

Efficiency Calculator

Manual

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**Online-Tool for
calculations of possible savings
regarding investments for lighting installations**

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1 Introduction



The efficiency calculator is a tool to ascertain the **cost effectiveness of a lighting installation**.

It enables the user to compare up to 5 alternative solutions. The first one - in the left column - serves as the reference to which the further alternatives are compared. It may be an existing installation to be replaced or a new one to be evaluated. Therefore the efficiency calcula-

tor is suitable to calculate a refurbishment as well as a new creation.

All statements in this manual refer to a **sample calculation** of an **inroom** project with the calculation scheme "Indoor luminaires". Further calculation schemes (e. g. for public street lighting) are contained in further samples (see below).

Particular features are:

- comparing up to **five alternative solutions**,
- calculating **single rooms**,
- calculating large conglomerate **multi room projects**,
- **convenient input** of relevant parameters,
- automatic import of luminaires **technical data**,
- three "calculator settings" for varying complexity (see chapter 2, figure 2.1, as well as section 2.2),
- sample files, based on available calculation schemes,
- convenient "copy and paste" functionalities,
- examination of all **economic relevant results**,
- large assortment of **figures (see chapter 5)** of the results,
- export of an individual **pdf-report (see chapter 6)**,
- storage of **own calculations** in xml format file on a local data memory (see chapter 7),
- choice of 14 languages and 12 currencies.

Conformance to technical requirements is presupposed to be proofed by a separate lighting calculation. Only proper solutions should be compared. Lighting technical calculation is not a feature of the efficiency calculator.

The efficiency calculator is available on <https://www.trilux.com/effizienz-rechner>.

2 Configuration

The screenshot shows the TRILUX software interface for configuring a project. The interface is divided into several sections, each with a red circle and a number indicating a step in the configuration process:

- 1a**: TRILUX examples (dropdown menu)
- 2**: Calculator setting (dropdown menu)
- 1b**: Own projects (on local system) (upload button)
- 3**: Language, currency and country settings (dropdown menus)
- 5**: Project data (Project name, Project description)
- 6**: Project data (Date of creation)
- 4**: Project data (Logo)
- 8**: Spaces (list of spaces)
- 7**: Installation configuration (Lighting installation, Number of luminaire types)

Figure 2.1: Configuration of a project to be calculated

The efficiency calculator offers lots of options when creating a new project. The procedure

may consist of up to 8 steps as shown in figure 2.1.

2.1 Loading a project

1 a) As a first step a predefined **TRILUX sample** can be loaded. Various samples with different presets are available. They serve as illustrative material as well as starting points for own calculations. Particularly the applied calculation scheme is determined by the choice of the sample file. It can't be varied subsequently. It contains all needed parameters and

therefore the data structure of the project (see chapter 7).

b) Project data can be stored in xml-format (see chapter 7) and carried on a data memory or can be sent via email. Afterwards they can be edited by any person at any place (with access to the internet).

Uploading the project means

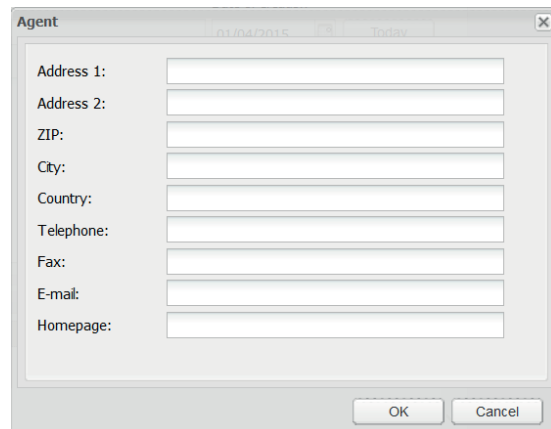
- selecting it in the opening window and then
- inserting the password (when necessary¹) and then

- uploading the file.

For frequent usage it is reasonable to create **own samples** on a local memory medium.

2.2 Input and display options

- The **calculator setting** defines how detailed the relevant parameters are displayed and taken into account. Three settings are available:
 - rapid:
Few entries for an overview (see chapter 3.4.1).
 - standard:
Significantly more entries. Some supporting functions regarding technical specifications of luminaires, lamps and control gears (see chapter 3.4.2).
 - expanded:
Additional entry fields for detailed recordings in individual cases (see chapter 3.4.3).
- The choice of the **language, currency and country** enables international adoption. The choice of the country produces specific TRILUX-samples (see above).
- A further option is to upload a personal **logo**. It will be displayed in the "pdf-report" (see chapter 6).
- The entry **„Project name"** defines the name of the storage data file (see chapter 7) and is displayed in the "pdf-report" (see chapter 6). Additional descriptions can be written into the field below to be taken over into the documentation.
- The **agent**'s name and the date of creation can be set. Additional personal data is possible (pencil, see figure 2.2).



The 'Agent' dialog box contains the following fields:

Address 1:	<input type="text"/>
Address 2:	<input type="text"/>
ZIP:	<input type="text"/>
City:	<input type="text"/>
Country:	<input type="text"/>
Telephone:	<input type="text"/>
Fax:	<input type="text"/>
E-mail:	<input type="text"/>
Homepage:	<input type="text"/>

Buttons: OK, Cancel

Figure 2.2: Personal data

2.3 Project structure

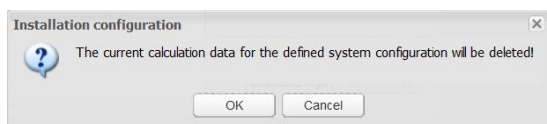


Figure 2.3: Warning to change the structure of the actual project. All included spaces would be affected.

- The structure of a project is defined with the **"Installation configuration"**. This determines the columns of the "calculation" screen (see also chapter 3.1). Therefore the structure of all spaces (calculations) included in one project is identical (see below).
 - Subsequent changes will affect all spaces (a warning appears, see figure 2.3).
 - The left column contains the reference installation. Its costs are defined as the reference costs (100%). It may refer to an old installation - regarding a reconstruction - or a new installation to compare the

¹A password that was set when storing the project has to be entered. It is not possible to reset a given password (see chapter 7).

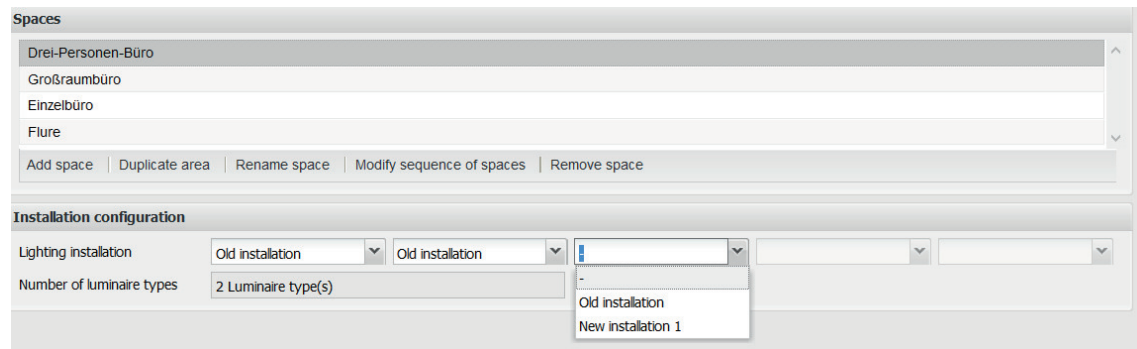


Figure 2.4: The “Installation configuration” is defined here. It will be preassigned for the calculation of all “Spaces” of the actual project. Therefore it has to be adjusted to the requirements of the most complex “Space”.

