# User Manual

This tool consists of two Excel documents. Both documents must be opened to use the tool. One document contains the life cycle costing tool and the other document contains the life cycle analysis with the environmental impact of the kitchens during the life cycle. This manual will consist of: 1. How to use the life cycle costing excel with the associated options to make better substantiated investment decisions and the second part will consist of the explanation about the LCA part with the explanation of how to add data here and what steps are needed to use this data and link it to the LCC excel.

LCC tool: On the dashboard, it is possible to enter four things.

1. Enter the discount rate used to calculate the present value.
2. Enter the mutation rate, which relates to how often building elements will be replaced after their first lifespan.
3. Thirdly, it is possible to indicate the number of buildings that will be acquired during the investment decision process.
4. It is possible to enter how many oven cabinets and base cabinets a whole kitchen consists of in this case. This is necessary because the associated EPDs specifically concern only one upper and lower cabinet and to make the results comparable it must be equated to the Bribus kitchen.

When adding the data from extra kitchens, this must also be taken into account otherwise the kitchens cannot be compared with each other.

The remaining sheets concern the calculations regarding the MKI CO2 emissions and the present value of the costs. A distinction has been made below between a lifespan of 20 years and 60 years so that both can be compared and this was a question from Vesteda.

Within the tool and underlying calculations as they are now, nothing needs to be changed without having implications for the entire calculation. When a new building element (kitchen) needs to be added to further expand the comparison and analyze more building elements (kitchens), this must be done carefully with knowledge of Excel. Currently, it is not user-friendly enough to do this.

Furthermore, there are three sheets that will be discussed on which nothing needs to be filled in now but are necessary for corresponding calculations. When building elements (kitchens) need to be added, it is necessary to supplement these sheets with the necessary information This must be taken into account when a building element (kitchen) has a different business model, such as a circular kitchen, which assumes that a kitchen will not be replaced. This distribution function should not be used. If other building elements need to be added in addition to the kitchens, this Weibull function must be rebuilt to include the characteristics of that building element in the calculation. 2. This sheet indicates the investment costs and maintenance costs, which are used in the calculations regarding the costs. When a new kitchen is added, the formulas used to arrive at the results must be linked to the expansion on the PV of costs sheet for both 60 years and 20 years. To make these calculations possible in it.

1. The third sheet concerns the indexation regarding inflation and construction costs, these indexations are used in the calculations on the MKI CO2 and PV of costs sheets.

The underlying calculations within the MKI CO2 emissions and PV of costs sheets for both 20 and 60 years retrieve data from the LCA document. MKI (20/60 years) This sheet calculates the MKI of building elements per phase over the time spans that are maintained. The data retrieved concerns the totals of each phase resulting in a total MKI of the entire life cycle. When adding new building elements (kitchens), consideration must be given to the allocation of the MKI per life phase within the chosen time span of the analysis. In addition, the underlying business model must be taken into account. This relates to the allocation of the MKI of the use phase, end of life phase, and beyond life phase. Because the time value of money is taken into account, discrepancies in the results will arise if this is done incorrectly. It is currently not possible to easily add and calculate the MKI of new building elements. As is the case with the CO2 emissions. This flexibility will be added later.

PV of Costs

This sheet calculates the present value of the costs associated with the building elements over the time span that is maintained. This sheet is not yet prepared, just like the MKI sheet, for the easy addition of new building elements, as has already been thought about in the CO2 sheet. Within this sheet, use is made of the investment costs and maintenance costs that need to be filled in on the previously mentioned sheets. Furthermore, the calculations to link the results of a new building element to the dashboard will require the blue-colored cells to be linked to the respective cells on the dashboard sheet.

This procedure should be carried out for both PV of Costs 60 years and 20 years.

CO2 Emissions

This sheet calculates the CO2 emissions of building elements per phase over the time span that is maintained. This sheet is already prepared for the expansion for additional building elements, taking into account the correct retrieval of the necessary data from the LCA Excel document. (More explanation about this within the explanation of the LCA document.) It is necessary to enter the same name as the sheet in which the data of the new building element is located within the LCA document, in the area indicated in green. This results in the retrieval of the GWP data from the LCC document and the calculations will be done automatically. To make this visible in the dashboard, the cells N8 to S8 for a lifespan of 60 years need to be linked with the CO2 Emissions 60 years sheet in column BJ.

The same procedure as above should be followed for calculating the CO2 emissions over a time period of 20 years.

LCA document

This Excel document is used for processing the environmental impact data that is displayed in EPDs. Each building element, in this case, kitchens, have a sheet where the environmental impact data from both EN15804 + A1 and A2 need to be added. For Chainables and Bribus, this has already been done and serves as an example. The environmental impact of the phases within the life cycle (A1-A5; B1-B3; C1-C4; D) along with the corresponding environmental impact categories are processed in this overview and make it possible to calculate the MKI costs attributed per category. This results in a total MKI per phase and the total MKI per environmental impact category. The MKI per phase is used in the LCC document. It also provides a total MKI. The MKI data needs to be linked in the correct way with the MKI 60y sheet and the 20y sheet. In the next version, this will be made easier, just like with the CO2 emissions, only a name (only the EN15804A1 data is used in the LCC document).

To add a building element (kitchen), a template is ready. This needs to be copied and given a different name. This name can be entered within the LCC document in the respective places as with the CO2 emissions in the green cell (this application still needs to be built for the MKI).

Furthermore, there are two more important sheets: 1) The dashboard, this is not a usual dashboard that can be used for input but to compare different building elements, in this case, kitchens with each other to see if the calculations have gone well. 2) The environmental costs sheet displays the environmental costs per different environmental impact categories. These are used for the MKI calculations.