

VELUX Energy and Indoor Climate Visualizer 2.0 User guide

December 2010

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General usage

Version

The VELUX Energy and Indoor Climate Visualizer is available in two versions, the normal and a pro version. The normal version gives access to a range of predefined typical geometries whereas the pro version opens up for the possibility to change the size of a generic building or to import geometry from various file formats. Read more information about the two versions on the website: <http://eic.velux.com>.

The version type can be found by selecting *About EIC Visualizer* from the *Help* menu. It will say 'Pro' or nothing.

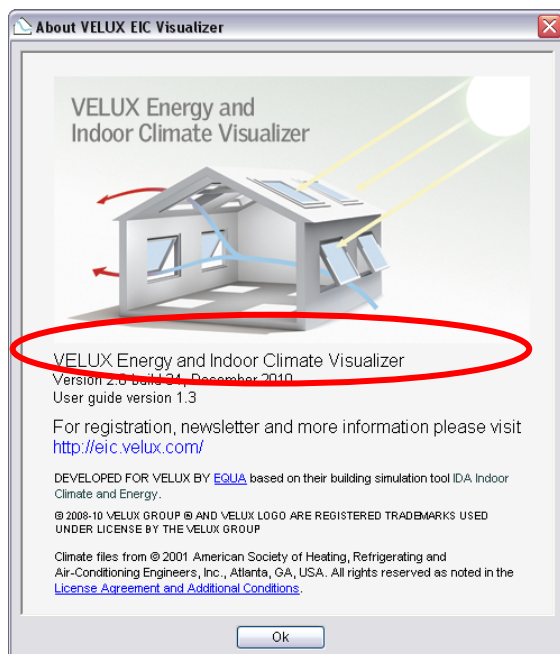


Figure 1 About dialogue

Starting a new case

A new case is created when you select *New* from the *File* menu. Several cases can be open at the same time. The open case windows are managed from the *Window* menu.

Save

You can save the current case by selecting *Save* from the *File* menu. You can also choose *Save as...* to save into a new file.

Open

Choose *Open* from the *File* menu to open an old case. Browse to the folder of your case and select the file. Finally click on the *Open* button.

The most recent opened cases will be available in the *File* menu.

Help and support

Pressing F1 or choosing *Help* will open the *User guide*. The user guide will be opened automatically in the section corresponding to the tab, which is active when F1 is pressed.

The About screen contains information on tool version and contact information about the VELUX EIC Visualizer team.

For further technical information download the technical background document on the website.

Automatic check for updates

When the EIC Visualizer starts it automatically checks if an updated version is available from the EIC Visualizer server via the internet. If an update is available the user is asked if the update should be downloaded and installed. The use of a firewall might conflict with the automated update function.

Keyboard shortcuts

Ctrl + s:	Save current file
Ctrl + o:	Open a project
Ctrl + n:	New project
Ctrl + F4:	Close active project

Geometry

This tab is active when a case is opened. Here the geometry and location of the building are specified. All input data fields have default values. When you change a value the 3D model is updated accordingly.

The 3D model is a representation of the overall building geometry. The calculations include joints between walls, roof and floor even though they are not shown in the 3D-representation.

The colours are default and do not represent specific construction materials used. The 3D model shows a simple representation of window insertions. For roof windows the calculations are based on installation principles and lining configurations as recommended by VELUX.

Building geometry

Geometry Select one of the default house types:

- 1-storey single-family house with open ceiling
- 1-storey single-family house with flat ceiling

1½-storey single-family house

Roof space on apartment building

End wall configuration Select if the house is free standing or part of a row of buildings. A house in a row will use less energy than a free standing house, because no energy is lost through the walls to the neighbouring buildings.

If the building is defined as a row house or an attic, the neighbouring or underlying building will be presented by a transparent, brown shape.

Size For each house, one of three default sizes can be selected. Internal measures are used, i.e. internal distances between walls.

You should choose the geometry, which is closest to the actual building geometry you are evaluating. An irregular, e.g. L-shaped building can be evaluated with a rectangular EIC Visualizer model representation. The building size – closest to the specific design - should be selected. Remember to place windows with the correct orientation.

The procedure will produce results, which are well-suited for comparing one case with

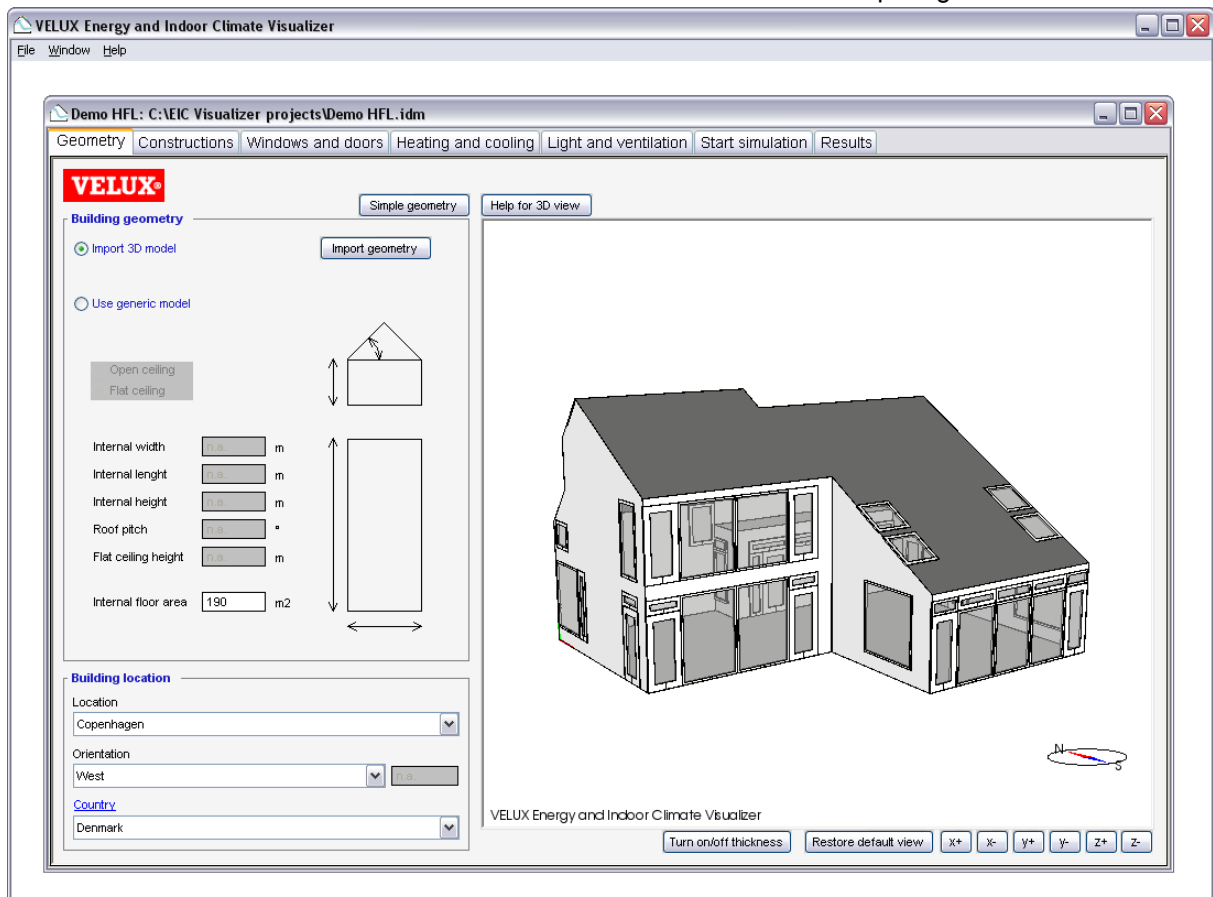


Figure 2 Geometry tab

another, i.e. the addition of a window, even if there are differences between the geometry of the EIC Visualizer model and the actual building's geometry (as long as they have comparable net area).

Alternatively, you can visit <http://eic.velux.com> and see how to get the full version where it is possible to change size and import geometry from various formats.

Building geometry (pro version)

Generic model

Change the size of the generic model with the input boxes. All dimensions should be given as internal measurements.

The ceiling can be either open or flat. If flat is chosen the roof windows will be modelled with light shafts with the same construction as the roof.

The internal floor area is automatically calculated from the volume of the building. If a value is manually typed in, this value will

override the calculated value.

Imported model

To import a model select the *Import 3D model* radio button and click the *Import geometry* button. On the dialogue browse to your geometry file and click open.

The EIC Viz currently supports 3D Studio Max (3ds), AutoCAD 200X (dwg and dxf), Google SketchUp (skp), OBJ (obj) and VELUX Daylight Visualizer 2.5 exports (exp). See the 3D guidelines for more details on how to create 3D models.

Building location

Location The location is the geographic location of the building. The list contains major cities from around the world and the most relevant should be selected. The selection ensures that the correct climatic data are used.

Orientation The orientation of the building is selected. Major orientations can be selected from the list or a number can be entered. The orientation is indicated by the compass at the 3D representation.

