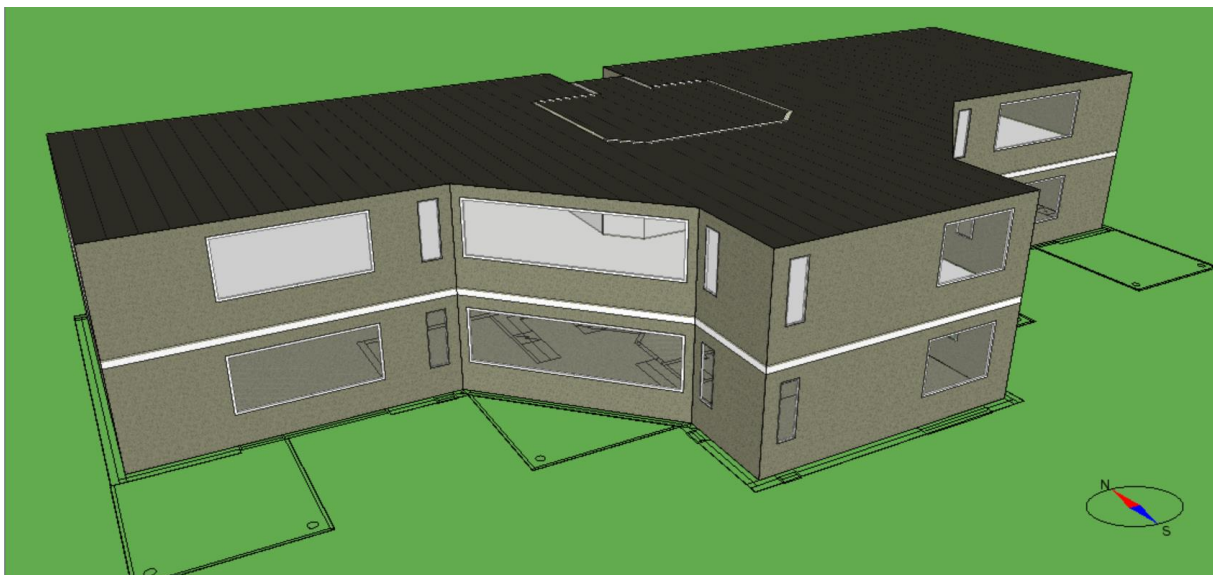


IDA Indoor Climate and Energy

Basic Course

# **POWER DEMAND FOR MULTIPLE ZONES**

Guide



# Purpose

This is the second part of the IDA ICE basic course 1. You learn how to perform a heating and cooling power demand for multiple zones of a building. During this guided exercise, we go through the following tasks:

- Handling of default constructions
- Importing of DWG (DXF) drawings
- Editing building and zone geometry
- Inerting windows from the floor plan view
- Copy zones
- Heat load and cooling load calculations
- Looking at important result diagrams according to the building level

To get more support, also use the getting started guide, accessible over the "Help" menu within the IDA ICE software.

This exercise requires the preceding guided exercise "Indoor Climate of a single zone"

# Background

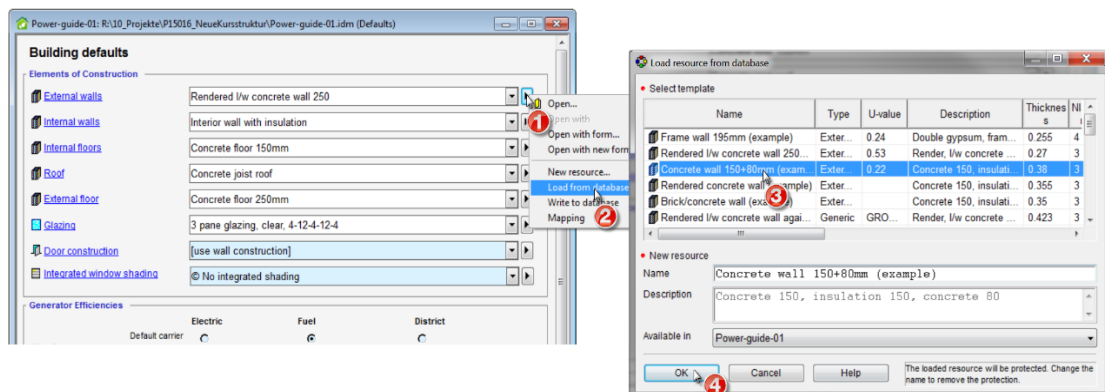
To calculate the power demand is an important issue for most building projects.

