



Danish Ministry of the Environment

Guidelines for

# **Tools for Total Cost of Ownership in public procurement**

## **Bulbs and lighting systems**

# Total Cost of Ownership and public procurement

## What is Total Cost of Ownership?

Total Cost of Ownership is the total of all costs resulting from acquisition of a product and the costs involved in using the product during its period of use. Both direct and indirect costs may be included in the calculation of total costs, and the total costs price may be used as a criterion for awarding a tender. Professionals often use the abbreviation TCO.

## Why TCO?

In continuation of the government's strategy for intelligent public procurement, the Environmental Protection Agency has instigated the development of national tools for incorporating TCO in public tenders. The aim of TCO is to calculate future outlay throughout the service life of the product. Instead of simply looking at the cheapest purchasing price, TCO tools make it possible to select the product that is cheapest throughout the service life of the product as a whole.

## Who constitutes the target group?

This tool has been developed primarily for public procurement officials and tender consultants, though it can also be used by private purchasers and by companies more generally.

## Why a TCO tool for lighting?

The product groups for which TCO tools were initially developed were selected based on a number of parameters - including the ability of the industry to develop uniform data for determining operating costs and the presence of a financial and environmental potential in demanding products that are cheap to operate.

## How is the TCO tool used?

These guidelines contain the information required to begin using TCO in public procurement. They consist of a quick guide and a more detailed description of how to use the tool and of its functions. Finally there are details of the background to the tool and a summary of the industry's involvement and how it has reacted to the tool.

## How can I get more help?

The Danish Competition and Consumer Authority's guidelines on "Total Cost of Ownership in tender processes" from 2014 examines the legal tender aspects that must be taken into consideration when using TCO in public procurements, as well as the various ways in which to involve TCO throughout the tender process.

### Good luck in using TCO.

General information about tender processes.

[www.kfst.dk](http://www.kfst.dk)

Information and directions on using dialogue with industry.

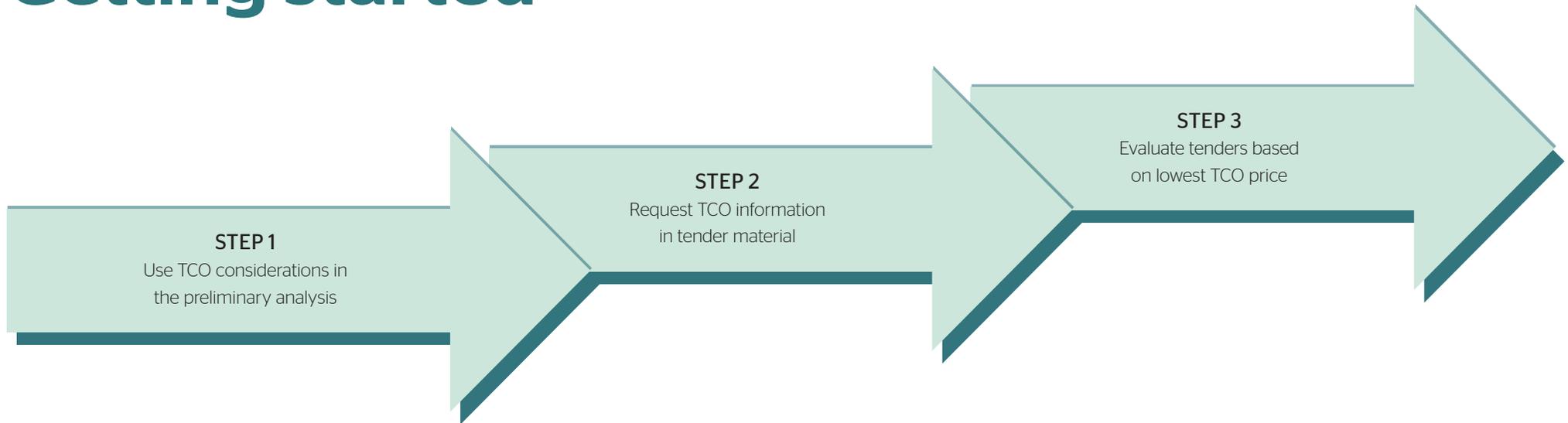
[www.kfst.dk](http://www.kfst.dk)

Inspiration in the form of how others have worked with TCO.

[www.ansvarligeindkob.dk](http://www.ansvarligeindkob.dk)

(Links in Danish only)

# Getting started



## 1. Use TCO considerations in the preliminary analysis

Before starting a tender process, it is helpful to launch a market dialogue. Find out what products exist on the market and which best meet the actual needs of your organisation. Only some selected, directly measurable costs are included in the TCO tool. Before drawing up the tender, it is therefore important to enter a dialogue with the market in relation to other cost factors and to establish what significance these could have for the resulting costs/savings of using various product types.

