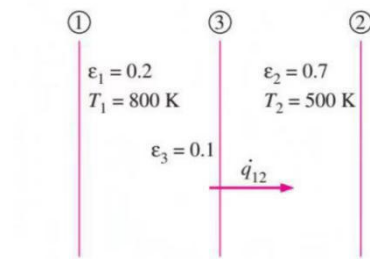


**** Task 1**** Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with $\epsilon = 0.1$ should you add in order to have the new heat transfer rate to be 1% of the case without shields ?



$$\begin{aligned}\dot{q}_{net1-2} &= \frac{\dot{Q}_{net1-2}}{A} = \frac{\sigma A (T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} * \frac{1}{A} = \frac{\sigma (T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} \\ &= \frac{(5.67 * 10^{-8}) * (800^4 - 500^4)}{\frac{1}{0.2} + \frac{1}{0.7} - 1} \\ &= 3625.4 W / m^2\end{aligned}$$

The new heat transfer rates should be 1% of the \dot{q}_{net1-2} :

$$\dot{q}_{net1-2} * 10\% = \dot{q}_{net1-2, n \text{ shields}} = 3625.4 * 1\% = 36.254 W / m^2$$

$$\begin{aligned}\dot{q}_{net1-2, n \text{ shields}} &= \frac{\dot{Q}_{1-2, n \text{ shields}}}{A} = \frac{\sigma A (T_1^4 - T_2^4)}{(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1) + (\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1) \dots (\frac{1}{\epsilon_{n,1}} + \frac{1}{\epsilon_{n,2}} - 1)} * \frac{1}{A} \\ &= \frac{\sigma (T_1^4 - T_2^4)}{(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1) + (\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1) \dots (\frac{1}{\epsilon_{n,1}} + \frac{1}{\epsilon_{n,2}} - 1)}\end{aligned}$$

$$\epsilon_1 = 0.2, \quad \epsilon_2 = 0.7, \quad \epsilon_3 = \epsilon_4 = \epsilon_5 = \dots = \epsilon_n = 0.1$$

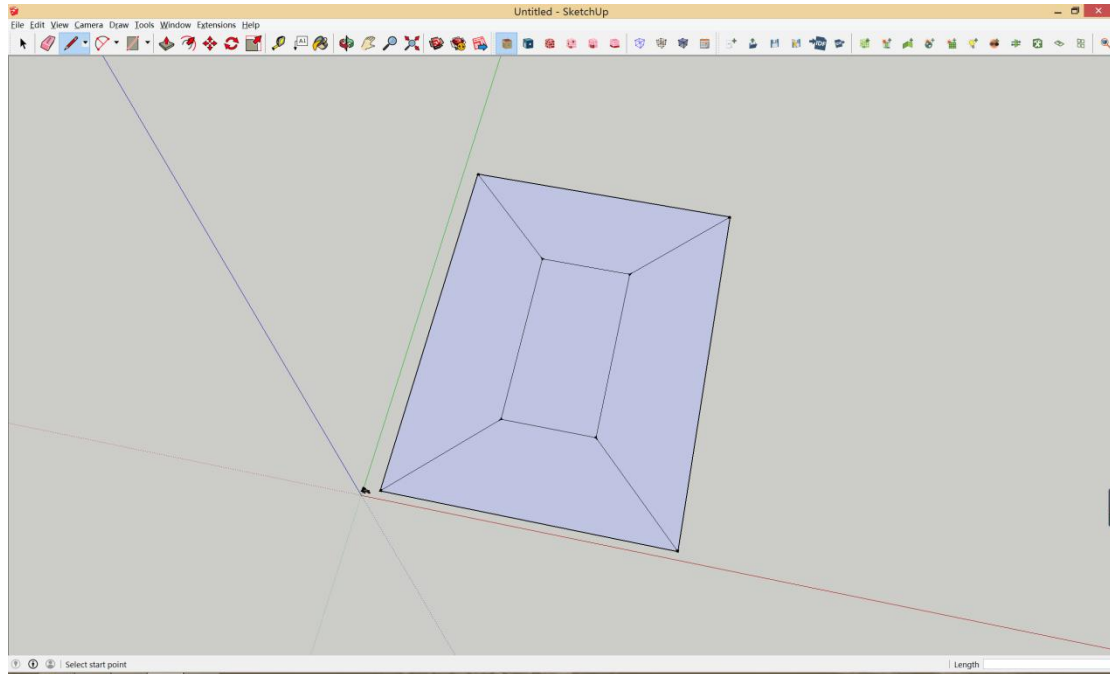
$$36.254 = \frac{5.67 * 10^{-8} (800^4 - 500^4)}{(\frac{1}{0.2} + \frac{1}{0.7} - 1) + n(\frac{1}{0.1} + \frac{1}{0.1} - 1)}$$

