iDbuild
user guide

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Index

1 Introduction

This note is a user guide to the module iDbuild in BuildingCalc/LightCalc version 2.4.2 (BC/LC). The user guide is supported by user manual for BC/LC.

iDbuild is a tool for parameter variations of performance-decisive parameters. The variations give building designers an overview of how different parameters affect the energy consumption and indoor environment of the room.
The program is evaluating energy performance of rooms based on the methodology from EPBD [xx] and the specific Danish requirements from the Danish building code and SBi anv. 213 [xx]. The indoor environment is evaluated according to prEN 15251 [xx].

At present time, iDbuild only applies for office building with single sided offices, class rooms and alike, meaning that there can be only one window in the simulation model. Furthermore only buildings of simple shapes, like quadrangular shape, can be evaluated.

Together with the user manual for BC/LC, the user should be able to perform parameter variations and create a space of solutions using iDbuild.

2 Performing parameter variations

A parameter variation is based on the reference value of a performance-decisive parameter and two variations: either a lower and a higher value compared to the reference value or a var.1 and var.2 value. The lower/higher parameter variation indicates that the parameter is scalable, e.g. room height, construction U-value, etc. The var.1/var.2 parameter variation indicates that the parameter is non-scalable, e.g. glazing component.

The designer decides which performance-decisive parameters to vary. Parameter variations can be performed in two different ways:

1. As variation of the single performance decisive parameters (default)
2. As bundles of performance decisive parameters (elective)

The two options are described separately in the following sections.

2.1 Single parameter variation

In this option, the program will first calculate the performance of the established reference room. Then the program will calculate each defined parameter variation separately, meaning that all other parameters than the performance parameter in question is fixed. This gives the designer an overview of the performance impact of the single performance decisive parameter. If no parameter variations are defined, the program will just calculate the performance of the reference.

In order to set up a parameter variation, the checkbox next to the performance-decisive parameter in question is checked, and a “var.1/lower” and “var.2/higher” value is filled in – see figure xx.

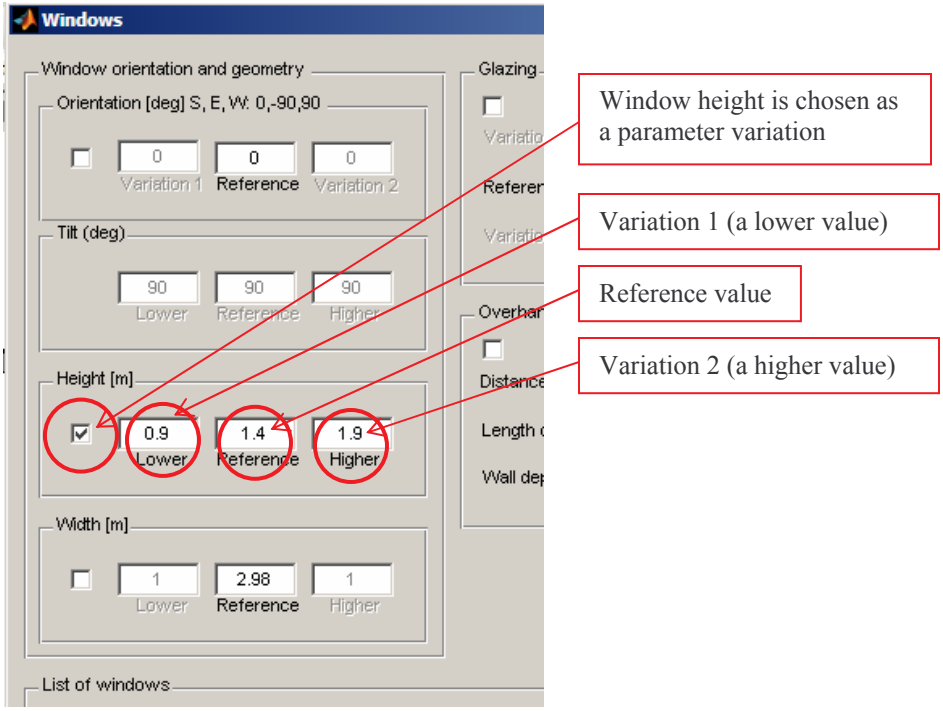


Figure 1: Screenshot from iDbuild – how to set up a parameter variation. The window height is varied with +/- 0.5 m

If single parameter variations are selected, the program will take all defined reference values and then do the following: 1) chance the selected parameter to the lower value of the single parameter and make a new performance simulation, then 2) chance the selected parameter to the higher value of the single parameter variation and make new performance a simulation.