# Instructions

An IDA ICE file is either stored as a single (packed) idm-file or as an (unpacked) idm-file together with a folder with the same name. To start this exercise, open *Power-guideStart.idm* and save the case as e.g. *Power-Myguide.idm* on a reasonable place.

## Step 1

- First we go to the **General** tab and click on  **Defaults** to get to the defaults of our project. In the defaults form you can define defaults for constructions, energy generator efficiencies, energy meters for different energy usage and carriers, zone model fidelity and surface temperature for ideal coolers.
- There is a certain number of constructions in the IDA ICE database. We will use them in this exercise. Do this following the figure below.



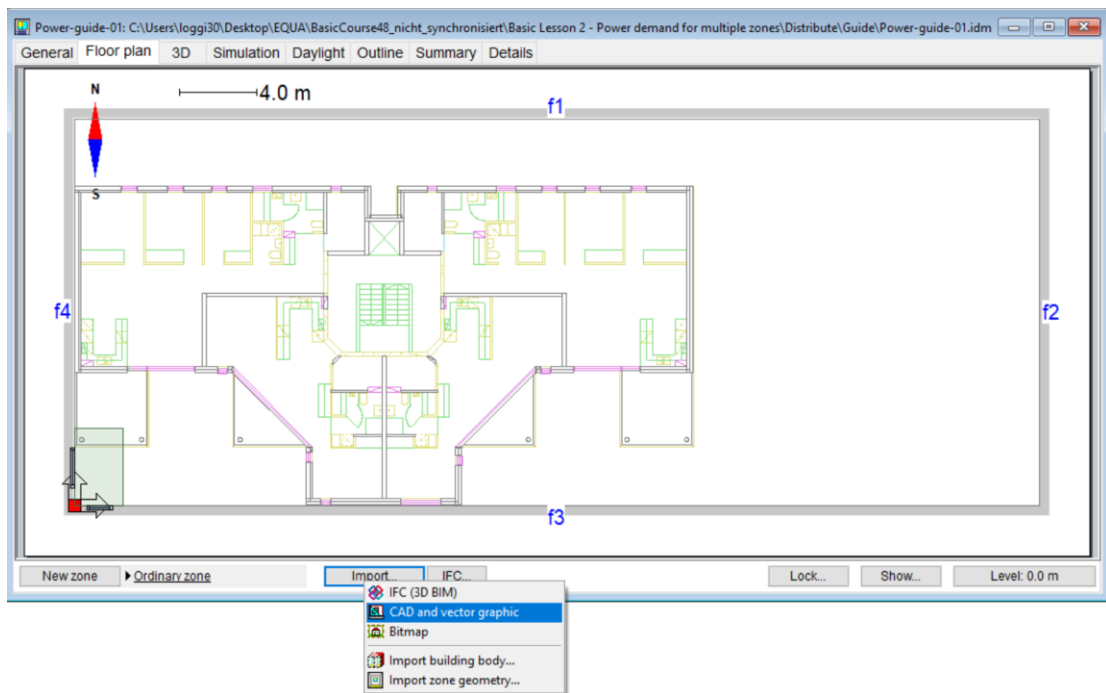
Load the following constructions to from the database to the defaults:

- For external walls: Concrete wall 150+80mm (example)
- For Roofs: Concrete joistroof (example)
- For glazings: The glazing with  $g = 0.46$  and  $U = 0.95$ .
- For all other constructions: Leave the defaults as they are

