

TASK 1. Radiative heat transfer between two parallel plates

How many shields with $\epsilon = 0.1$ should you add in order to have the new heat transfer rate to be 1% of the case without shields ?

CASE WITHOUT SHIELDS

$$Q_{12, n \text{ shields}} = \frac{A\sigma(T_1^4 - T_2^4)}{(N+1)\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right)}$$

$$Q_{12, n \text{ shields}} = \frac{1}{(N+1)} Q_{12NO \text{ SHIELD}}$$

$$N = 1 \frac{Q_{12NO \text{ SHIELD}}}{Q_{12 n \text{ shields}}} - 1$$

$$N = 1 \frac{100\%}{1\%} - 1$$

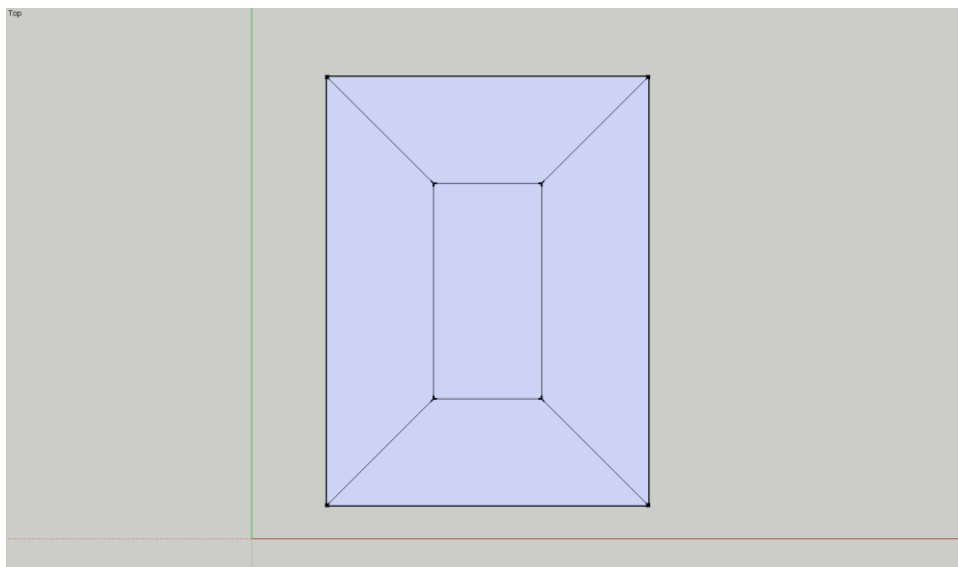
$$N = 99$$

To reduce the heat exchange to 1% of the initial value without shields, it is necessary to introduce 99 shields with $\epsilon = 0.1$

TASK 2. Sketchup – Open studio

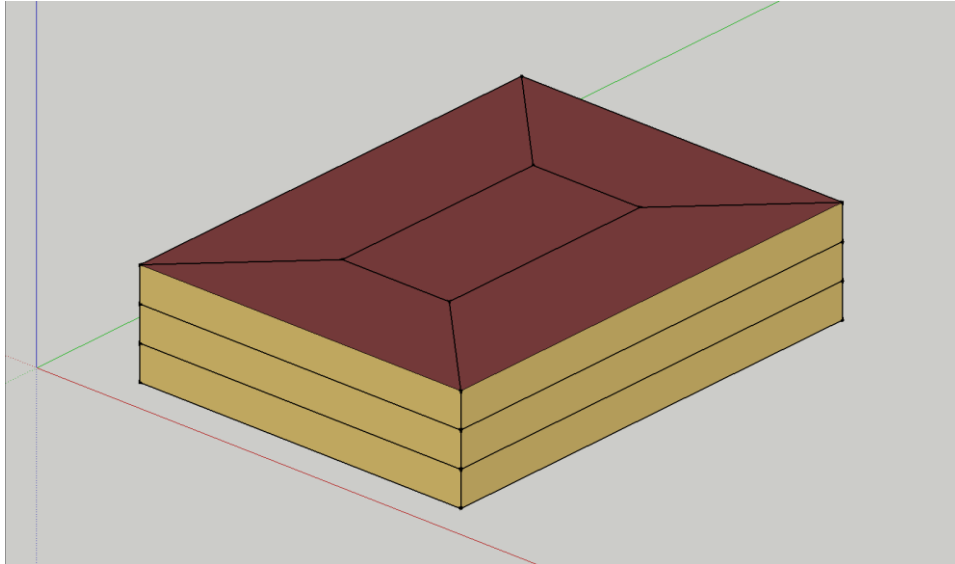
STEP 1.