$$n \approx 28$$

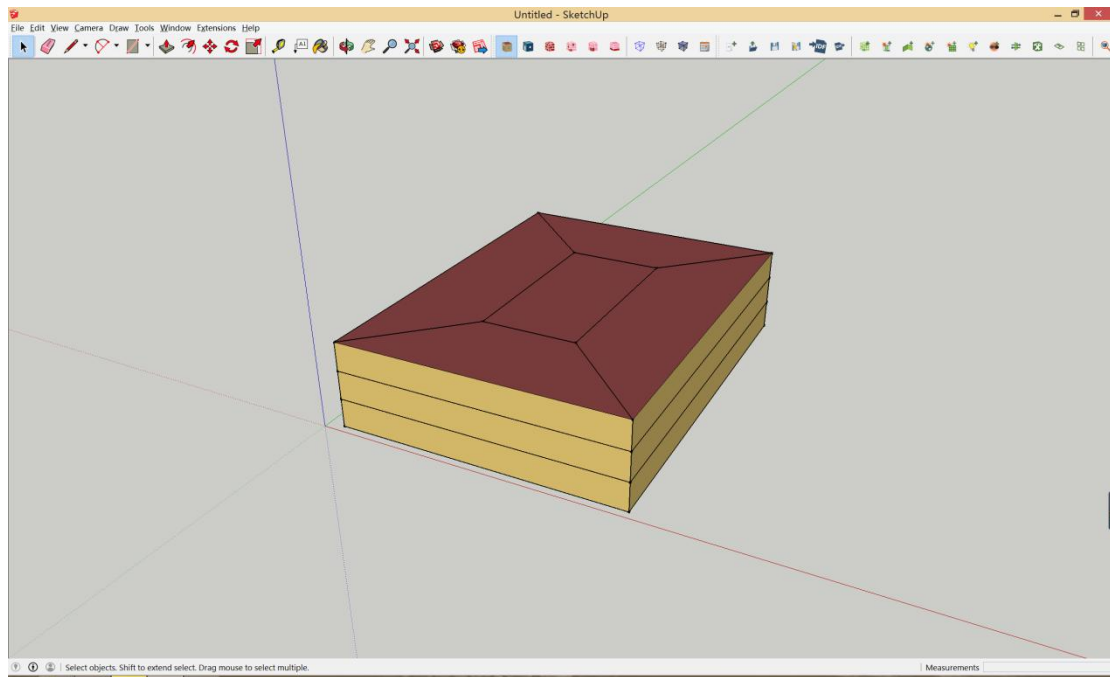
To have the new heat transfer rate be 1% of the previous rate without any shields, we need 28 shields, which $\epsilon = 0.1$.

**** 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!)

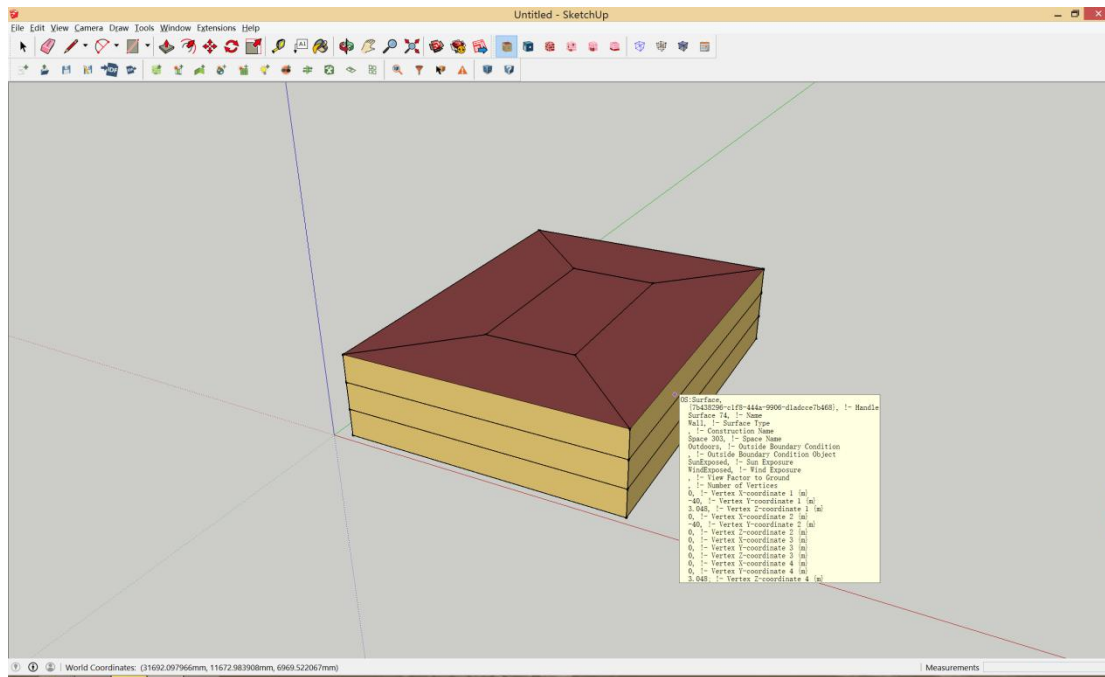
1. Draw the outline and shape of the building in Sketchup.



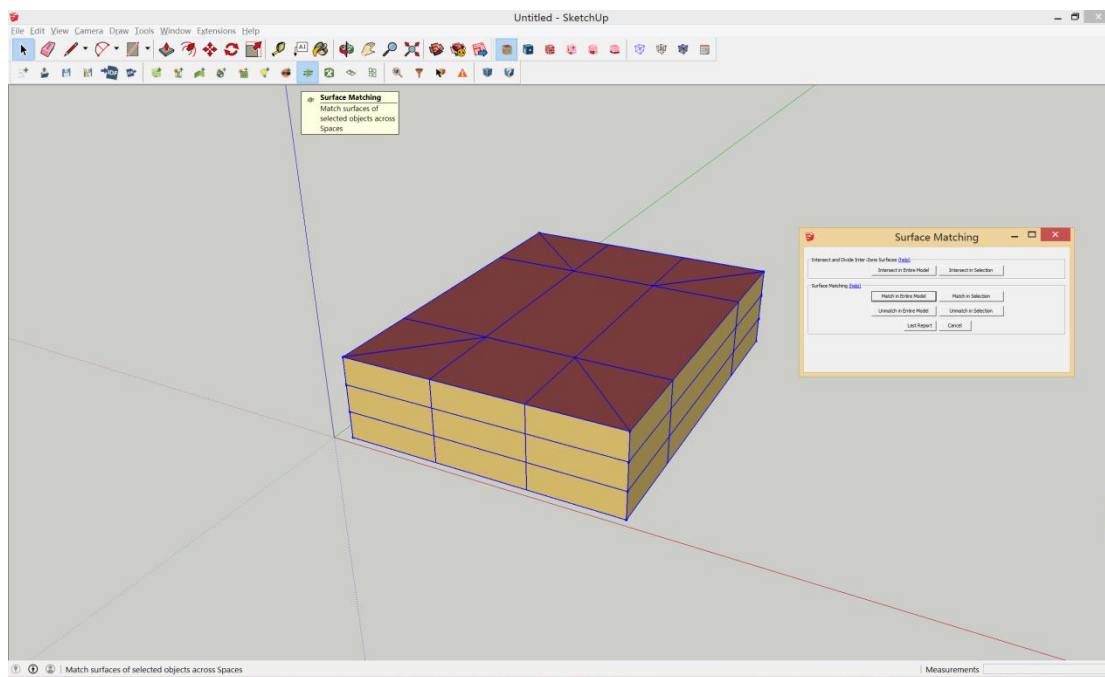
2. Use “Creat spaces from diagram”creat a 3 floor building.



