Copy/Paste Results of Scenario 1, 2 or 3**, respectively. The results are stored next to the results of the **Basic Scenario**.

→ If you wish to examine additional scenarios, you can clear the results already stored and use again the **Copy/Paste Results of Scenario 1, 2 or 3** for placing the new results.

6. The sheet “**Sensitivity Analysis**” displays the final ranking of the examined alternatives for a maximum of 4 scenarios as derived from the sheets “**RATIO results**” and “**LEVEL results**”.

→ The displayed results have been automatically saved when constructing your scenarios in the previous sheets. For better differentiating the most preferred alternatives, 3 different colours indicate 3 different priority groups:

- The orange colour indicates the alternatives ranked in the top 5 places.
- The blue colour indicates the alternatives ranked between the 5th and 10th place.
- The white colour indicates the alternatives ranked below the 10th place.