Calculating life cycle costs: a joint detailed plan for clients and experts.

We would like to say that we design well thought out and make a realization of future proof buildings. We are all familiar with examples of buildings that require major renovations within 10 years. Indoor climate is a key challenge we phase and still needs to be thought about years after the completion of the building. How can we ensure that we can make a responsible and sustainable investment choice? This starts with insights into the life cycle of the building and the life cycle costs, at the right time and using ambiguous and objective methods.

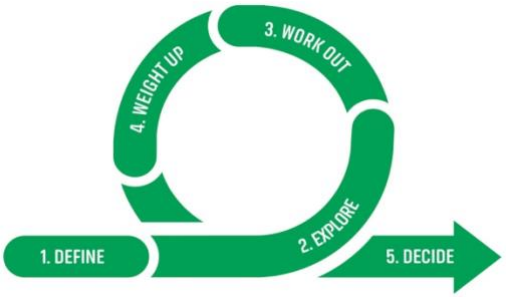
In the sixth part of this series, we present a detailed plan to achieve a comparison of the lifetime costs. The proven approach is suitable for all parties involved: clients, suppliers, specialists and process managers.

There is a lot to consider when calculating the lifecycle costs of a construction project. A detailed (step-by-step) plan is needed to ensure that the process runs efficiently and consistently. This will help all parties involved to draw up a process plan that helps them achieve a tailor-made calculation together. If the detailed plan is made up of main steps (for people who manage more in outline, such as the client) and sub steps (for experts who make the calculation)

In 2006 Regieraad Bouw made the first steps towards a detailed plan. In this article we present an updated variant of this which is based on experiences and feedback from the market.

Multiple levels

The new step-by-step plan is simpler and more suitable for clients and experts due to the use of multiple levels. As a result, experts are able to view the customers' questions into solid advice where they can agree on a supported decision together. In addition, this generic step by step plan makes it possible to design from coarse to fine. From an area to building concept and from systems to products.



At every point in the design phase, the step-by-step plan provides guidelines for structurally calculating the life cycle costs and determining the feasibility and desirability of specific variants or alternatives. The realization and operations are always in view, which leads to better sustained design choices.

The steps are listed below and a sub-step for each step, at the end of this article you will find an extensive explanation.

Step 1: Define the goal and process.

a) Determine what you want to achieve with the intended result.
b) Determine how a decision Is made.
c) Coordinate the goal and the significance with the client

Step 2: Explore the alternatives

a) Determine the possible alternatives.
b) Determine the generic and specific assumptions per alternative.
c) Determine the alternatives and assumptions together with the client.

Step 3: Work out the alternatives

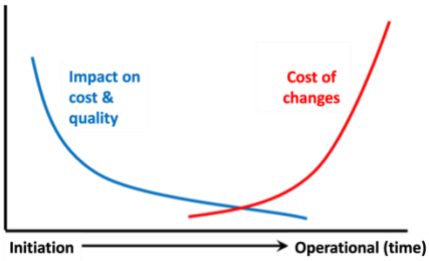
a) Determine the numbers and capacities for the alternatives.
b) Determine the investment, maintenance costs, energy costs and other costs (CO_2, facility management, etc) Determine the potential benefits.
c) Put the costs and benefits aside in time.
d) Present the cash flow and determine the net present value.

Step 4: Compare and weigh the alternatives

a) Put the alternatives next to each other.
b) Make a sensitivity analysis of the results.
c) Include any weighting in your calculations, including the extra aspects.

Step 5: Give advice & make a decision

a) Determine which alternative best fits the principles (see step 1). Make a decision or give advice.
b) Present the alternative to the client.
c) Make a decision.



A recurring loop

When calculating the life cycle costs, always keep an eye on the assumptions and calculations from previous loops. Have the principles changed in the meantime? Adjust the previous calculations accordingly so that you can make a better choice. The above step by step plan is intended as a recurring loop. It helps you design from course to fine.

An example, suppose you have assumed a certain number of square meters of functional area in the schematic design. And suppose in the next design phase more areas in the building are designated as workplaces. This naturally influences the required furnishing and installations. It is then advisable to redo your previous calculations with the new starting points. In this way you test whether your decision from the sketch design phase is still the right one in the new situation. Because the principles for a life cycle cost calculation change during the design process, it is important to check them regularly.

The explanation of the steps:

Step 1a: Define the goal and the process. Determine what you want to achieve with the intended result. Why is it necessary to visualize the life cycle costs and what is the intended result? Do you want to substantiate an investment decision? Do you want to choose the best alternative? Or do you want to optimize a design? This requires a specific approach and/or a different level of detail.

Step 1b: Define the goal and the process. Determine how a decision is made.
What information do you need to determine the best option? After all, the alternative with the lowest total cost over the lifetime Is not necessarily the best. Do you also consider other financial and qualitative arguments? Check whether there are also parts of the design phase or the invitation to tender. Which calculation method do you use, on the basis of which you make a decision? In this step-by-step plan, we use the net present value (NPV) from NEN ISO 15686. Other methods are also possible, such as management based on, among other things, the annual costs, the cost-effective rent, the payback period and the ECN method.

Step1c: Define the goal and the process. Coordinate the goal and the weighting with the client. Discuss this step carefully with your client. After all, you want to have a clear picture of the rules of the game before you start calculating to avoid duplication of work.

