

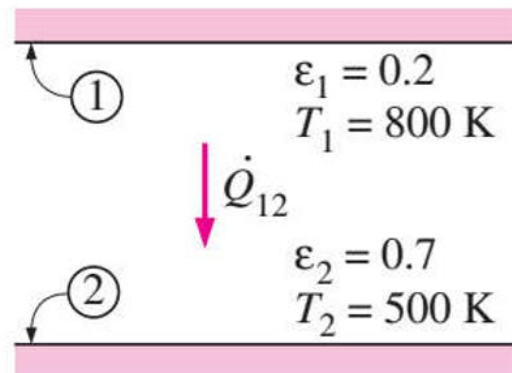
Week6 Assignment

Name: GAO MENGQI Personal code: 10721987

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?

Define the radiative heat transfer rate between two parallel plates shown in the picture.

$$\begin{aligned} \dot{q}_{1-2} &= \frac{\dot{Q}_{1-2}}{A} \\ &= \frac{\sigma A (T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) \cdot A} \\ &= \frac{\sigma (T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} \\ &= \frac{(5.67 \cdot 10^{-8}) \cdot (800^4 - 500^4)}{\frac{1}{0.2} + \frac{1}{0.7} - 1} \\ &= 3625.3 \text{ W/m}^2 \end{aligned}$$



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

$$\dot{q}'_{1-2} = \dot{q}_{1-2, n \text{ shields}} = \frac{\dot{q}_{1-2}}{100} = 36.253 \text{ W/m}^2$$

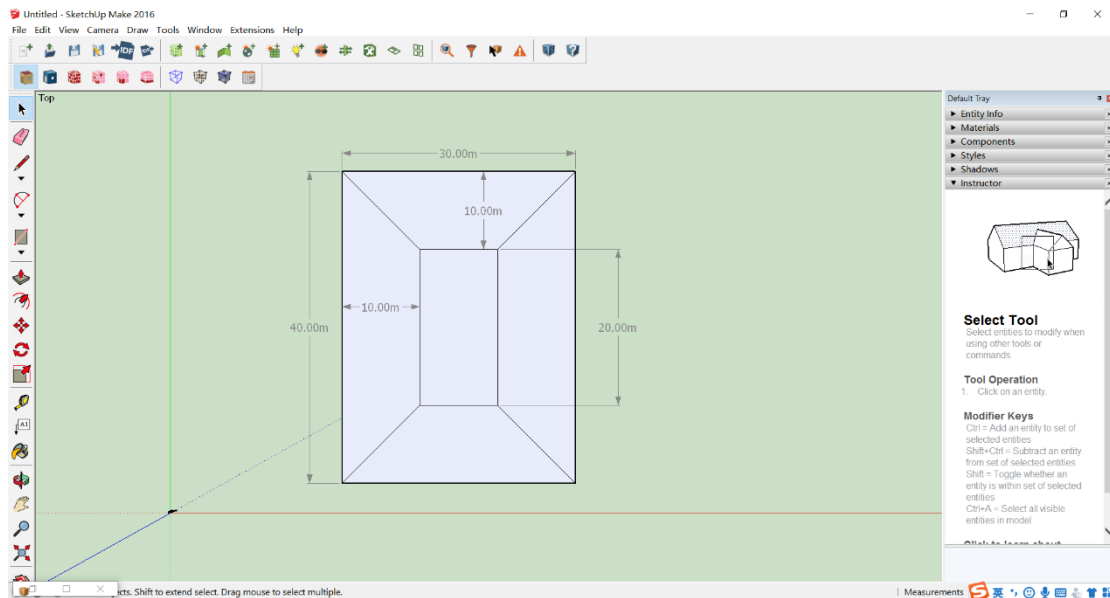
$$\begin{aligned} \dot{q}_{1-2, n \text{ shields}} &= \frac{\dot{q}_{1-2}}{100} = \frac{\sigma (T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + n \cdot \left(\frac{1}{\epsilon} + \frac{1}{\epsilon} - 1\right)} \\ \rightarrow \dot{q}_{1-2} \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + n \cdot \dot{q}_{1-2} \left(\frac{1}{\epsilon} + \frac{1}{\epsilon} - 1\right) &= 100 \cdot \sigma (T_1^4 - T_2^4) \\ \rightarrow 36.252 \cdot \left(\frac{1}{0.2} + \frac{1}{0.7} - 1\right) + n \cdot 36.252 \left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right) &= 100 \cdot (5.67 \cdot 10^{-8}) \cdot (800^4 - 500^4) \end{aligned}$$