- economical effectiveness of different new installations.
 - The next column may contain an additional component (luminaire type) of the reference installation or a luminaire of an alternative installation (see figure 2.4).
 - Every further column can be defined as an additional component of the actual installation or as the first column of the next installation.
 - Maximum 5 columns can be defined.
- 8 Defining multiple **spaces** enables the combination of multiple installations into one project regarding the total economical efficiency. If there are fractions of an installation in a building, that can be seen as independent and separate units (for example a general lighting system and an accent lighting system) it may be reasonable to regard them as separate “spaces”. In case of a bigger project a skilful fragmentation of the spaces can be very helpful. Therefore
- different rooms may be defined as spaces,
 - groups of identical or similar rooms may be defined as one space,
 - identical or similar lighting components in one room or multiple rooms may be summed up to one space,
 - it must be possible to assign this “space” to the equivalent “space” (equivalent components) of the reference installation.
- Spaces can be defined, copied, renamed, re-sorted and deleted (see figure 2.4).
- The **Installation configuration** always is **identical for all spaces** of the actual project. Therefore it must be adjusted to the most complex space with the maximum number of components (see above).
- For instance the **deletion** of columns whilst working on a project affects the mentioned columns in all spaces. If columns are not needed in particular spaces they should be left empty.

3 Calculation

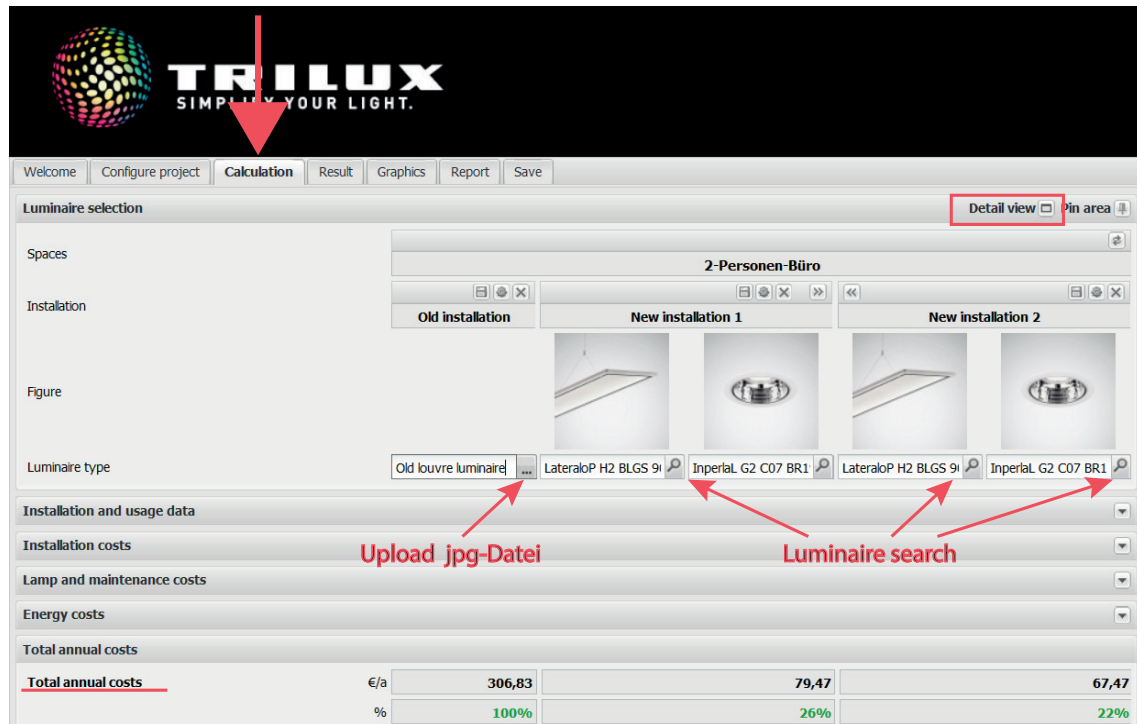


Figure 3.1: On the calculation page all cost parameters have to be entered. The total costs per annum are calculated for each group of parameters (installation costs, lamp and maintenance costs, energy costs)

On the screen “calculation” all relevant parameters have to be edited. They are processed instantly and the relative and absolute annual costs are displayed. The influence of the singular parameters to the overall result can easily be estimated via variation of their values.

Some comments can be given in separate fields. Additional fields “Installation description” and “Luminaire description” are available when the “Detail view” is opened (see figure 3.1).

3.1 Reference system and compared systems

The first (left) installation always has to be the **reference installation**, which defines the 100%-level of the total costs. In case of a reconstruction this is always the old installation.

The arrangement of the further columns should follow the intention of the projects creator. One intention can be to reduce the total costs from the left to the right to figure out the optimum of possible investments (see figure 3.1). The sequence of the installation can be

varied during the process (see chapter 3.5.7, “Copy and paste functionalities”).

Remark: As only the aspects of the costs can be displayed via the efficiency calculator it is necessary to make sure via additional documentations that the quality aspects are also followed. It should be presupposed that the quality of all installations is at least on par with the reference level.

3.2 Luminaire type

The definition of the installations to be compared starts with the choice of the luminaire type. The efficiency calculator provides some functionalities to support the user in respect of the accuracy of the technical data.

- Luminaires in a new installation can be chosen from the TRILUX online catalogue via the **Luminaire search** (see figure 3.2). All actual TRILUX products are available. By the choice of the luminaire all relevant technical data¹,

a product picture and the complete product name are transferred (see figure 3.1).

- Luminaires not contained in the TRILUX online catalogue can be edited manually.
- Luminaires of the **“old installation”** generally are not part of the TRILUX online catalogue. Therefore their names have to be edited manually. A picture can be inserted by upload if it is available in jpg format (see figure 3.1).

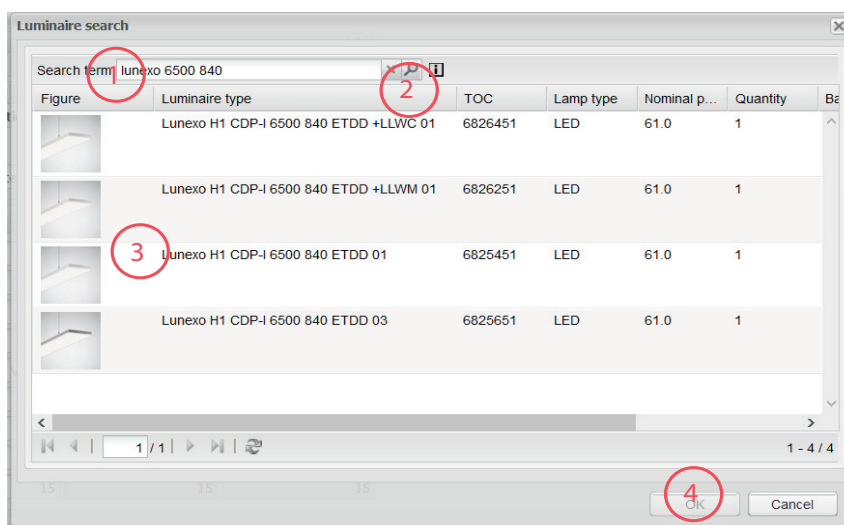


Figure 3.2: Luminaire search in four steps:
- Entry of a character string (parts of the product name or TOC number)
- activate search
- choice of a matching result
- confirm by OK

¹The technical data are transferred once at the time of the creation of the calculation. They will not be updated automatically. In case of a reuse of a given calculation file (upload in xml format) it may be useful to restart the “luminaire search” for a refresh of the data.

