submission week **6**

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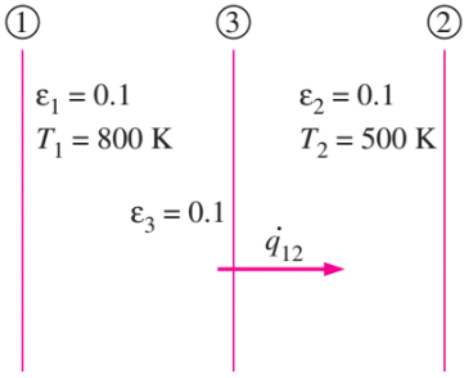
1 Considering the radiative heat transfer between two parallel plates calculated in the previous assignment, how many shields (ε_3=0.1) should you add in order to have the new heat transfer rate to be 1% of the case without shields?

$$\dot{Q}_{12} = \frac{A \times \sigma \times (T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} = \frac{5{,}67 * 10^{-8} \times (800^4 - 500^4)}{\frac{1}{0{,}1} + \frac{1}{0{,}1} - 1} = \frac{19680{,}57}{19} = 1035{,}82\ W$$



$$\dot{q}_{12} = 1\%\ \dot{Q}_{12} = \ 0{,}01 * 1035{,}82 = 10{,}3582\ W$$

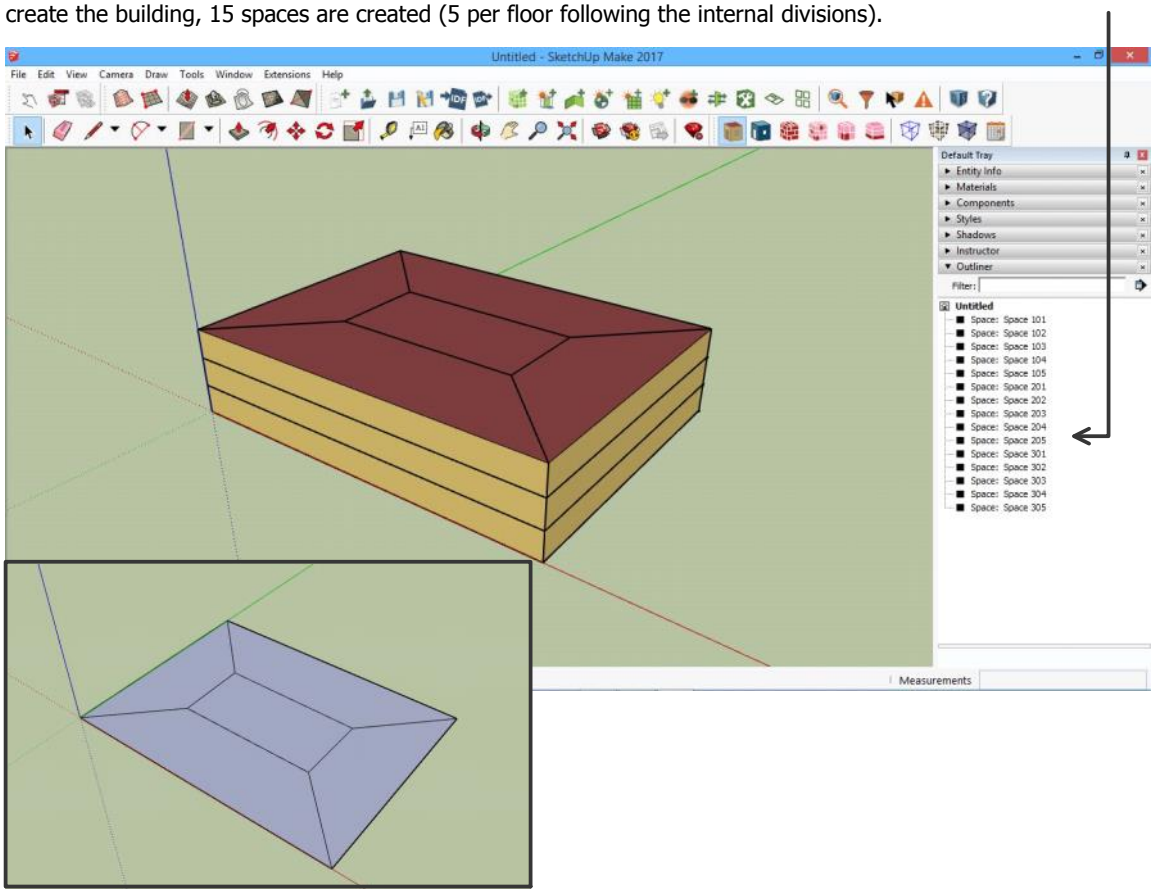
$$\dot{q}_{12} = \frac{\sigma\left(T_1^4 - T_2^4\right)}{\left(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1\right) + \left(\frac{1}{\varepsilon_{3,1}} + \frac{1}{\varepsilon_{3,2}} - 1\right)N}\ (W)$$