$$\rightarrow n=28$$

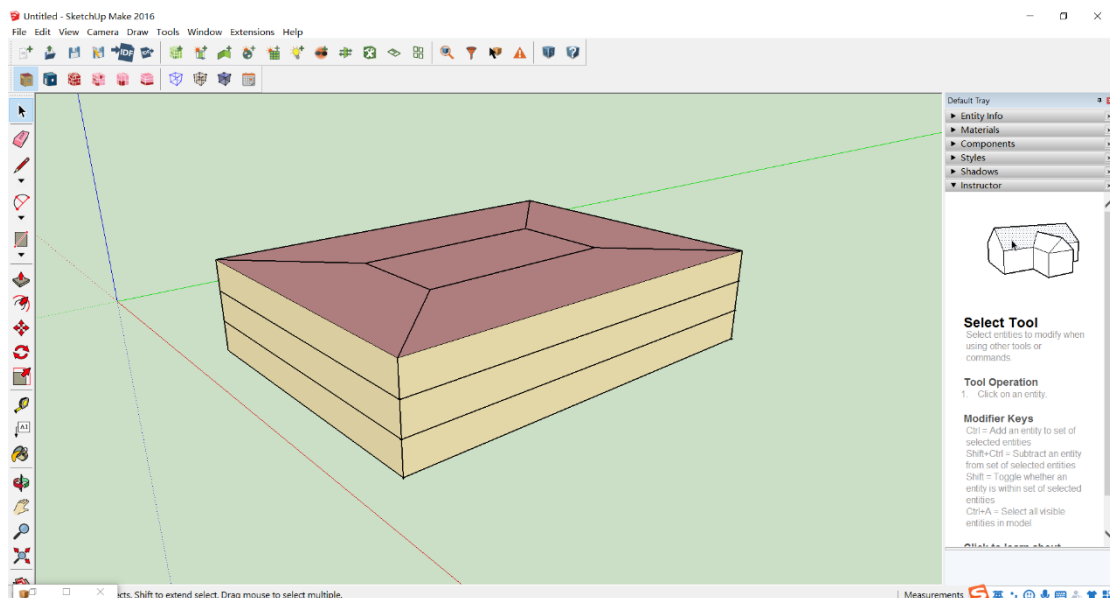
To have the new heat transfer rate be 1% of the previous rate without any shields, we need 28 shields, which $\epsilon = 0.1$.

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).

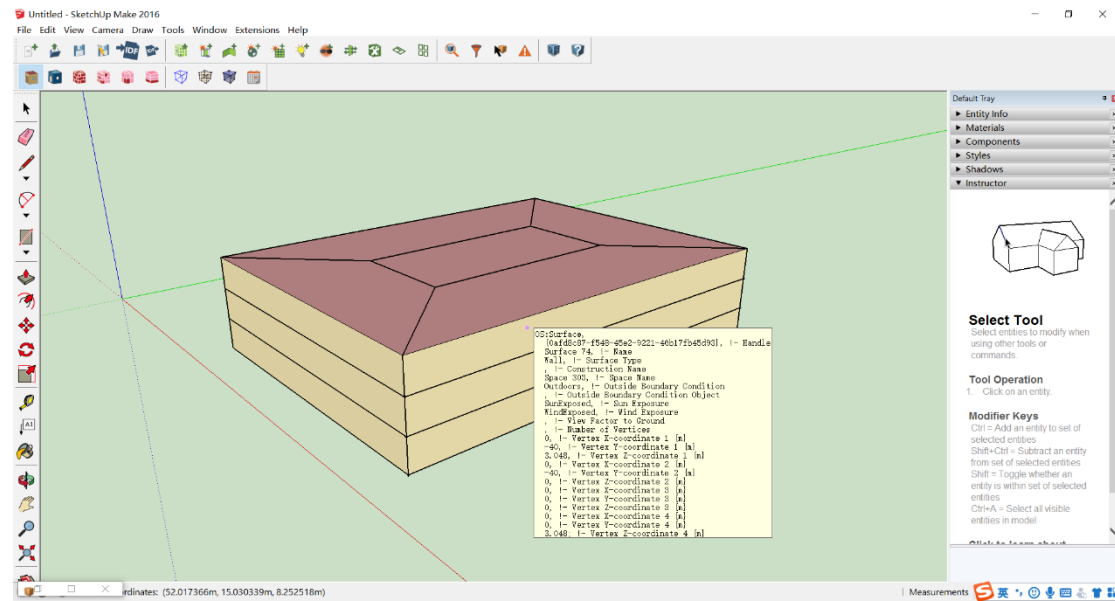
(1) Create a 30m * 40m rectangle in SketchUp, scale in 10m, and connect the four corners of the two rectangles.



