

Task 1:

Considering the same example, you solved in the previous assignment (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?

➡ $\epsilon_1 = 0.2 \quad T_1 = 800 \text{ K}$
 $\epsilon_2 = 0.7 \quad T_2 = 500 \text{ K}$
 $q = 3625.37 \text{ W/m}^2 \quad (\text{without shields})$

$$\frac{3625.37}{100} = \frac{\delta(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_3} + \frac{1}{\epsilon_3} - 1\right)(n \text{ of shields})}$$

$$\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_3} + \frac{1}{\epsilon_3} - 1\right)(n \text{ of shields}) = \delta(T_1^4 - T_2^4)/36.2537$$

$$\left(\frac{1}{\epsilon_3} + \frac{1}{\epsilon_3} - 1\right)(n \text{ of shields}) = \frac{\delta(T_1^4 - T_2^4)}{36.2537} - \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right)$$

$$n \text{ of shields} = \frac{\frac{\delta(T_1^4 - T_2^4)}{36.2537} - \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right)}{\left(\frac{1}{\epsilon_3} + \frac{1}{\epsilon_3} - 1\right)}$$

$$n \text{ of shields} = \frac{5.67 * 10^{-8}(800^4 - 500^4) - \left(\frac{1}{0.2} + \frac{1}{0.7} - 1\right)}{\frac{1}{0.1} + \frac{1}{0.1} - 1} = 28 \text{ shields}$$

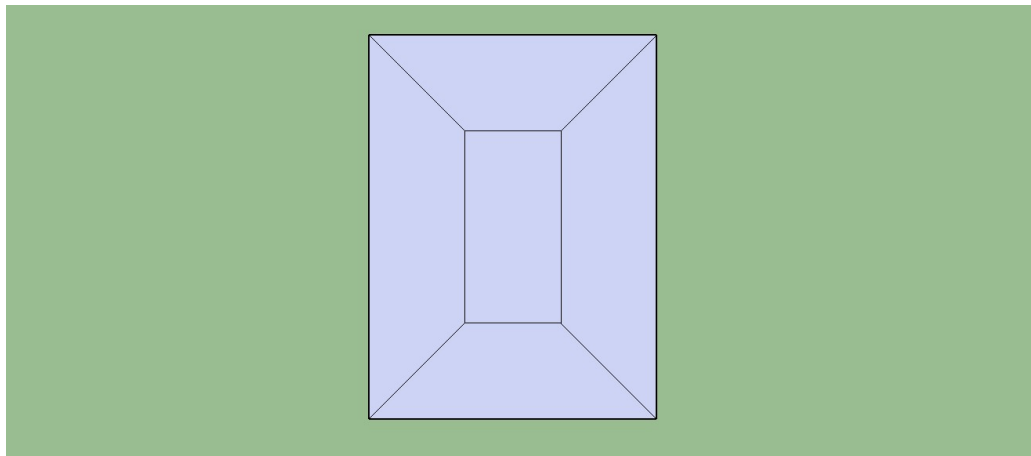
$$q = \frac{\delta(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_3} + \frac{1}{\epsilon_3} - 1\right)(n \text{ of shields}) + \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right)} = 5.67 * \frac{10^{-8}(800^4 - 500^4)}{\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right) * 28 + \left(\frac{1}{0.2} + \frac{1}{0.7} - 1\right)} = 36.62 \text{ W/m}^2$$