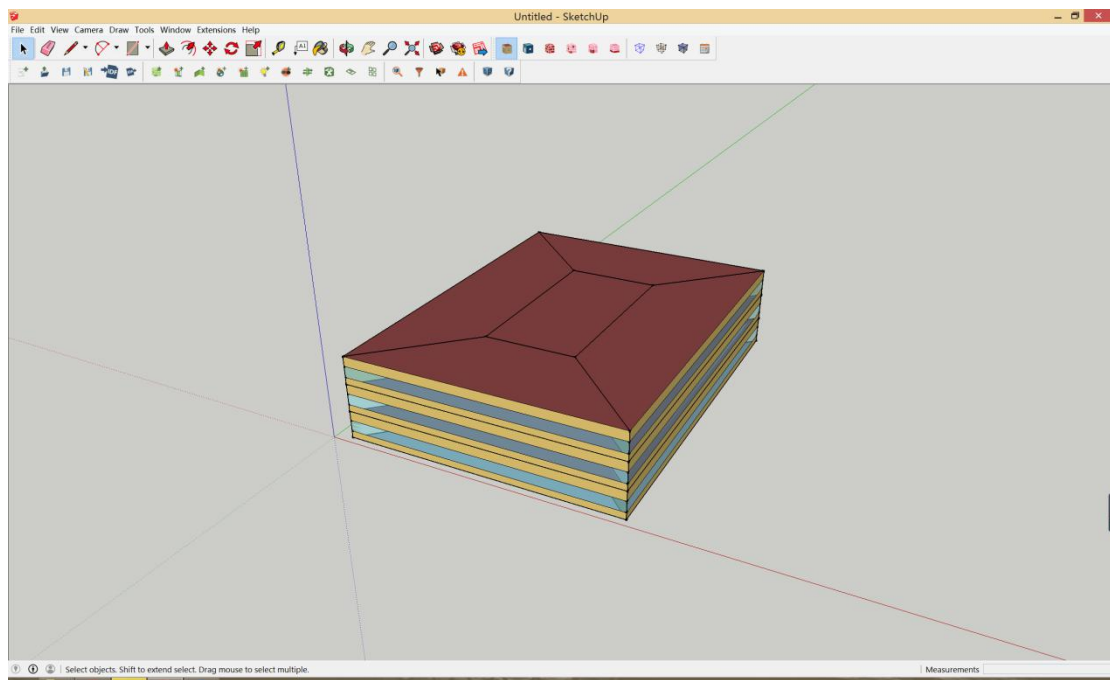
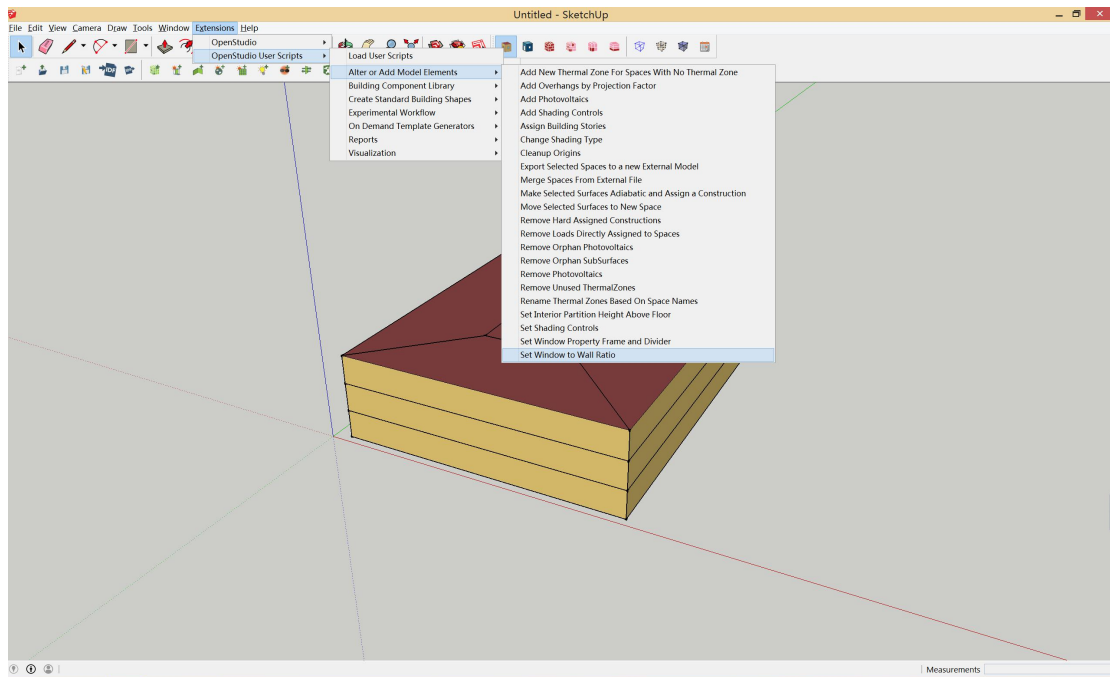
3. We can see the material information using the "Info tool".