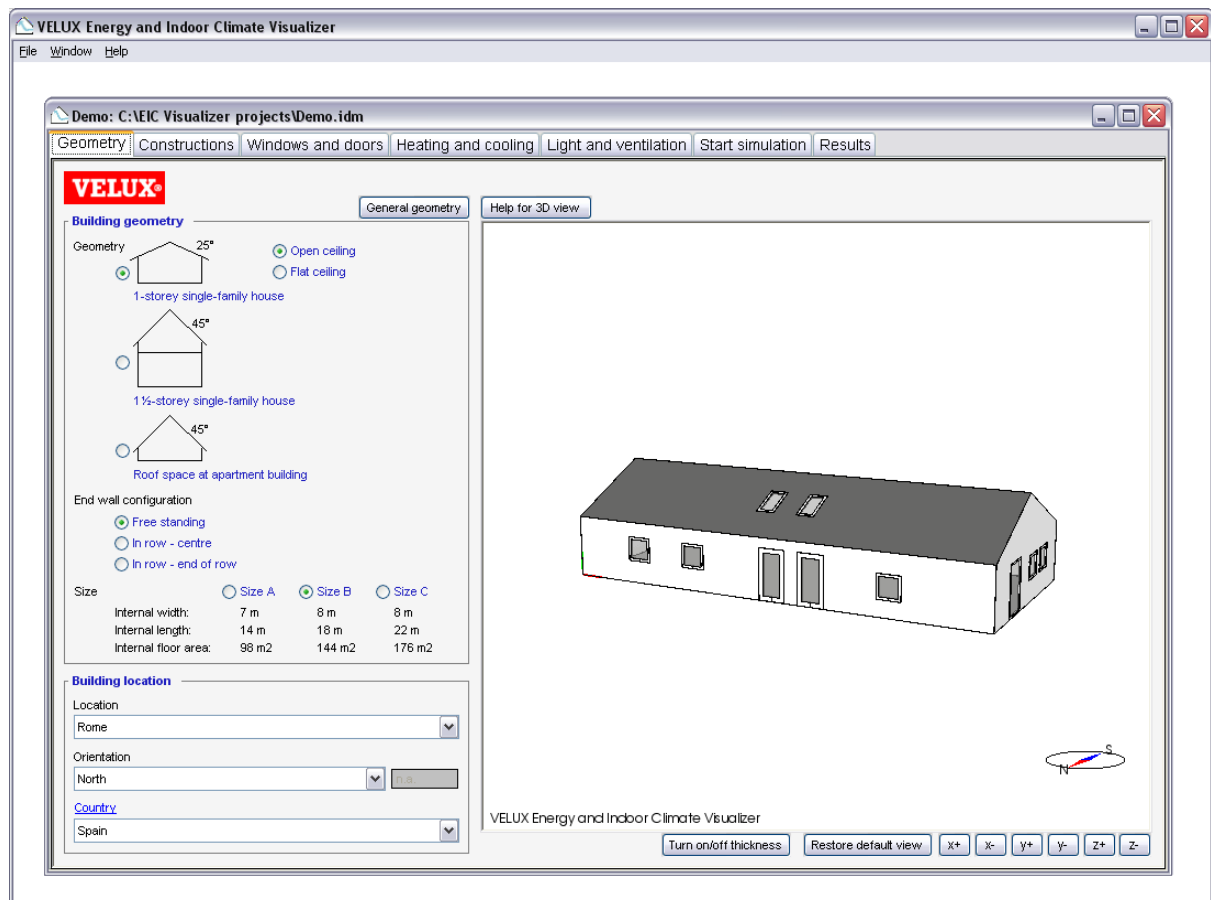


Figure 3 Import geometry

If another orientation is needed this can be made by choosing *Degrees from north* and typing the relevant orientation towards east.

Country The country selection affects issues on country and regional levels: Currency, energy price and Energy Balance control schedule for solar shading.

The selections of Country can be changed by pressing [Country](#) in the Building location box. This opens the Country dialog as seen in Figure 4. Here data for currency and energy price for the selected country are specified.

This dialog is also where the Energy Balance© control schedule is selected. The Energy Balance control feature is available with all Integra© installed VELUX roller shutters and awning blinds. The control feature provides an energy optimised control of roller shutters and awning blinds for the climatic location of the building. It will activate the solar shading in daytime during summer and at night in the winter. This reduces the need for cooling in summer and the need for heating in winter. The Energy Balance feature is particularly relevant in warm climates.

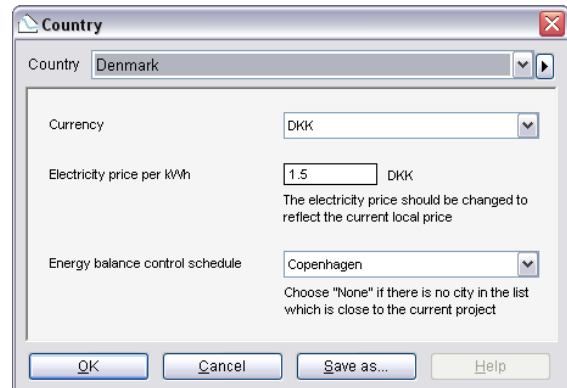


Figure 4 Country tab

It is defined for major cities, and the city closest to the actual location of the project should be selected. If no relevant city is available, “None” should be selected.

It is possible to define a new Country item, which will appear in the list of countries. This is done with the “Save as...” button. The country item will be saved with the current project, and will only be available within the current project.

Constructions

Here the construction types of external walls, roof and floor are specified.

When you change a value, the 3D model is updated to reflect the thickness of the selected construction type if wall thickness is turned on.

Building envelope

Any construction can be assigned to one of the four construction types. Click the desired construction to select it and choose the relevant construction type from the radio buttons.

The lowest horizontal construction will automatically be assigned as floor, vertical constructions as walls and sloped constructions as roof.

External wall construction The wall construction of the house is selected from the items on the list.

Roof construction The roof construction of the house is selected from the items on the list.

External floor construction The external floor construction of the house is selected from the

items on the list. This is the floor at the lower boundary of the house.

Adiabatic The adiabatic construction type is used to represent a construction facing a heated room, for instance the walls dividing a row house. There is assumed to be no heat loss through an adiabatic construction.

Leakiness The leakiness of the house is selected from the items on the list. Choose the construction period, which is most representative for the project.

Editing walls, roofs and floors

It is possible for experienced users to edit the definition of walls, roof and floor. This is done by clicking the blue, underlined titles. Clicking a link opens a dialog as shown in Figure 6. In most situations, the standard construction items will be sufficient.

The U-value and thickness of the construction are shown, as well as each individual layer of the construction. It is possible to change the thickness of each layer. When a value is changed, the construction U-value and thickness are updated.

It is also possible to change materials or to add materials. Materials can be selected from the library of construction materials.

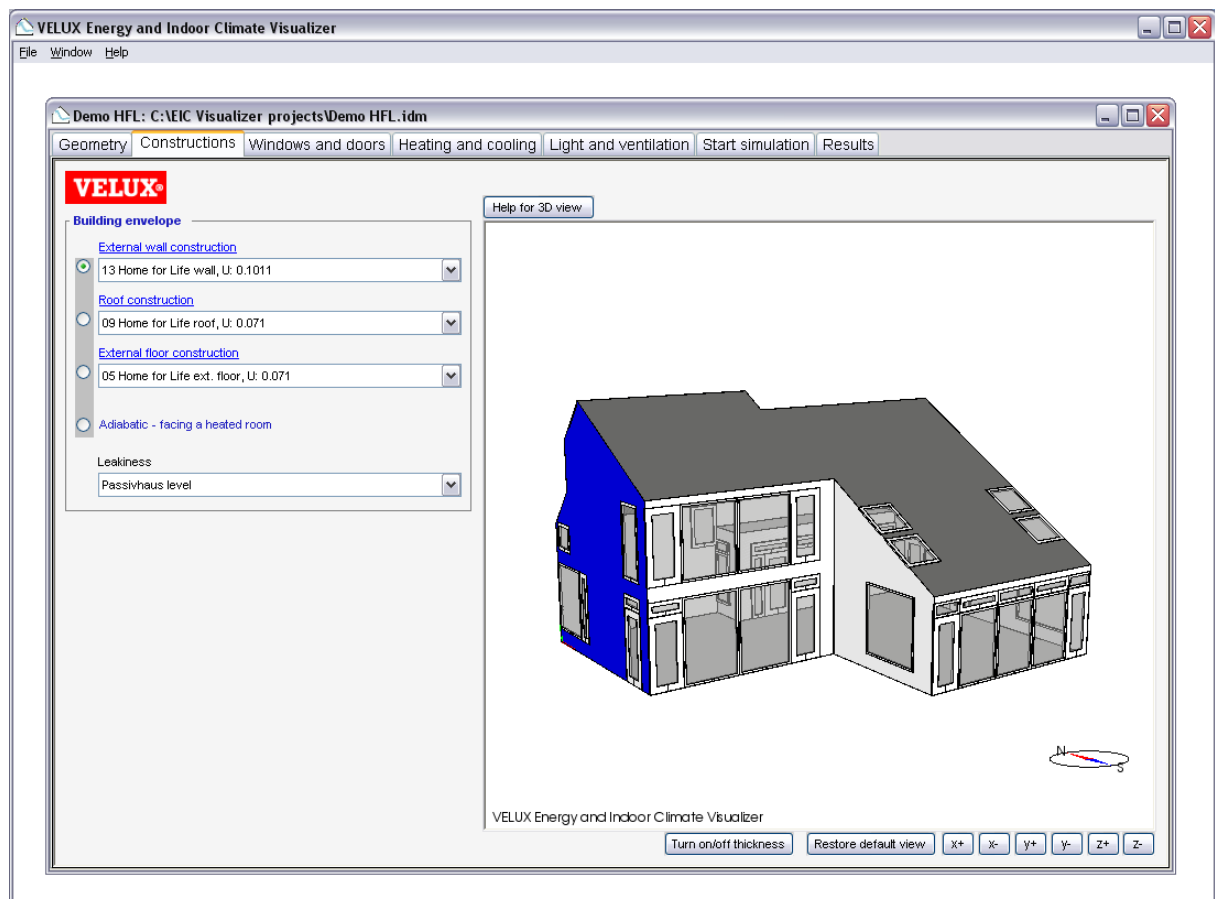


Figure 5 Constructions tab

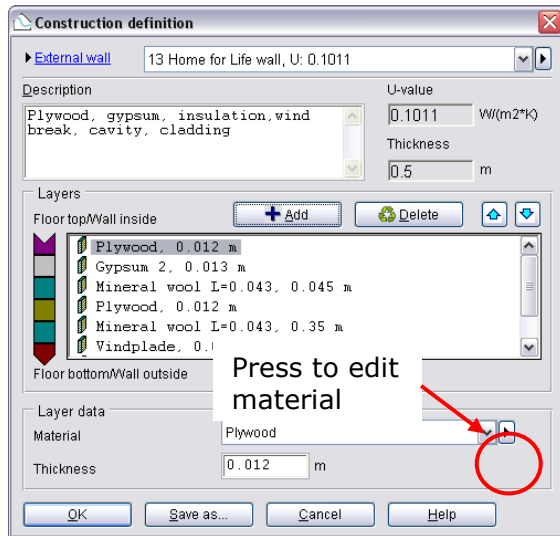


Figure 6 Dialog for editing walls, roofs or floors.