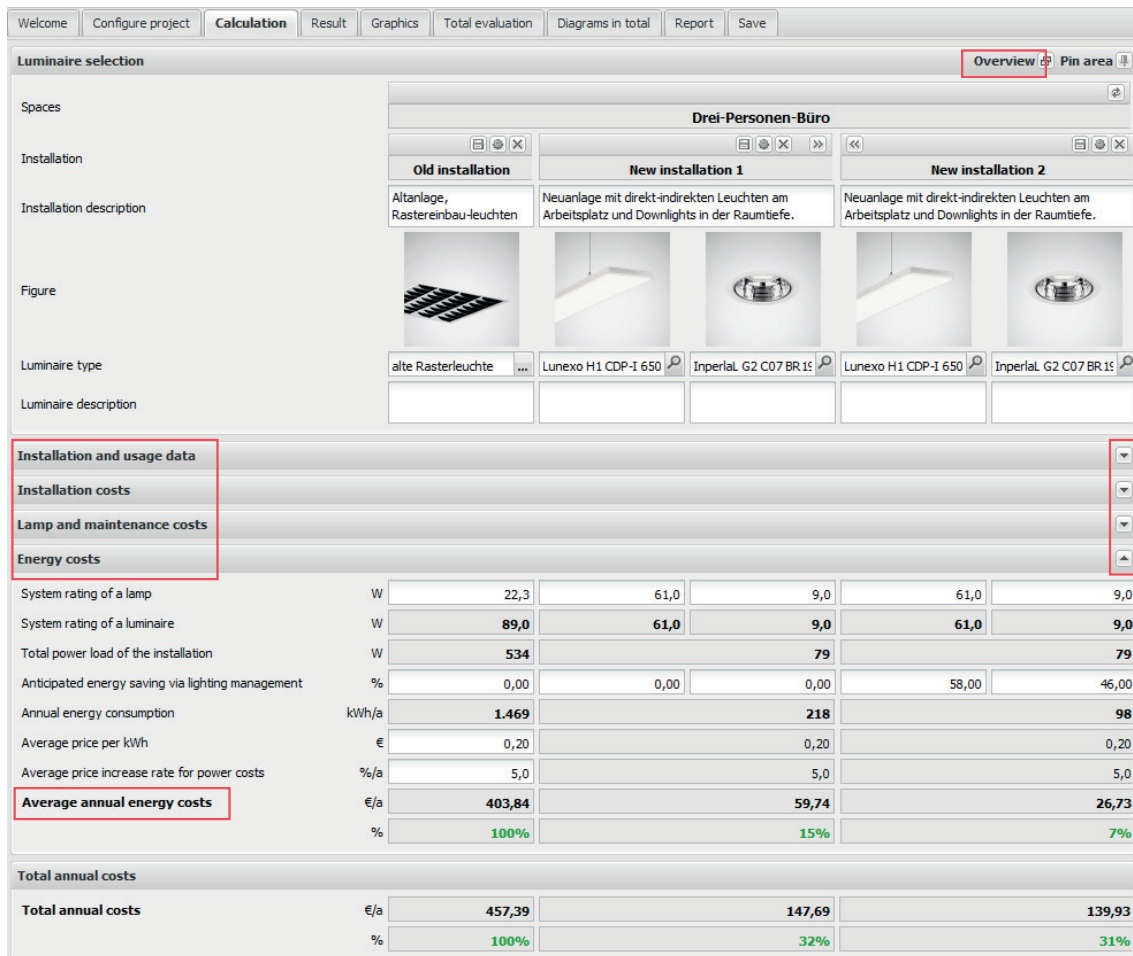


Figure 3.3: Cost categories can be folded in and out. The luminaire selection can be fixed as a headline.

3.3 Usage data and cost categories

An evaluation of the cost efficiency of a lighting installation means to consider

- the installation costs,
- the lamp and maintenance costs and
- the energy costs.

with respect to

- the installation and usage data.

According to this the data entry fields are separated into further **four groups**, that can be **folded in and out** during development of the calculation (see figure 3.3). The preceded "Luminaire selection" can be fixed as a headline

(see figure 3.3), to keep it visible during the whole process.

The relevant parameters have to be edited in the **white coloured fields**. The content of the **grey coloured fields** is calculated or transmitted from the given entries.

At the end of each cost category appears a summarising field „ \sum Average annual ...costs" (see figure 3.3). Here the costs are summed up for the whole "Anticipated service life of the lighting installation" including a price increase and interest rate, when indicated. The result is divided by the number of years of the "Anticipated service life of the lighting installation".

3.4 Calculator settings

For each cost category several factors are relevant. They may have more or less influence on the result in individual cases. Therefore it is reasonable, to offer a detailed recording of the influencing variables in case of necessity.

On the other hand too many details sometimes constrain the concentration on the essential.

For this reason the efficiency calculator distinguishes between three calculator settings:

- rapid,
- standard,
- expanded.

The calculator setting affects the **number of entry fields** for the cost categories.

At any time it is possible to **switch between calculator settings** during the processing of the project. This means:

- From the start with a basic concept of an approximate evaluation (rapid mode) a detailed calculation can finally be made up (expanded mode).
- Although a complex and detailed calculation is already done (expanded mode) a reduced display of a few parameters for an overview can be selected (rapid mode).

For each calculation setting the displayed result (only) represents the actually activated parameters.

3.4.1 Calculator setting „rapid”

This calculator setting generates a very short entry template. It can be displayed completely on a computer screen with standard resolution (see figure 3.4).

With 5 columns in use the maximum of 36 entry fields have to be filled.

The displayed result is calculated with just basic parameters (see chapter 6). Lamp and maintenance costs are neglected as well as cost increases.

This calculator setting is therefore suitable for a **short overview**.

3.4.2 Calculator setting „standard”

This calculator setting generates a more detailed entry template than “rapid” with additional parameters. Also included are lamp costs, maintenance costs and cost increases to ensure that the result is of satisfying accuracy in the most cases.

Further on there are **supporting functions** given with this template, for example helping to identify the energy data of the old luminaires. Wide spread combinations of lamps and control gears can be configured and the resulting power load is taken from a data base (see figure 3.5) to calculate the energy consumption.

3.4.3 Calculator setting „expanded”

Some additional entries are offered to cover individual cases. A detailed description follows.

Luminaire selection

Spaces: **Drei-Personen-Büro**

Installation: Old installation, New installation 1, New installation 2

Figure: [Images of luminaires]

Luminaire type: alte Rasterleuchte, Lunexo H1 CDP-1 65, R19 1000-840 ET 01, Lunexo H1 CDP-1 65, InperiaL G2 C07 BR 1

Installation and usage data

Number of luminaires according to photometric planning	pcs.	6	1	2	1	2
Number of lamps per luminaire	pcs.	4	1	1	1	1
Number of operating hours (annually)	hours/a	2.750	2.750	2.750	2.750	2.750
Anticipated service life of the lighting installation	years	15	15	15	15	15

Installation costs

Price of one luminaire	€	0,00	800,00	180,00	1.300,00	220,00
Price of lighting management	€	0,00	0,00	0,00	0,00	0,00
Total investment	€	0,00	1.160,00	1.160,00	1.300,00	1.740,00
Annual system costs over the service life	€/a	0,00	77,33	77,33	77,33	116,00

Energy costs

System rating of a lamp	W	22,3	61,0	9,0	61,0	9,0
System rating of a luminaire	W	89,0	61,0	9,0	61,0	9,0
Anticipated energy saving via lighting management	%	0,00	0,00	0,00	58,00	46,00
Annual energy consumption	kWh/a	1.469	218	218	218	98
Average price per kWh	€	0,23	0,23	0,23	0,23	0,23
Average annual energy costs	€/a	337,76	49,97	49,97	49,97	22,35

Total annual costs

Total annual costs	€/a	337,76	127,30	127,30	127,30	138,35
	%	100%	38%	38%	38%	41%

Figure 3.4: Just few entries with calculator setting „rapid”

3.5 Editing

All three calculator settings (templates) contain **white fields** as well as **grey fields**. The white fields are to be edited and the grey fields display resulting parameters.

The tables 3.1 to 3.5 in the following chapters will show, which data belong to which entry fields and in which calculator setting they are available.