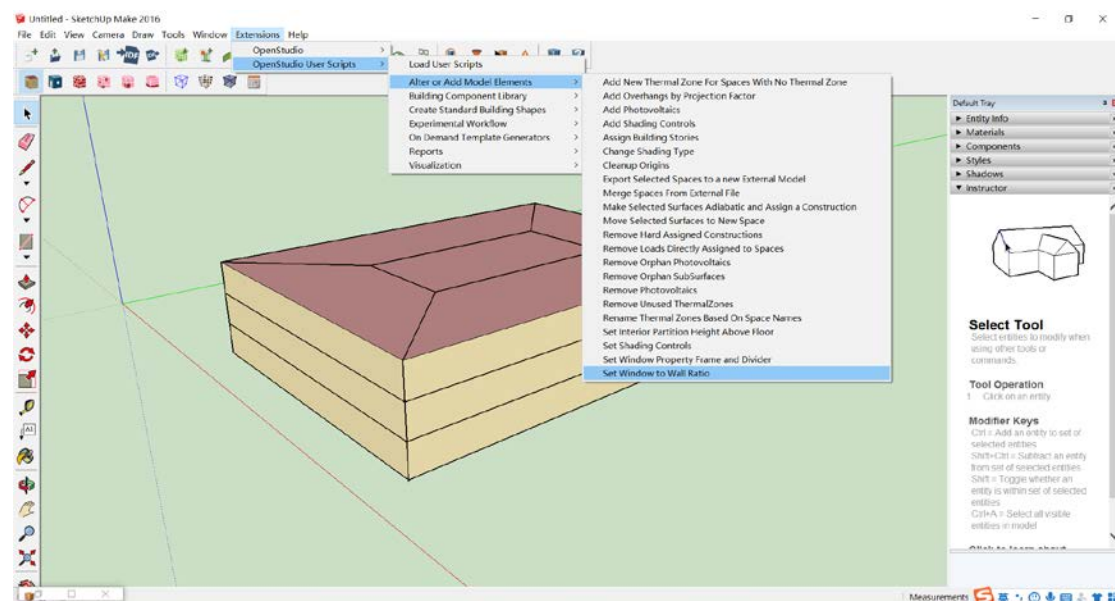
(2) Click the “Creative space from diagram” to create three levels.