## Step 2

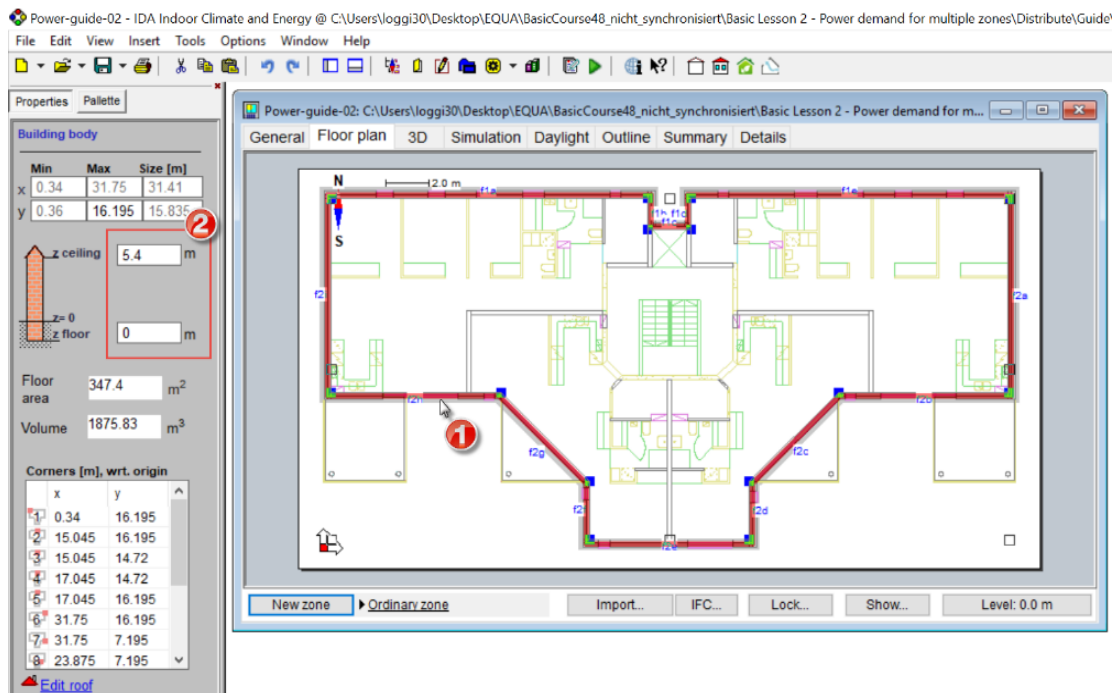
We now start modelling the building and its zones. To do this go to the **Floor plan** tab.

- Click on the "Import ..." button and select "CAD and vector graphic". Select the file "DWG example.dwg" in the folder <ida>\samples\ICE, where <ida> is the folder where IDA ICE is installed (usually C:\Program Files (x86)\IDA) and click "Open". Click "OK" in the upcoming preferences dialog. The dwg drawing should now be shown as a background in the floor plan view.

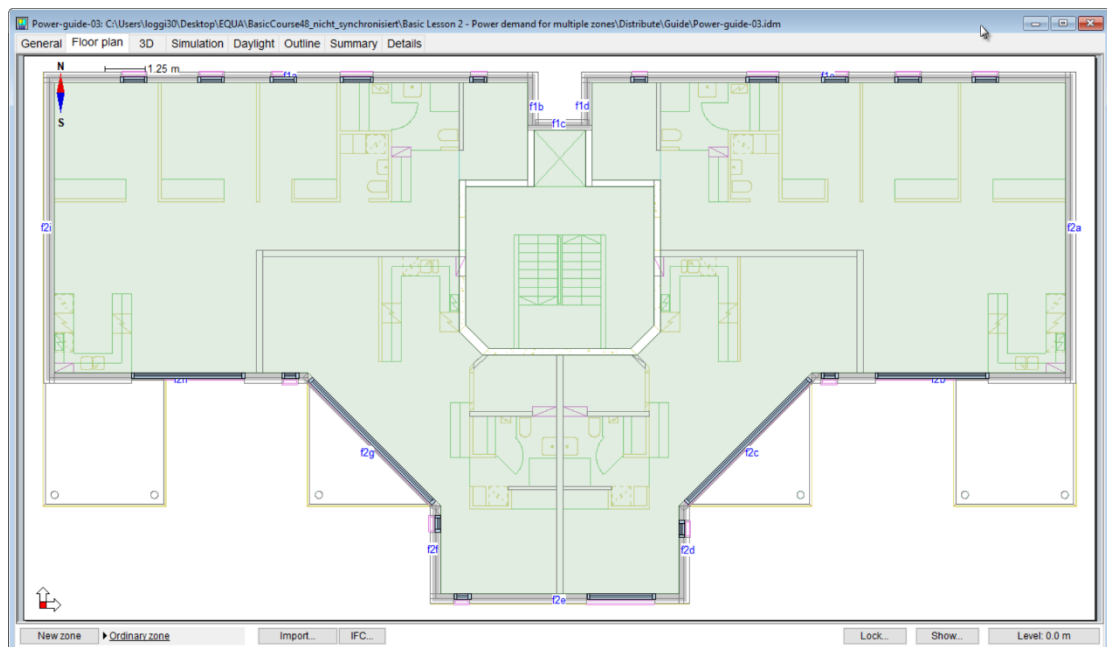


- Delete the zone from the preceding exercise and edit the building body by snapping it to the inner side of the external walls of the CAD drawing. See Getting started guide, chapter 1 "Building geometry and CAD import" for detailed instructions how to edit the building body.