To fill the white entry fields most values of the parameters have to be determined and edited by the user of the program. This particularly affects the installation data, usage data, prices and price increases. They should be re-

quested from the prospective user or owner of the lighting installation.

For the entry of technical data the efficiency calculator offers several support functions.

- For TRILUX luminaires in the actual online catalogue all relevant technical data is imported from the catalogue (see chapter 3.2).
- For other luminaires - e.g. for stock installations - the lamp and control gear data and resulting system loads are given in a lamp data base.

Therefore the user of the calculator does not need any expert knowledge about technical data.

Figure 3.5: Choose the lamp and the type of ballast via drop down menu with calculator setting „standard“ and „expanded“. Technical data is given in a data base.

Automatic entries (blue letters for manual editing)

Installation and usage data						
Number of luminaires according to photometric planning	pcs.	4	1	2	1	2
Number of lamps per luminaire	pcs.	1	1	1	1	1
Number of operating hours (annually)	hours/a	2,250	2,250	1,750	2,250	1,750
Anticipated service life of the lighting installation	years	15		15		15
Installation costs						
Energy costs						
System rating of a lamp	W	66.0	48.0	9.0	48.0	9.0
System rating of a luminaire	W	66.0	48.0	9.0	48.0	9.0

Figure 3.6: Some automatically generated entries can be overwritten (edited manually) and appear further on in blue letters.

Imported technical data values and some calculated values can be **replaced** - when needed - by a manual entry. In this case they are displayed in **blue letters** on the screen (but not in the pdf-report, see chapter 6). This emphasis serves as a reminder because these parameters are now fixed to the edited values. They will not be actualised when the original source of the automatic transmission is changed. The automatic function is therefore disabled. It can

be re-enabled by deletion of the content and pressing “Enter” on the keyboard.

Also in the row “Number of operating hours (annually)” a manual replacement is possible from the second to the fifth column (see figure 3.6).

As needed all overtyped entry fields can be reset to automatic function (in one space or over the complete project, see figure 3.7²).

²This often is useful when a given calculation (local xml-file) serves as the basis for a new project. Also a refresh of the technical data should be done by new upload via the luminaire selection field (see footnote in chapter 3.2).

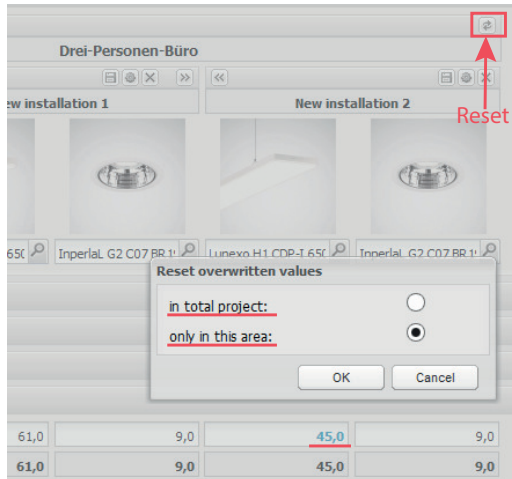


Figure 3.7: Manually edited (deactivated) automatic entries appear in blue letters. They can be reset (re-activated).

3.5.1 Luminaire selection (1st block of entries)

In this first block of entries the names of the space and installations, as defined according to chapter 2.3, are displayed and the utilised luminaires have to be specified.

- 1 **Spaces:** The name of the space - as defined on the page "Configure project" - is displayed.
- 2 **Installation:** As defined on the page "Configure project".
- 3 **Installation description:** Text entry, will be displayed in the pdf-report. Only visible in the "Detail view" of the entry template (see figure 3.3).
- 4 **Figure:** A (product-) picture in jpg format can be uploaded and displayed for an old in-

stallation. It is also shown in the pdf-report. In case of a new installation a product picture is inserted via the luminaire selection (see figure 3.2).

- 5 **Luminaire type:** This field can be edited manually. During data import via luminaire selection (see figure 3.2) the complete name of the luminaire is transmitted. It can be overwritten subsequently, while the product picture will be removed, but the technical data will remain.
- 6 **Luminaire description:** Text entry, will be displayed in the pdf-report. Only visible in the "Detail view" of the entry template (see figure 3.3).

Nr.	row name	data type	r s e
1	Space	from "Configure project"	x x x
2	Installation	from "Configure project"	x x x
3	Installation description	edited string (Detail view)	x x x
4	Figure	Upload / OPC import	x x x
5	Luminaire type	edited string / OPC import	x x x
6	Luminaire description	edited string (Detail view)	x x x

Table 3.1: Entry fields, their data types and their appearance in calculator settings rapid, standard and expanded. **OPC** = Online Product Catalogue.

3.5.2 Installation and usage data (2nd block)

- 7 **Number of luminaires according to photometric planning:** The necessary number of

luminaires has to be determined via a separate photometric calculation.

Nr.	row name	data type	r s e
7	Number of luminaires according to photometric planning	edited value	x x x
8	Lamp type	Choice / OPC import	x x
9	Nominal lamp rating	Choice / OPC import	x x
10	Number of lamps per luminaire	Auswahl / OPK-Import	x x x
11	Type of ballast	Auswahl / OPK-Import	x x
12	Number of operating hours (daily)	edited value, transmitted	x x
13	Number of operating hours (daily) / night tariff	edited value, transmitted	x x x
14	Number of operating days (annually)	edited value, transmitted	x x
15	Number of operating hours (annually)	edited value, (transmitted, typeover mode)	x x x
16	Number of operating hours (annually) / night tariff	edited value, (transmitted, typeover mode)	x
17	Number of operating hours (annually) / normal tariff	calculated	x
18	Anticipated service life of the lighting installation	edited value, transmitted	x x x
19	CO ₂ emission in g per kWh	edited value, transmitted	x
20	Illumination area	edited value, transmitted	x

Table 3.2: Entry fields, their data types and their appearance in calculator settings **rapid**, **standard** and **expanded**. **OPC** = Online Product Catalogue.

- 8 Lamp type:** For TRILUX luminaires the lamp type is transmitted from the online catalogue. Further on a drop-down menu offers several commercially available lamp types. For each lamp type a data base provides a selection of available versions, specified by the nominal lamp rating.
- 9 Nominal lamp rating:** Commercially available nominal lamp ratings (specifications of the lamp supplier) are offered, depending on the chosen lamp type. For LED no "Nominal lamp rating" is defined as the regarded LED light sources are integral components of luminaires (the specific power load of a luminaire is transmitted to row 43 via "Luminaire selection", see below).
- 10 Number of lamps per luminaire:** Usual configurations are available for each lamp. For LED the value of this parameter is set to 1 as the regarded LED light sources are an integral unit in a luminaire. Therefore no "System rating of a lamp" (see chapter 3.5.5) can be determined.
- 11 Type of ballast:** Choice of a commercially available control gear to operate the chosen lamp. Provided that specifications of the entries 8 to 11 are complete, the "System rating of a lamp" is transmitted to the automatic entry field in the actual column in row 43.
- 12 Number of operating hours (daily):** Value edited in the first column (white) and transmitted to the following (grey). It is multiplied by the value of "Number of operating days (annually)", to calculate the value "Number of operating hours (annually)" (see below). Useful hints referring to different lighting applications can be found in table 8.1.
- 13 Number of operating hours (annually) / night tariff:** This value is needed to calculate energy costs when a "Average commodity price per kWh / night tariff" is given in row 52. It is included in "Number of operating hours (daily)".
- 14 Number of operating days (annually):** see row 12.
- 15 Number of operating hours (annually):** row 12 by row 14.
- First column: Overtyping results in an automatic modification (recalculation) of the value in row 12. This value is transmitted to the following columns.
 - Second column (and further): The transmitted value can be overtyped. On the screen it appears in blue colour. The automatic transmission from the first column is deactivated.
- Advice:** To determine the "Number of operating hours (annually)" the user profiles of the German standard **DIN V 18599-10** can be helpful (see table 8.1).
- 16 Number of operating hours (annually) / night tariff:** Row 13 by row 14.
- 17 Number of operating hours (annually) / normal tariff :** Difference of row 15 and row 16.