Do the plan drawing of your building. IMPORTANT: Do not extrude any shapes using sketchup tools. And if you want to save the file, you must do it with open studio tools and not with sketchup.



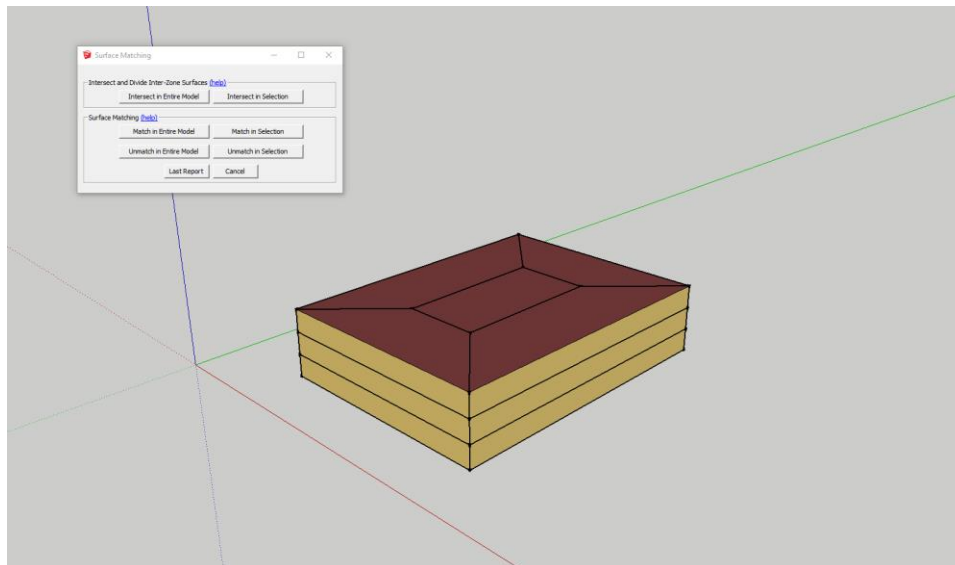
STEP 2.

Use the tool – Create space from diagram – on the open studio toolbar. In the new window, you can modify the height of each floor and the number of floors. In this case, the floor height is 10 inches and the number of floors are 3



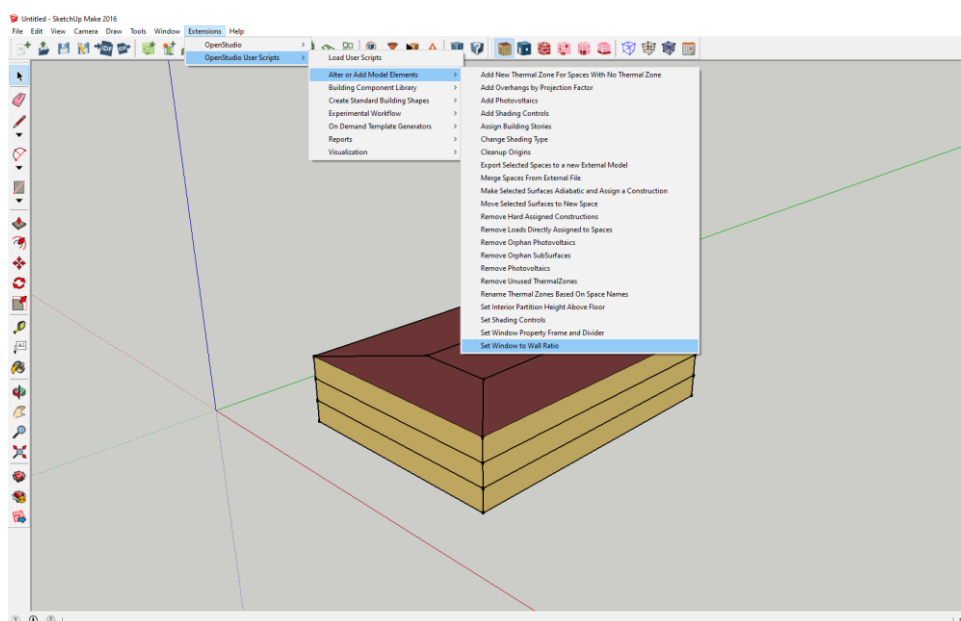
STEP 3.