*The program performs one simulation for **each** of the defined parameter variations.*

If the user sets up two single parameter variations, the program will perform: 1 performance simulation of the reference + 4 individual parameter variations = 5 simulations. The user may set up as many single parameter variations as found necessary. However, the time consumption for simulations will increase with the number of parameter variations. The time consumption for simulation may also increase/decrease with the room size and the controls set up under "systems".

2.2 Bundle parameter variation

In this option, the program will first calculate the performance of the established reference room. Then the program will calculate the performance of 1) the reference including all defined "lower/var.1" values and 2) the reference including all defined "higher/var.2" values. The parameter variations are set up as in "Single parameter variation" but are bundled into two parameter variations (one "lower/var.1" and one higher/var.2). The distinction between "lower/higher" values is not as important for this simulation option as for single parameter variations.

*The program performs one simulation for **all** of the defined parameter variations.*

If the user sets up two single parameter variations, the program will perform: 1 performance simulation of the reference + 2 parameter variations = 3 simulations. However, the 2 parameter variations may, as mentioned earlier, contain the variation of several parameters. An example when to use "Bundle parameter variation" is that if the user wants to vary the room height but at the same time wants the window height to be correspondingly "lower/higher".

In order to activate the bundle parameter variation option, go to the menu "Calculate" and click the submenu "Simulation settings". Check the box next to "Bundle parameter variations", see figure xx.

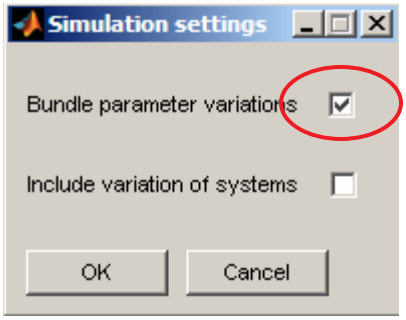


Figure 2: If the check box next to "Bundle parameter variations" is checked, the program is bundling parameter variations as described above.

2.3 Special cases when setting up parameter variations

All parameter variations are set up as described in section xx. Help may also be found in the BC/LC manual. However, there are some special cases in the setting up parameter variations where the user must be extra careful and aware. These cases are described in the following sections.

2.3.1 Setting up "Systems" for parameter variations

In the menu "Building" there is 3 system submenus: "System, reference", "System, variation 1" and "System, variation 2". The user should set up the system for the reference first. The user should then open submenu "System, variation 1" and "System, variation 2", and press the button "Copy data from reference", see figure xx.

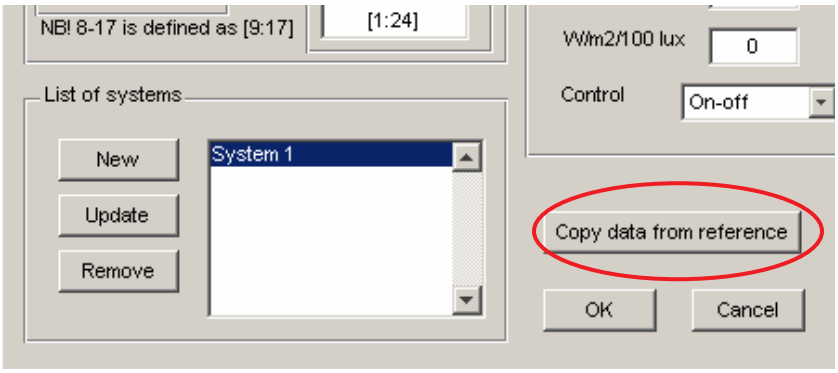


Figure 3: If the user wants the same system settings for all parameter variations, go to "System, variation 1" and "System, variation 2", and press "Copy data from reference".

When "Copy data from reference" is pressed, an information dialogue box appears, see figure xx. This message is the reason why systems for reference, variation 1 and variation 2 in principle should be defined separately; the control of shading (windows) might differ if the user has different glazings as parameter variation.