$$\dot{q}_{12} = \frac{5{,}67 * 10^{-8} \times (800^4 - 500^4)}{\left(\frac{1}{0{,}1} + \frac{1}{0{,}1} - 1\right) + \left(\frac{1}{0{,}1} + \frac{1}{0{,}1} - 1\right)N} = \frac{19680{,}57}{19 + 19N} = \frac{19680{,}57}{19(1+N)} = \frac{1035{,}82}{(1+N)} = 10{,}3582\ W$$

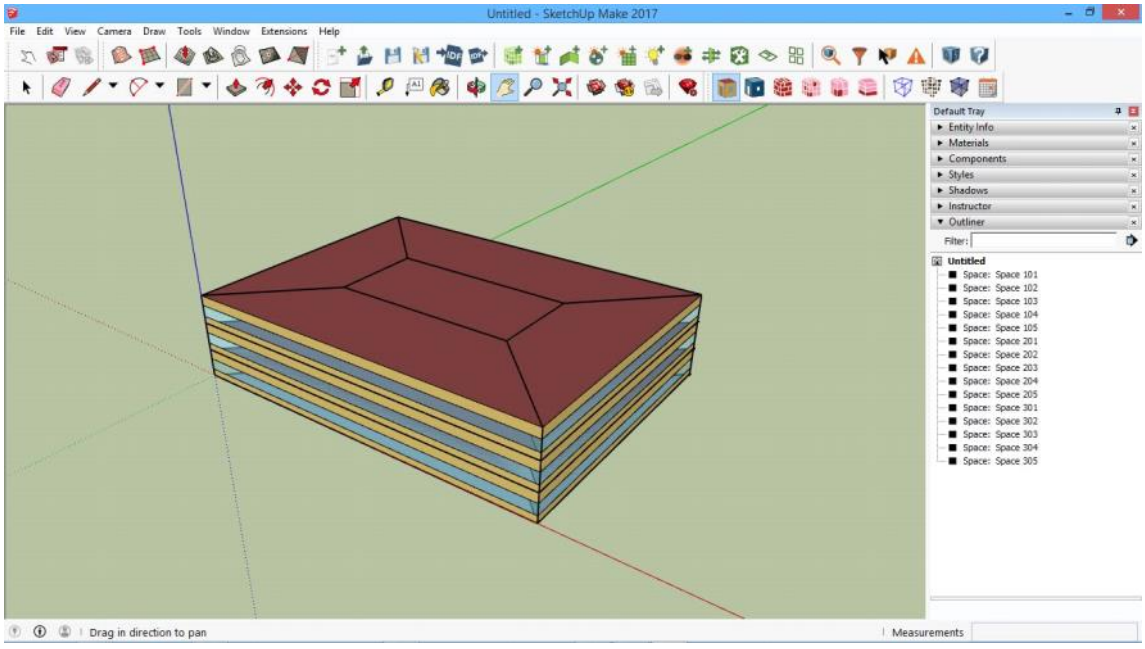
$$\frac{1}{(1+N)} = \frac{10{,}3582}{1035{,}82} \quad \rightarrow \quad 1 + N = \frac{1035{,}82}{10{,}3582} \quad \rightarrow \quad N = 100 - 1 = 99$$

2 Make screenshots of all of the steps we went through during class practice (Sketchup and OpenStudio) and explain briefly the reason behind the use of each step.