Select all model and use the open studio tool called – surface matching – In the new window, you select “ Match in entire model”. This step is important to separate the facades with the entire model.



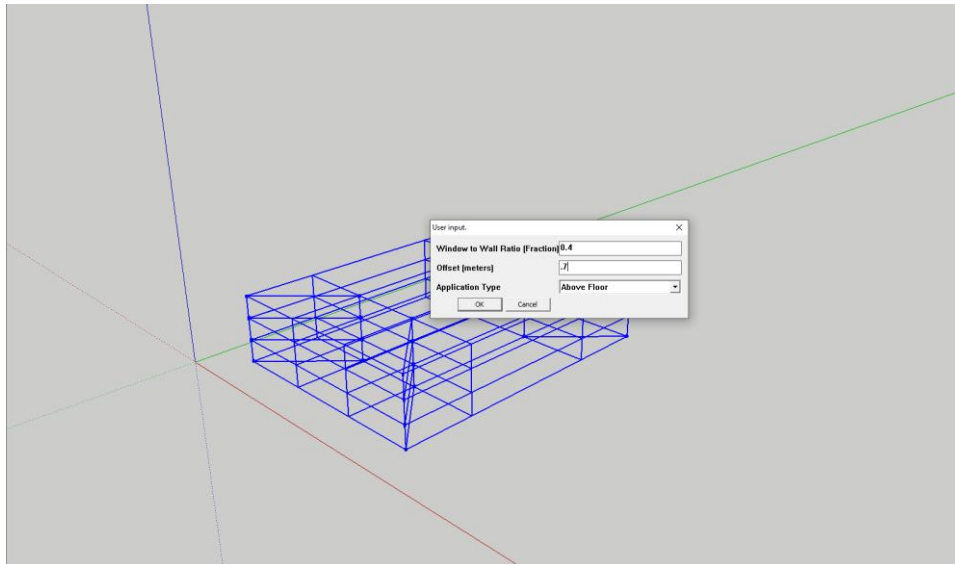
STEP 4.

Create windows in the 4 facades following the path shown in the image.



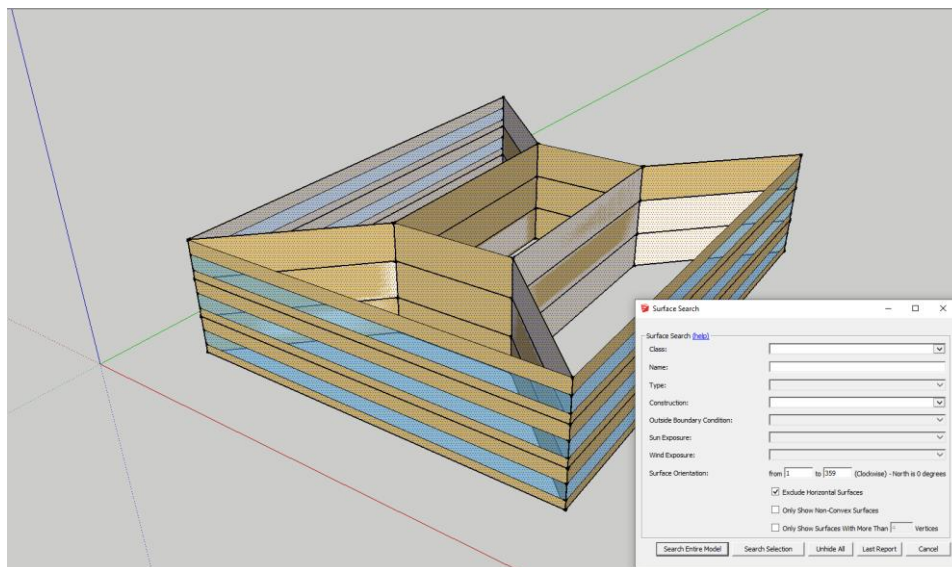
STEP 5.