The changed construction can be saved as a new construction type. The new construction will be saved in the current project, so it will not be available for other projects.

Editing material properties

Material properties can be edited. This will only be necessary in rare cases. The Material dialog is accessed from the dialog for editing construction types.

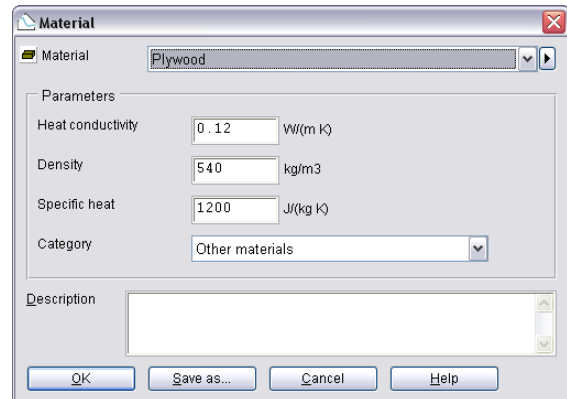


Figure 7 Dialog for editing construction materials

The heat conductivity, density and specific heat can be edited. The material can be assigned to a category.

Windows and doors

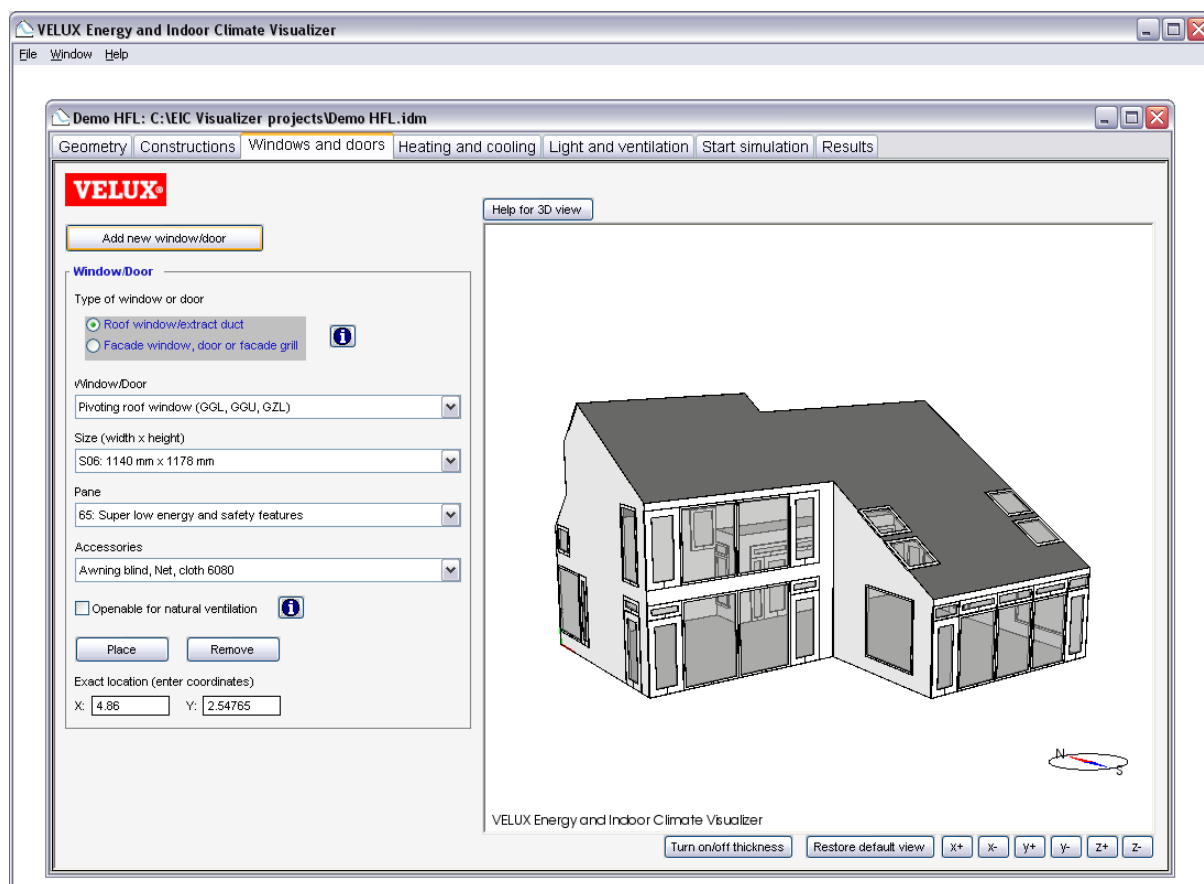


Figure 8 Windows and doors tab

Here windows, doors and openings are added and edited. When you add or change a value, the 3D model is updated to reflect the change and show the window or door.

To add a new window or door, the “Add new window/door” button should be pressed. Then the properties of the new window, door or opening are selected, and finally the “Place” button is pressed. The new window, door or opening can then be placed in the model using the mouse. There is a visible 0.5 m x 0.5 m grid which the window snaps to.

The windows, doors and openings installed in the house can be duplicated using the 3D view. A window is selected by clicking on it. The selected window/door is shown in blue and the coordinate system of the wall is shown, see **Error! Reference source not found.** To copy the window, press the button “Add new window/door” followed by pressing the “Place” button.

When a window is selected, the properties of the window are shown in the fields to the left of

the 3D view. It is possible to change properties at any time.

It is not possible to select more than one window at the time.

Window/door

Type of window or door You can select a roof window, a facade window or a door.

Window/Door The type of window or door is selected.

Facade windows can be openable or not-openable. Façade windows can have a ventilation flap (or grille) built into the frame.

It is possible to define custom window types by choosing “Custom window/roof window”. With Custom window selected “[Window/door](#)” becomes clickable, which will open a dialogue where the properties can be edited.

Custom window/roof window/door

Values needed are the U-value of the frame (U_f), the widths of the frames and the linear transmission loss (Ψ)

between window and roof. For roof windows the maximum opening area and effective height can also be edited. See the technical background document for more details on how this is done.

Size The size of window or door is selected (or typed in for façade windows).

Pane The pane type for the window or door is selected.

It is possible to define custom pane types by choosing “Custom pane”. With Custom pane selected “[Pane](#)” becomes clickable, which will open a dialogue where the properties can be edited.

Values needed are the g-value, t_v , t_e , ψ and U-value of the glazing. The U-value is needed for three slopes: 0°, 45° and 90°. Values in between are interpolated from these. If accessories are to be used F_c , F_t , dU_g of the products are needed. See more details on this in the technical background document.

Accessories If the window is installed with solar shading, the solar shading is selected from the list.

Openable for natural ventilation With this selection it is decided which windows will be used for natural ventilation. Windows, which are openable for natural ventilation, will be used for natural ventilation with the control options that can be selected at the Light and ventilation tab. Windows, which are not marked as openable for natural ventilation, will not be used for natural ventilation.

All selected windows will be controlled with the same control options, so it is not possible to select different control options for different windows.

Place When the “Place” button is pressed, the mouse can be used to decide where the window should be placed.

Remove The “Remove” button is used to delete the selected window/door.

Exact location The exact coordinates of the selected window are shown in the boxes. The location can be changed by changing the numbers if the window cannot be dragged with the mouse to the desired location. The coordinates are relative to the surface where the window is installed.

Include natural ventilation extract duct or façade grill

It is possible to add a natural ventilation extract ducts or façade grills. These can be selected from the Window/door dropdown and be placed and edited in the same way as windows and doors. The duct or grill will be open constantly, and the airflow through ducts will depend on the diameter and height above roof ridge of a duct or the width and height of a façade grill, and also on leakiness of the house and the distribution and control of windows for natural ventilation.

Natural ventilation extract ducts and façade grills are common in bath rooms and kitchens.

Extract duct

Diameter The diameter of the duct.

Height above roof ridge The distance from the roof ridge to the top of the duct. The lower end of the duct starts at the underside of the ceiling. The length of the duct is from the underside of the ceiling to the top of the duct.

Façade grill

Width and height The dimensions of the free opening area of the grill. This area is less than the actual hole in the wall and is the total area minus the area of the physical grill.

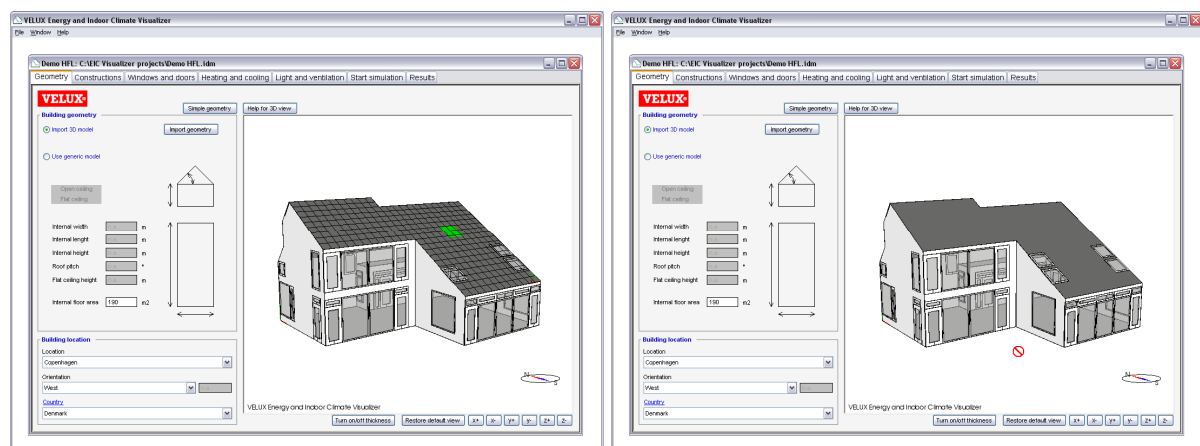


Figure 9 A green rectangle indicates a location where the window can be placed. The red “no-drop” cursor indicates a window location, which is not valid

Heating and cooling

At this tab the controls for heating, cooling and solar shading are selected as well as the schedule for the occupants of the house.