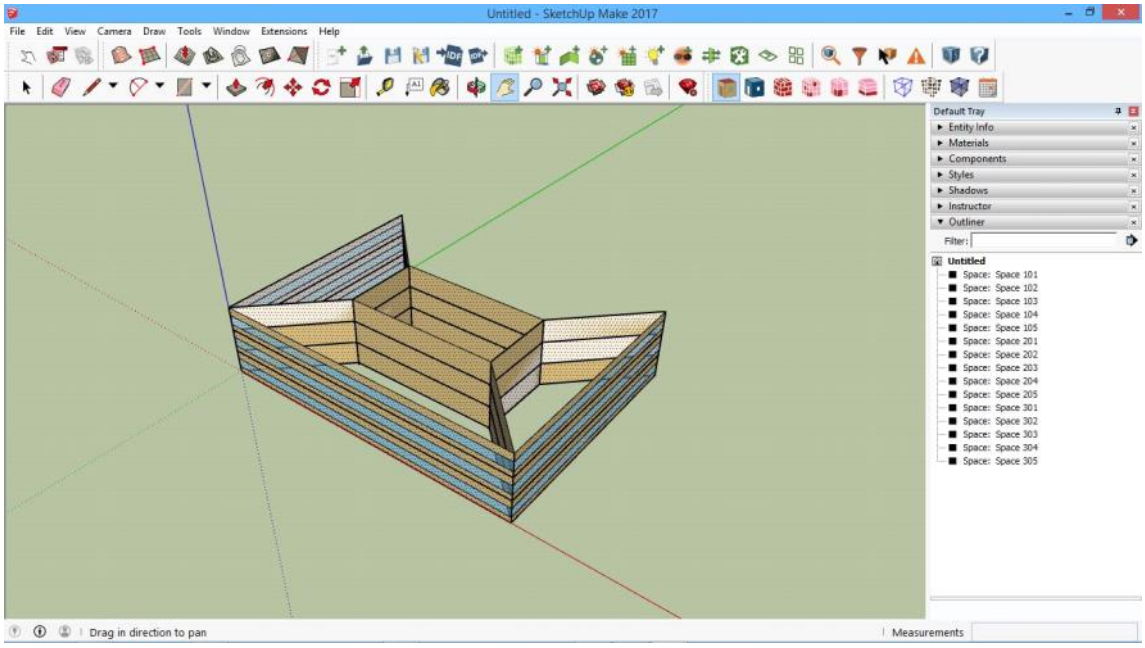
1 Starting from a rectangular diagram (30mx40m with another rectangle inside it with offset of 10m and the edges connected with 4 lines), with the tool Create Spaces From Diagram and putting 3 as number of floors create the building, 15 spaces are created (5 per floor following the internal divisions).

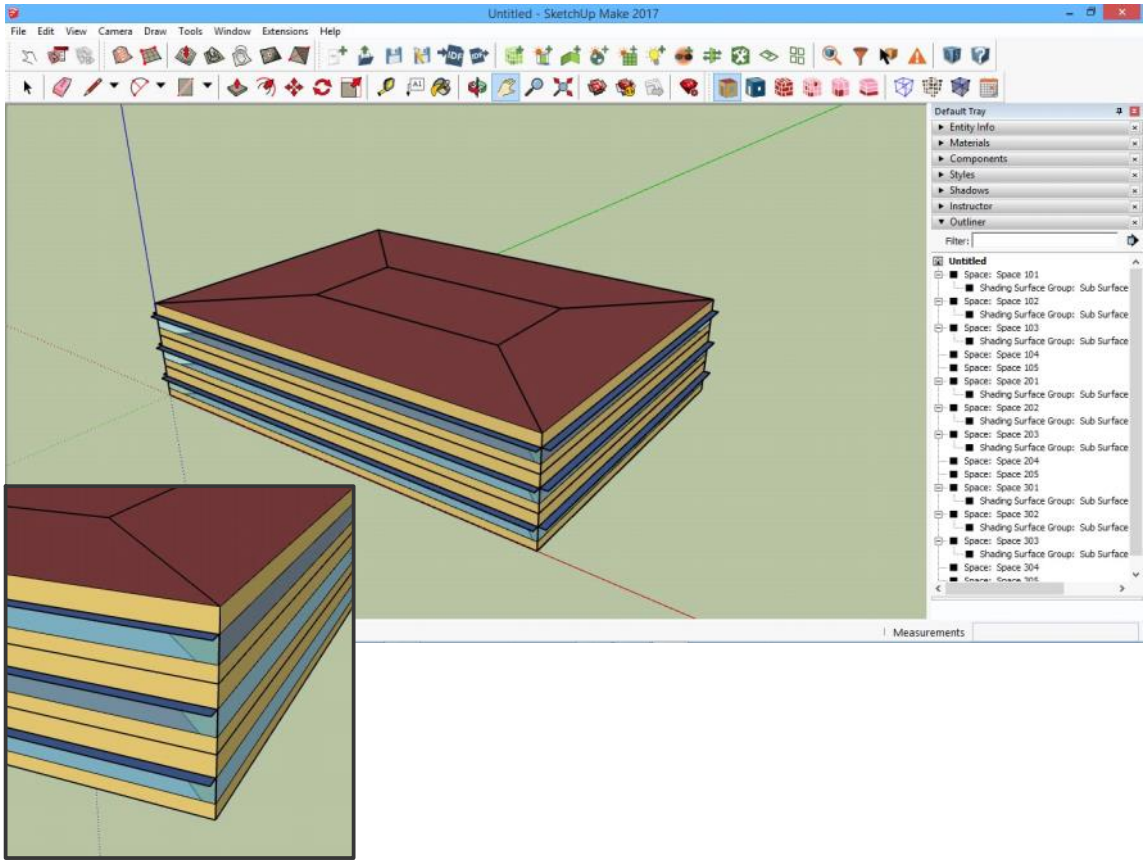


2 Before to create windows we need to match surface (Surface Matching > Match Entire Model) to not having windows inside the building. To add windows we go on Extencion > Alter or Add Model Element > Set Window to Wall Ratio. Now we have windows on all surfaces.