After following the route to create windows you can configurate the height of the windows, as it is shown in the new window.



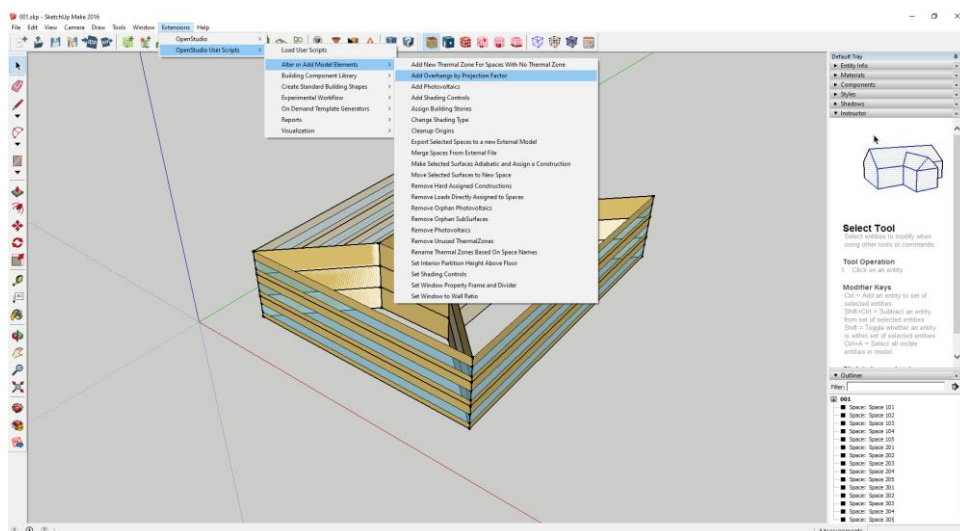
STEP 6.

To select certain surfaces you can use – Select with filter – In this case, we want to select all surfaces except north facades. In the new window, you can modify the angle of the selection, change it from values different to 0 or 360



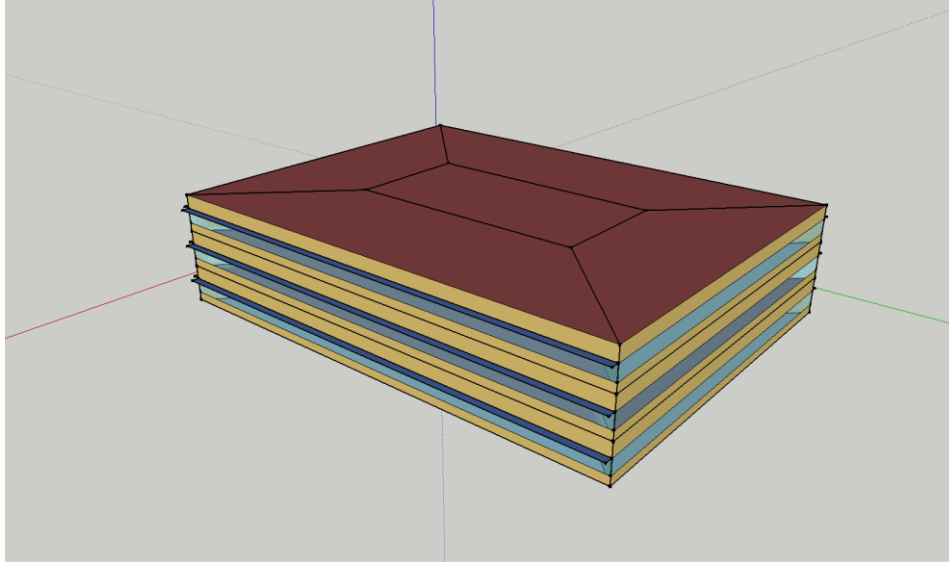
STEP 7.