1% of 3625.37

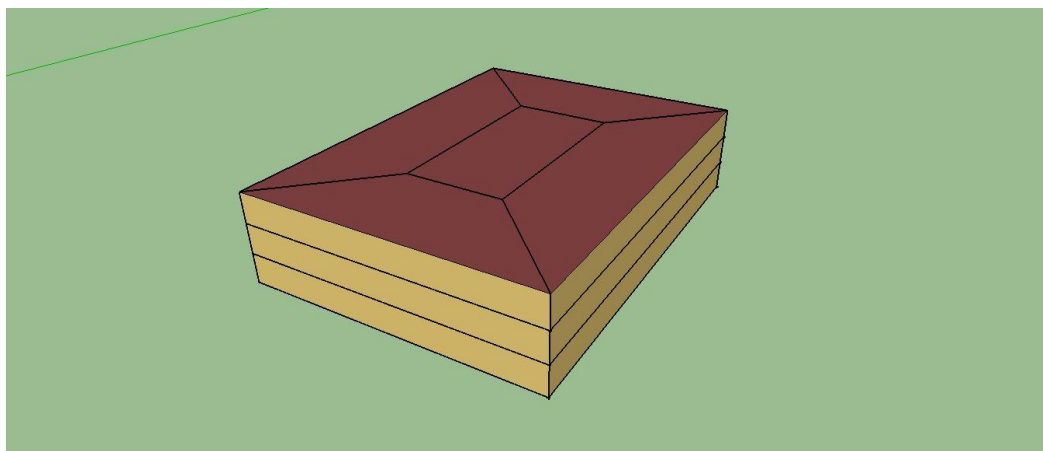
Task 2:

You should create a pdf file with screenshots of all of the steps we went through (clearly from your own file) and explain briefly the reason behind the use of each step (in your own words!)

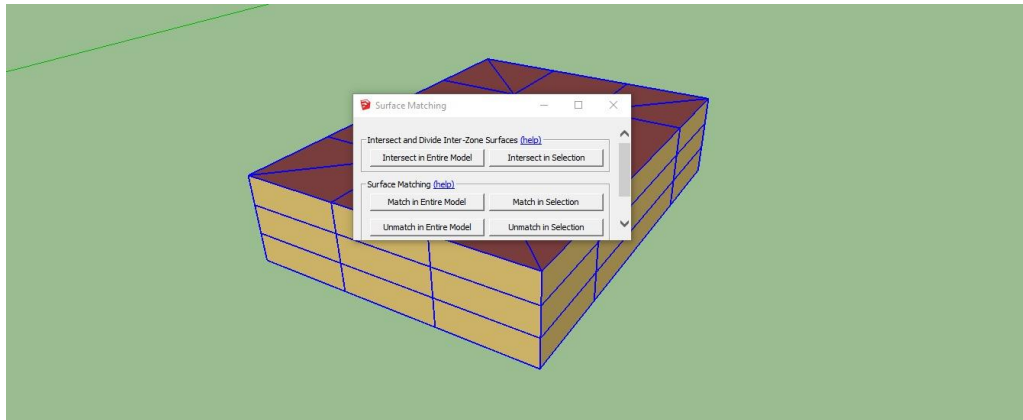
Step 1: build the 30x40 diagram



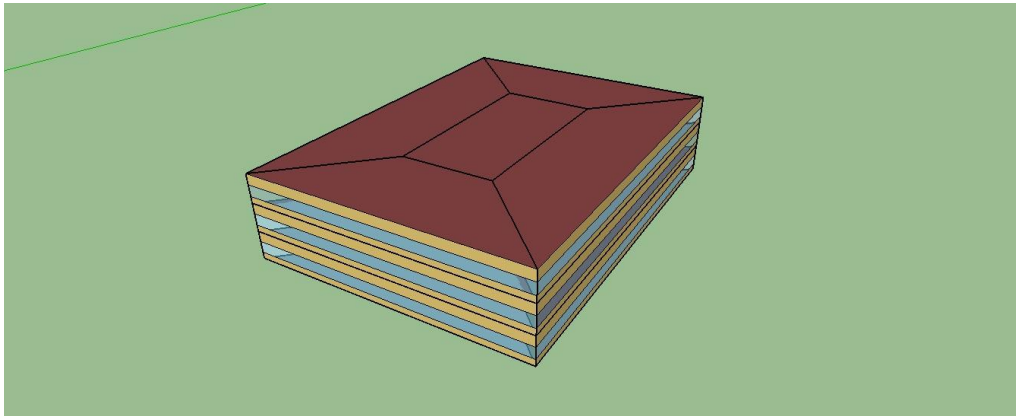
Step 2: Create a building composed of 3 floors from the initial diagram