- c. Set the building body's height to 0 ... 5.4 m:

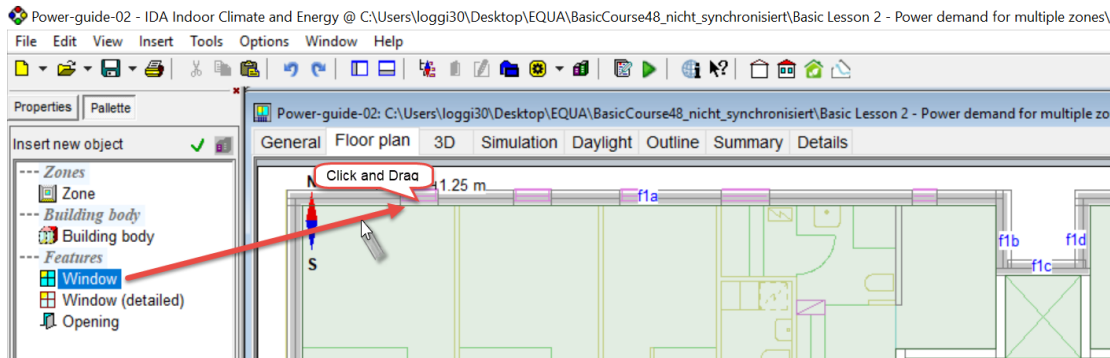


- d. Insert the first 2 zones to the level 0 m. See Getting started guide, chapter 4 "Inserting zones" for detailed instructions how to insert zones.

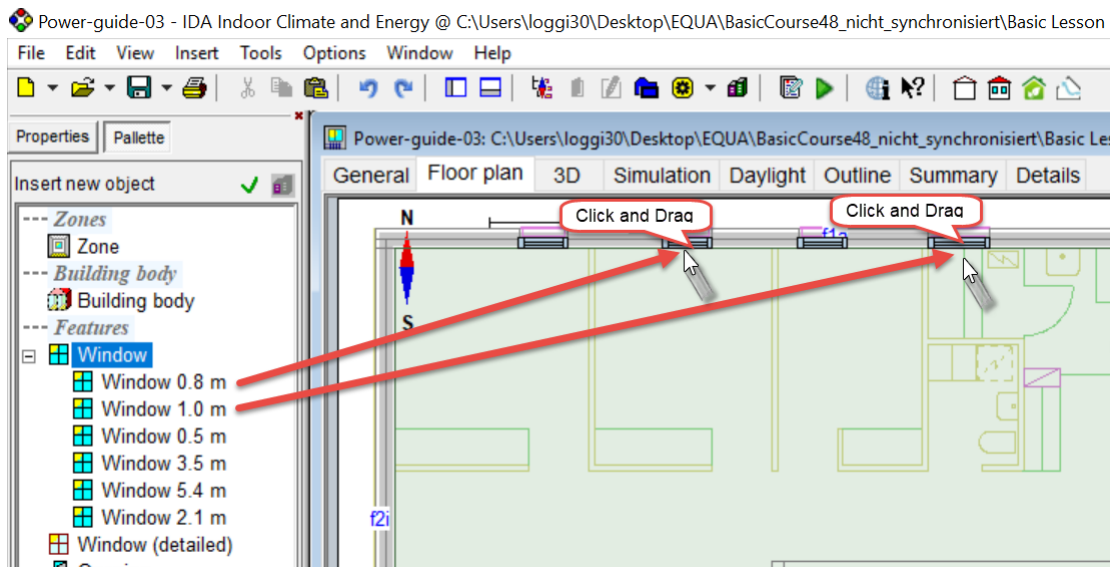


### Step 3

- a. Insert a window by drag and drop from the palette to the correct position in the floor plan. Drop the window at its center, near the blue border line of the zone, keeping inside the zone. Edit the width of the window to 0.8 m and it will fit with the CAD drawing. See Getting started guide, chapter 5 "Inserting windows and internal openings" for detailed instructions how to insert windows.