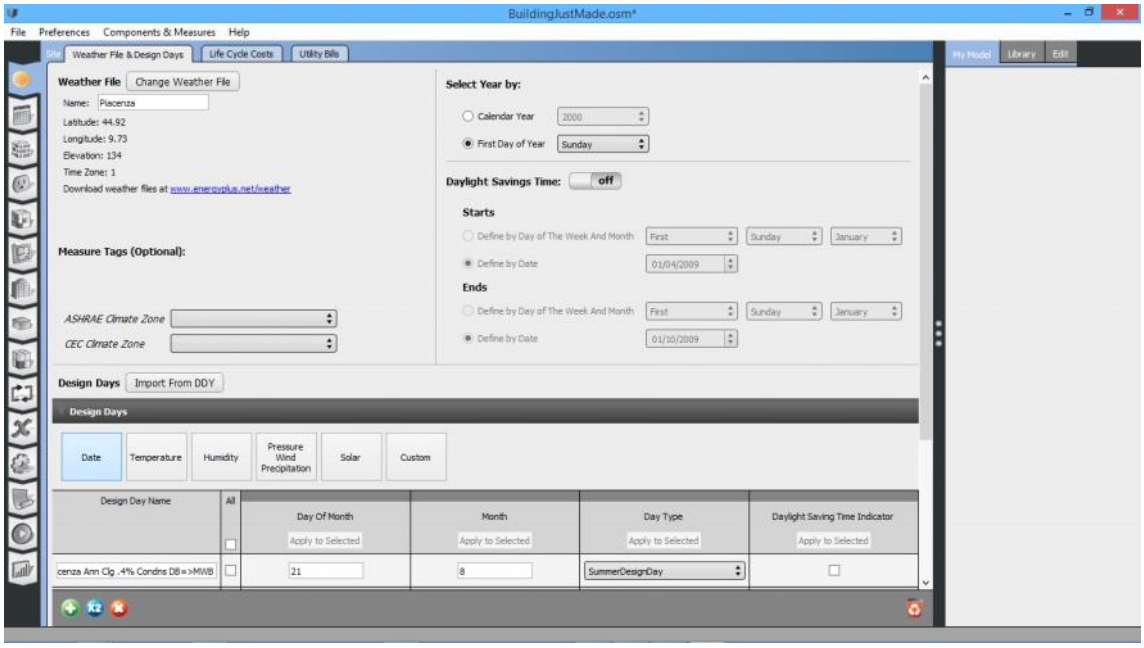
3 Now we can add overhang external shading, we go on Extencion > Alter or Add Model Element > Add Overhangs by Projection Factor. Before we need to select all of the surfaces except the north with the tool Search Surfaces and putting 90-360 in Surface Orientation and exluding horizontal surfaces.
Then we reselect 0-360 surfaces to go back to the previous selection.