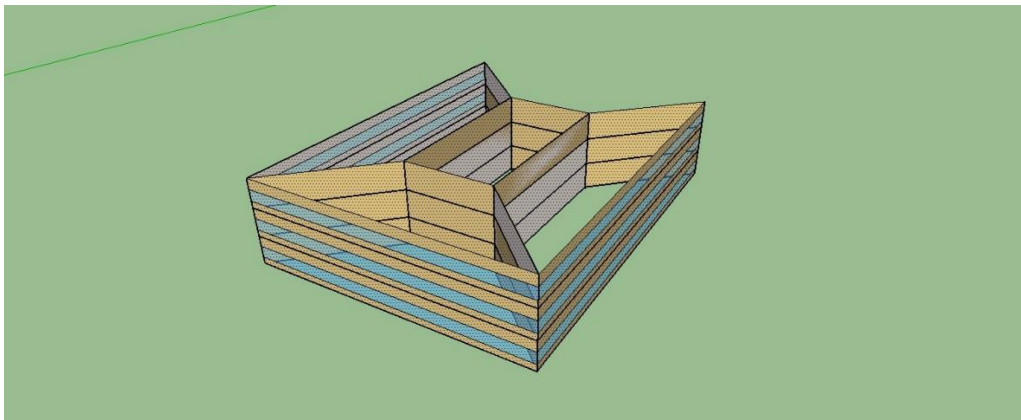
Step 3: distinct between the interior and exterior walls by selecting surface matching



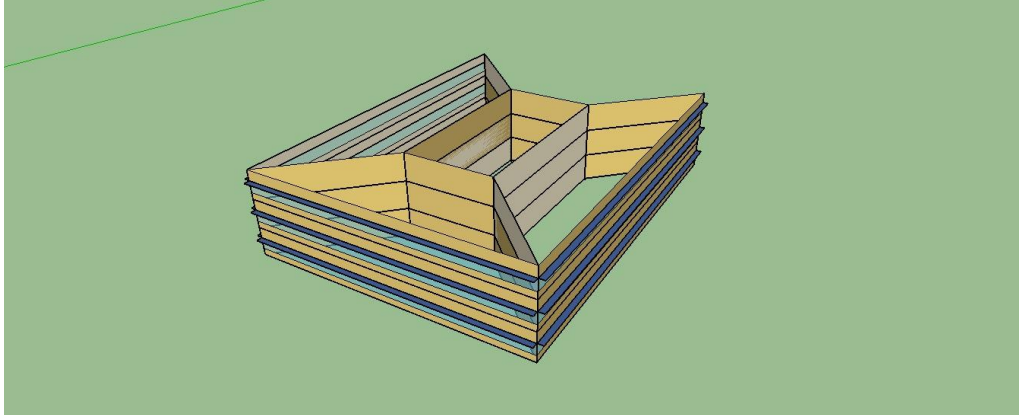
Step 4: use alter/add model elements to add the windows



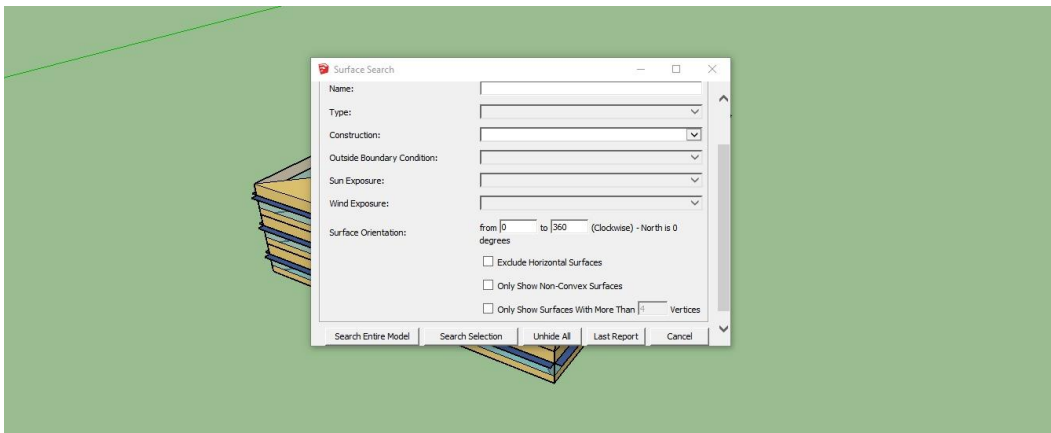
Step 5: use surface search to select all of the façade surfaces except for the north side