- b. Once a window is sized correctly, you can create a resource from this window in order to easily drag in more windows of the same size. Rightclick on your inserted and correctly sized window and select "convert to resource" from the context menu. Give a reasonable name to the new resource (here we choose "Window 0.8 m"). Your new resource will then be available in the palette.

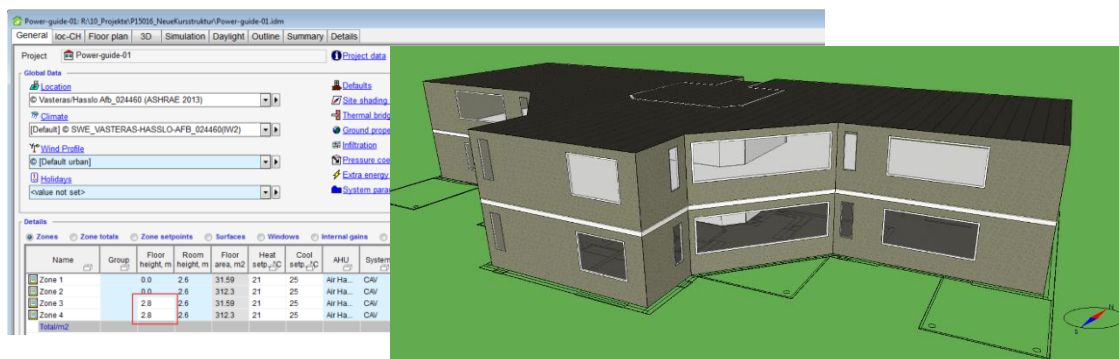


- c. Create resources for all requested window widths (0.5, 0.8, 1.0, 2.1, 3.5 and 5.4 m) and drag and drop all windows to the floor plan. To insert multiple windows from one resource, you can optionally doubleclick on the resource and then click once to the floor plan for each window. In this case, click "OK" to exit the multiple window positioning.

## Step 4

We now copy both zones with all windows and other properties to the second floor.

- Go to the **General** tab and select Zone 1. Click Ctrl+c for "copy" and Ctrl+v for "paste". Do the same with zone 2 (you cannot select multiple objects in the input data tables). The new zones are inserted at the end of the list.
- As they do have exactly the same position as the 2 original zones, you will not yet be able to see them in the 3D view. Set the floor height of both copied zones to 2.8 m (you can do this directly in the zone table) and check your model in the 3D view.