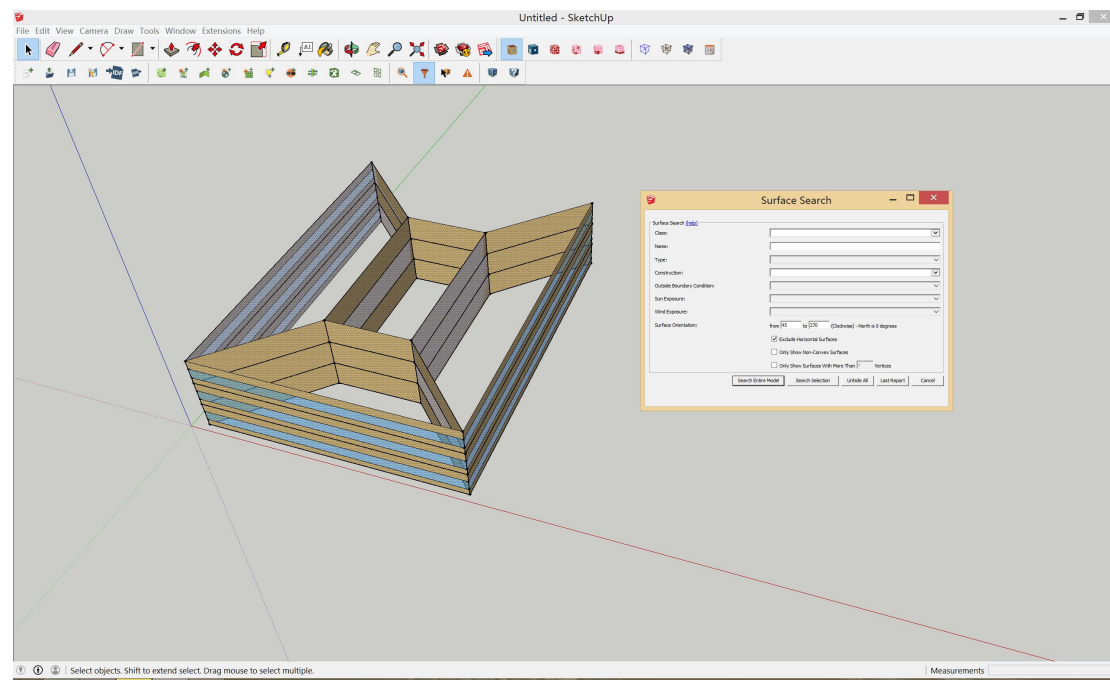
4. Click "Surface matching".



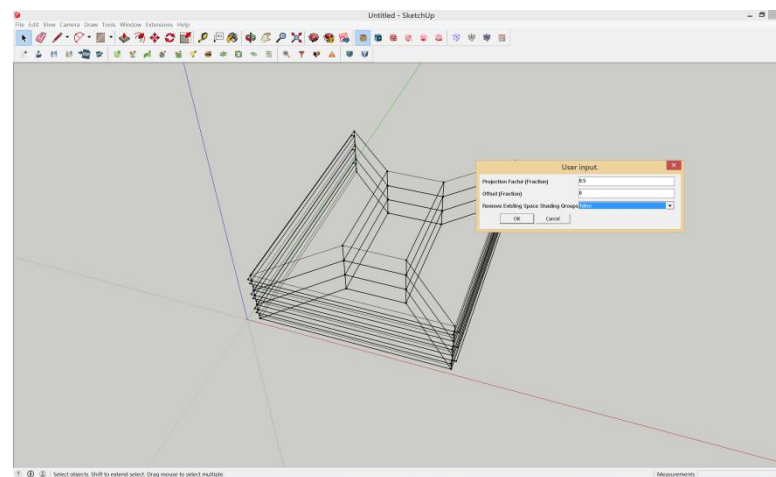
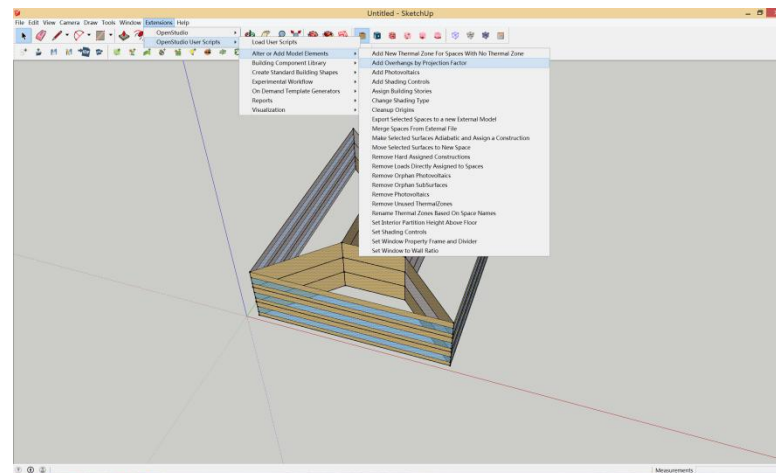
5. Click "Set Window to Wall Ratio" to built the windows.



