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# LIFE CYCLE COSTS (LCC) FOR INDOOR LIGHTING - DESCRIPTION OF THE TOOL AND ITS PARAMETERS

## LCC IN THE PROCUREMENT

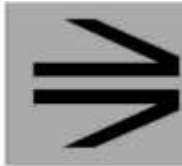
The LCC tool for indoor lighting has been prepared by the Swedish Energy Agency, see <http://www.energimvndigheten.se/Global/F%20c3%b6retag/Energieffektivisering%20i%20f%20c3%b6retag/LCC%20belvsning%20ver%202010-12-17%20ver%202011-05-20.xls>. The tool can be used in the evaluation of tenders to clarify the actual (compiled) costs that the procuring entity/authority will need to pay for the product during its service life. The tool can also provide assistance in the needs analysis to better plan purchases and to make an estimate of what a green alternative would cost in comparison to a conventional product - it may prove to be less rather than more expensive! In the needs analysis, MSR's general calculation tool may also be of assistance, see [www.msr.se/sv/Upphandling/LCC-och-miljoekonomi/Generell-LCC-kalkyl/](http://www.msr.se/sv/Upphandling/LCC-och-miljoekonomi/Generell-LCC-kalkyl/).

When the tool is used in the needs analysis, there are no specific demands on how it should be used. The user may instead try different scenarios (see chapter on uncertain parameters below) to arrive at the best solution. If the tool is used in the tender evaluation, however, the Swedish Public Procurement Act (LOU) will apply, and just as in other requirements, the LCC requirements must comply with this legislation. This document therefore focuses on how LCC is used in the tender evaluation.

In order to use LCC as an award criterion when assessing what is the economically most profitable tender, the tender documentation must clearly describe the parameters that will be included in the calculation. The documentation and measuring methods that will be applied also need to be described, so that it is clear what information the tenderer must provide. Below is an example of what information the procurer should provide in the tender documentation document and what information should be requested from the suppliers in order to make the evaluation. The tool also contains explanations for each parameter, see comments in the Excel spreadsheet (the red triangles). Don't forget to specify if the prices will apply with or without VAT.

### THE PROCURER DEFINES THE FOLLOWING CONDITIONS IN THE TENDER DOCUMENTATION

<b>Calculation conditions</b>
Number of years the calculation comprises (years of use), <small>i.e. en economic life cycle, see chapter "Definition and explanation of the tool's parameters" below.</small>
Annual real interest rate (in percent) <small>Real interest rate is defined as interest rate minus inflation during the life cycle. See chapter "Conditions" for more information.</small>

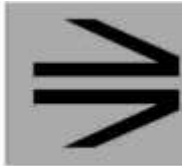


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Annual energy price increase over and above inflation (in percent)
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Annual price increase (or decrease) for light sources over and above inflation (in percent)
<b>Running and maintenance cost</b>
Operating time before control/regulation h/year, see Excel spreadsheet for guidelines.
Electricity price (SEK/kWh)
Replacement costs per light source, each (SEK) The procuring authority specifies the costs for replacing light sources, excluding the light source itself. If different costs are estimated for different light sources, this must be specified.
Reduction factor <sup>1</sup> through manual control, motion detection or daylight detection (the procuring entity specifies what the procurement comprises).  The procuring authority bases these factors on SS-EN 15193, see the standard values defined in "Ljus och rum", chapter 10. To determine total reduction, multiply the values by each other.  Example for reduction factor for office with motion-detecting controls: Reduction factor manual control = 0.8 Reduction factor motion-detecting controls = 0.75 Total reduction = 0.8*0.75=0.6  <sup>1</sup> Reduction factor is a measurement of the extent to which energy consumption can be reduced with controls.

THE SUPPLIER MUST PROVIDE THE FOLLOWING DATA

<b>INVESTMENT COSTS</b>
<b>Luminaires</b>
Manufacturer/Name
Number of luminaires
Unit price (SEK)
<b>Light sources</b>
Number of fluorescent tubes/lamps (light sources) per luminaire (each)
Power output of fluorescent tubes/lamps (light sources) (W)
Power per light source including operating losses (W)
Price per unit (SEK/unit)
Lifespan of light source Lifespan of halogen lamps, fluorescent lamps (low-energy lamps) and LED lamps, measured in average lifespan as specified in IEC EN 60901. For tubular fluorescent lamps, single-capped fluorescent lamps and metal halide lamps, service life applies as specified in IEC EN 60081 Annex C.



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<b>Installation</b>
Material and labour costs/luminaire (SEK)
Control and regulation equipment: Costs for control equipment (SEK) <small>The procurer must specify type, i.e. motion detection, daylight detection, simple timer, dimmer)</small>
Other costs for installation
<b>OPERATING COSTS</b>
Stand-by (Parasitic power) <small>As specified in SS-EN 15193 (also see information below).</small>
<b>Maintenance costs</b>
Maintenance costs per luminaire <small>If this is included, it should be specified what the maintenance service will comprise.</small>
Operating times between maintenance (hours) <small>If this is included, it must be specified under a maintenance service</small>


From the above parameters, it is important to select those parts that are appropriate for the procurement in question. In simpler procurements or call-offs, all parameters may not need to be included, such as maintenance costs that must be clearly specified if they are to be included in the tender documentation.