*Read more on page 4.*

## 2. Request TCO information in the tender material

When drawing up the tender material, it is important to ask for the TCO values used in the relevant TCO calculation. In order to be able to use the values provided by the tenderers, it is important that these are stated using the standards given in the TCO tool. The TCO tool itself must either be integrated in the tender lists or included in the tender material, so that the supplier knows how the total TCO price will be calculated and used as a basis for the evaluation.

*Read more on page 7.*

## 3. Evaluate tenders based on lowest TCO price

When the tenders are received, the TCO price is calculated, and subsequently used as the basis for evaluation. The TCO price replaces the pure purchase price irrespective of the weighting of the price in the tender evaluation.

*Read more on page 8.*

# Use TCO considerations in the preliminary analysis

# 1.

Before a tender process is started, it is helpful to initiate a market dialogue and to find out what product types exist on the market and how to best meet the needs of your organisation at the cheapest price in the long term. Calculation of TCO is relevant where costs relate to both procurement and subsequent use.

## Identify important cost drivers

Not all costs are included in the TCO tool itself, and are thus not used directly in the tender evaluation. We recommend including the significance of some of the costs in the preliminary analysis instead, where they can influence the selection of product type and thus which requirements are subsequently set out in the tender. In order to ensure market acceptance of the tools, an industry-acknowledged standard/method must exist on how costs are measured before this factor can be included in the tool. For example, product quality usually has some influence on the service life of the product, but in most cases it is not possible to ascertain different service lives between products. Standardised

methods rarely exist for ascertaining the service life of products in any given use situation, and it may therefore be difficult to incorporate this TCO factor in the tool. It is therefore important to consider the effect of different quality parameters on the overall costs during the preliminary analysis. These considerations can subsequently be used as requirements and criteria in the tender material and thereby continue to have an effect on the total TCO price.

In the preliminary analysis, it is relevant to consider the expenses/savings that may result from different product types. How might certain product types affect work procedures? What related savings will this result in for operations?

## Costs arising from lighting

Specific to lighting, it may be relevant to investigate the significance of the service life of various bulbs as well as the quality of the bulbs and how they affect the overall TCO. It is also important to consider whether it may be worthwhile investing in a lighting

control system. This depends on your lighting needs.

Compile all of the questions that are relevant in terms of TCO that may feature in a market dialogue and the needs analysis. The answers you find can be used as part of the decision basis that you use to select a product type and thus what you ultimately ask for in your invitation to tender. This will ensure that TCO considerations are integrated early on in the tendering process.

## Enter into dialogue with interested parties

It can be a good idea to involve the intended users and suppliers in these considerations. Use the needs analysis and the market dialogue as a decision-making basis for how TCO is to be involved in the tender process in question. See the Danish Competition and Consumer Authority's guidelines on opportunities for dialogue in tender processes [www.kfst.dk](http://www.kfst.dk) (in Danish only).

When selecting which factors you wish to include in your TCO consider-

ations, be pragmatic and make sure you only use significant factors that give a real picture covering the entire period of ownership.

## TCO factors

It may be relevant to ask about the following TCO factors in connection with the needs analysis and market dialogue:

- Purchase price
- Total installation costs
- Training/teaching/instruction
- Other initial one-off costs
- Operating costs for energy (fuel, propellant, electricity)
- Operating costs for use of related products (e.g. coffee, filters)
- Maintenance costs (service inspections, repairs)
- Time wastage when using the product
- Labour costs for maintenance of the product (cleaning etc.)
- Service life
- Licence/subscription
- Residual value/disposal price
- Insurance
- Repairs
- Leasing or renting
- Costs for training employees in use of the product type
- Costs from changing supplier
- Other transaction costs



## Important considerations when selecting lighting

There may be many hidden operating and maintenance costs associated with buying lighting. That is why it is important to investigate these costs before issuing the invitation to tender.

### Consider the minimum requirements

In connection with this, you might consider whether the various operating costs should be included in a TCO calculation used to evaluate tenders, or whether it would be better to factor in these costs by e.g. setting minimum requirements in the tender documents, requesting a service agreement or similar.

In the TCO tool itself, we have included the TCO factors that are deemed to be the most relevant for inclusion in an actual calculation. If your preliminary analysis identifies other relevant cost factors, these may be included in the form of (minimum) requirements in the invitation to tender or by actually changing the tool so that they are included.

### Adapt the TCO tool

The purchase of large lighting systems is often a complex business.