Without changing the selection made automatically by the computer, we can start adding overhang to those facades.



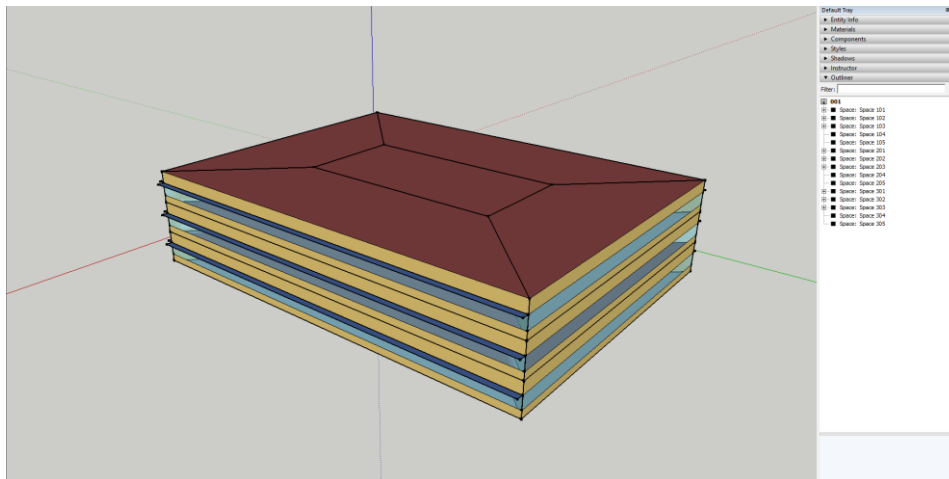
STEP 8.

Once you added overhang, you re-do the step related with - search surface - changing the values to 0 – 360 in a way it includes all surfaces.



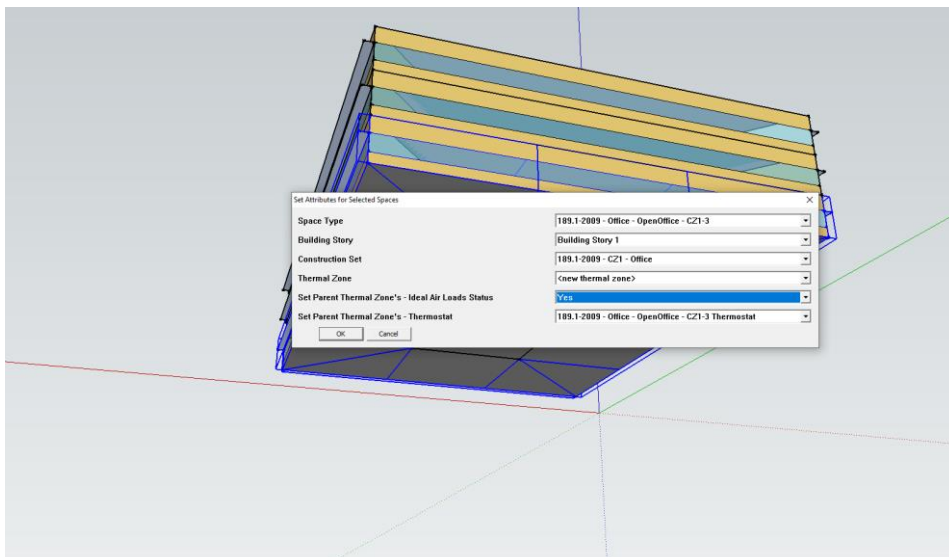
STEP 9.