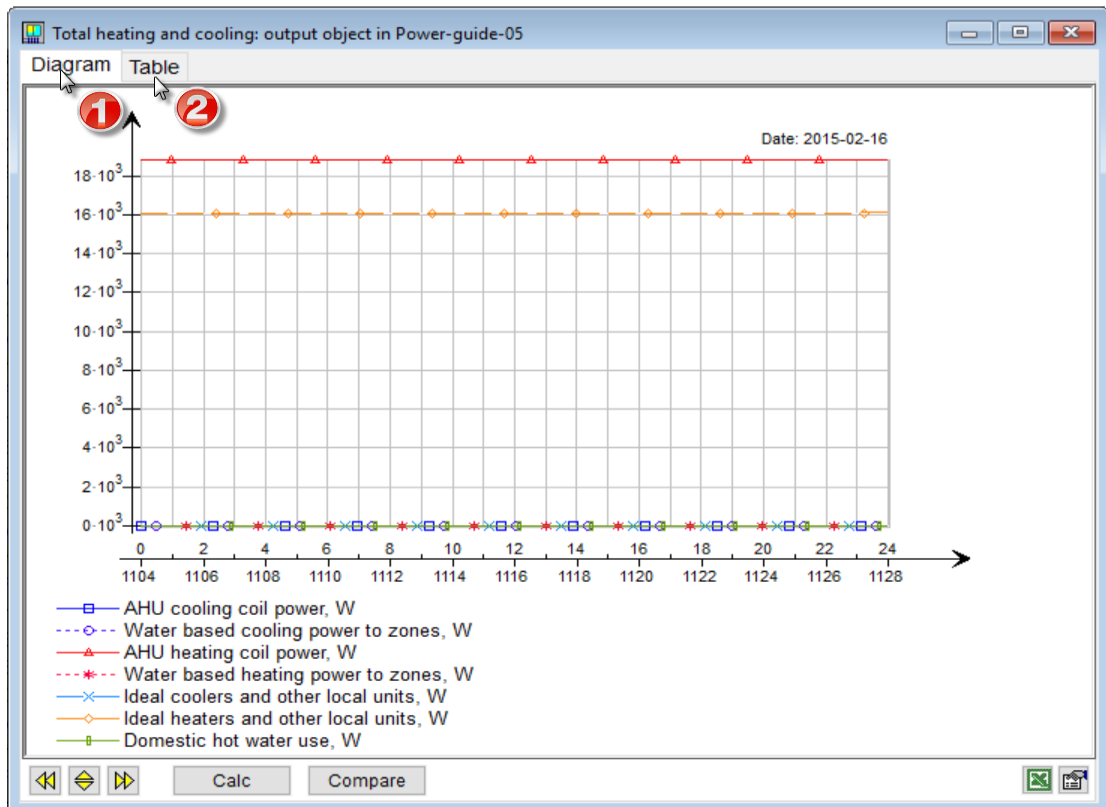
## Step 5

We are now ready to run a heat load calculation.

- Use the same settings as in the lesson "Indoor climate for a single zone", i.e. 0 % of internal loads, constant ambient temperature = -15 °C and 0 % of solar radiation.
- Study the result table in the **Summary** tab (extreme values of the heating case).

| Zone   | Group | Zone multipl. | Heat supplied, W | Time         | Room unit heat, W | Temp, °C | Op temp, °C | Sup airflow, L/s | Sup airtemp, °C | Ret airflow, L/s | Other sup airflow, L/s | Other sup airtemp, °C | Rel hum, % | CO2, ppm | PPD, % | Envelope & Ther, W |
|--------|-------|---------------|------------------|--------------|-------------------|----------|-------------|------------------|-----------------|------------------|------------------------|-----------------------|------------|----------|--------|--------------------|
| Zone 1 | 1     | 1             | 138.4            | 16 Feb 17:53 | 445.0             | 21.0     | 21.16       | 63.95            | 16.99           | -63.08           | 0.0                    |                       | 6.046      | 400.0    | 16.28  | -140.8             |
| Zone 2 | 1     | 1             | 4436.0           | 16 Feb 17:53 | 7450.0            | 21.0     | 21.03       | 629.6            | 16.99           | -621.1           | 0.0                    |                       | 6.046      | 400.0    | 17.04  | -2741.0            |
| Zone 3 | 1     | 1             | 179.5            | 16 Feb 17:53 | 484.7             | 21.0     | 21.21       | 63.95            | 16.99           | -63.08           | 0.0                    |                       | 6.044      | 400.0    | 15.96  | -159.4             |
| Zone 4 | 2     | 1             | 4718.0           | 16 Feb 17:53 | 7724.0            | 21.0     | 21.11       | 629.6            | 16.99           | -621.1           | 0.0                    |                       | 6.044      | 400.0    | 16.59  | -2852.0            |

- Study the diagram "Total heating and cooling" from the **Details** tab: Click on [Total heating and cooling](#) to open the diagram in a separate window. Look at the diagram as well as at the table.



- d. Study the "Delivered Energy" report from the **Details** tab: Doubleclick on "Delivered Energy". Here you will find the peak demand of all your energy meters.