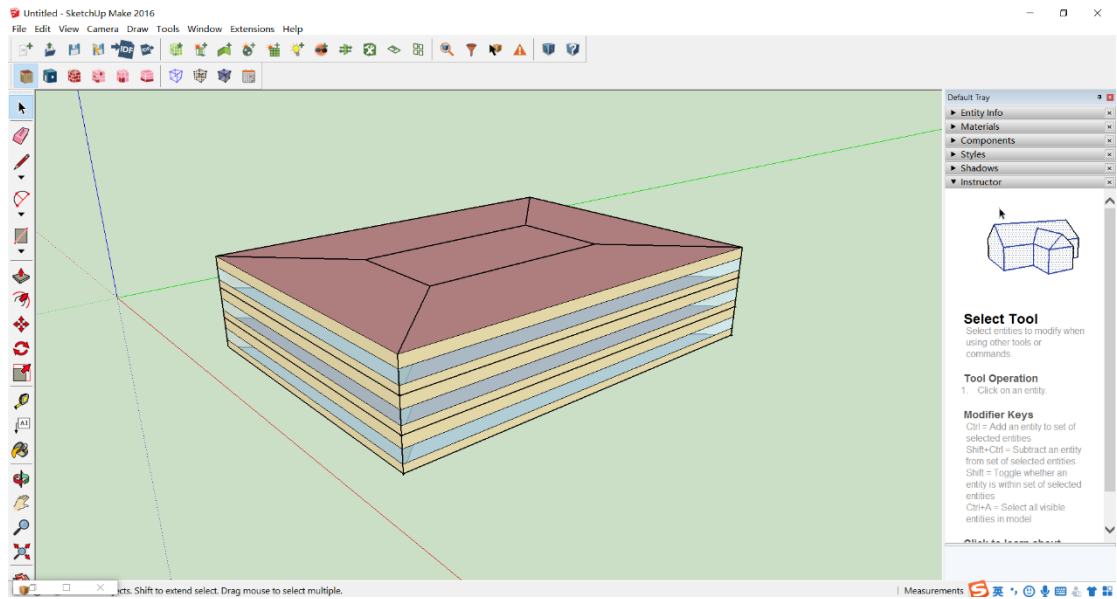


(3) Click the “info tool” to see the properties of each surfaces.

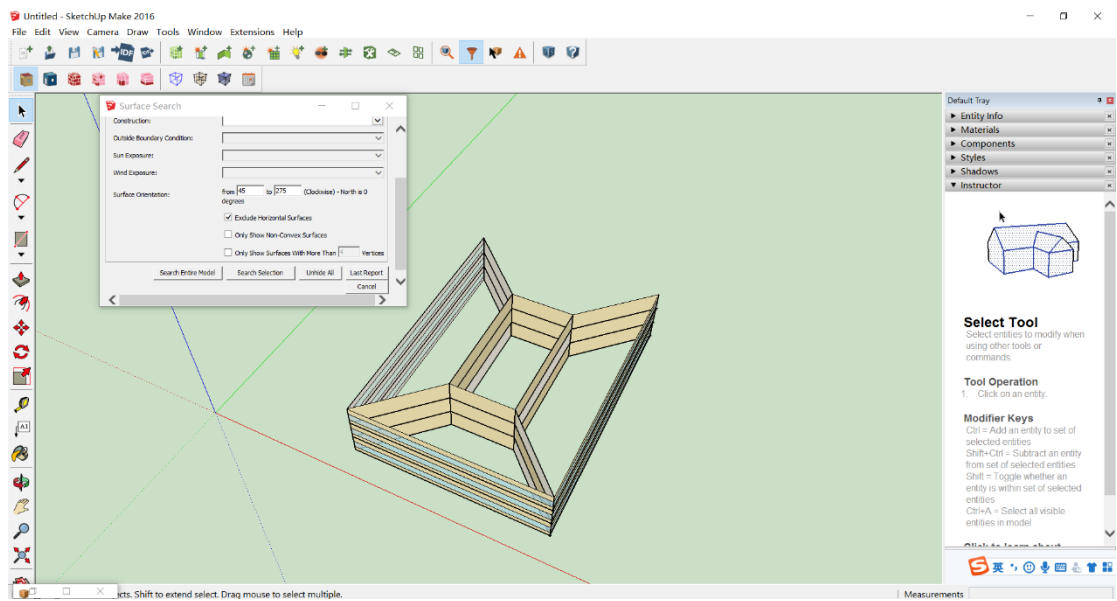


(4)Click the 'Surface matching' to match in entire model, and add the windows.