- 18 **Anticipated service life of the lighting installation:** The time basis (in years) for the calculation of the economic efficiency of the installations. All costs are calculated in respect of this time basis.
- 19 **CO₂ emission in g per kWh:** Factor to calculate the CO₂ emission caused by the gen-

eration of the needed electricity. Regional (national) differences should be taken into account depending on the locally used technology.

- 20 **Illumination area:** To calculate the “Result per m²” (see chapter 6).

3.5.3 Installation costs (1st block)

- 21 **Price of one luminaire:** Manual entry. It is **removed (set to zero)** when a new luminaire is loaded from the catalogue.
- 22 **Price of lighting management:** Entry for the total costs of all components (not referencing to the number of systems).
- 23 **Costs for mounting and connecting a luminaire:** Manual entry.
- 24 **Installation costs for lighting management:** Costs for mounting and initiation, see also row 22.
- 25 **Additional costs (e.g. installation technology):** An additional amount, not referencing to the number of luminaires.
- 26 **Comment on additional costs:** Text input.
- 27 **Maintenance costs for existing luminaires:** Only old installation. Maintenance costs as an investment to continue operation, when indicated.
- 28 **Total investment:** Sum of all costs to raise an operable installation, also for the old installation when indicated.
- 29 **Percentage of the annual straight-line depreciation:** 100 / „Anticipated service life of the lighting installation”.
- 30 **Interest rate for the capital employed (debt service).**
- 31 **Annual system costs over the service life:** The costs of the investment including the interest payments over the service life, divided by the service life (in years). The row below indicates the relative value. The reference installation (100%) is always the left one. In case of an old installation with no “Maintenance costs for existing luminaires” (Investment = 0,00 €) as reference the relative value is not defined and set to 0 %.

Nr.	row name	data type	r s e
21	Price of one luminaire	edited value	x x x
22	Price of lighting management	edited value	x x x
23	Costs for mounting and connecting a luminaire	edited value	x x
24	Installation costs for lighting management	edited value	x x
25	Additional costs (e.g. installation technology)	edited value	x
26	Comment on additional costs	edited text	x
27	Maintenance costs for existing luminaires	edited value	x x
28	Total investment	calculated	x x x
29	Percentage of the annual straight-line depreciation	calculated	x x
30	Interest rate for the capital employed (debt service)	edited value, transmitted	x x
31	Annual system costs over the service life	calculated	x x x
	%	calculated	x x

Table 3.3: Entry fields, their data types and their appearance in calculator settings rapid, standard and expanded.

3.5.4 Lamp and maintenance costs (4th block)

- 32 **Total number of lamp:** “Number of luminaires..” · “Number of lamps per luminaire”.
- 33 **Price of a lamp:** Manual entry.
- 34 **Relamping costs per luminaire:** Depending of the complexity of necessary work.
- 35 **Price of a starter:** Manual entry.
- 36 **Lamp service life:** Values of the service life time for commercially available lamp types are taken from a data base. They are depending on the choice of lamp type and control gear. There is no preset value for the lamp type “LED”. For LED luminaires from the TRILUX online catalogue a service life time of 50.000h is preset and can be over-typed when indicated. Specific values can be taken from the product documentation in the online catalogue.
- 37 **Lamps included in delivery:** Preset is “yes” for LED luminaires from the online catalogue. Otherwise “no” is preset.
- 38 **Number of replacements during lifetime:** = $\frac{\text{row 16} \cdot \text{row 18}}{\text{row 36}}$, rounded down to a whole number.
- 39 **Number of additional maintenance processes during lifetime:** Additional cleaning etc. when indicated.
- 40 **Costs for maintenance without relamping per luminaire:** Manual entry.
- 41 **Annual price increase rate for lamp costs:** Manual entry.
- 42 **∑ Average annual lamp/maintenance costs:** Lamp and maintenance costs are summed up over the service life time and divided by the service life time (in years). Continuously upcoming costs are anticipated for simplification although maintenance is done in time intervals. Relative values refer to the left column (100 %) as far as not zero (see also row 31).

Nr.	row name	data type	r s e
32	Total number of lamps	calculated	x x
33	Price of a lamp	edited value	x x
34	Relamping costs per luminaire	edited value	x x
35	Price of a starter	edited value	x x
36	Lamp service life	lamp data or catalogue data, typeover mode	x x
37	Lamps included in delivery	choice / catalogue data	x x
38	Number of replacements during lifetime	calculated	x x
39	Number of additional maintenance processes during lifetime	edited value	x
40	Costs for maintenance without relamping per luminaire	edited value	x
41	Annual price increase rate for lamp costs	edited value transmitted	x x
42	∑ Average annual lamp/maintenance costs	calculated	x x

Table 3.4: Entry fields, their data types and their appearance in calculator settings rapid, standard and expanded.

3.5.5 Energy costs (5th block)

Nr.	row name	data type	r s e
43	System rating of a lamp	lamp data or catalogue data, typeover mode	x x x
44	System rating of a luminaire	calculated	x x x
45	Total power load of the installation	calculated	x x
46	Series compensation	choice	x
47	Anticipated energy saving via lighting management	edited value	x x x
48	Annual energy consumption	calculated	x
49	Energy requirement for air-conditioning	edited value	x
50	Annual energy consumption	calculated	x x x
51	Average price per kWh	edited value transmitted	x x x
52	Average commodity price per kWh / night tariff	edited value transmitted	x
53	Average price increase rate for power costs	edited value transmitted	x x
54	Annual provisioning costs per kW	edited value transmitted	x
55	Yearly supply costs	calculated, überschreibbar	x
56	Average annual energy costs	calculated	x x x
	%	calculated	x x
Total annual costs			
56	Total annual costs	calculated	x x x
	%	calculated	x x x

Table 3.5: Entry fields, their data types and their appearance in calculator settings rapid, standard and expanded.

- 43 **System rating of a lamp** (including gear): Taken from the lamp data base (see rows 8 to 11) or the online catalogue. Overtyping is possible. Overtyped values appear in blue coloured numbers to indicate that the data import from the lamp data base and online catalogue is deactivated.
- 44 **System rating of a luminaire** = row 8 · row 43.
- 45 **Total power load of the installation** = row 7 · row 44
- 46 **Series compensation:** Traditional power factor correction in Germany. Accepted until 2005. It induced an increased power consumption (System rating of a luminaire).
- 47 **Anticipated energy saving via lighting management:** This value should be determined with respect to the users statement. Helpful advice can be found in the German standard DIN V 18599.
- 48 **Annual energy consumption:** intermediate result with the calculator setting "expanded".
- 49 **Energy requirement for air-conditioning:** The power consumption for lighting can be assumed as an additional power (warmth) input into the building. A relative value (percentage) of this has to be estimated as an additional power requirement for air conditioning when indicated. It is depending on utilisation of the building, the type of the air condition installation, and the climate. The exact value may be determined by an expert.
- 50 **Annual energy consumption:** Is to be calculated by the "Total power load of the installation" plus resulting power for air conditioning and then multiplied by "Number of operating hours (annually)".
- 51 **Average price per kWh:** Basic unit for energy costs.
- 52 **Average commodity price per kWh / night tariff:** See row 16.
- 53 **Average price increase rate for power costs:** The increase of energy costs is assumed as constant over the service life time.

- 54 **Annual provisioning costs per kW:** Annual costs depending on the connected wattage may be stipulated from large consumers. The price per kW can be entered here³.
- 55 **Yearly supply costs:** Row 45 multiplied by row 54. Overtyping is possible. Overtyped values appear in blue coloured numbers to

indicate that the data import from the lamp data base and online catalogue is deactivated, see figure 3.8).