People

Number of people The number of people occupying the house is selected.

Schedule Here you can select when the occupants will be in the house by choosing the schedule, which best describes their occupancy of the house. The schedule can be edited by pressing [Schedule](#).

Edit schedule for the people occupying the house

The schedules for occupancy can be edited by pressing [Schedule](#), which opens the Schedule dialog.

Where the blue curve is 1.0, all occupants are in the house. If there is nobody in the house, the curve should be 0.0. It can be 0.5 if half of the occupants are at home.

The blue curve is edited directly in the diagram by clicking and dragging parts of the curve. The schedule for weekdays, Saturdays and Sundays can be different depending on the checkbox selections.

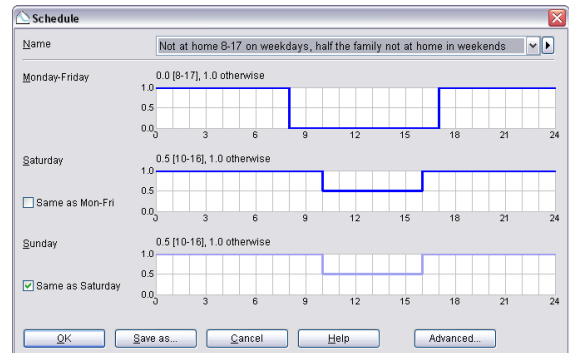


Figure 10 Dialog for editing occupancy schedule

Heating and cooling system

Heating set point The set point for the heating system. The heating system will attempt to maintain the specified temperature.

Preferred max. summer temperature This input has two purposes and must always be specified:

If a cooling system is present in the house, this

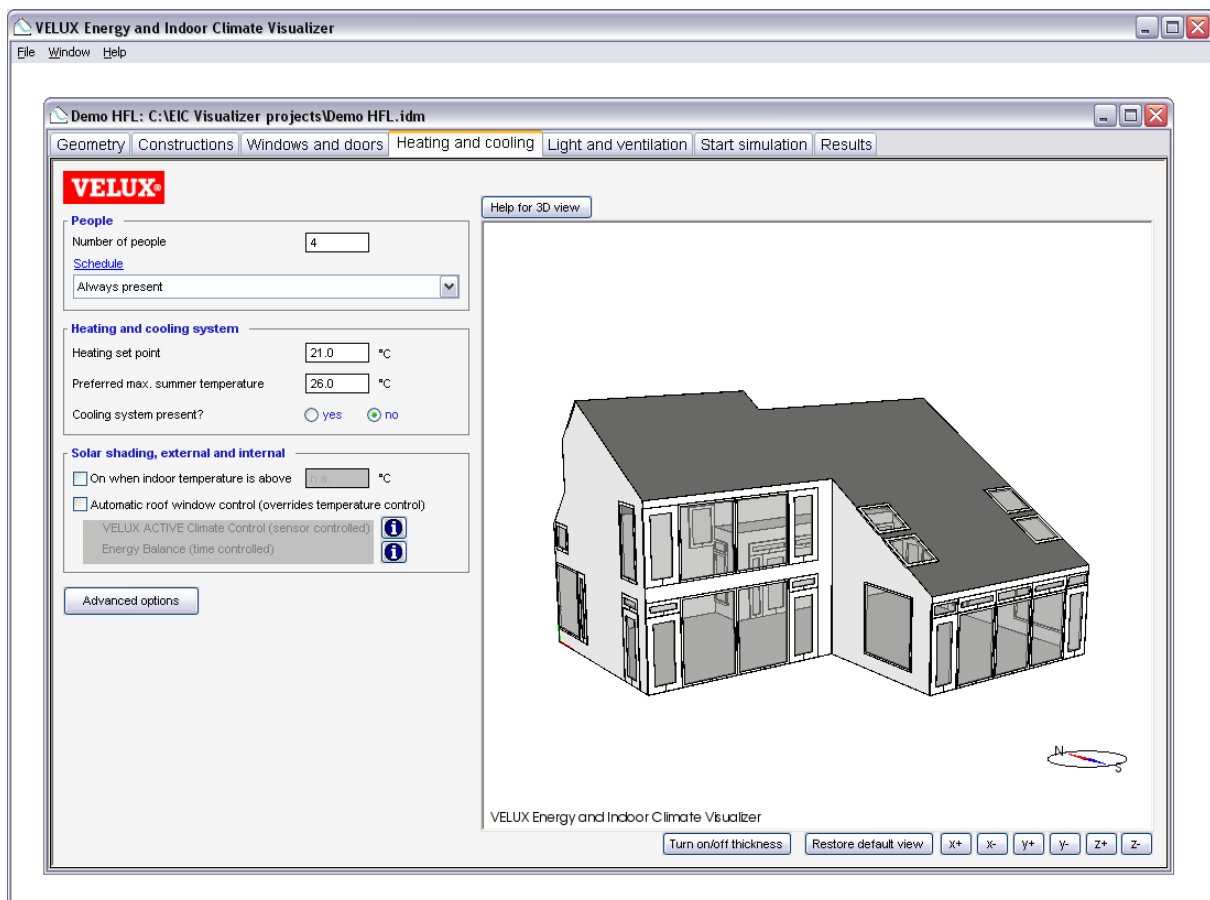


Figure 11 Heating and cooling tab

is the set point for the cooling system. The cooling system will then attempt to maintain the specified temperature.

The temperature is used for the night cooling control of natural ventilation.

Cooling system present If “yes” is selected, a cooling system (air conditioner) is installed in the house.

Solar shading, external and internal

On when indoor temperature is above ____ °C If this control is activated, the shading is activated when the indoor temperature is above the set point and deactivated when the indoor temperature is below the set point.

Automatic roof window control (These features apply only to the roof windows and will override the temperature control if active)

VELUX ACTIVE Climate Control (sensor controlled) If this control is activated the solar shadings are controlled by sensors on the window.

The VELUX ACTIVE Climate Control feature is available for all electrical products for both external and internal shading.

It is an intelligent and self controlled shutter/external solar shading. The external shutter/solar shading device is controlled by two wireless external sensors; One for measuring external temperature and one for measuring solar irradiation on the roof window. Based on input from the sensors, an intelligent algorithm has been developed for optimal control of the shutter/solar shading device.

VELUX Energy Balance (time controlled) If this control is activated, the energy balance control strategy is used for roller shutters and awning blinds.

The Energy Balance control feature is available with all Integra© installed VELUX roller shutters and awning blinds. The control feature provides an energy optimised control of roller shutters and awning blinds for the climatic location of the building. It will activate the solar shading in daytime during summer and at night in the winter. This reduces the need for cooling in summer and the need for heating in winter. The Energy balance feature is particularly relevant in warm climates.

Advanced options

Pressing this button opens options for electrical equipment, heating and cooling. Figure 12.

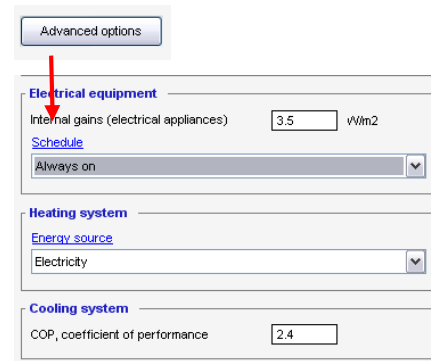


Figure 12 Pressing the Advanced options buttons opens more options

Electrical equipment

Internal gains (electrical appliances) The internal gains are the electricity used by appliances, which are not part of the energy calculation. These are kitchen appliances, electronics, etc. The internal gains are not included in the energy demand of the building, but they are considered a “free gain”, which will reduce the heating demand of the building. Increasing the internal gains will reduce the heating demand of the building.

It is difficult to make a precise estimate of the internal gains, but a value between 2 and 5 W/m² will often be reasonable.

Schedule The schedule for the gains can be edited if they are not the same during the day. They are edited as described for Figure 10.

Heating system

Energy source Here the energy source for the heating system is selected. These options are used for the results of energy costs. The energy source can be edited by pressing [Energy source](#).

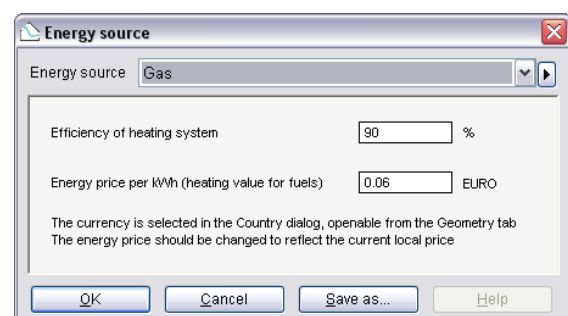


Figure 13 Energy source dialog

Efficiency of heating system The efficiency of the heating system has an influence on the amount of fuel used. An electrical heating system is approximately 100% effective. The efficiency of an oil-burning boiler is lower, e.g. 70%.

Energy price per kWh (heating value of fuels) The energy price should be per kWh.