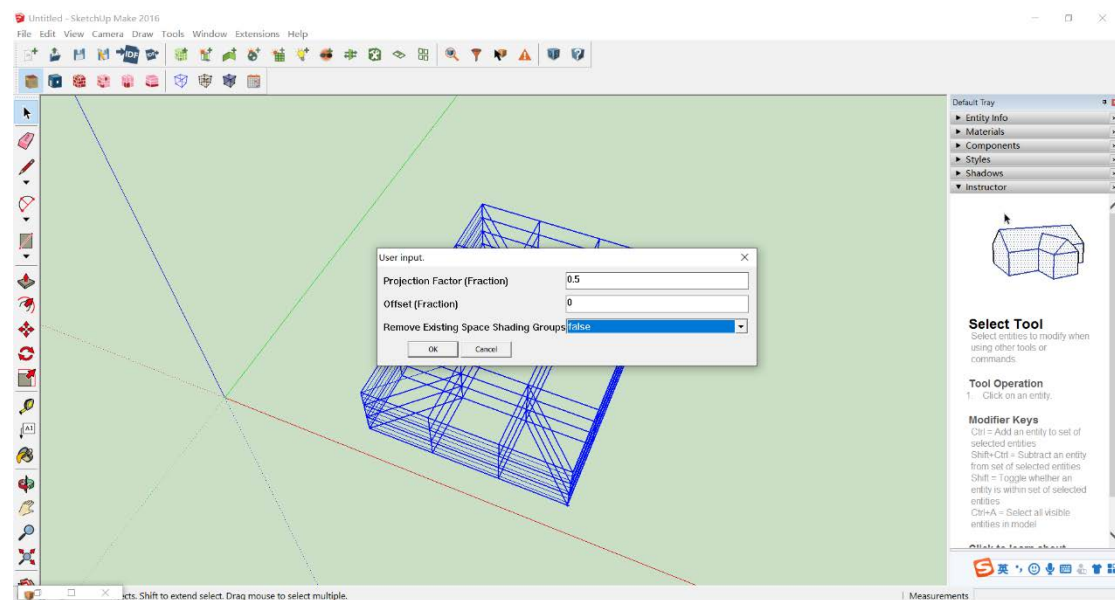
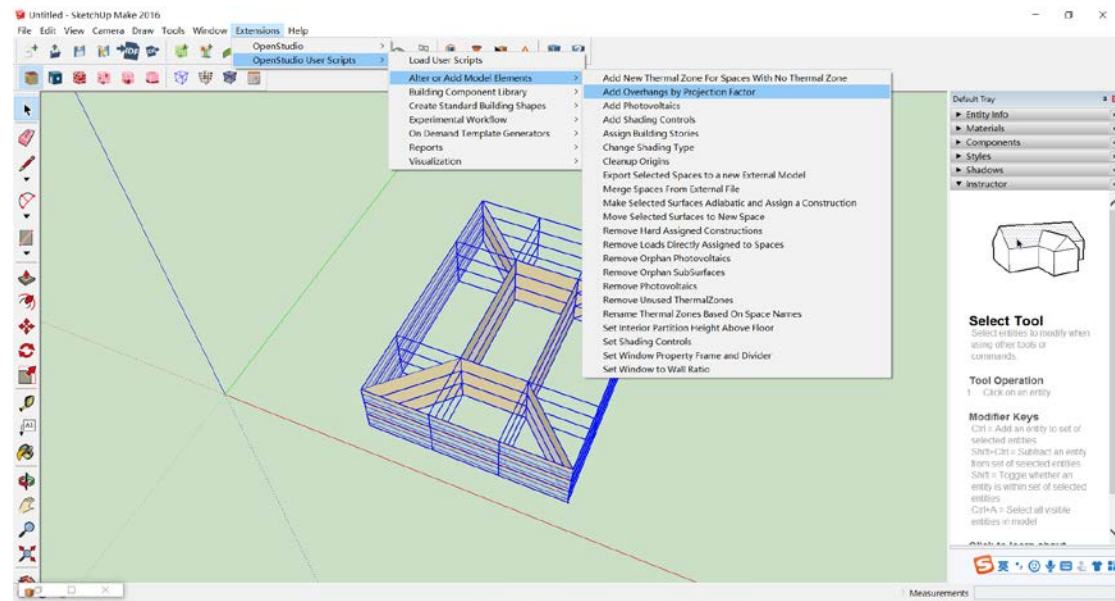