- 56 **Average annual energy costs:** Energy costs are summed up over the service life time and divided by the service life time (in years).

Annual provisioning costs per kW	CHF	88.00	88.00
Yearly supply costs <input type="text"/>	CHF	604.03	216.22
Average annual energy costs	CHF/a	4,379.23	1,567.57

Annual provisioning costs per kW	CHF	0.00	0.00
Yearly supply costs <input type="text"/>	CHF	600.00	200.00
Average annual energy costs	CHF/a	4,375.20	1,551.35

Figure 3.8: To calculate the “Yearly supply costs” the “Annual provisioning costs per kW” can be inserted. The calculated “Yearly supply costs” can be overtyped (blue).

3.5.6 Total annual costs

- 57 **Total annual costs:** Sum of the annual contributions of all cost categories.

³The total load of the lighting installation is to be taken into account when indicated.

3.5.7 Copy and paste functionality

The efficiency calculator provides some copy and paste functionalities to enable efficient editing of actual projects. A convenient option is to copy a whole space in the “Configure project” view (see also chapter 2). After opening the space there are further options in the “Calculation” view. “Installations” (columns) can be copied to the clipboard and transferred to neighboured “Installations” in the same space. But they can also be transferred to an “Installation” in another space or another project.

This has to be expected:

- The **columns** to transfer to have to be inserted before transfer. This has to be done in

the view “**Configure project**” (see also chapter 2).

- Only data of the same **kind of “Installation”** can be transferred (New/New or Old/Old).
- If installations with **multiple columns** are transferred to installation with less columns the spill-over columns on the right will be lost.
- **Neighboured** installations can be **swapped**, if their structure is identical.
- If the calculator is opened repeatedly, **several projects** can be edited at the same time. Installations can be **transferred** between the projects.

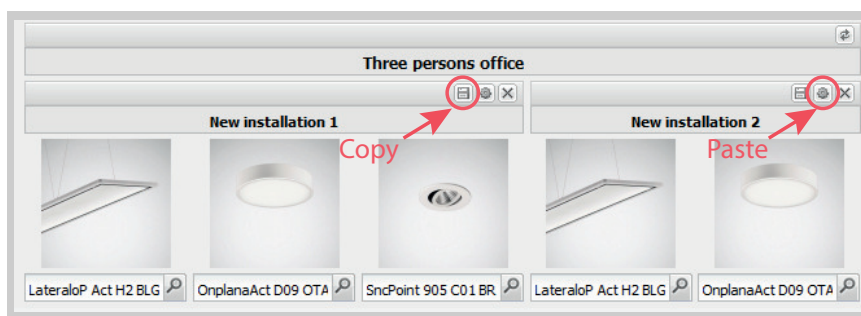


Figure 3.9: If installations with multiple columns are transferred to installation with less columns the spill-over columns on the right will be lost.

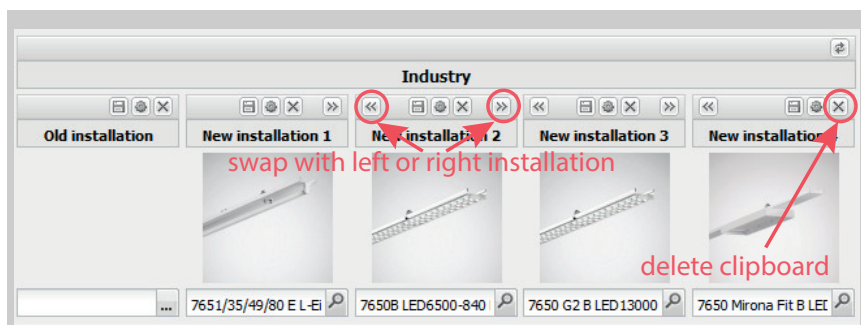


Figure 3.10: Only data of the same kind of “Installation” can be swapped or transferred.

4 Result

The view "Result" displays all economical implications as an overview. This view is mainly self-explanatory. Some advice is given by info buttons to open windows for explanations.

The "Result" can be calculated for the actual space in work or the whole project. Both can be embedded in the pdf-documentation.

The "Result" always refers to the actual "Calculator setting". Only the visible entry fields

are taken into account in the "Calculation" and "Result". In particular cases the calculated results of the same project can differ widely depending on the chosen "Calculator setting". The "standard" setting may e.g. produce a far more economic result than the "rapid" setting, if the lamp and maintenance costs are significant.

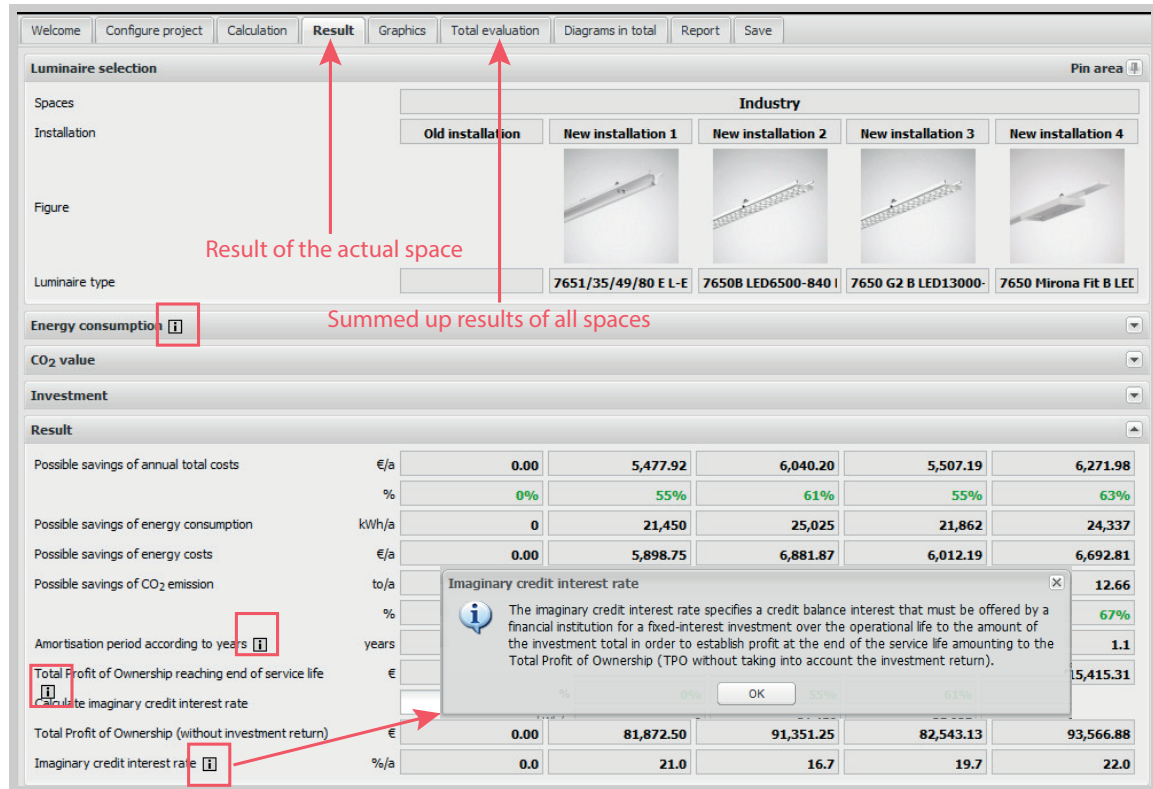


Figure 4.1: "Result" of one space.

5 Graphics

The efficiency calculator offers vertical-bar diagrams (see figure 5.1) and trend diagrams (see figure 5.2) to display the calculated results.

They can be adopted to the pdf-report (see chapter 6).