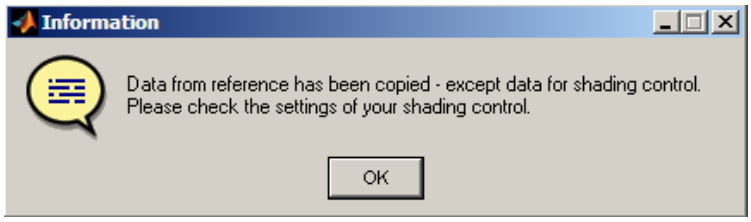


Figure 4: Information box regarding the control of shadings appears when "Copy data from reference" is pressed.

The dialogue closes when "Ok" is pressed and all data from the reference – except the shading control, is copied. The user must then set up shading control for variation 1 and 2, if necessary. Now all defined parameter variations will use "System, variation 1" for the performance calculations of *all* "lower/var.1" variations and "System, variation 2" for the performance calculations of *all* "higher/var.2".

If the user wants to make a variation of a certain setting in the "Systems" separate from all other parameter variations, go to the menu "Simulation" and choose the submenu "Simulation settings". Check the box next to "Include variation of systems", see figure xx

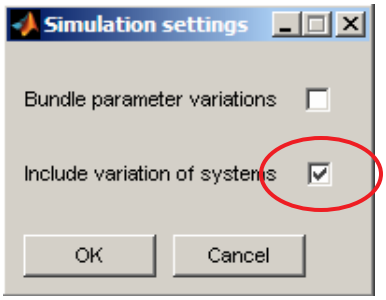


Figure 5: If the user wants a parameter variation simulation of different system settings, check the box as shown in the figure.

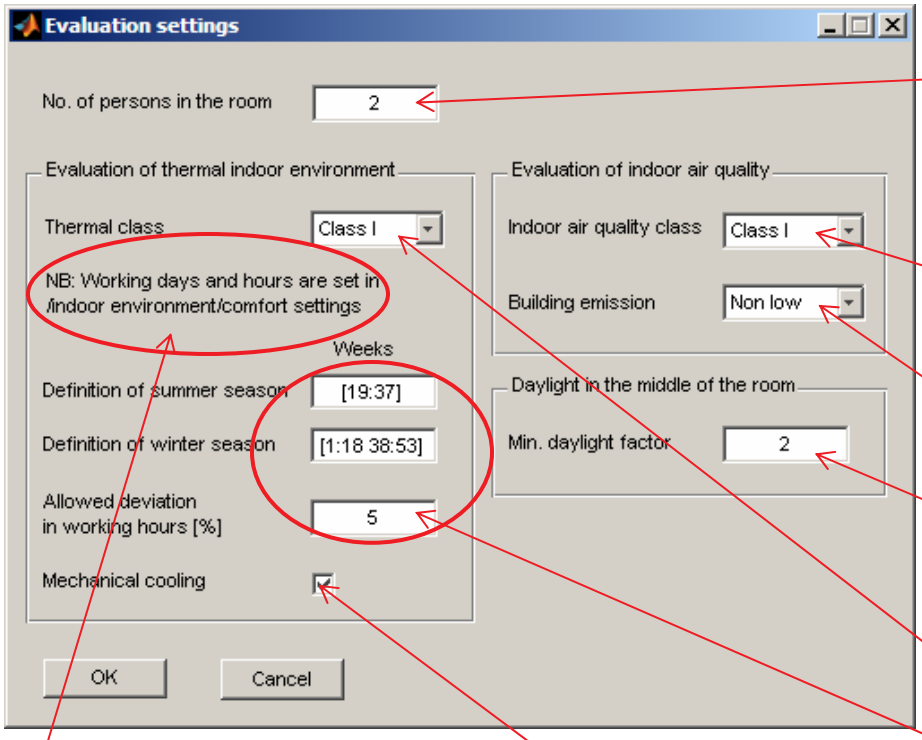
The setting will make a parameter variation simulation where all parameters except the 3 system settings are fixed.

2.3.2 Parameter variations of "Energy data"

All parameters in the submenu "Energy data" in the menu "Building" does not need simulations time. The program needs, as minimum, to calculate the performance of the reference. After this simulation, the user can – *without additional simulation time* – specify parameter variations for all parameters in the submenu "Energy data". The parameters in this dialogue are merely factors which together with the output data of the simulation are used for calculation of the energy performance of the model. The variation of an "Energy data" factor does not affect the simulated result. The user may therefore add "Energy data" variations after simulations without additional simulation time.