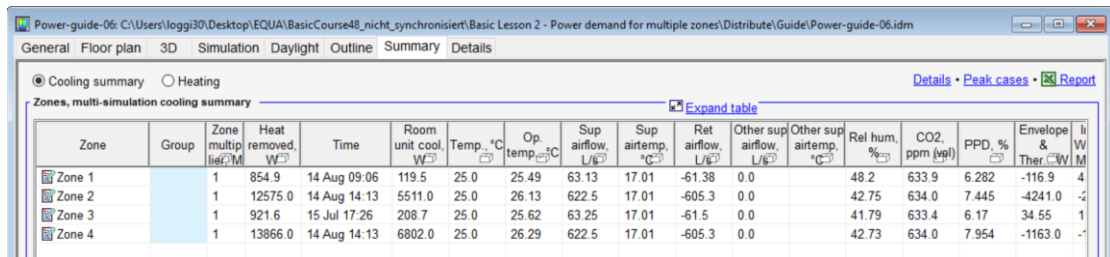
### Delivered Energy Overview

|                          | Purchased energy |                    | Peak demand |
|--------------------------|------------------|--------------------|-------------|
|                          | kWh              | kWh/m <sup>2</sup> | kW          |
| Lighting, facility       | 0                | 0.0                | 0.0         |
| Electric cooling         | 0                | 0.0                | 0.0         |
| HVAC aux                 | 52               | 0.1                | 2.18        |
| Total, Facility electric | 52               | 0.1                |             |
| Fuel heating             | 931              | 1.4                | 38.81       |
| Domestic hot water       | 0                | 0.0                | 0.0         |
| Total, Facility fuel*    | 931              | 1.4                |             |
| Total                    | 983              | 1.4                |             |
| Equipment, tenant        | 0                | 0.0                | 0.0         |
| Total, Tenant electric   | 0                | 0.0                |             |
| Grand total              | 983              | 1.4                |             |

\*heating value

## Step 6

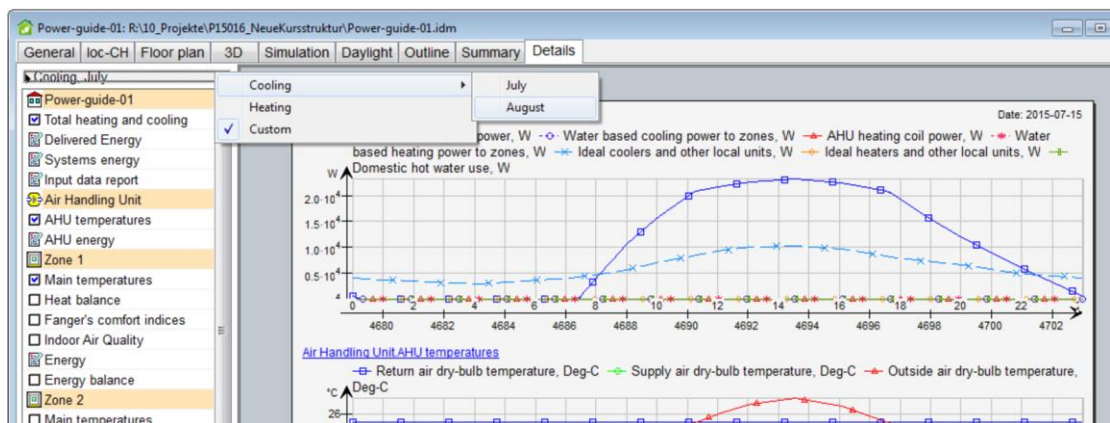
- Run a cooling load calculation with default settings.
- Study the result table in the **Summary** tab (extreme values of the cooling case).



| Zone   | Group | Zone multip | Heat removed, W | Time         | Room unit cool, W | Temp, °C | Op. temp, °C | Sup airflow, L/s | Sup airtemp, °C | Ret airflow, L/s | Other sup airflow, L/s | Other sup airtemp, °C | Rel hum, % | CO2, ppm (vvl) | PPD, % | Envelope & Ther, W | li W |
|--------|-------|-------------|-----------------|--------------|-------------------|----------|--------------|------------------|-----------------|------------------|------------------------|-----------------------|------------|----------------|--------|--------------------|------|
| Zone 1 |       | 1           | 854.9           | 14 Aug 09:06 | 119.5             | 25.0     | 25.49        | 63.13            | 17.01           | -61.38           | 0.0                    |                       | 48.2       | 633.9          | 6.282  | -116.9             | 4    |
| Zone 2 |       | 1           | 12575.0         | 14 Aug 14:13 | 5511.0            | 25.0     | 26.13        | 622.5            | 17.01           | -605.3           | 0.0                    |                       | 42.75      | 634.0          | 7.445  | -4241.0            | -2   |
| Zone 3 |       | 1           | 921.6           | 15 Jul 17:26 | 208.7             | 25.0     | 25.62        | 63.25            | 17.01           | -61.5            | 0.0                    |                       | 41.79      | 633.4          | 6.17   | 34.55              | 1    |
| Zone 4 |       | 1           | 13866.0         | 14 Aug 14:13 | 6802.0            | 25.0     | 26.29        | 622.5            | 17.01           | -605.3           | 0.0                    |                       | 42.73      | 634.0          | 7.954  | -1163.0            | -1   |

- Study the diagram "Total heating and cooling" from the **Details** tab.

**Note:** For the cooling load calculation results, you can switch between the different design days as shown below.



- Study the "Delivered Energy" report from the **Details** tab.