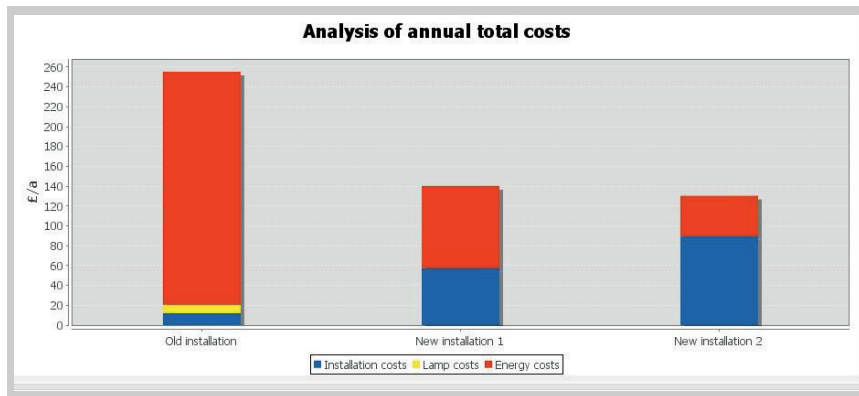


Figure 5.1: Display of the quota of the cost categories - Installation costs (blue), Lamp- and maintenance costs (yellow), Energy costs (red) - in the average, annual total costs (see chapter 3.3).

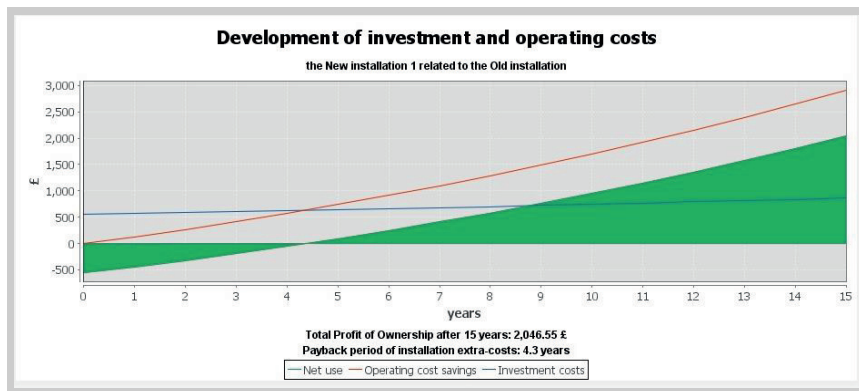


Figure 5.2: Display showing the costs over the lifetime and the resultant benefit: In a profitable case the investment (negative value at the beginning) will be compensated (point of amortization) during the service life time. The further development will produce a benefit. The amount of benefit is called "Total Profit of Ownership" (TPO, value at the end of the service life).

6 Report

The efficiency calculator offers the configuration and compilation of a comprehensive pdf document (see figure 6.1). A convenient trans-

mission via email enables the user use provide well structured information to his customer.



Figure 6.1: pdf-report:

- Report output as a pdf file
- Title page with exchangeable (individual) logo
- including the agents personal data and a project description
- Documentation of all calculated parameters
- Output of the results in tables
- and in figures
- separate calculations of up to 10 spaces (rooms, installations)
- overall calculation of the whole project (e.g. building)

Office with 3 windows
Calculation

Luminaire selection

Installation	Old installation	New installation 1		New installation 2	
Installation description	Old system with similar recessed luminaires.	New system with direct/indirect task lighting and downlights situated deeper in the room.		As new system 2, however with Light Management in a Master Luminaire.	
Figure					
Luminaire type	Enterio	Luceo H UXP-S 235/49 E 03	Inperial. G2 C07 BR19 1000-840 ET 01	Luceo H UXP-S 235/49 EDD 03	Inperial. G2 C07 BR19 1000-840 ETDD 01
Luminaire description		version E	version E	version EDD	version EDD

Installation and usage data

	Old installation	New installation 1	New installation 1	New installation 2	New installation 2
Number of luminaires according to photometric planning	pcs.	6	2	2	2
Number of lamps per luminaire	pcs.	1	2	1	2
Number of operating hours (annually)	hours/a	2,250	2,250	2,250	2,250
Anticipated service life of the lighting installation	years	15		15	15

Installation costs

	Old installation	New installation 1	New installation 1	New installation 2	New installation 2
Price of one luminaire	£	0.00	236.00	90.00	286.00
Price of lighting management	£	0.00		0.00	190.00
Total investment	£	0.00		652.00	1,036.00
Luminaire costs + costs for lighting management					
Annual system costs over the service life	£/a	0.00		43.47	69.07

Energy costs

	Old installation	New installation 1	New installation 1	New installation 2	New installation 2
System rating of a lamp	W	71.0	39.0	9.0	39.0
System rating of a luminaire	W	71.0	78.0	9.0	78.0
Anticipated energy saving via lighting management	%	0.00	0.00	0.00	55.00
Annual energy consumption	kWh/a	959		392	185
Average price per kWh	£	0.15		0.15	0.15
Average annual energy costs	£/a	143.78		58.73	27.64

Total annual costs

	Old installation	New installation 1	New installation 1	New installation 2	New installation 2
Total annual costs	£/a	143.78		102.20	96.71
	%	100%		71%	67%

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Figure 6.2: Page of a pdf report. Interactive link (blue) to the luminaires data sheet in the online catalogue.

The configuration of the content of the produced pdf file is done via mark boxes in the

“Report” view of the efficiency calculator (see figure 6.3).

Print options:

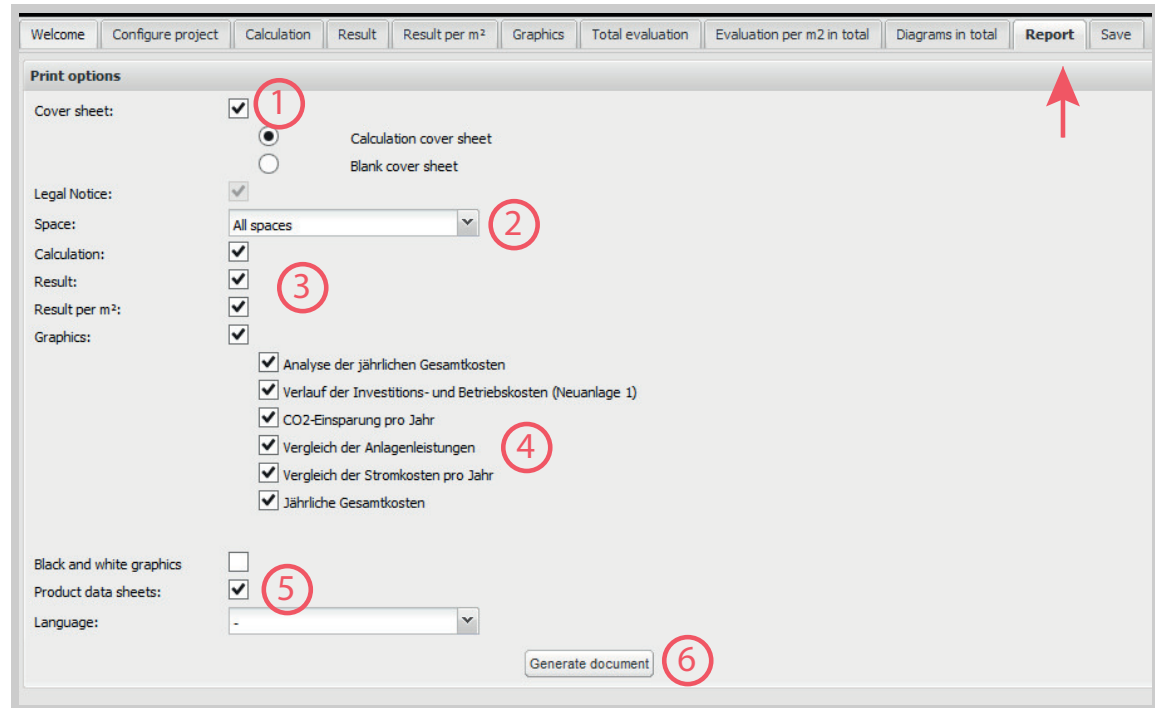


Figure 6.3: Selection of the content of the pdf report

1 Title page:

- On the pdf title page general information (as project name, date etc.) is displayed. Also the applied calculation scheme is specified here. It is loaded with the project data file (see chapter 2.1).
- Also detailed information about the agent and project and an individual logo can be included (see chapter 2). For the logo file formats of jpg, png and gif are compatible. The maximum size is 800pt x 400pt with a resolution of 200 dpi. This ends up in the figures size of ca. 10cm x 5cm. The logo may be displayed incompletely on the screen but nevertheless it should be correct in the pdf-file. You should check this to be sure.