2.3.3 Setting up "Evaluation settings"

"Evaluation settings" in the menu "Indoor environment" is essential to the evaluation of the simulated data in terms of the quality of indoor environment. Figure xx shows the dialogue for "Evaluation settings" together with explanations of the data fields. The settings are closely linked to the definitions in prEN 15251. It is recommended that the values in "Evaluation settings" correspond to the settings in "Systems" or vice versa.



Number of persons in the room. For evaluation purpose only – is NOT linked to internal load in system settings

Class of indoor air quality according to prEN 15251

Building emission rate according to prEN 15251

Minimum daylight factor in the middle of the room

Class of thermal indoor environment according to prEN 15251

Very important in terms of evaluation settings!

prEN 15251 has different thermal indoor environment demands dependent on whether the building has mechanical cooling or not

Evaluation period for summer and winter and allowed deviation (according to prEN 15251)

3 Results from simulations

The following example of results is based on the default room “xx” in the BC/LC program folder. The room is briefly described in appendix xx (load the model in BC/LC for further details). Three parameter variations are set up:

- Variation of window height
- Variation of glazings
- Specific fan power (SFP)

Note that only variation of window height demands simulations. SFP is a part of “Energy data”, see section xx.

Then all simulations are performed, go to the menu “Simulation” and the submenu “Result, parameter variations” for results of the parameter variation. The dialogue in figure xx will pop up.

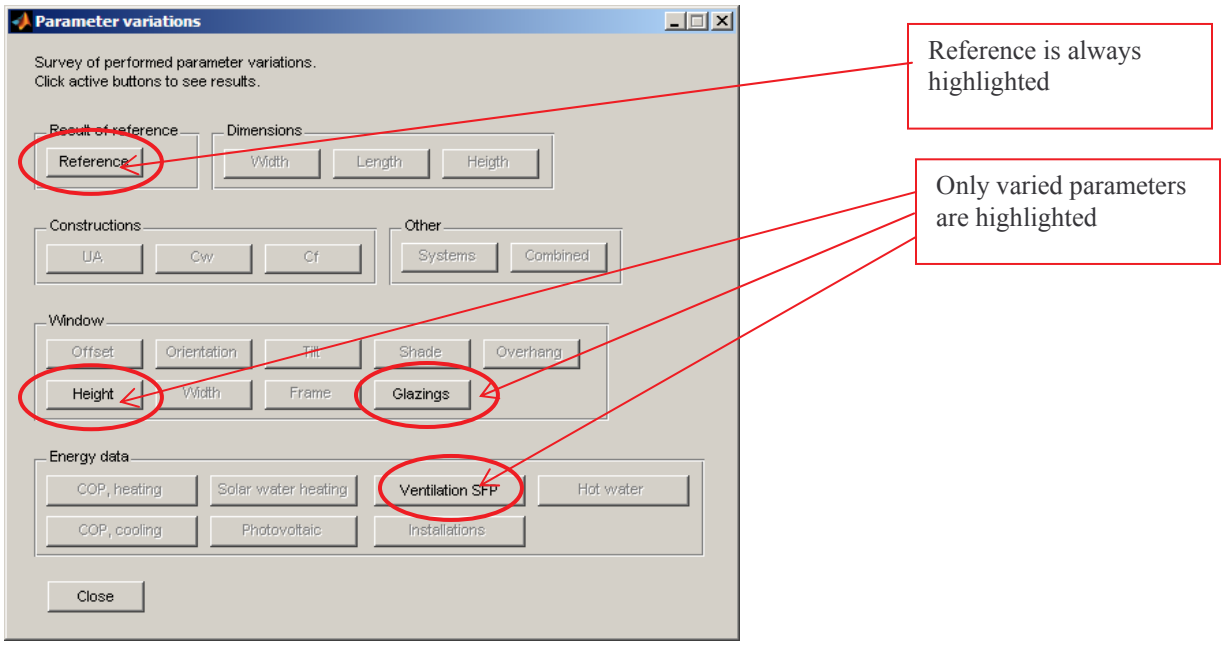


Figure 6: Overview of parameter variations.

Push the button of the varied parameter, and an overview of the consequence of the parameter variation in terms of energy consumption and indoor environment will show. The program is distinguishing between scalable and non-scalable parameters in the presentation of the results. The following examples of the presentation of results are for variation of glazing, which is a non-scalable parameter (figure xx) and the variation of window height, which is a scalable parameter (figure xx).