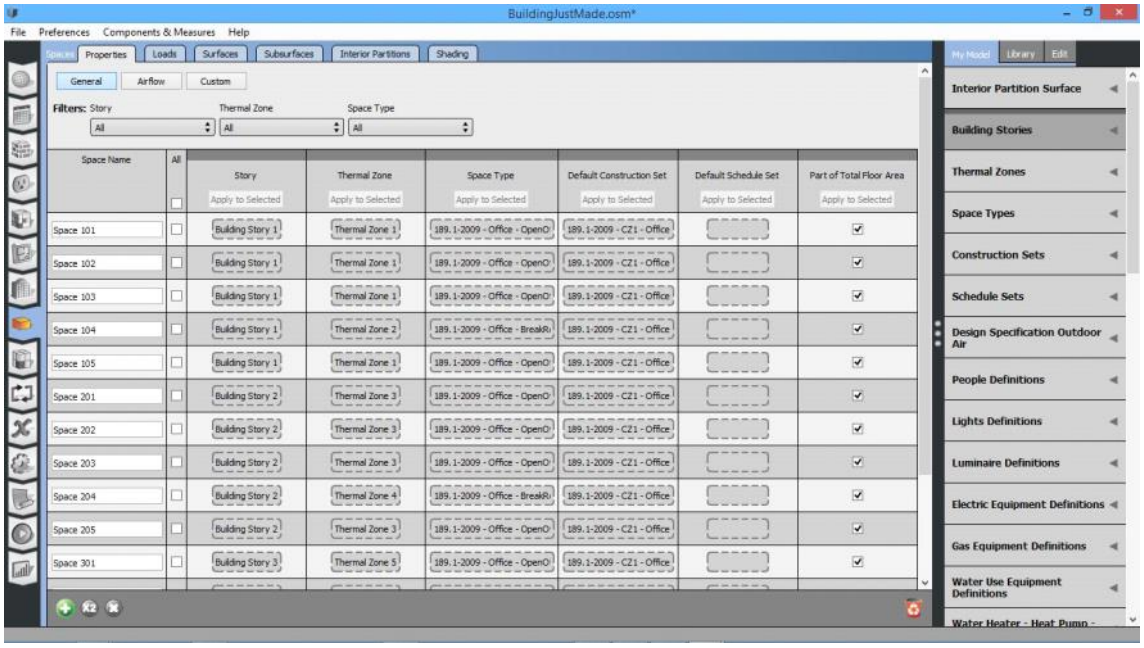




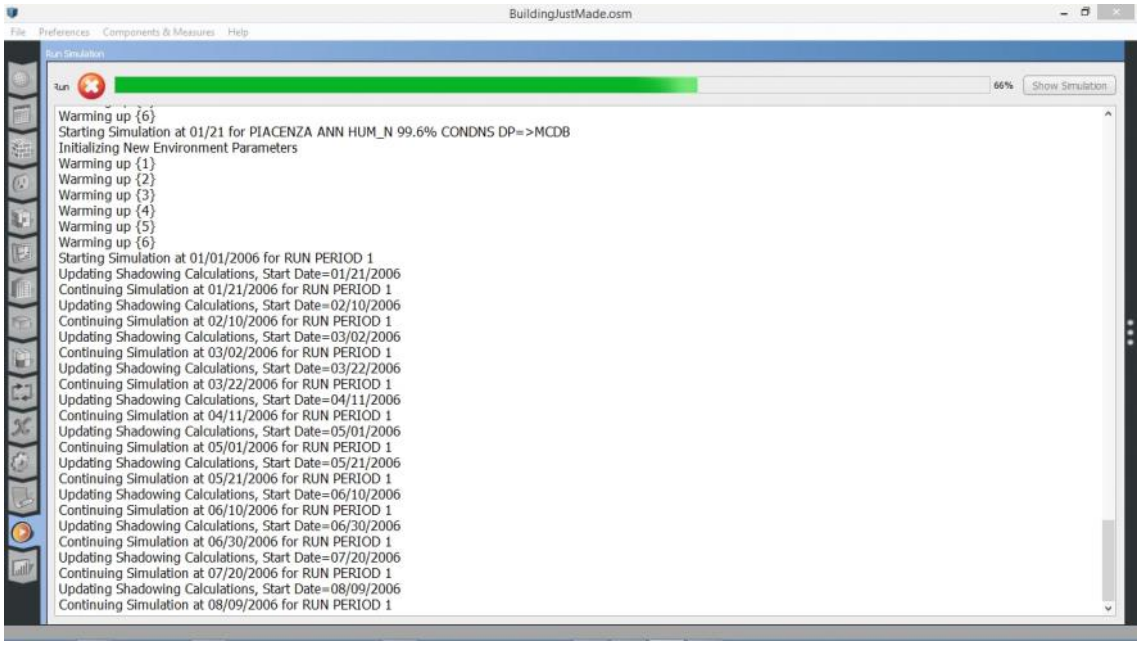
4 Now we choose the spaces of each thermal zone and we add specifications with the tool Set Attributes for Selected Spaces. A thermal zone is an air-conditioned environment maintained at uniform temperature through the same heating, cooling or ventilation system. So spaces 101, 102, 103, 105 are part of the same thermal zone; spaces 201, 202, 203, 205 same thermal zone; spaces 301, 302, 303, 305 same thermal zone. All of them are open offices. Spaces 104, 204 and 304 (the ones that are in the middle) are break rooms so they are different thermal zone. In the end we have 6 thermal zone.

5 Now we save the work as an OpenStudio file and we open it with OpenStudio. First we need to add the weather Data (in our case of Piacenza). Under the menu properties we can check thermal specifications.





6 Next we run the simulation.



7 Finally we can review our results in the summary tab.