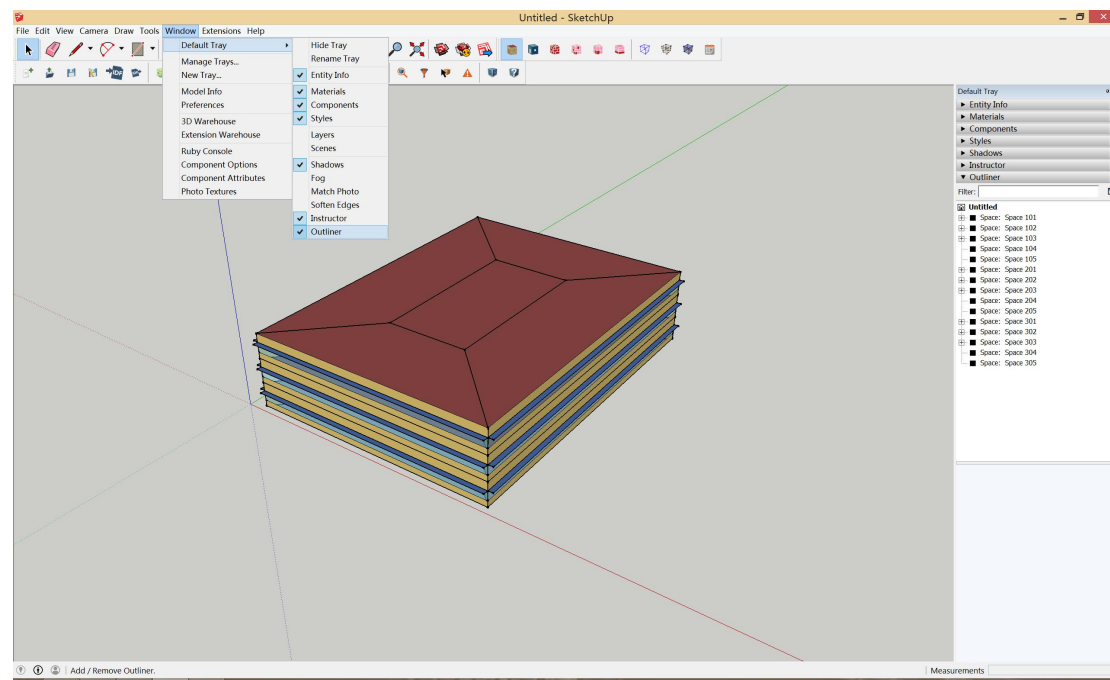
6. Check other directions besides the north.



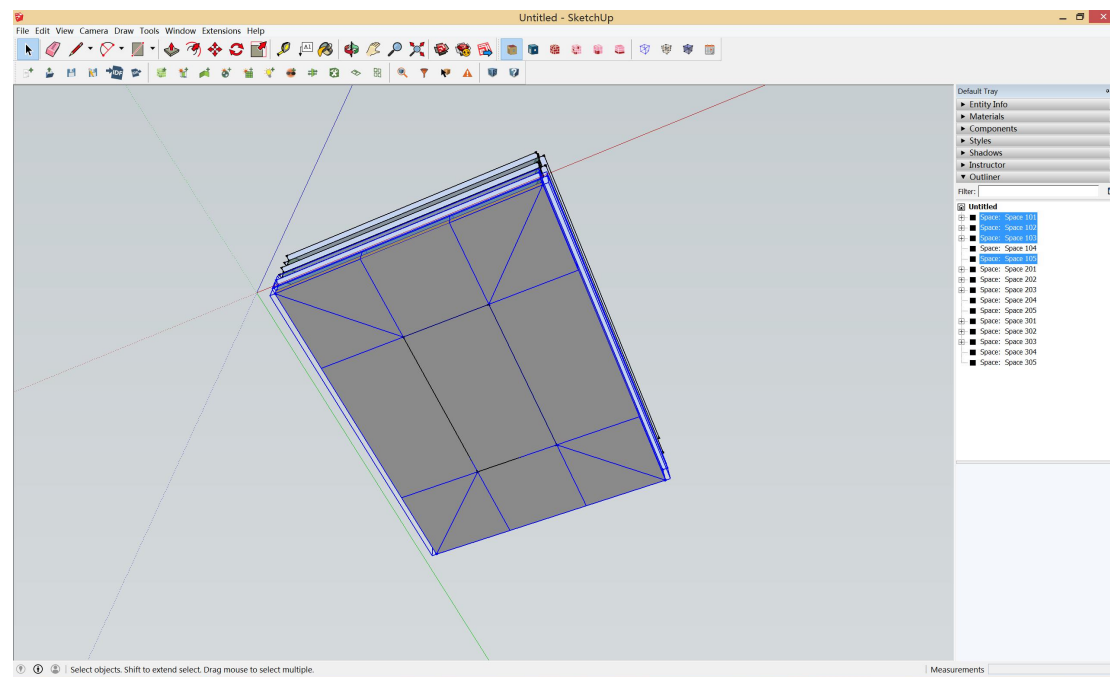
7. Click "Add Overhangs by Projection Factor" to built overhangs.