If, based on your initial considerations, you find out that there will be additional cost factors associated with the TCO tool, you may add them yourself.

There may for example be special conditions concerning the ownership and service of various parts of the system that mean that changes have to be made to the TCO tool.

### Determine the operating and maintenance costs for different solutions

When buying large lighting systems, it is also important to look at any differences in operating and maintenance costs, e.g. how often different fixture designs require cleaning and other types of service.

The TCO tool can be adapted at any time to the individual organisation's actual invitation to tender and the organisations requirements for inclusion of TCO factors. The tool may thus be extended by adding more TCO factors, if required.

### Consider the benefits of lighting control

There are a lot of intelligent and automatic lighting control options on the market. Investigate the market for solutions that will satisfy your specific needs, and roughly calculate the potential savings. Remember to say in the requirement specification that a running-in period for lighting control must also be budgeted for, so that after installation you can work with the supplier on fine-tuning the lighting and thus secure the expected savings.

It is particularly important that you consider the points in the green boxes in the case of TCO for lighting.

### Identify your needs

One area where clarification is important is the organisations lighting needs. The more precise the specification of needs, the greater the understanding you will have of the benefits and drawbacks of various forms of lighting control systems. If necessary, enter into a dialogue with the suppliers prior to issuing the invitation to tender. They will be able to help you identify your needs. You can also use the FABA lighting diagnosis tool to analyse the savings potential associated with various solutions.

[www.faba.dk](http://www.faba.dk) (in Danish only)

### Stipulate requirements for lumens per watt for bulbs and watts per square metre for lighting systems

These requirements will ensure an energy-efficient solution.

### Work out the cost of replacing bulbs/fixtures

There are considerable costs associated with replacing bulbs, and a higher price for a long service life is therefore usually money well spent. Roughly calculate the expected cost of replacing bulbs. For example, use the following parameters: estimated loss of earnings, employee hours for reporting faulty bulbs, the time taken by technical personnel to replace the bulb and overall transaction costs for the purchase.

## Important considerations when selecting lighting



Read more in the Danish Competition and Consumer Authority's guidelines on "Total Cost of Ownership in tender processes" in relation to involvement of TCO prior to the actual tender. [www.kfst.dk](http://www.kfst.dk) (In Danish only)

### Receiving further guidance and support

You can use the Danish Energy Agency's Purchase Guidelines and Checklist for energy-efficient design. [www.spareenergi.dk](http://www.spareenergi.dk)

Use the standards in the DS 700 series to set requirements for lighting, and check the applicable rules in the Building Regulations.

[www.bygningsreglementet.dk](http://www.bygningsreglementet.dk)

Also use the guidelines from the Danish Building Research Institute (219 and 220) concerning daylight and lighting control.

(Links in Danish only)

## Consider a performance based tender

As an alternative to using TCO calculations to calculate total costs for a product, you may want to consider a performance based tender.

In a performance base tender, the contracting entity does not prepare a detailed description of how the commission is to be filled, but instead sets out a number of performance based requirements (goals). The product, and any essential service provisions associated with the product, are therefore bought in as a collective service, allowing the contracting entity to hand over responsibility for ensuring low overall costs to the tenderers. You should note however that costs for electricity are not usually included in the tender price in the case of a performance based tender. In this case the TCO calculation can be used together with a performance based tender. See the guidelines from the Danish Competition and Consumer Authority concerning functional requirements in tenders.

[www.kfst.dk](http://www.kfst.dk) (In Danish only)

# Request TCO information in the tender material

## 2.

Once it has been decided which product solution is to be requested in the tender, TCO can be incorporated into the relevant tender in order to identify the supplier offering the product with the lowest overall costs.

Go through the following steps to complete and use the TCO tool:

The tool's **blue** area contains the information to be provided by the supplier, and thus the information to be requested in the tender material. It is important to stress that information is provided in accordance with the standards stated or equivalent standards. The information can be requested via individual tender lists. Tenderers can also enter the information in the tool itself.

In the **green** area, you enter your own information about usage/needs within your organisation. This lets tenderers know your specific needs and allows them to offer the product that meets your needs at the cheapest price.

The **brown** area is completed in advance with various qualified background data. If your organisation has more precise information, this can be used instead. The basis for the background data used can be found in the tool's help texts.

Remember to publish the evaluation method, including the partly-completed total costs tool together with the tender material in order to create transparency and consistent competition conditions.

Specific to bulbs, some invitations to tender may request many different types of products. In this case, it may be beneficial to perform the TCO calculation in your own tender lists. This can be done by copying the calculation method from the tools to your own tender lists.