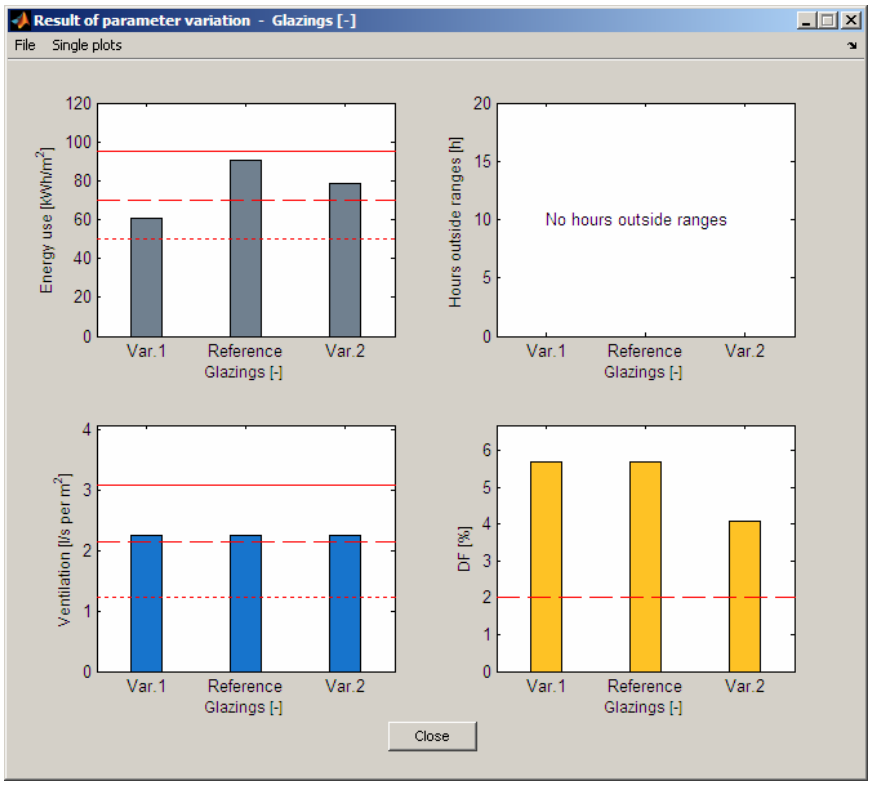


Figure 7: Result overview of a parameter variation of glazings – a non-scalable parameter: variations are seen as bars. Var.1: dbl glz w/ shd, ref: dbl glz w/o shd, var.2: solar dbl glz.

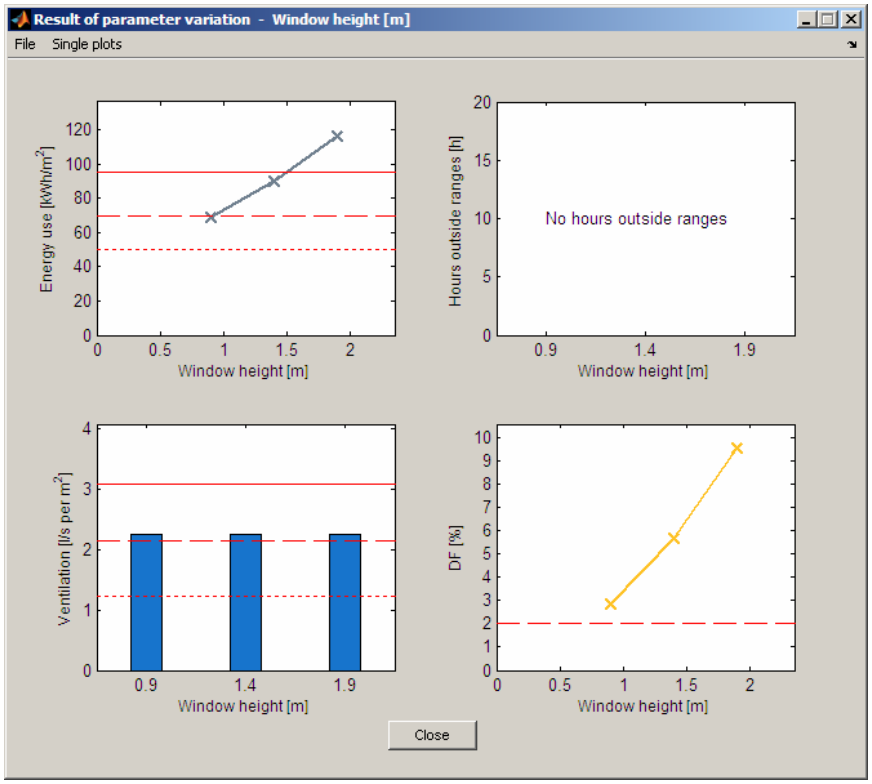


Figure 8: Result overview of a parameter variation of window height – a scalable parameter: variations are seen as a continuing line.