Cooling system

COP, coefficient of performance The COP of the cooling system should be inserted.

Light and ventilation

At this tab the controls for lighting and ventilation are selected.

Natural ventilation

Windows marked as “openable for natural ventilation” are used as follows This control should be used when making calculations for buildings with natural ventilation. The windows, which have been marked as “openable for natural ventilation” on the Windows and doors tab, will be used with the controls below.

Open windows when indoor temperature is above ___ °C Facade and roof windows are opened when the temperature is high. The specified temperature will be used as a set point so that the windows will start opening 1-2°C before the set point is reached. The windows will not open all at once, but will “modulate” to maintain the set point.

Will only be activated when people are present in the house, and if the outdoor temperature is

less than 2°C above the indoor temperature. The last control prevents the building to be heated further if the outdoor temperature is warmer than indoors. This control option can be used to prevent overheating.

Use windows for airing when outdoor temperature is above ___ °C for ___ minutes All windows are opened in the selected intervals at the selected times of day. Roof windows are opened approx. 21 cm (corresponding to the max. opening of an electrical Integra window). Façade windows are opened 10% for window height above 1,5 m, and 20% for window heights below 1,5. Airings are only made when people are present in the house. This control option can be used to refresh the air in the house and is recommended in cold climates to reduce moisture problems.

The temperature set point can be used if ventilation is considered undesirable on very

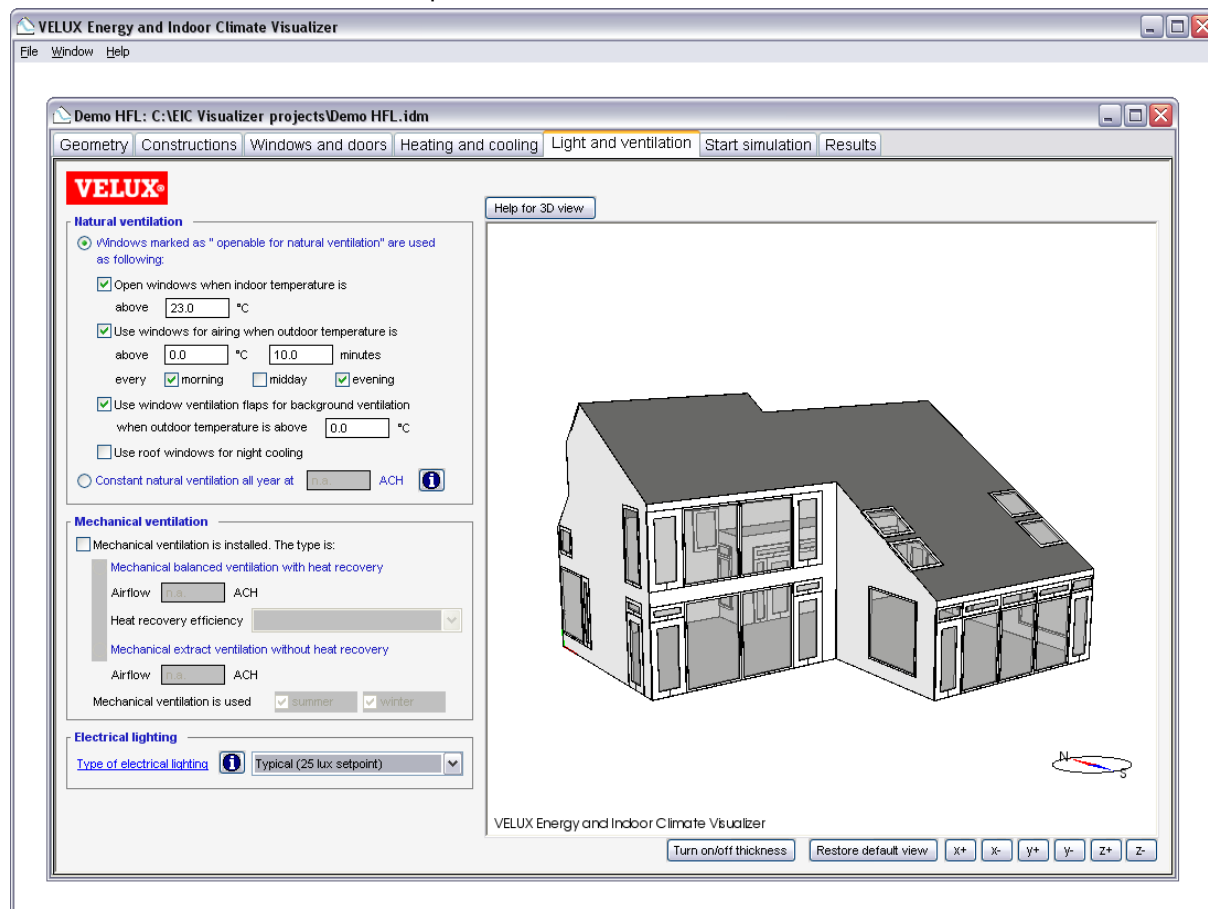


Figure 14 Light and ventilation tab

cold days.

Morning, midday and evening is defined as follows:

Morning: 6:00

Midday: 12:00

Evening: 20:00

Use ventilation flaps for background ventilation when outdoor temperature is above ____ °C With this control option the ventilation flaps of all windows (not only those marked as “openable”) are kept open all year to supply background ventilation. It is recommended to use this option to provide a healthy indoor environment. The temperature set point can be used if background ventilation is considered undesirable on very cold days.

Use windows for night cooling All “openable” roof windows open between 22:00 and 7:00 if the indoor temperature at 22:00 is above the average of the heating set point and the preferred maximum summer temperature, and if the outdoor temperature is below the indoor temperature. This control option is relevant in warm climates to cool the building during the night.

Constant natural ventilation all year at ____ [ACH]. This control option should generally *not* be used. It does not reflect how natural ventilation works in real buildings. It is included in the EIC Visualizer for comparison with other simulation tools, which use a constant natural ventilation rate. When this control is selected, infiltration from leakiness through cracks in the building is not included.

Mechanical ventilation

Mechanical ventilation is installed If this is activated, mechanical ventilation is considered active. Mechanical ventilation is considered on 24 hours a day in the part of the year selected below.

Type of mechanical ventilation Choose between two types of mechanical ventilation:

Balanced ventilation with heat recovery.
The airflow rate in ACH should be entered as a number.

The heat recovery efficiency should be selected among three options (high (85%), medium (75%), low (65%))

Extract ventilation without heat recovery.
The airflow rate in ACH should be entered as a number.

Mechanical ventilation is used

summer/winter If the mechanical ventilation system is on all year, both summer and winter should be activated.

The period for summer and winter is based on the Energy Balance control in the Country dialog. Some weeks are not included in the energy balance definition. When summer or winter is selected alone, the weeks of the Energy Balance definition is used.

Advanced options

Pressing this button opens options for electrical equipment, heating and cooling.

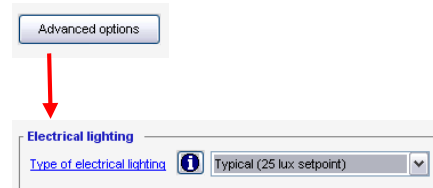


Figure 15 Pressing the Advanced options buttons opens more options

Electrical lighting

Type of electrical lighting The lighting can be selected from three types: Typical, Only fluorescent and Only Incandescent. Typical is an equal mix of fluorescent and incandescent lighting.

Incandescent lighting uses more electricity, but has a better colour representation than fluorescent lighting.

Each type of lighting can be combined with a set point. When the daylight level is below this level, the electrical lighting will be in use if there are people occupying the house who are not sleeping. People are considered to be sleeping between 23:00 at night and 7:00 in the morning.

The electrical lighting is controlled by using “dimming”, which means that the electrical lighting is only on at 100% if there is no daylight at all.

The options for electric lighting can be edited by pressing [Type of electric lighting](#). This opens the dialog of Figure 16.

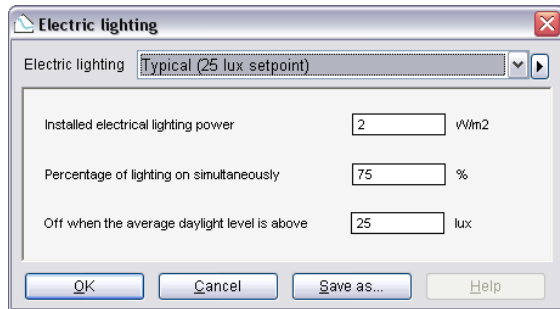


Figure 16 Dialog for electric lighting options

Installed electrical lighting power The default values of installed power can be edited. The values are in W/m².

Percentage of lighting on simultaneously All light may not be on simultaneously in a house. If only 50% of the rooms have the light switched on at the same time, this is typed in here.

Off when the average daylight level is above ___ lux Here the set point for electrical light should be entered.

If a new combination of options is created, a new lighting item can be saved under a new name using "Save as..."