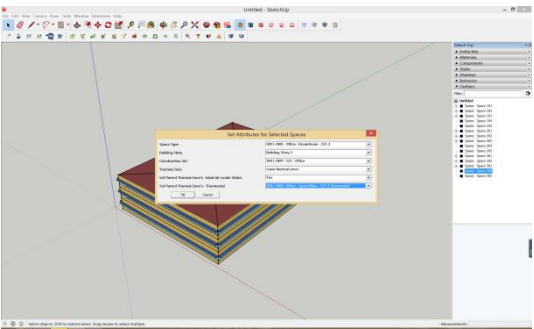
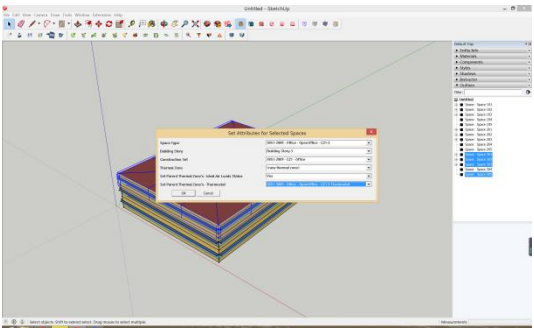
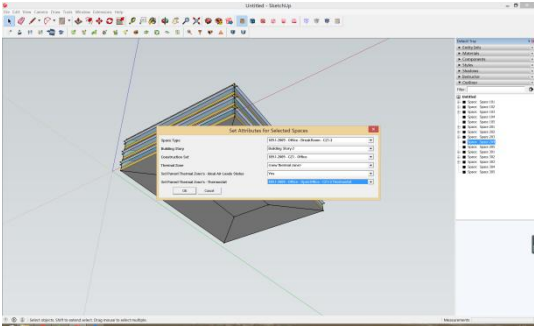
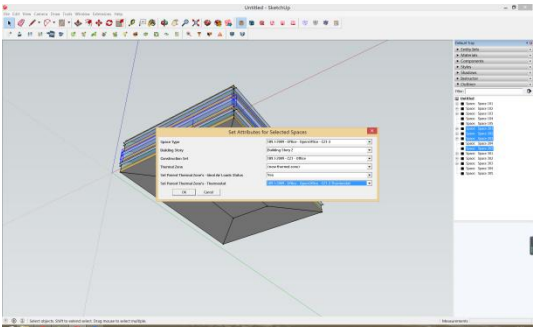
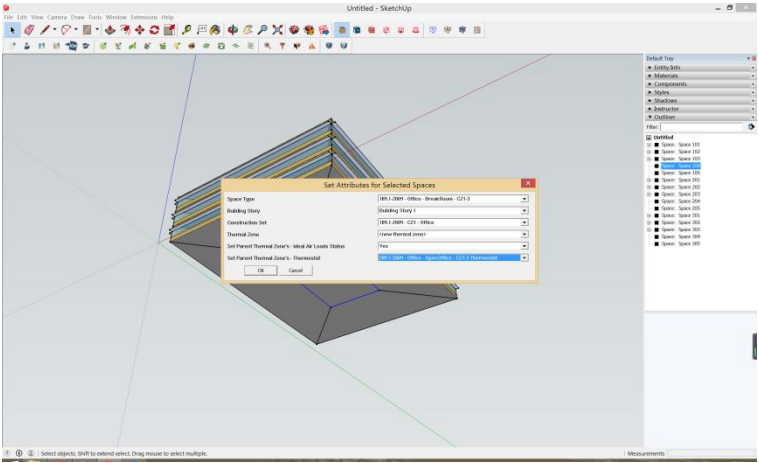
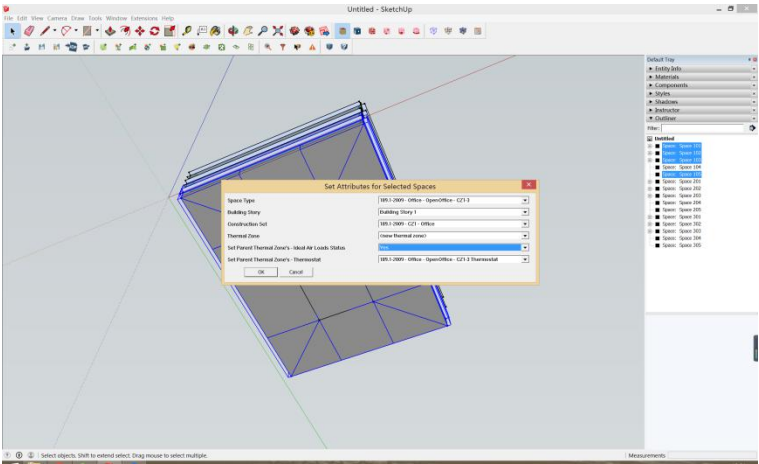
8. Open the "Outliner"



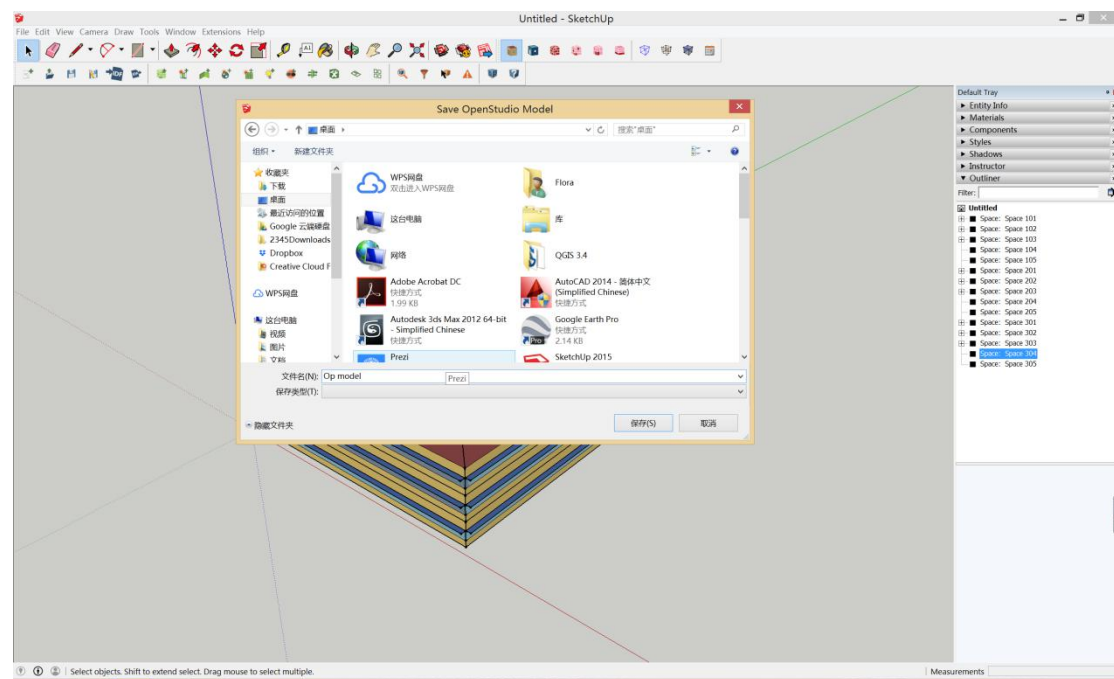
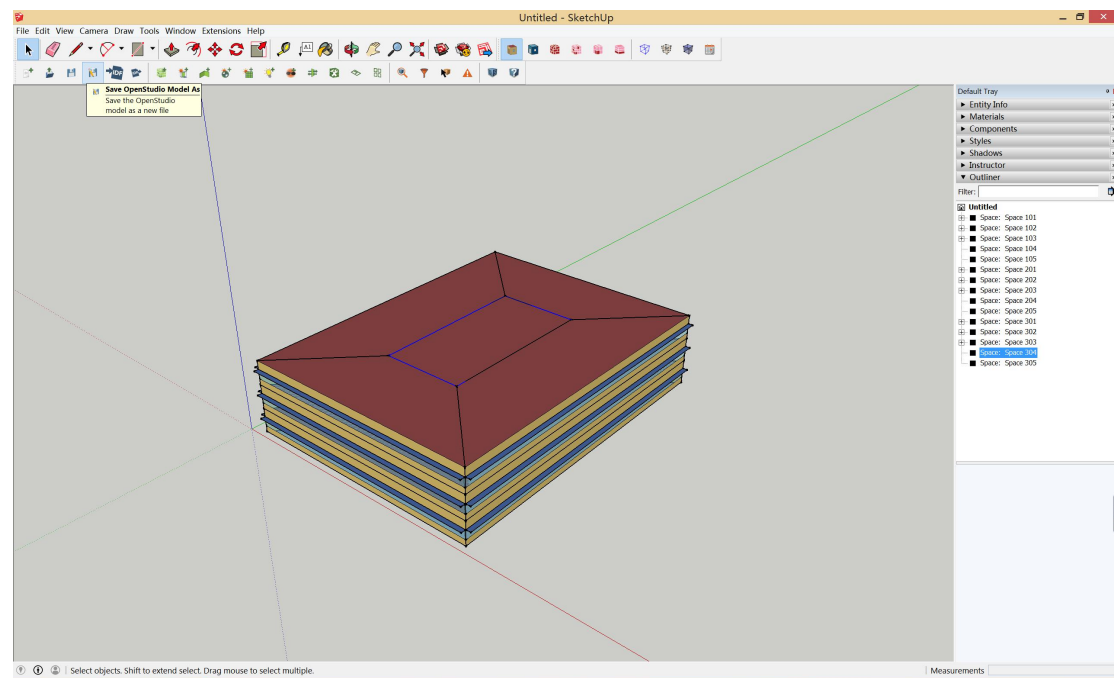
9. Choose the space of each thermal zone.