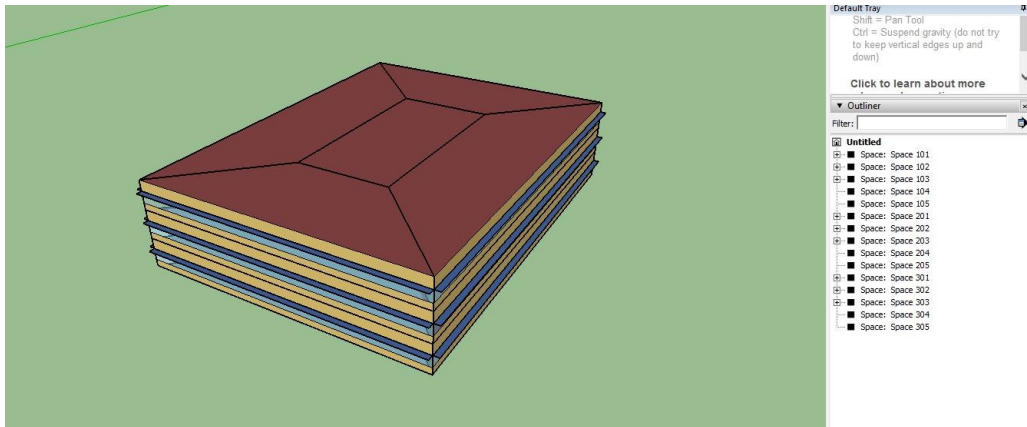
Step 6: use alter/add model element to add external shading to your elements



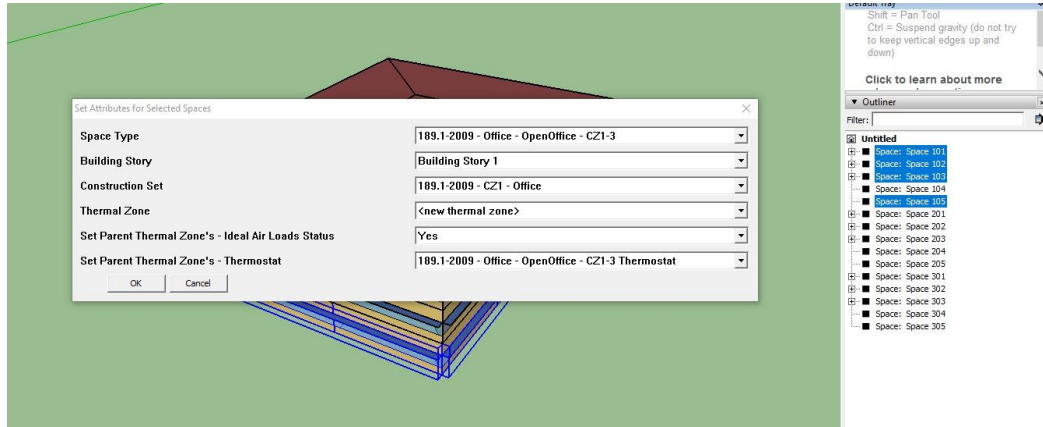
Step 7: select all the surfaces of the building with the surface search