To start adding specifications to each space is necessary to have outliner on, so you can choose the spaces in a list.



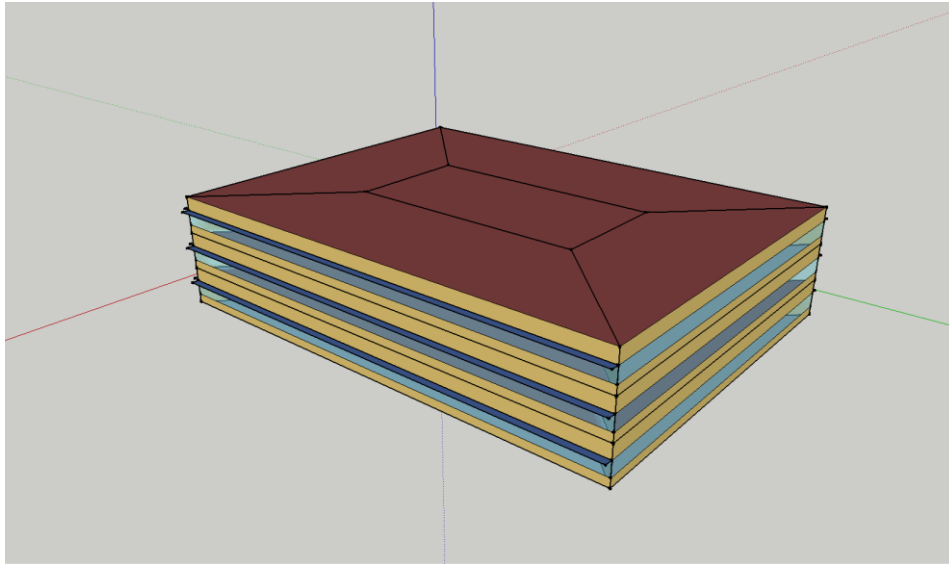
STEP 10.

Using the tool – Set attributes to selected spaces – you can add the attributes to each thermal zone in the building.