The conditions that apply for the procurement must be clearly specified by the procurer and it must be clear what the supplier will provide. The information requested from the suppliers must also be produced in a standardized and uniform manner in order to permit a comparison. Of course, the evaluation must also compare equivalent products, which must be specified in the tender documentation.

## DEFINITION AND EXPLANATION OF THE TOOL'S PARAMETERS

The tool analyzes an economic life cycle and *not* a “cradle to grave” life cycle like in life cycle analyses (LCA). Accordingly, the tool only takes costs that impact the procuring entity into consideration and not other environmental costs that impact society. In order to guarantee that the investment becomes environmentally appropriate, we recommend that the tool is used as a supplement to the Swedish Environmental Management Council's environment criteria, perhaps as part of a needs analysis or as an award criterion.

The user can enter the necessary parameters into the calculation and include all the costs that arise during the *period of ownership*. Standard figures have been entered into the tool as examples to demonstrate how it works. The tool includes red tabs with examples. However, explanations are provided below for some important parameters in the tool.

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## CONDITIONS

The conditions at the top of the spreadsheet define the terms for the calculation. The procuring entity provides this information.

The interest used internally within the procuring entity is entered as the interest and may consequently vary depending on the organization. Interest must be entered as real interest, i.e. an interest rate that is unaffected by inflation (nominal interest minus inflation). A real interest rate of 4-5% is usually recommended for municipalities and counties. Energy price increases can also be entered here.

## INVESTMENT COSTS

The supplier enters information here on light sources and luminaires, such as power output, price and installation costs. If the lighting has control and regulation systems and this has been specified, the supplier fills in the costs for these here.

## OPERATION AND MAINTENANCE COSTS

It is important that the information provided by the suppliers is standardized so as to permit a comparison of different products. Under operation and maintenance costs, the procurer must then specify a number of particulars such as operating time, electricity price and reduction factor, if any. See below. The supplier provides information on the parasitic power (stand-by, see below for more information), and any maintenance costs if this service is requested by the procuring entity.

### Reduction factors


Reduction factor is a measurement of the extent to which energy consumption can be reduced with

1. manual controls
2. motion detection
3. daylight detection

This factor should either be obtained from the supplier or standard values should be found, see "Ljus och rum", chapter 10. To determine total reduction, multiply the values by each other.

Example reduction factors for office with motion-detecting controls:

- Reduction factor manual control = 0.8
- Reduction factor motion-detecting controls = 0.75
- Total reduction =  $0.8 \times 0.75 = 0.6$

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#### Parasitic power

Parasitic power is the power output for control and regulation equipment when the luminaire is turned off (stand-by power). This information should be requested by the supplier and the values should either be calculated in accordance with standard SS-EN 15 193 or should be standard values. See, for example, [www.ljuskultur.se](http://www.ljuskultur.se). Bear in mind that there are differences in power output between standard and adjustable ballasts.

#### Maintenance

Maintenance costs can be entered as replacement costs per unit on the spreadsheet. If this is done, it must be clearly indicated in the tender documentation.

## PRESENT VALUE

The present value method is used to recalculate all expected expenses in the investment and any earnings to a present value in order to compare future costs with those of today. This is because a Swedish Krona today has a different value from a Swedish Krona tomorrow, as a Swedish Krona today can be invested or provide a return in some other way. Therefore, all future costs are recalculated to the time of the purchase. The extent to which the future costs are counted down depends, among other things, on the rate of interest chosen and this can accordingly have a major significance for the final overall cost. The interest rate used by the organization is specified in the spreadsheet under *real interest rate*. A high value here affects future costs such as operating and maintenance costs and ascribes these less significance in the total calculation.

## UNCERTAIN PARAMETERS

There are many uncertain factors in the tool, such as that it is difficult to have advance knowledge on parameters such as price changes on light sources and price increases on energy. Even interest is an uncertain factor in this context. The calculation will change according to what cost of capital is used. This interest rate varies somewhat between different organizations and should be determined within the organization.

Another uncertain factor that affects cost is the number of years the lighting system will be used. This can be the economic lifespan or the total lifespan that the product will have in its existing condition. Lifespan must be defined by the procuring entity and will have a significance for the final total cost as the purchase price from a cost standpoint becomes less important the more years the product is used.

To understand how these uncertain parameters effect the final outcome, a "test calculation" can be made with a number of different values. In the procurement itself, however, it is important to not exaggerate these uncertain factors and to clearly specify what figures you will be using. This will ensure that the suppliers are aware of the conditions for evaluation and that there will be equal treatment and transparency, two basic criteria for public procurement.