2 The coverage of the pdf report can be defined:

- A single space can be reported.
- All spaces can be documented as single spaces plus a total view (summing up).
- A total view can be reported without considering the single spaces.

In the total view the documentation of the calculation (of the single spaces) is dropped.

3 The documentation of the calculation, the results and the diagrams can be added to the pdf file.

4 A selection of figures to deliver into the pdf documentation can be defined.¹

5 Data sheets of all luminaires used in the project can be exported from the online catalogue to a zip file (also including the pdf documentation)².

6 At last the pdf document can be generated (see footnote).

¹for large projects (≥ 10 spaces) it may occur, that no pdf processing is possible. In these cases the selection of figures should be reduced.

²This ensures the availability of the luminaires actual technical data at the time of calculation. Alternatively a link to the online catalogue (see the blue letters in figure 6.2) can be used to display the data sheet.

7 Save

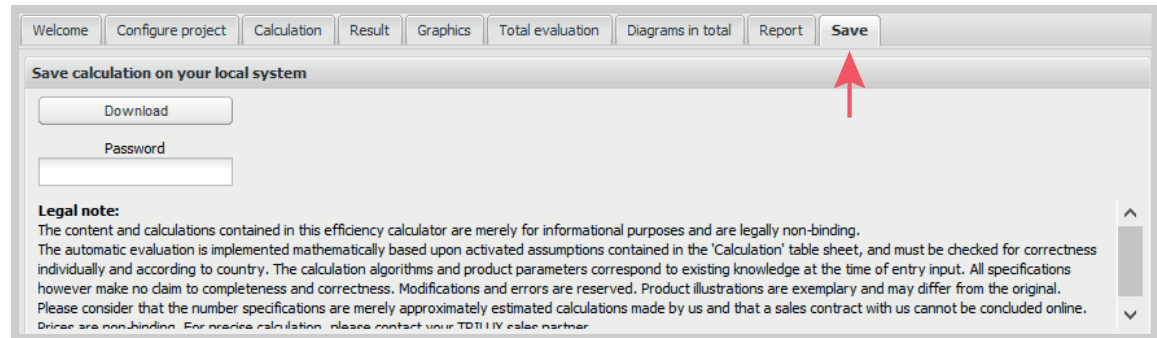


Figure 7.1: Saving project data

The efficiency calculator offers the option to store the project data in **xml-format** and load them up again later on. The project file is stored on a **local data carrier**. The xml-file also contains the unchangeable definition of the calculation scheme it is based on. It was first loaded with an applied online sample.

The name of the project file is automatically generated from the "Project name" (see chapter 2). It can be renamed manually. Now the xml-file can be stored and transported on a data memory or it can be sent via email. Later on the xml-file can be opened by any person at any place on page „Configure project" (see chapter 2) to edit it again.

For frequent usage of the Efficiency Calculator it is recommended to create various sam-

ple xml-files. They can be used as a basis for projects with similar configurations.

A **password** can be set before storing. But this must be taken into consideration: The password must necessarily be known to open the xml-file again! There is **no way to reset the password** of a stored file.

TRILUX goes to great lengths to keep **stored data compatible**. Even if they are stored with an early version of the Efficiency Calculator sample files generally will be reusable. However **no guarantee** can be given for this.

If an urgent availability of a project documentation might be necessary, the **local archiving of a pdf-report** (and pdf-versions of product data sheets when indicated, see chapter 6) is **strongly recommended**.

8 Appendix

Pro- file no.	Utilisation	Type of lighting	Working time	Absence factor
			$\frac{h}{d} \cdot \frac{d}{a} = \frac{h}{a}$	
1	Individual office	dir./indir.	11 · 250 = 2.750	0,3
2	Group office	dir./indir.	11 · 250 = 2.750	0,3
3	Open-plan office	dir./indir.	11 · 250 = 2.750	0
4	Meeting, conference, training	dir./indir.	11 · 250 = 2.750	0,5
5	Banking hall	direct	11 · 250 = 2.750	0
6	Retail/department store (without refrigerated products)	-	12 · 300 = 3.600	0
7	Retail/department store (with refrigerated products)	-	12 · 300 = 3.600	0
8	Classroom	dir./indir.	7 · 200 = 1.400	0,25
9	Lecture theatre, auditorium	direct	10 · 150 = 1.500	0,25
10	Hospital ward	dir./indir.	24 · 365 = 8.760	0
11	Hotel room	dir./indir.	11 · 365 = 4.015	0,25
12	Canteen/cafeteria	dir./indir.	7 · 250 = 1.750	0
13	Restaurant	-	14 · 300 = 4.200	0
14	Kitchens	direct	13 · 300 = 3.900	0
15	Kitchen - prep, storage	direct	13 · 300 = 3.900	0,5
16	WC and sanitary facilities	direct	11 · 250 = 2.750	0,9
17	Other common rooms	dir./indir.	11 · 250 = 2.750	0,5
18	Ancillary areas (without common rooms)	direct	11 · 250 = 2.750	0,9
19	Circulation areas	direct	11 · 250 = 2.750	0,8
20	Storage, utility/engineering room, archive	direct	11 · 250 = 2.750	0,5
21	Server room, data centre	direct	24 · 365 = 8.760	0,98
22	Workshop, assembly, manufacturing	direct	9 · 230 = 2.070	0,1
23	Auditorium (theatre and event spaces)	-	4 · 250 = 1.000	0
24	Foyer (theatre and event spaces)	-	4 · 250 = 1.000	0,5
25	Stage (theatre and event spaces)	-	10 · 250 = 2.500	0
26	Trade fair / congress	direct	9 · 150 = 1.350	0,5
27	Exhibition rooms / showrooms and museum with conservation requirements	-	8 · 250 = 2.000	0,5
28	Library – reading room	dir./indir.	12 · 300 = 3.600	0
29	Library – open access area	dir./indir.	12 · 300 = 3.600	0
30	Library – magazine and depot	direct	12 · 300 = 3.600	0,9
31	Sports hall (without audience area)	direct	15 · 250 = 3.750	0,3
32	Parking garages (office and private use)	direct	11 · 250 = 2.750	0,95
33	Parking garages (public use)	direct	15 · 365 = 5.475	0,8
34	Sauna area	direct	12 · 365 = 4.380	0
35	Fitness room / gym	direct	15 · 365 = 5.475	0
36	Laboratory	dir./indir.	11 · 250 = 2.750	0,3
37	Examination and treatment rooms	direct	11 · 250 = 2.750	0
38	Special hygiene areas	dir./indir.	24 · 365 = 8.760	0
39	Corridors of the general care area	direct	24 · 365 = 8.760	0,8
40	Doctor's offices and therapeutic practices	dir./indir.	10 · 250 = 2.500	0
41	Warehouses, logistics warehouses	direct	24 · 365 = 8.760	0,6

Table 8.1: User profiles according to the German standard DIN V 18599-10 with working times related to the given utilisation. Also a n “absence factor” is given to estimate the potential savings by presence detection