Start simulation

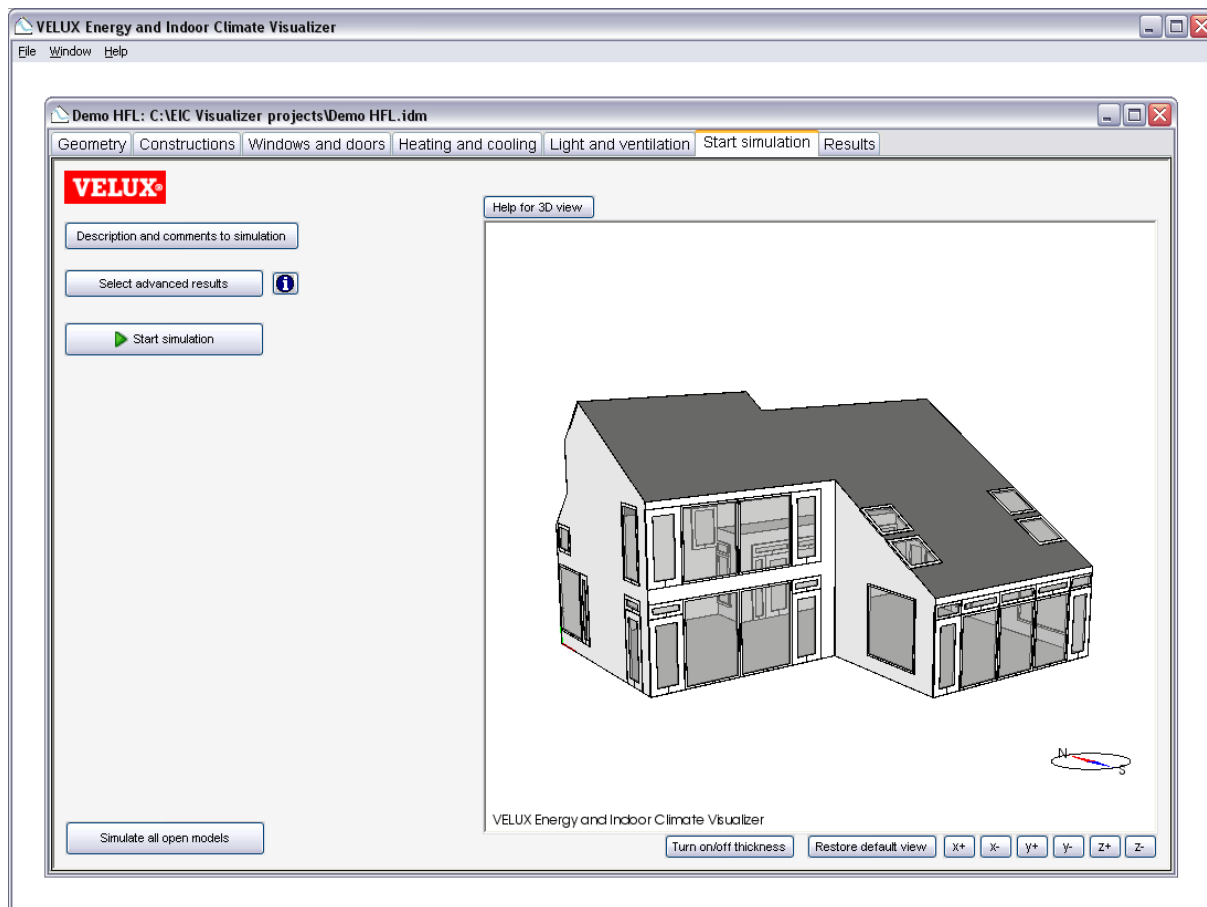


Figure 17 Start simulation tab

At this tab the simulation is described and started, and advanced results can be selected.



This button opens the Description dialog where information about the project can be entered. The information will be included in the results report.

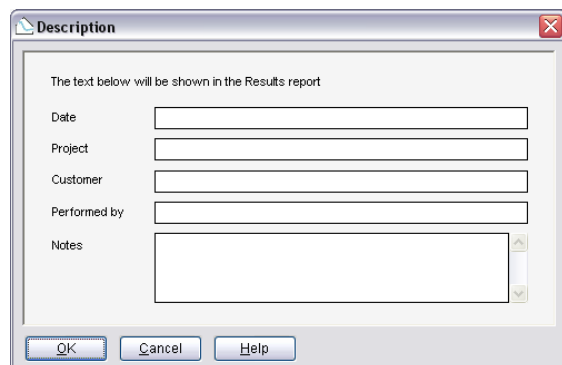
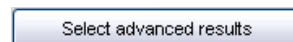


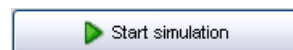
Figure 18 Description dialog

Select advanced results



This button reveals the advanced results, which can be logged during the simulation. The options selected here have no influence on the results report. The options only have an influence on which advanced results will be available after simulation for analysis by experienced users.

All options can be selected, but some of the options will generate large data files (more than 10 MB).



Pressing the "Start simulation" button will start the simulation.

Simulate all open models

If more than one model should be simulated, the “Simulate all open models” button can be used. Pressing this button will start the simulation of all models which are open in the program window one after another.

While the simulation is running, a simulation progress window will be visible. The date at the top-right corner shows the progress during the year. During the simulation, the indoor and outdoor temperatures are shown on a scale from -10°C to 30°C and the ventilation rate of the building is shown on a scale from 0 to 5 ACH.

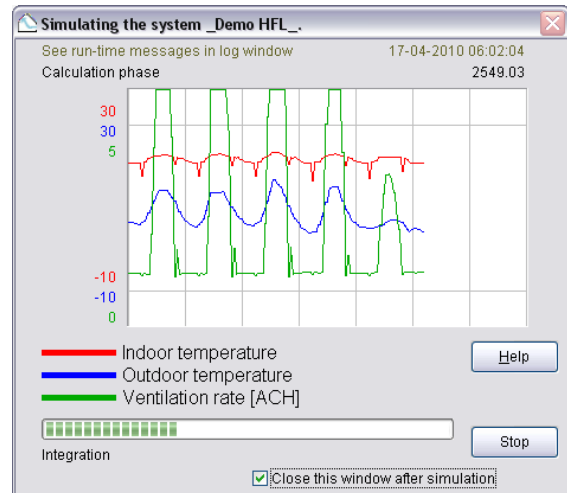


Figure 19 Simulation progress window

Results

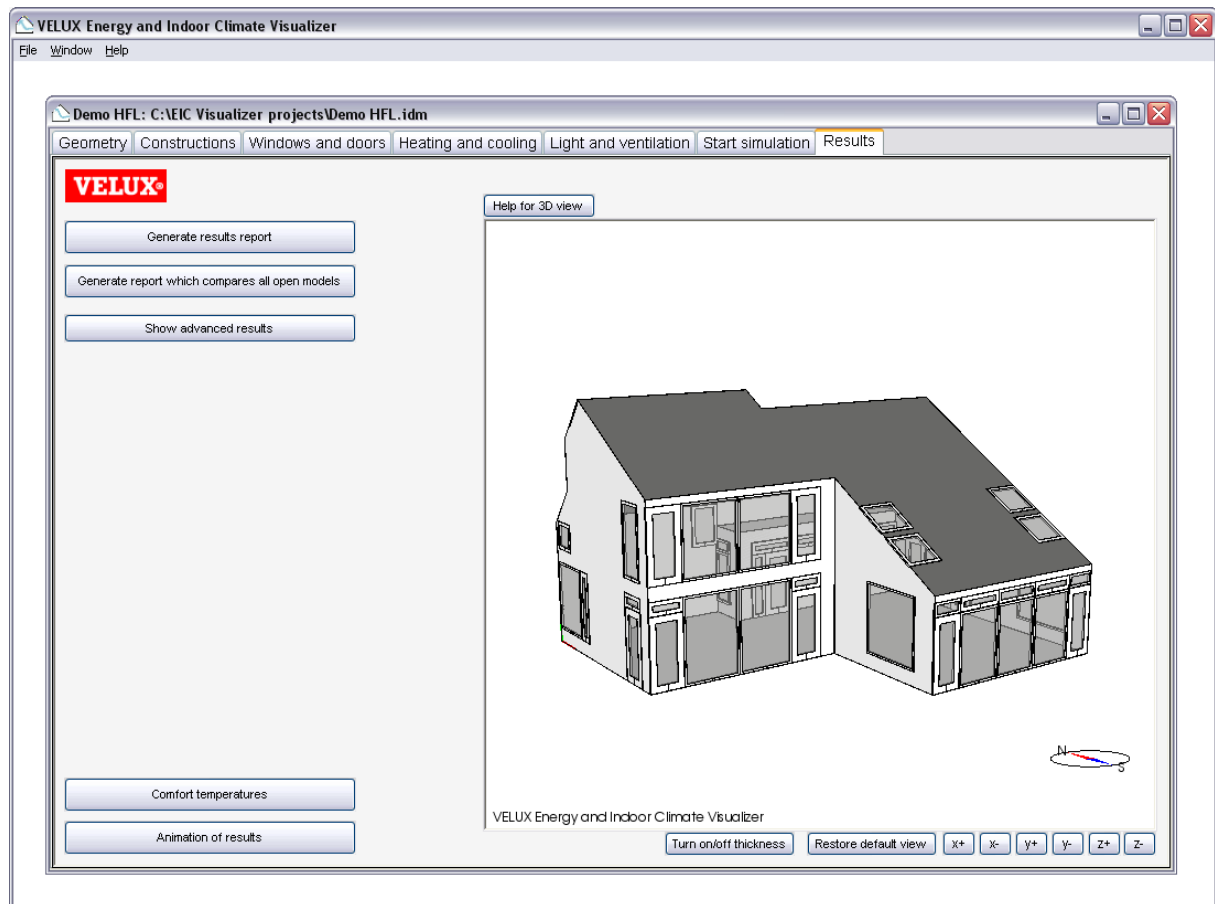
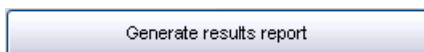


Figure 20 Results tab

At this tab results are selected and viewed.

Generate report

The results reports are printable reports, which contain the main results of the simulation. The reports cover the needs of most users. The contents can be customised.

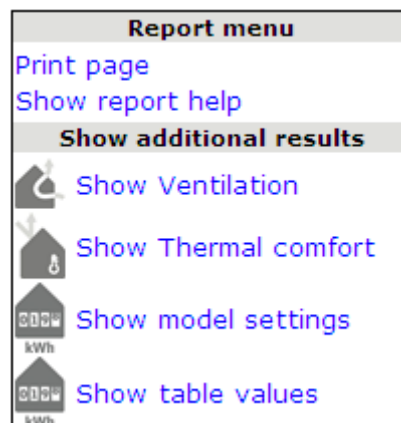


When this button is pressed, a report is generated with results on the model.