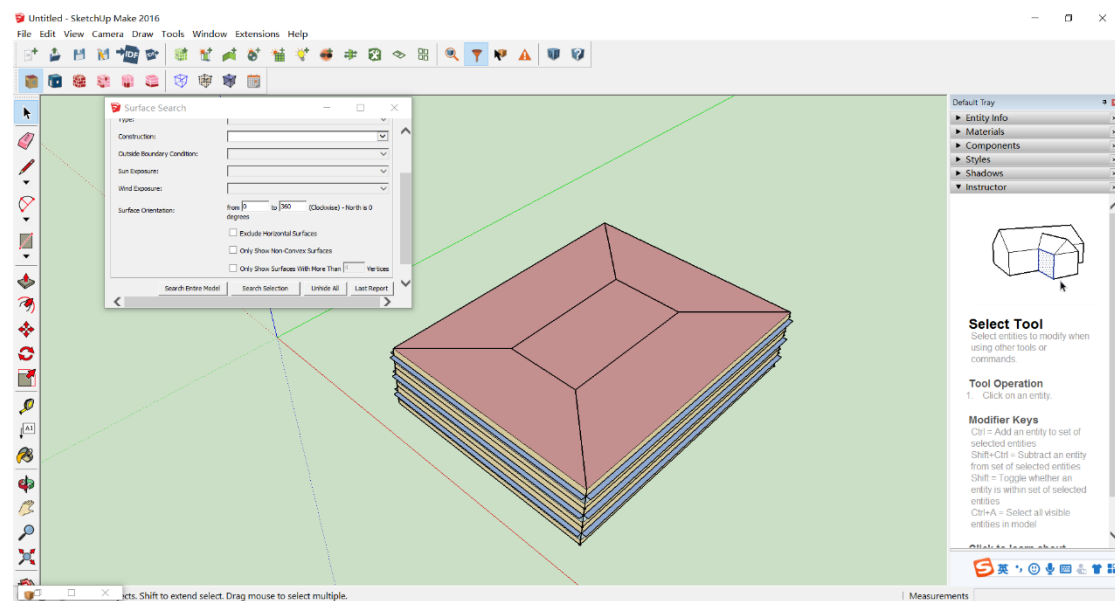
(5) Choose all surfaces except the north.



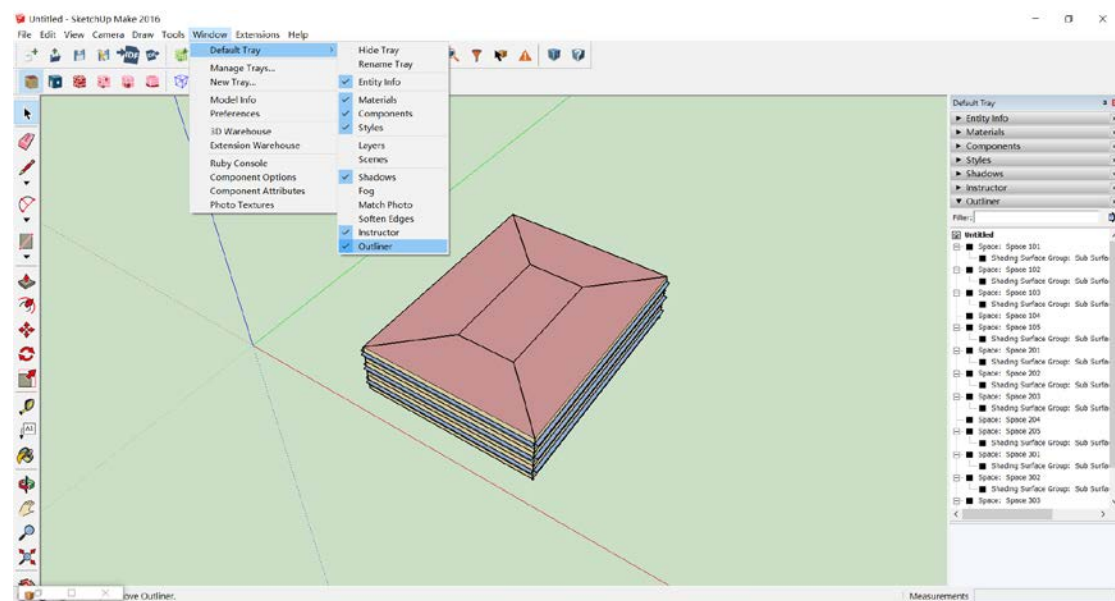
(6) Select all the surfaces and add overhang.