### Supplement with energy and environmental requirements

It is recommended that you supplement the TCO-calculation with minimum requirements for energy consumption in order to avoid cheap but very power-hungry products.

There are also other environmental requirements that may be relevant to your tender.

Find, for example, guidelines for energy and environmental requirements in [EUs Green Public Procurement criteria's](#) or at:

[www.csr-indkob.dk](http://www.csr-indkob.dk) (in Danish only)

It can be considered to establish sanction options in the event the supplied products do not conform with the information provided by the tenderers in relation to TCO. Guidelines concerning sanction options can be found in the Danish Competition and Consumer Authority's guidelines on total costs from 2014.

[www.kfst.dk](http://www.kfst.dk) (in Danish only)

# Evaluate the tenders on the basis of lowest TCO price

# 3.

Once the tender period has ended, the submitted tenders must be evaluated on the basis of lowest TCO price.

The tool automatically calculates the TCO price for the product based on the details entered. If several tenders have been received, the details can be copied over into one tool if necessary, to allow comparison of the various tenders by means of graphs and bar charts at the bottom of the tool.

Select the tender which has the lowest TCO price overall according to the TCO tool. This allows the contract to be awarded based on the lowest overall costs of procurement of the specific product and the costs of using the product during its period of use.

When the tenders are evaluated, in addition to the TCO calculation, one or more qualitative criteria may also be established on which the tenders must compete. There will often be factors other than total costs that will have some significance in terms of overall evaluation of the tenders. This could be quality or user-friendliness, for example.

## Relevant links

*Click on the links to see more. Links in Danish only.*

### The Danish Energy Agency's procurement recommendations

[www.ens.dk](http://www.ens.dk)

### The tender portal - The responsible procurer

[www.csr-indkob.dk](http://www.csr-indkob.dk)

### Forum for sustainable procurements

[www.ansvarligeindkob.dk](http://www.ansvarligeindkob.dk)

### The Danish Competition and Consumer Authority's guidelines on functional requirements

[www.kfst.dk](http://www.kfst.dk)

### Danish Standard's DS 700 series

[www.ds.dk](http://www.ds.dk)

### Baltic GPP - Green Public Procurement

[www.balticgpp.eu](http://www.balticgpp.eu)

### The Danish Competition and Consumer Authority's guidelines on total costs in tender processes

[www.kfst.dk](http://www.kfst.dk)

### The Danish Competition and Consumer Authority's guidelines on opportunities for dialogue in tender processes

[www.kfst.dk](http://www.kfst.dk)

### The Danish Competition and Consumer Authority's guidelines on the tender process - Step by step

[www.kfst.dk](http://www.kfst.dk)

### The Danish Energy Agency's checklist for energy-efficient design - Lighting

[www.spareenergi.dk](http://www.spareenergi.dk)

### Guidelines from the Danish Building Research Institute

[www.sbi.dk](http://www.sbi.dk)

# Guide to the tool's functions

**1** The bulb's output is specified in accordance with measurement standards that comply with the European Commission's requirements in connection with energy labelling or similar.

The service life of the bulb is ascertained using the B50 L70 scale. L70 means that the service life is set at when the strength of the light (Lumen) is 70% of its original strength. B50 means that no more than 50% of the bulbs tested have less than 70% of the strength of light left.

In Background data, "Period for which TCO is to be calculated" must be stated. This is not always the same as the expected service life of the bulb, but it can be set higher in order to reflect the operating costs incurred to replace the bulb.

It is important that, before the supplier completes the blue field, the contracting entity decides whether a service agreement and leasing/renting are relevant to the issued invitation to tender. If they are not relevant, this must be made clear to the supplier, possibly by removing the relevant lines from the blue area.

**2** The green area must be completed by the contracting entity.

**3** The brown area contains background data that is completed in advance. It is possible however for the procurer to change the background data if more precise information is available.

**4** The grey area contains the results of the TCO calculation.

**5** TCO prices for the various tenders received are illustrated by means of two diagrams that show the gains. The graph shows whether, and if so when, one product pays for itself compared to the other. The bar chart shows distribution between operating costs and purchase costs in the specific calculation.

**6** Much of the information to be provided by the supplier requires the conditions for the data to be described in the tender material, e.g. in the requirements specification. If, for example, a price is requested for a service agreement, the requirements specification must state precisely what is to be included in this agreement.

**7** This tool does not necessarily give an accurate picture of TCO for an existing product compared with a new solution (product). If a comparison of this kind is required, it is recommended that a rough calculation be performed based on the TCO factors highlighted under "TCO PRIOR TO TENDER".