In the top right corner a menu is shown where additional results can be turned on and off. The menu can be hidden if it interferes with the content.

The report is an HTML file, which can be printed and saved from the file menu. The "Save" function will only save the text and not the diagrams, so it is recommended to print the report to a PDF conversion utility. Choose "Print" from the file menu, and select a pdf

printer. See the report help for more information.



Generate report which compares all open models

Pressing this button creates a report which compares the results of all the models which are open in the EIC Visualizer. Several models can be open at the same time in the EIC Visualizer, and this function is used to compare variants of the same building, e.g. a base case and a case with added windows or solar shading.

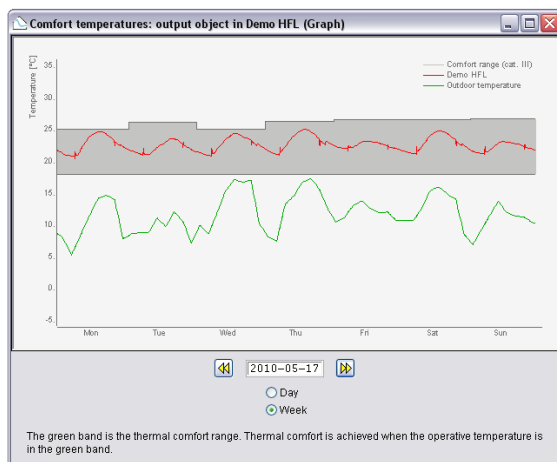
The report can be changed, printed and saved following the same principles as the single report.

Comfort temperatures

When this button is activated it is possible to animate the operative temperature and compare it to the comfort range and other simulation results. Each open project will automatically be compared to the active project.

The comfort range is based on the active model and is calculated on the basis of the outdoor temperature, according to the European Standard EN15251. The outdoor temperature is also shown.

Important note: If models with different climate or models with and without mechanical cooling are compared the comfort ranges only apply to the active project. The comfort range is based on the outdoor air temperature and the presence of a cooling system.

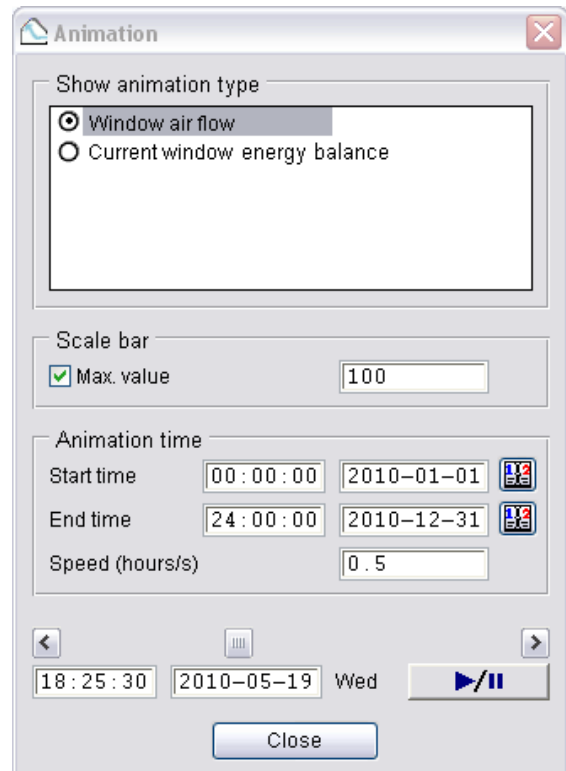


The graph shows the temperatures and comfort range for either one day or one week.

Under advanced results the comfort range (class I, II and III), outdoor temperature together with the operative temperature of the open projects can be seen for the entire year.

Animation of results

When this button is activated, it is possible to make an animation of the ventilation flows through windows and the current energy balance of the windows.



Ventilation flows

Arrows show when there is a flow through individual windows. The size and colour of the arrow represents the magnitude of the airflow in l/s.

There can be two airflows through each window. This represents how pivoting roof windows work, but also applies to other types of windows. The airflow can be in the same direction at the lower and upper part, but can also be in opposite directions.

The airflows take into consideration that there is infiltration in the building (air entering through leakages in the façade). Due to the stack effect, it is common that air will enter the house through façade windows and be extracted through roof windows.

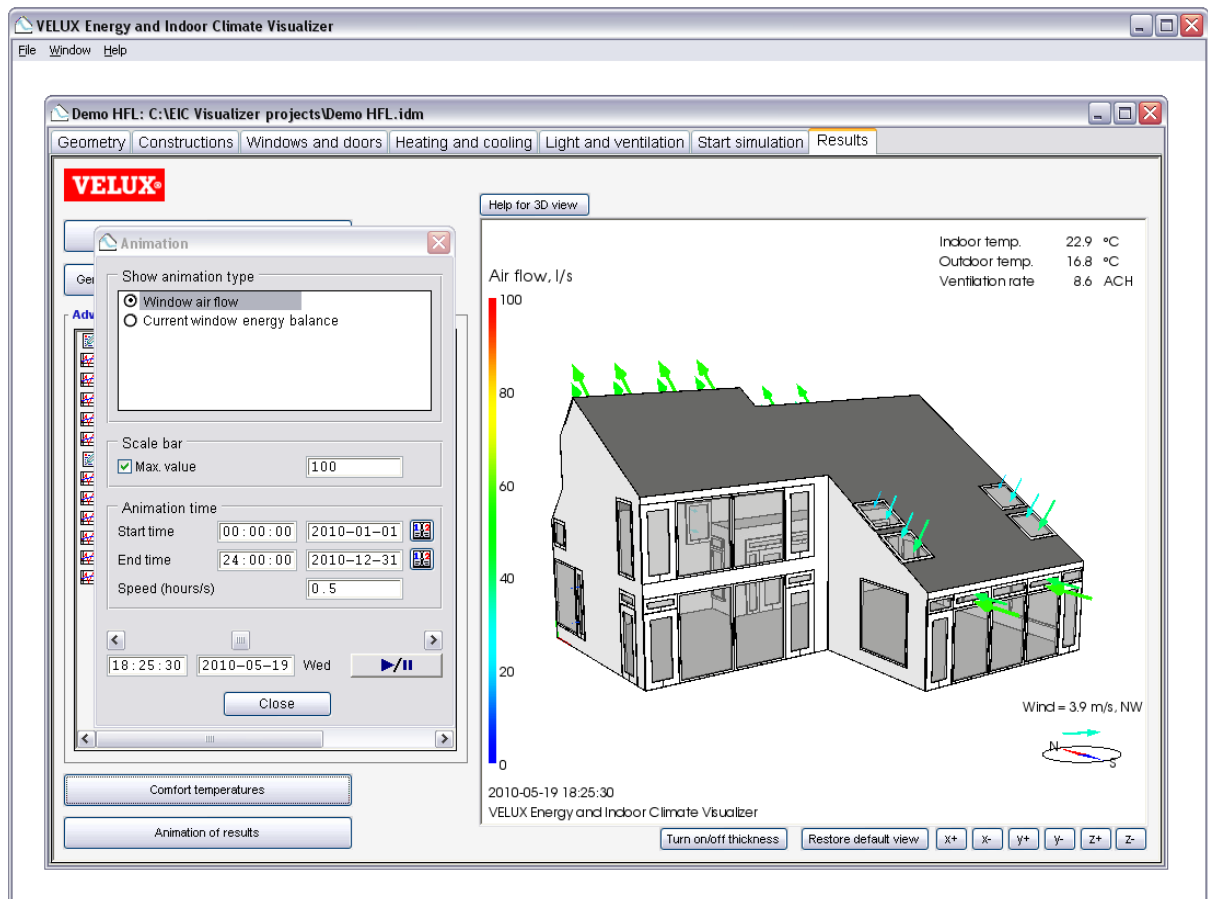


Figure 21 Visualisation of ventilation flows

Current window energy balance

Arrows show the energy flow in and out through individual windows. The size and the colour represent the magnitude of the energy flow. The arrow with two arrow heads shows the solar gain and the arrow with one arrowhead show the transmission loss. The transmission loss can be in both directions.

The energy flow is visualized for each window for each time step. This shall not be compared with energy balance equations for a whole year.

Animation settings

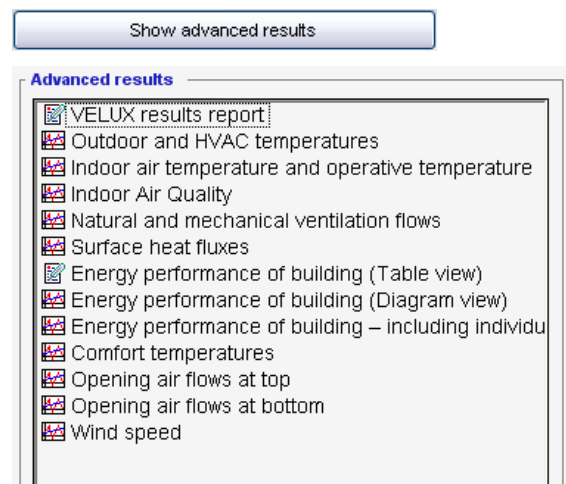
It is possible to change the start and end time of the simulation. This can be used to investigate a typical summer, winter or spring day, for example. The animation speed can also be adjusted. The higher the number in hours per second, the faster the animation will run.

Scale bar: Max. This option can be used to adjust the scale of the arrows. The maximum is automatically assigned to the highest airflow or energy flow occurring during the animation, but

this can be much higher than the typical values. It will often be helpful to reduce the maximum to 50 l/s or less for ventilation. For the current energy balance animation the maximum value should be adjusted according to the season in focus.

Show advanced results

Here experienced users can select detailed results to analyse specific issues.



Each advanced result will open a diagram. This can be changed to a table view using the tabs at the top of the results window.

The arrows at the bottom of the results window can be used to change from annual to for example monthly results.