The result overview shown in figure xx shows the consequence of changing the window height in the reference model in terms of energy performance and indoor environment parameters. This overview can be saved by clicking “File”, then “export”. In the export, go to “file” and “save”.

By clicking the menu “Single plot” in the result dialogue, the single graphs from figure xx can be opened separately for more detailed analysis. As an example the single plots from the variation of window heights are shown in figure xx-xx. For saving and/or editing of the single plot, click “file” in the single plot dialogue and choose “export”.

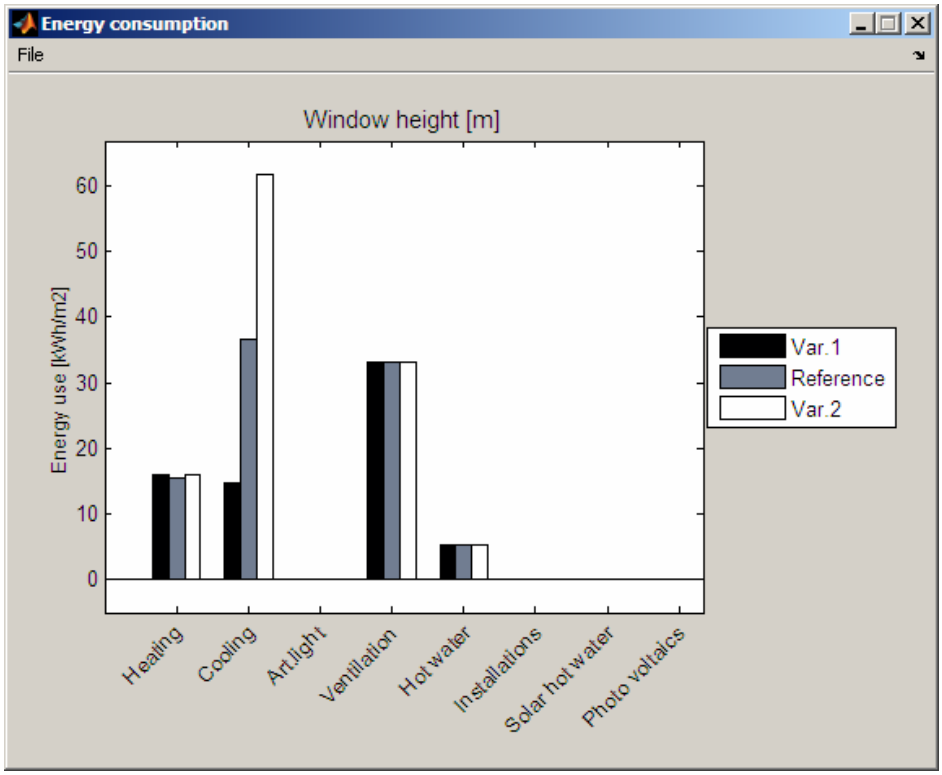


Figure 9: Energy consumtion of the reference and variation 1 and 2 distributed on the different types of energy consumption according to EPBD. Compared to figure xx it is clear that increased energy consumption for cooling is the main consequense of the increasing of window height.