Step 8: in the window menu select outlier tray

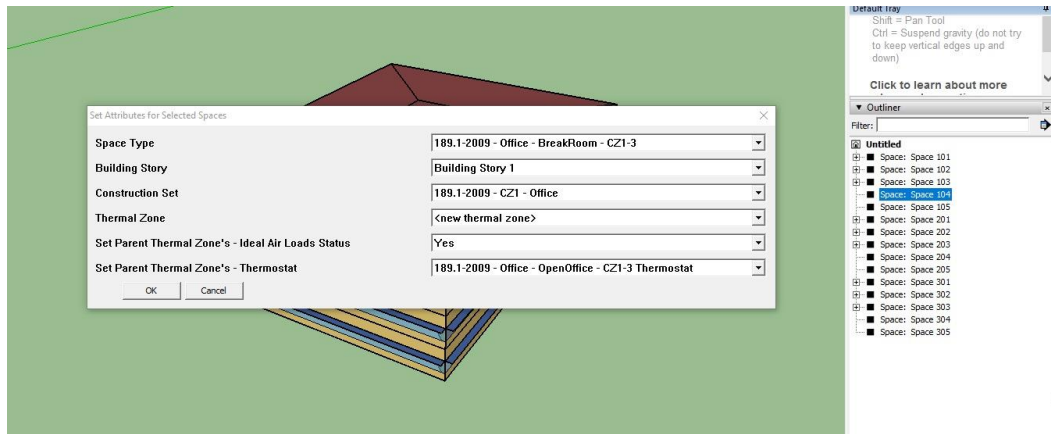


Step 9: pick the outer spaces of floor 1 and give it the specifications

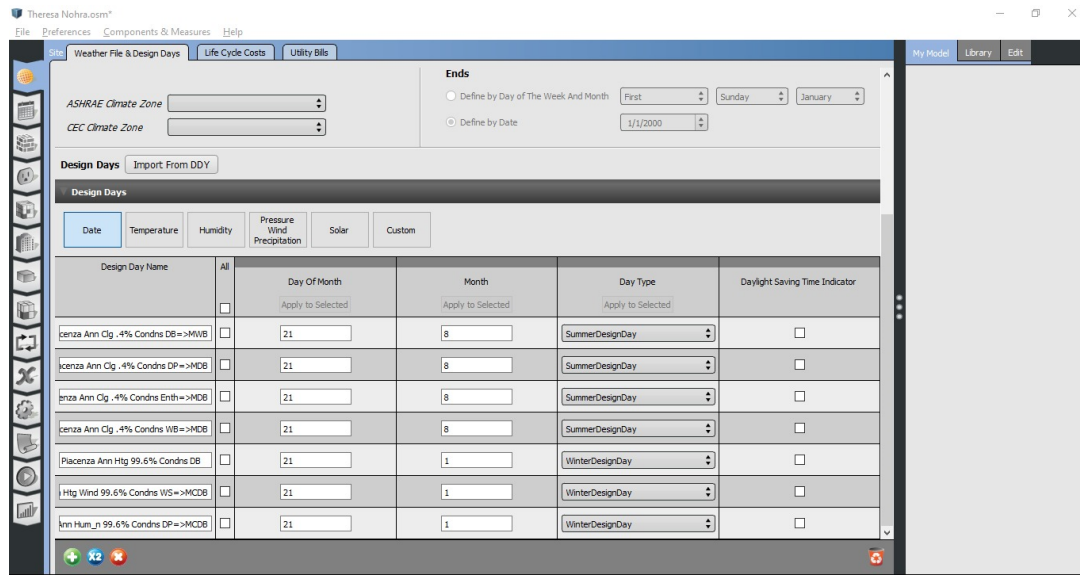


Step 10: pick the internal space of the floor 1 and add specifications

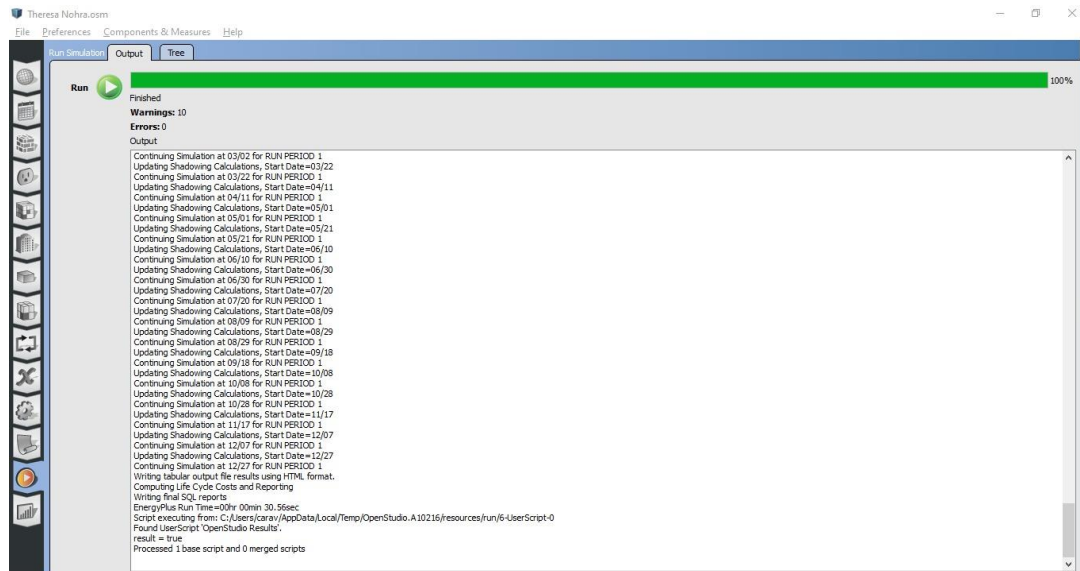
Step 11: repeat the steps 9 and 10 to the rest of the building



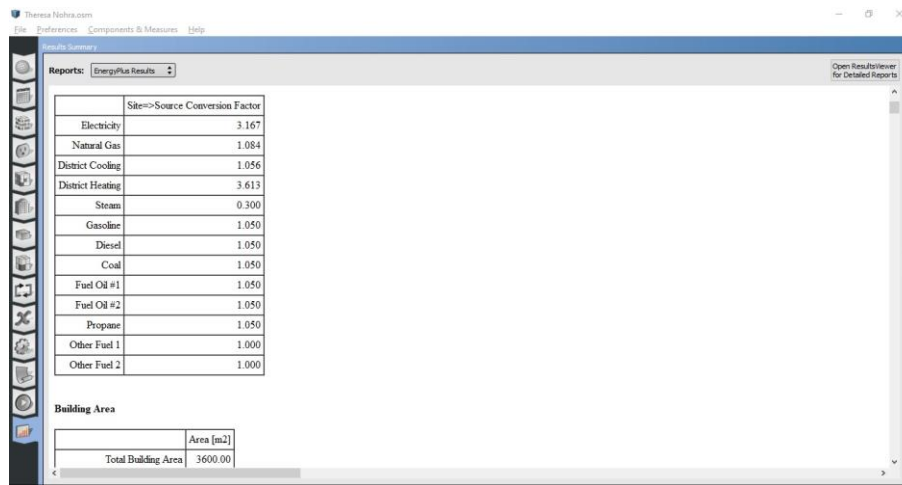
Step 12: add Piacenza weather data on open design studio file



Step 13: run the model



Step 14: review the results



The screenshot shows the 'Results Summary' window of EnergyPlus. The 'Reports' dropdown is set to 'EnergyPlus Results'. The main area displays a table of 'Site->Source Conversion Factor' and a 'Building Area' section at the bottom.

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
Diesel	1.050
Coal	1.050
Fuel Oil #1	1.050
Fuel Oil #2	1.050
Propane	1.050
Other Fuel 1	1.000
Other Fuel 2	1.000

Building Area	
	Area [m2]
Total Building Area	3600.00

NOTE: ctrl+z doesn't work with this program, therefore it is best to save the progress all along the way, otherwise you'll have to repeat all the steps after each mistake.