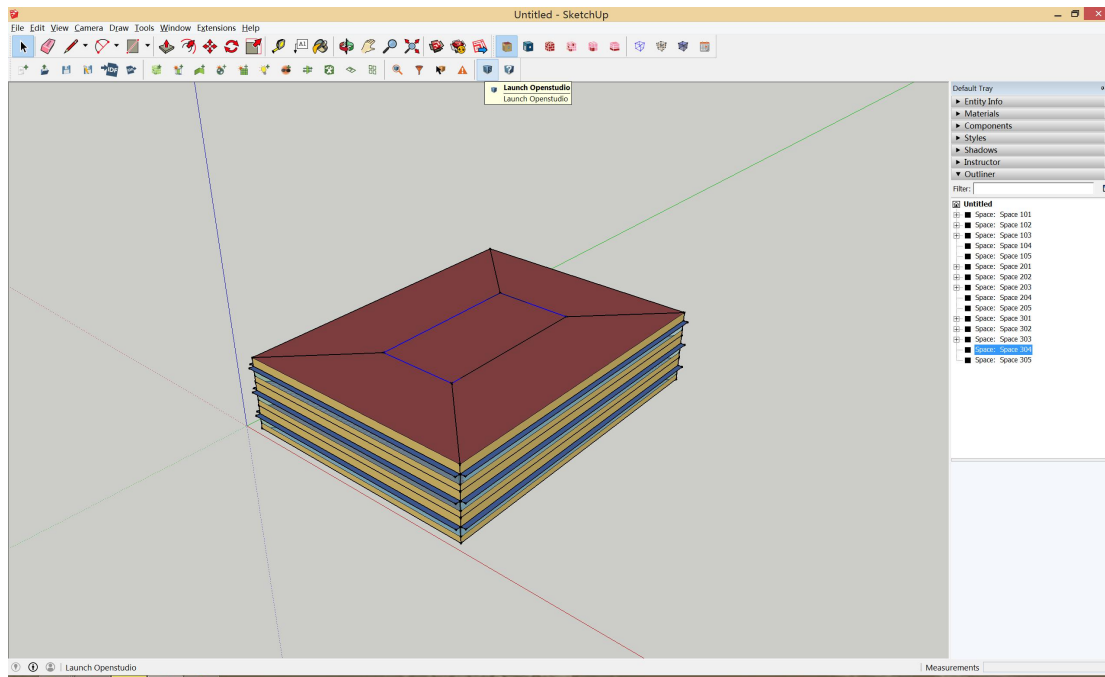
10. Click “Set Attributes for Selected Space” to set parameters.



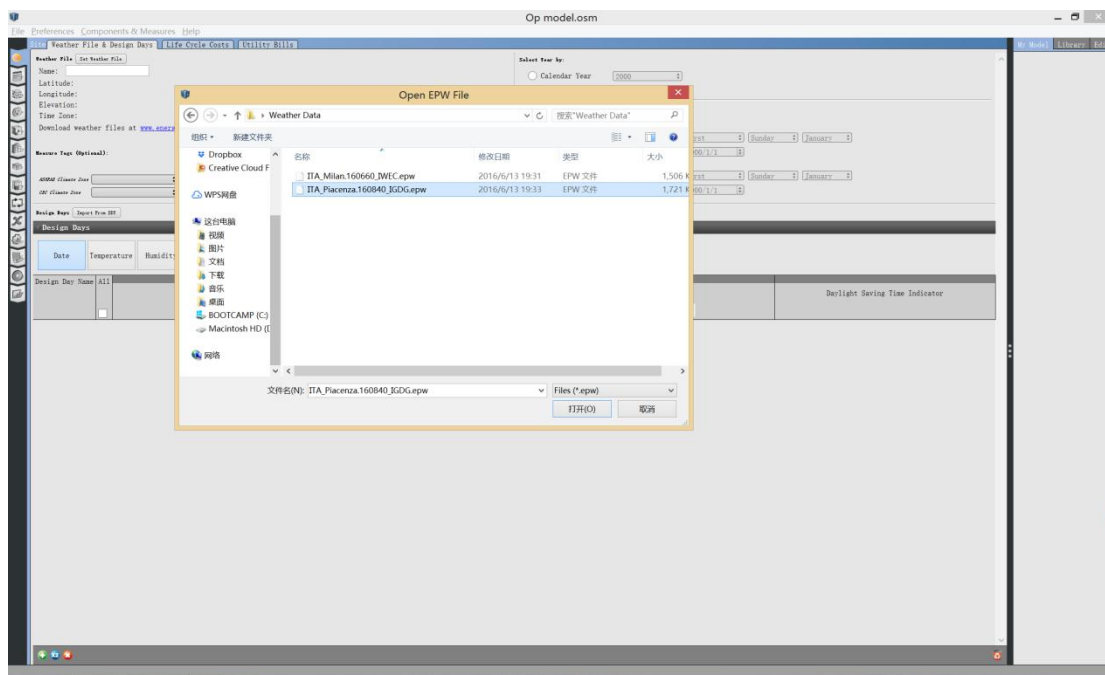
11. Save the model.