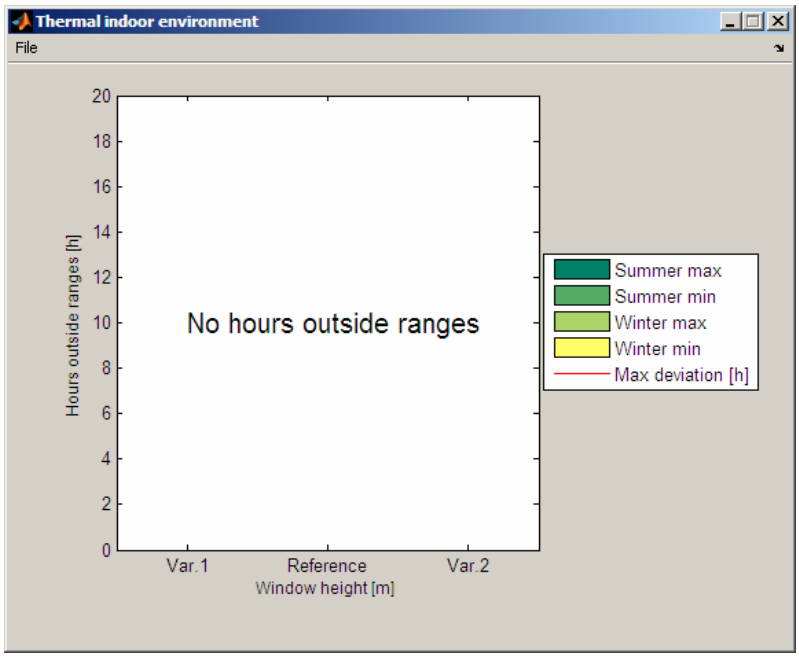


Figure 10: If there are no oversteppings of temperatures according to prEN 15251, then ”No hours outside ranges” will appear in the graph. If there are oversteppings – see figure xx.

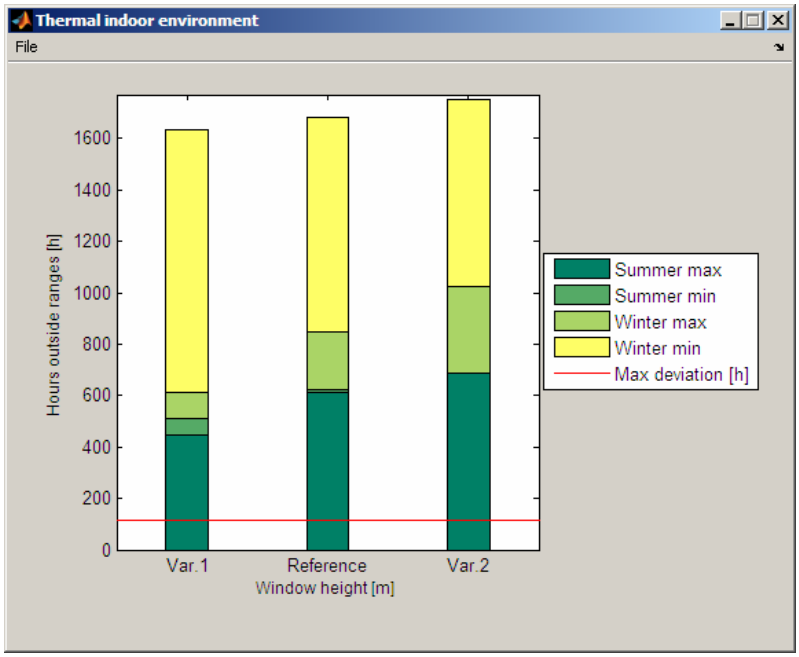


Figure 11: If there are oversteppings of temperatures according to prEN 15251, they will be presented as above. The read horizontals line is the ”Allowed deviation in working hours” from the menu ”Evaluation settings”. The graph shows the number of hours outside every min/max set points (see legend) and add them up for compliance control of the ”Allowed deviation in working hours”. If there are no oversteppings – see figure xx.

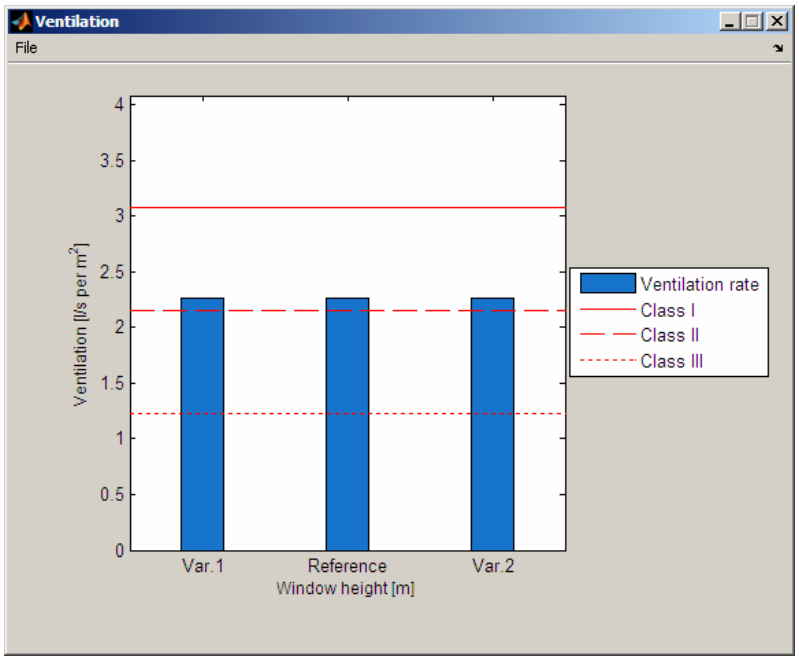


Figure 12: The ventilation does not change when the window height is varied. All three simulations is fulfilling class II according to prEn 15251. However, other parameters may result in different ventilation rates.