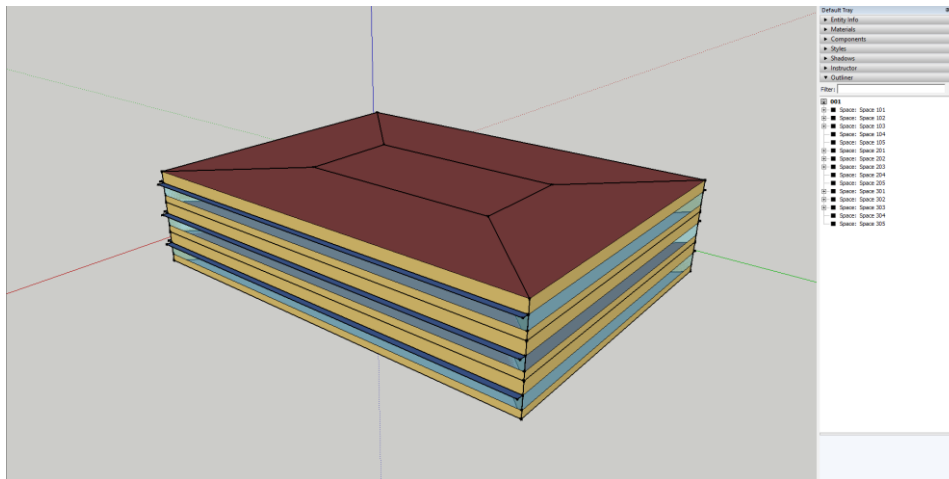
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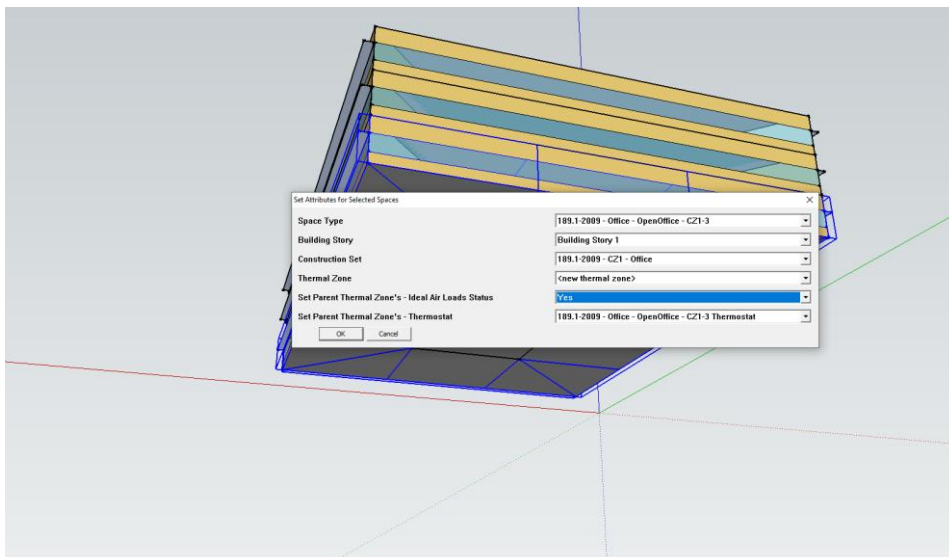
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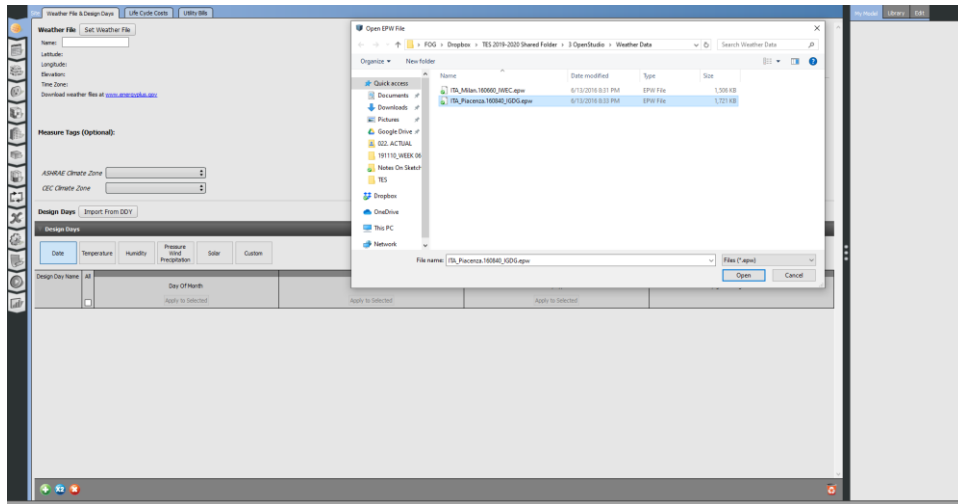
STEP 10.

Using the tool – Set attributes to selected spaces – you can add the attributes to each thermal zone in the building. Repeat this step in all the stories and all the spaces.



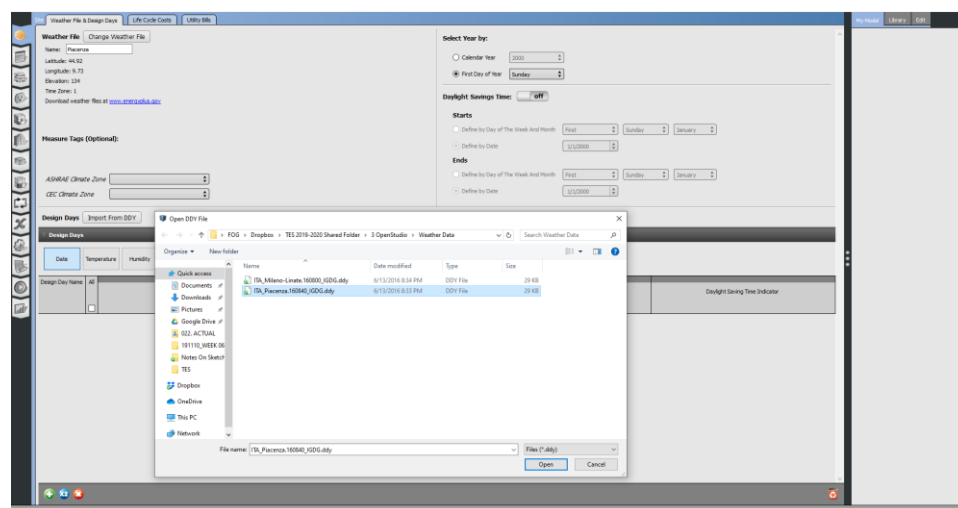
STEP 11.