**8** The formula used to calculate the final TCO price is explained under a separate tab in the Excel TCO tool itself.

**9** If not all values are required to be included in the TCO calculation, these can be removed by deleting the lines from the tool in order to remove them from the formula. This might be the case if a service agreement were required, for example.

**10** Brief directions for how the various values can be gathered are found to the right of the tool.

**11** Click on the plus sign to add more product columns.

**12** The tool has a print tab and a tab containing a description of the calculation method.

**13** Tab with a simplified version of the tool. This version does not include calculation of current value and energy price increase. The calculation formula in this version is therefore simpler, and it will therefore be easier to add/remove factors or integrate the method into individual tender lists.

The screenshot shows the 'TCO tool for bid evaluation' interface. It is divided into several color-coded sections:
 

- Blue area (1):** Information about the product – provided by the tenderer. Includes fields for product name, involvement costs, operating costs, and lighting control options.
- Green area (2):** Information about use – provided by the contracting entity. Includes days of use per year, hours of use per day, and length of service agreement period.
- Brown area (3):** Background data – supplied by the contracting entity. Includes price of electricity, replacement factor with manual control, and replacement factor with automatic control.
- Grey area (4):** Result. Shows accumulated total costs, cost of purchase, cost of operation, and total TCO for two products.
- Grey area (5):** Accumulated total costs. A line graph showing the TCO for two products over time.
- Grey area (6):** TCO for the... A bar chart showing the distribution of costs for two products.
- Blue area (7):** Information about the product – provided by the tenderer (repeated).
- Green area (8):** Information about use – provided by the contracting entity (repeated).
- Brown area (9):** Background data – supplied by the contracting entity (repeated).
- Grey area (10):** Result (repeated).
- Grey area (11):** Accumulated total costs (repeated).
- Grey area (12):** TCO for the... (repeated).
- Blue area (13):** Information about the product – provided by the tenderer (repeated).

 On the right side, there are 'Directions for completing fields' with numbered callouts 10 and 11, providing instructions on how to use the tool and how to gather data.

# Background

## Background to the TCO tools

Further to the Danish government's strategy for intelligent public procurement, the Environmental Protection Agency has initiated the development of national tools for involving Total Cost of Ownership (TCO) in tenders within the public sector.

The Environmental Protection Agency has been in charge of development of this TCO tool. Development of the tools is qualified by an advisory group made up of representatives of National Procurement Ltd. Denmark, The Danish Building & Property Agency, The Confederation of Danish Industry, The Danish Energy Agency, Danish Regions, City of Copenhagen, Local Government Denmark, The Danish Competition and Consumer Authority, The Danish Construction

Association, the Agency for Modernisation, the Danish Ministry of Climate, Energy and Building, the Danish Chamber of Commerce, Central Denmark Region, the Danish Ministry of Business and Growth and the Environmental Protection Agency.

FORCE Technology, department of applied environmental assessment, acting as consultants to the Environmental Protection Agency, has been responsible for the development of the TCO tools and guidelines. Operate A/S and Responsible Procurement Excellence have also been involved in development as subcontractors.

## The industry's acceptance of the methods

During the development of the TCO tools for lighting, there has been an ongoing dialogue with the industry. In June 2014 an industry workshop was held at FORCE Technology in Lyngby, north of Copenhagen, at which the industry was able to provide input for development of the tools. Similarly, in November 2014 a consultation was held on the tools. The following enterprises took part in the workshop, or were involved in the development process in some other way: Dansk Center for Lys, FABA, Lightinglab/DOLL, Louis Poulsen A/S, Phillips Lighting, Solar Danmark, Energi Midt A/S, Thorn Lighting, Lemvigh-Müller, Fokus Lighting A/S, Flash Light A/S, Osram, Fagerhult, RIEGENS A/S. The industry has approved the method of calculation applied,

including the use of standards, and the industry has stated that they will submit tenders in procedures using the calculation in the TCO tool.

Comments from the industry  
It was noted that tenders for lighting systems can be made in many different ways and with many subcontractors, and this raises some challenges to using the tool. There are often numerous requirements and criteria for lighting, including quality of light, which are not included in the tool. These requirements and criteria should be addressed in the specification of requirements.

## Disclaimer

We wish to stress that the TCO tool and these directions contain material and information which is generally very extensive and complex. Although both guidelines and tools are updated continuously, we are unfortunately unable to guarantee that all information is fully updated at all times.

Specifically for these reasons we must renounce any potential liability for errors, omissions and insufficient updates that may be contained in information and analyses in the TCO tool, including in texts, diagrams and guidelines.

Liability for the content of websites to which references or links are provided, as well as material which has been explicitly produced by other parties rests solely with the stated author.

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