Step 2a: Explore the alternatives. Determine the possible alternatives.
Lifetime cost analysis is usually aimed at choosing the best alternative. In this phase you define the different alternatives. Please note you will only calculate this in step 3. For the sketch design (SO) you look at the alternatives at a different level of detail than for the final design (DO). So, you always work from course to fine.

Step 2b: Explore the alternatives. Determine the generic and specific assumptions for each alternative.
In addition to specific assumptions for individual alternatives, there are also variables that apply to all alternatives. For example: the consideration period, inflation, energy rates and the calculation system. The period of consideration is especially crucial. Therefore, keep in mind:

- the functional lifespan: the functions of buildings change continuously.
- The contractual lifespan: this is often determined in advance in a tender.
- The economic lifespan: better alternatives may become available in the future, making a replacement economically sensible.

Also take uncertainties into account. Work this out as completely possible.

Step 2c: Explore the alternatives. Determine the alternatives and the assumptions together with the client. Establish the generic assumptions in advance. After all, these have a strong influence on the results of all variants. Also discuss the uncertainties and possible bandwidths. These are important for the sensitivity analysis and influence the outcomes which leads to changes in the decision making.

Step 3a: Work out the alternatives. Determine the numbers and capacities for the alternatives. Make the alternatives transparent and verifiable with frameworks and requirements. Limit the number of alternatives to keep an overview and avoid unnecessary calculations.

Step 3b: Work out the alternatives. Determine the investment costs, maintenance costs, energy costs and other costs (CO2, facility management etc) Determine the potential benefits. Estimate the actual life cycle costs for the various disciplines and phases. Use the cost structure of NEN2699 for this. This includes the following cost categories:

- The investment costs (or foundation costs): the initial costs to complete a structure.
- Consumption costs: the costs for energy, C02 and water, among other things, can have a major influence on the life cycle costs over the years.
- The maintenance costs: think of the costs for architectural and technical installation maintenance (annually and in case of replacement)
- The cost of future adjustments and extensions: minor and major renovations take place in every building during its lifespan.
- Residual value/demolition costs: the building may still have a certain (circular) residual value at the end of its life. If not, the demolition costs can be included.
- The functional usage costs: all costs to support the function of a building, such as catering, cleaning and security.

Work with actual costs and the current price level. This is simpler and contributes to recognizability.
It can be complex to build a complete cost model. Still, it's worth it. Buildings are very complex due to all the principles and dependencies and changes are almost impossible to process without integrated knowledge. In addition, a complete model also gives a clear picture of the differences in the total costs. A multidisciplinary approach is therefore the only method to bring the right knowledge together. Check for each item in the model whether it is relevant and/or significant. Does the item make a significant difference in terms of outcome?

Step 3c: work out the alternatives. Put the costs and benefits aside in time.
See when certain changes are made. Further distinguish between costs that lead to an actual expense and costs that do not. Lifetime costs only concern actual expenses (the cash flows or cashflows)

Step 3d: work out the alternatives. Present the cashflow and determine the net present value
Use the net present value (NPV) calculation system from NEN ISO 15686. Make all cash flows present by discounting them to their present value. Add up these cash flows for each alternative. You now have one number: the NPV.

Step 4a: Compare and weigh the alternatives against each other. Put the alternatives side by side. The alternative with the lowest NPV has the lowest lifetime costs.

Step 4b: Compare and weigh the alternatives against each other. Make a sensitivity analysis of the results. View the investment costs (capex), the operating costs (opex) and the principles. Perform a sensitive analysis. You vary with one or more variables. After all, these will fluctuate in the future and thus influence the outcome. Calculate possible scenarios. This can create new alternatives that can also be worked out again. This allows you to discuss uncertainties and take them into account in your advice or decision.

Step 4c: Compare and weigh the alternatives against each other. Include and weighting in your calculations, including the extra aspects. You have already agreed with your client in advance which components are taken into account in the decision-making process. Additional financial and/or qualitative aspects may also be taken into account.
Financial aspects include subsidies and accounting arguments, such as depreciation. Qualitative aspects include aesthetic quality and flexibility. In addition, there are also benefits and costs that are difficult to express in

monetary terms, such as comfort and absenteeism due to illness. You can still include such aspects in your consideration by weighing them qualitatively in relation to each other, as determined in the first step.

Step5a: Give advice & make a decision. Determine which alternative best fits the principles (see step 1). Make a decision or give advice. Make a qualitative and a quantitative analysis. These can lead to a sorting of alternatives. The best alternatives are not always financially possible. Sometimes it also does not lead to the desired effect or to more risk.

Step 5b: Give advice & make a decision. Present the alternatives to the client. Use the steps above to provide comprehensive advice, including possible scenarios and uncertainties.

Step 5c: Give advice & make a decision. Make a decision. After that, the decision can be made to further develop the plan.

As mentioned, in the step-by-step plan described above, we are using the Net Present Value calculation method, and there are more calculation methods. We will list these for you in a future publication.

To calculate costs, benefits, and value in an integrated way. Now and in the long term.

Rijksvastgoedbedrijf, Life Cycle Vision, AT Osborne, IGG Bouweconomie, and Brink are collaborating on the topic of lifecycle costs over the next period. They are working in close cooperation with the Dutch Association of Construction Cost Engineers (NVBK) and the Dutch Association of Cost Engineers (DACE). Together, they are seeking to develop definitions and calculation methods for lifecycle costs. In doing so, they are particularly focused on ensuring that they speak the same language.

We share all publications on LinkedIn and there is room for sharing experiences: https://www.linkedin.com/groups/8970183/

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