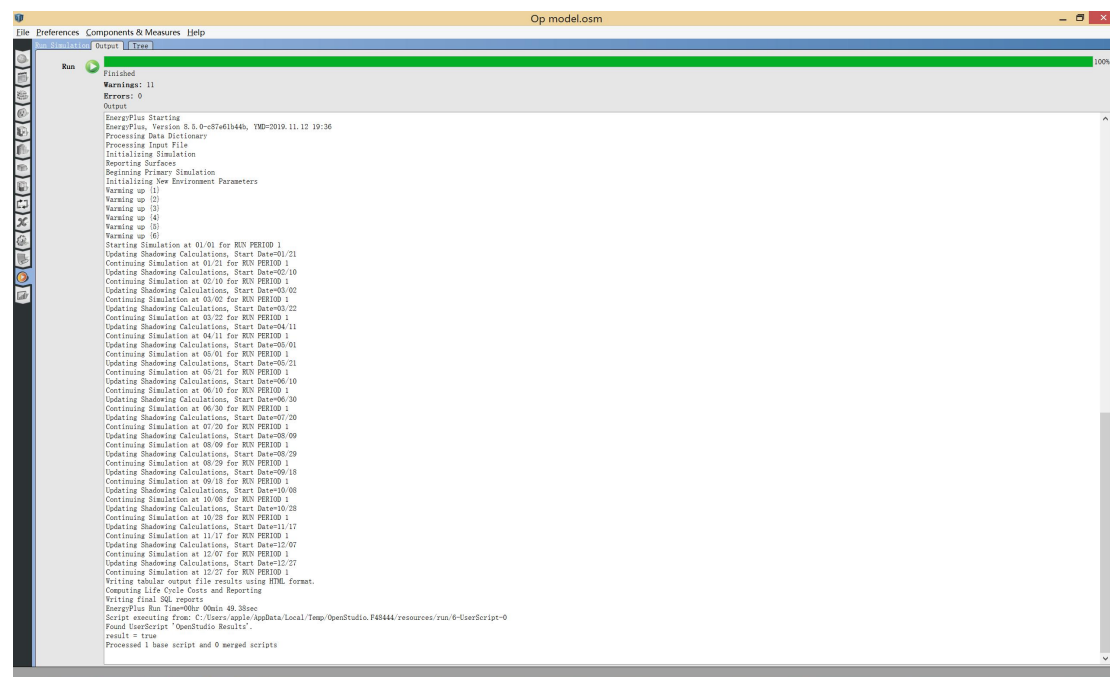
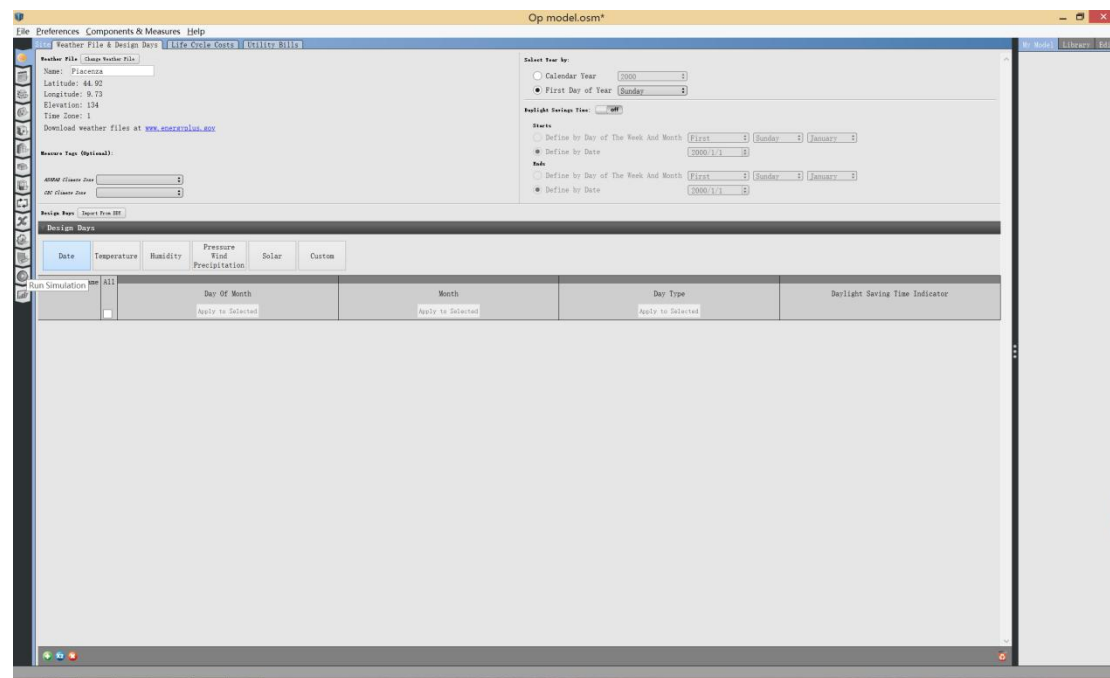
12. Run the Open studio.



13. Add the weather data.



14. Run the analysis.



15. Show the result.