After adding all attributes in sketchup we are done with the program. Now, we move to Openstudio program to set all the weather data. First in file tab/ open. You must open your OMS model file. Then, in WEATHER FILE button, you must select piacenza.epw.



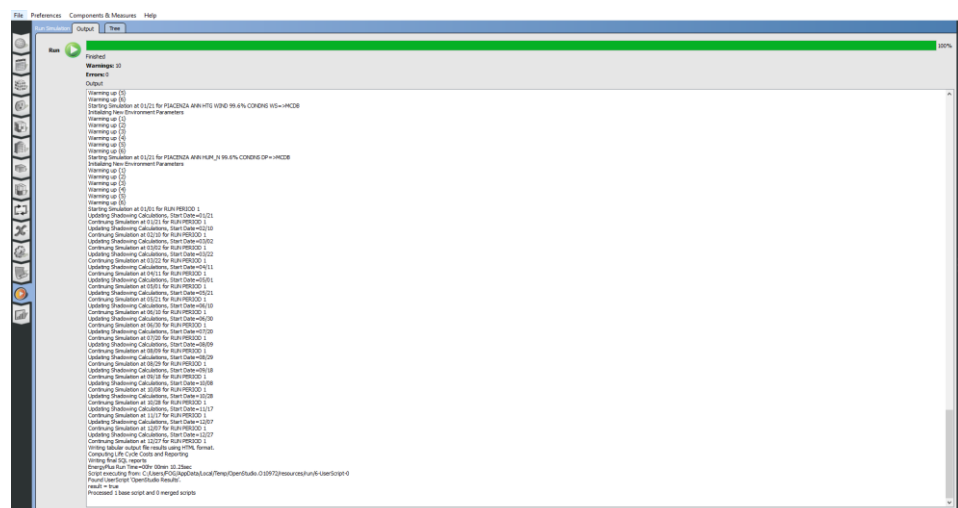
STEP 12.

In the Button – IMPORT FROM DDY – you must select Piacenza.ddy



STEP 13.

Now you are ready to run the software. Be aware, if it shows errors, you must repeat the process, and check if you assigned wrong the attributes to the spaces on sketchup or the imported file and weather data in openstudio.



STEP 14.

Finally, you can check your results on the final tab, and you find them in two ways: EnergyPlus results or OpenStudio results.

The screenshot shows the 'Results Summary' window in OpenStudio. The 'Reports' dropdown is set to 'EnergyPlus Results'. The window displays the following information:

- Program Version: EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.11 11:57
- Tabular Output Report in Format: HTML
- Building: Building 1
- Environment: RUN PERIOD 1 ** Piacenza - ITA IGDG WMO#-160840
- Simulation Timestamp: 2019-11-11 11:57:13

Report: Annual Building Utility Performance Summary

For: Entire Facility

Timestamp: 2019-11-11 11:57:13

Values gathered over 8760.00 hours

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	2118.34	588.43	588.43
Net Site Energy	2118.34	588.43	588.43
Total Source Energy	5600.09	1555.58	1555.58
Net Source Energy	5600.09	1555.58	1555.58

Site to Source Energy Conversion Factors

	Site=>Source Conversion Factor
Electricity	3.167
Natural Gas	1.084
District Cooling	1.056
District Heating	3.613
Steam	0.300
Gasoline	1.050