The energy balance for each window in a project can be found in “Energy performance of building – including individual windows”. For each window there is a column titled QSOLAR and a column titled QTRANSM. QSOLAR is the heat gain, and QTRANSM is the transmission. QTRANSM will be negative during the winter season. On warm summer days it can be positive, when the outdoor temperature is above the indoor temperature.

Data can be exported directly to Excel via the logo at the bottom right corner. The standard exported values uses the time steps used in the calculations. To get for instance hourly values use the table pane and change the table properties to hourly values. Then copy the data manually into Excel. This method, however, will export the hourly mean values of the preceding hour. More details on this issue are found in the technical background document.

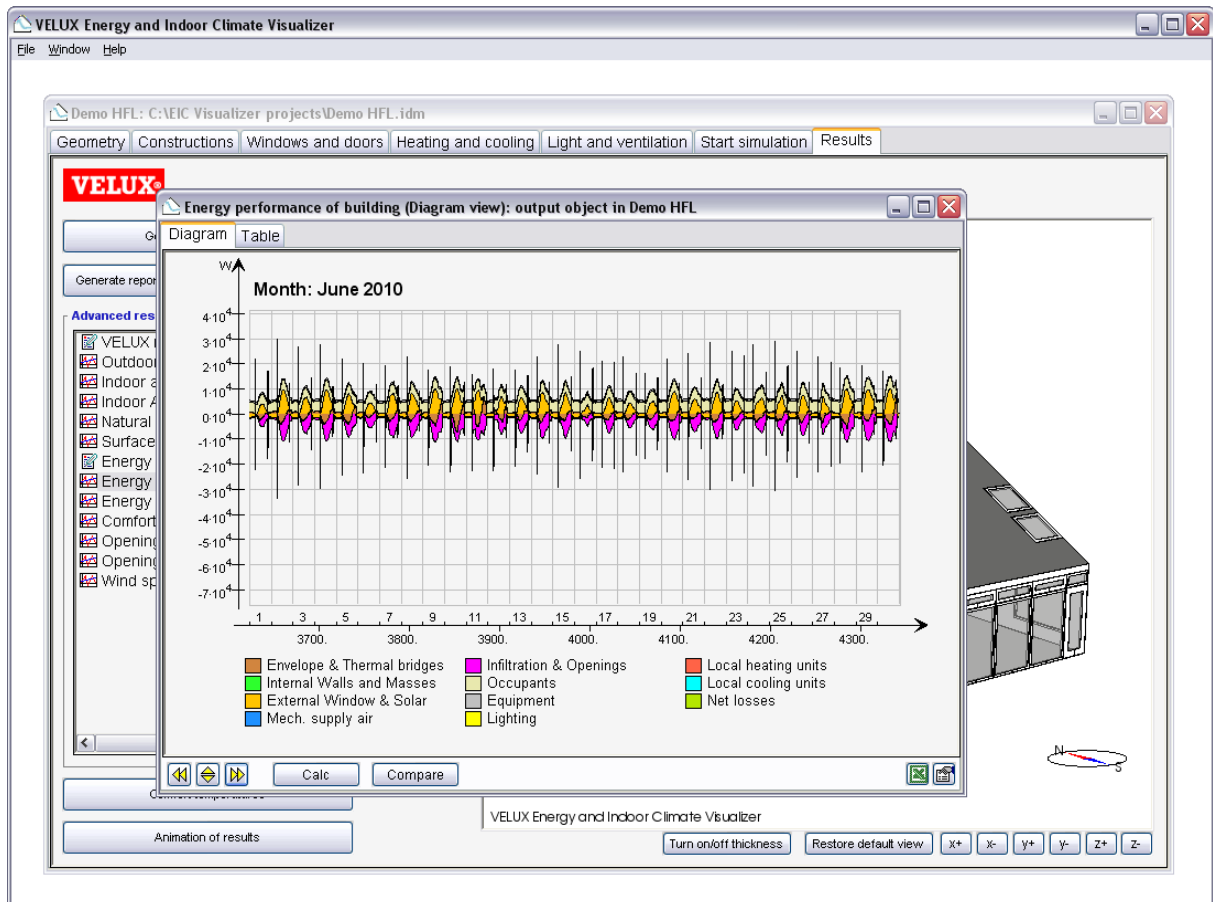
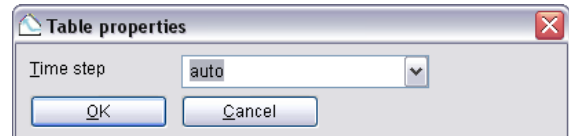


Figure 22 Advanced results

Using the 3D view

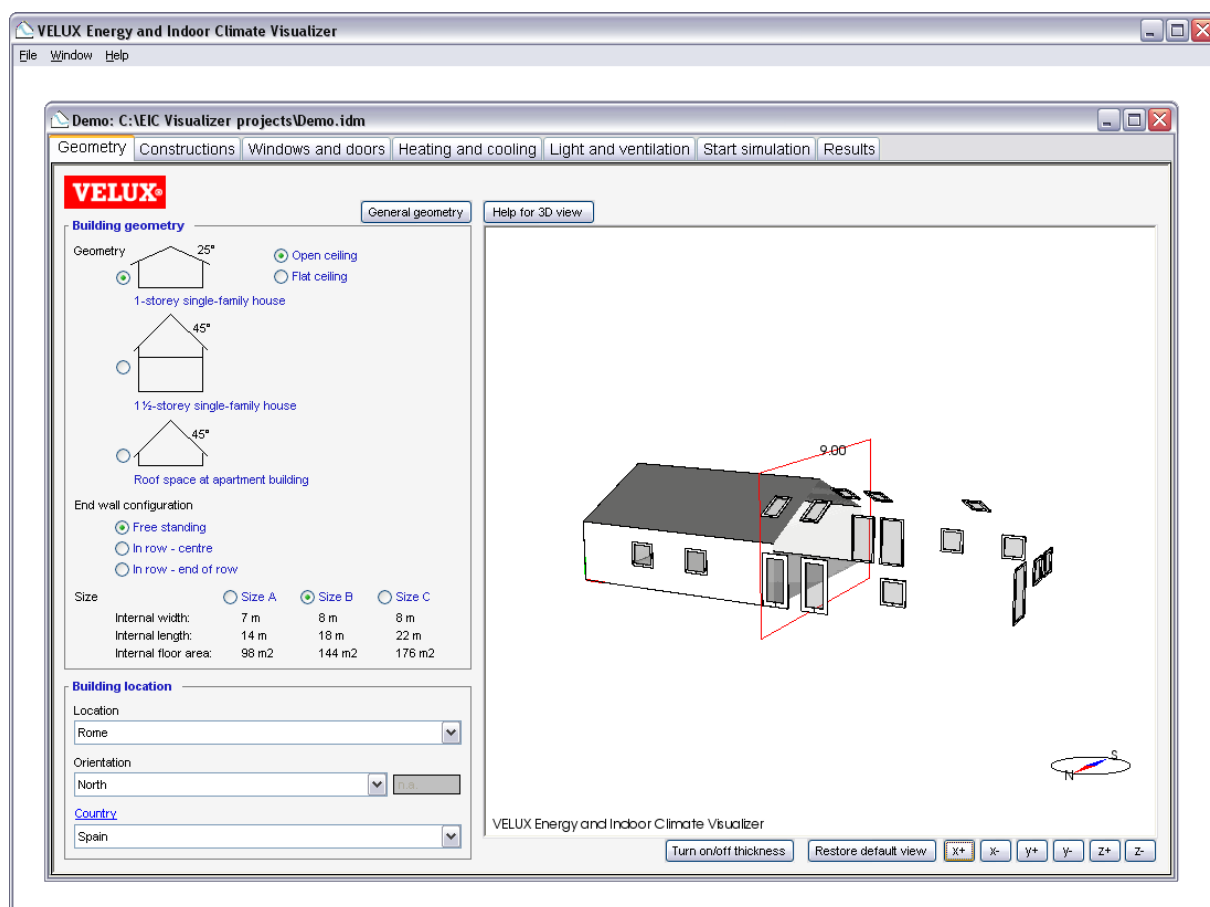


Figure 23 3D view

The geometry of the building is shown in the 3D view to the right with solid walls showing the wall construction. A compass is shown to keep track of the building orientation. The 3D model can be interactively rotated, zoomed and panned.

Figure 24

Descriptions of buttons:

Turn on/off thickness This button will turn on or off the thickness of the constructions.

Restore default view This buttons resets the section view and displays the full building.

x+ Cut 3D model along the x-axis removing all geometry on the positive side of the cut plane.

x- Cut 3D model along the x-axis removing all geometry on the negative side of the cut plane.

y+ Cut 3D model along the y-axis removing all geometry on the positive side of the cut plane.

y- Cut 3D model along the y-axis removing all geometry on the negative side of the cut plane.

z+ Cut 3D model along the z-axis removing all geometry on the positive side of the cut plane.

z- Cut 3D model along the z-axis removing all geometry on the negative side of the cut plane.

Description of mouse operations:

Left mouse button: **Click** Select object. Selected object is shown in blue.

Left mouse button: **Hold down and move mouse** Rotate the model. The model is always oriented so that the positive z-axis is upwards.

Left mouse button: At cut, press Ctrl-key, click within red frame, hold down and move mouse Move the cut plane.

Middle mouse button (or both the left and the right mouse buttons on a two-button mouse): **Hold down and move the mouse** Move the model up, down, right or left.

Right mouse button: **Click** Open right mouse button menu.

Right mouse button: **Hold down and move the mouse** Zoom in/zoom out. Move the mouse upwards to zoom in and downwards to zoom out.

Right mouse button menu: **Set focus** Set the point around which the model is rotated and towards which it is zoomed (Hotkey F).

Right mouse button menu: **Zoom extends** Zoom and pan the model so that the entire model is visible (Hotkey R).