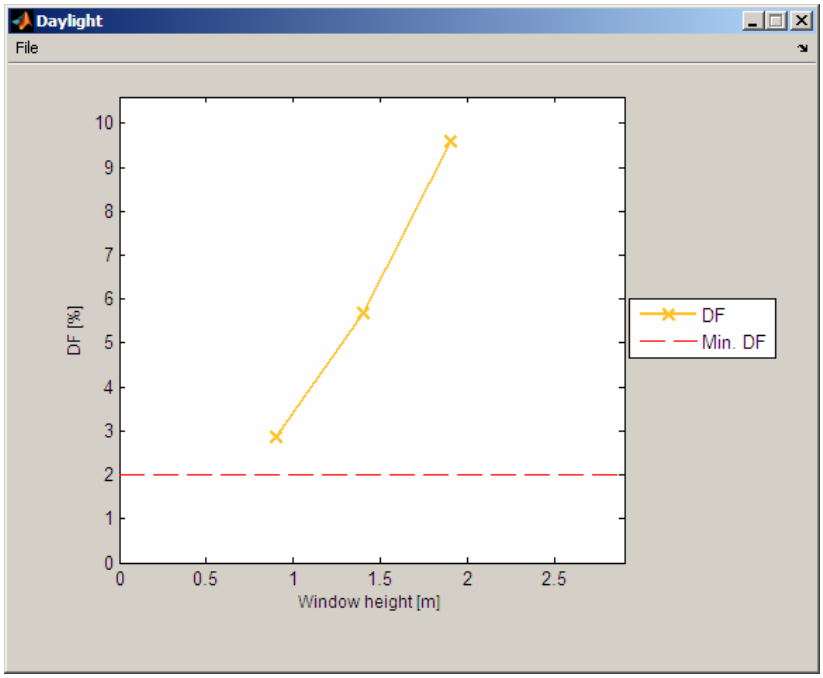


Figure 13: The figure shows that the daylight factor in the middle of the room increases very much with the height of the window.

4 Other important information

- Summer and winter in Denmark is usually defined as:
    - Winter: 1. October – 30. April. In BC/LC this is written as [1:16 41:53]
    - Summer: 1. May – 30. September. In BC/LC this is written as [17:40]

- Name all your BC/LC your files so they are easily recognized.

- Windows – use the standard solutions in BC/LC (database called "glzdtb.mat" in the BC/LC library) or generate your own with WIS (optional)

- If the user wants to change "Type of simulation" for a new model, remember to close BC/LC and start it again, the choose type of simulation.

- Keep all files related to the program in the BC/LC folder – do NOT make subfolders or folders with files somewhere else on your computer.

There are a number of examples of parameter variation in iDbuild within the program folder. The rooms have a number of parameter variations as examples. The filename of the rooms are:

- PV_12m.mat – a single person office, indoor climate class II
- PV_18m.mat – a 2-person office, indoor climate class II
- PV_60m.mat – a class room for 40 persons, indoor climate class II

Appendix xx

Room used for result example.

Geometry

Room depth	6 m
Room widht	3 m
Room height	2.71 m
Window geometry	2.98 x 1.4 m (width x height)
Panel wall height	0.7 m
Orientation	South

Constructions

U-value	0.2 W/(m2K)
Window component	Two-layer energy glass (U=1,1), standard frame
Sun screen	None
Thermal mass	Medium heavy

Systems

Internal load	300W (2 persons v/ laptops)
Infiltration	0.2 h-1 (or approx. 0.13 l/s m2 - max jf. the building code)
Ventilation	Mechanical – ventilation class B (ca. 2 h-1), SEL=1 kJ/m3
Heat recovery	75%
Solar shading	External blinds
Cooling	Mechanical cooling
Elec. light	general max 6 W/m2, work lamps max 2 W/m2