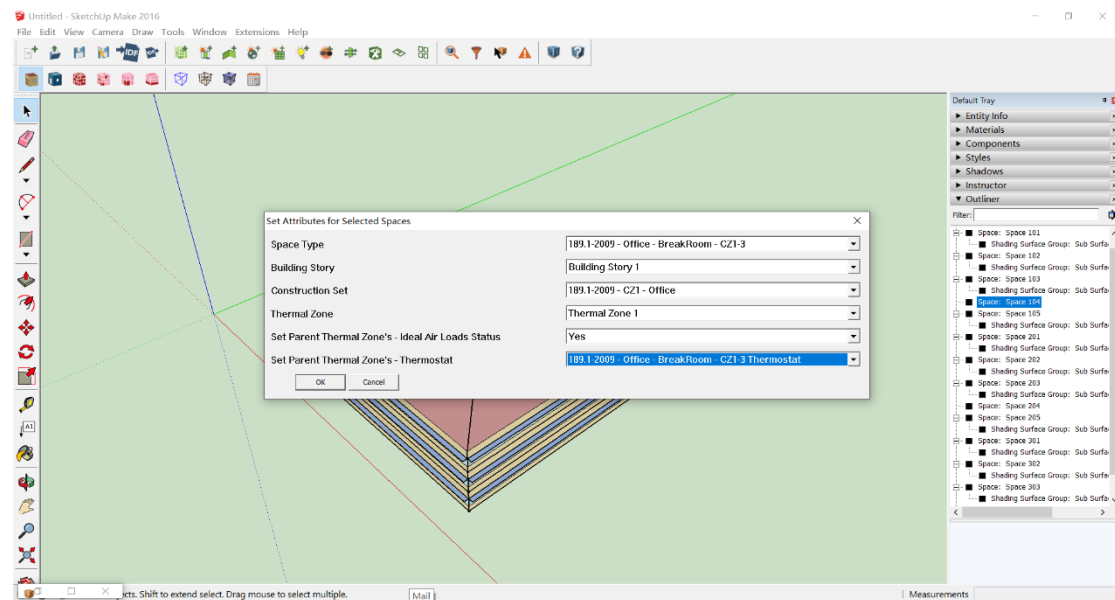
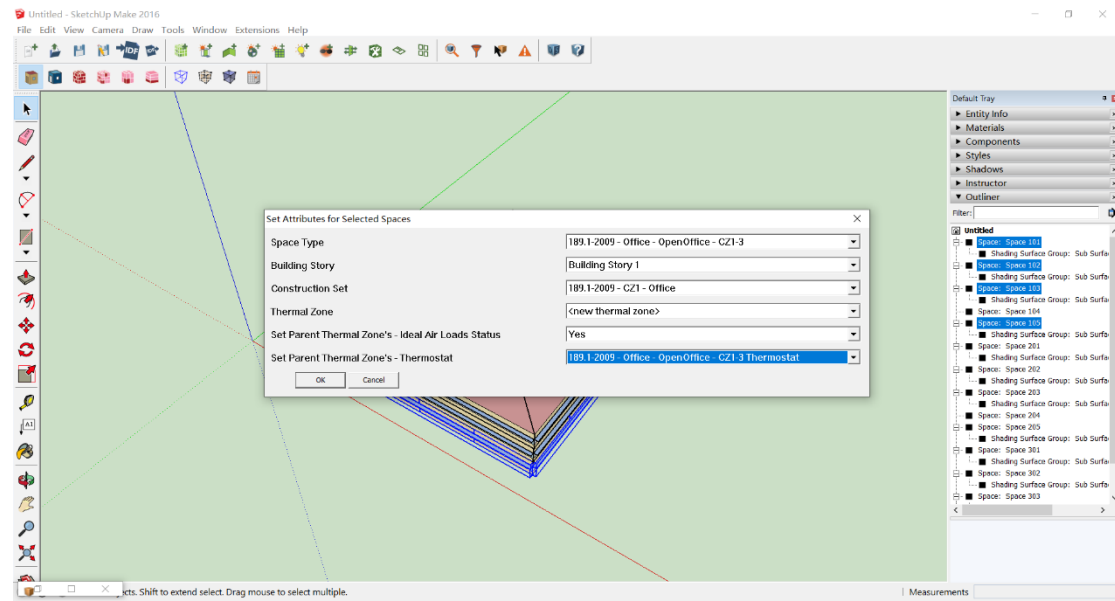
(7) Repeat the previous step and choose 0-360 surface to make the model go back previous selection.

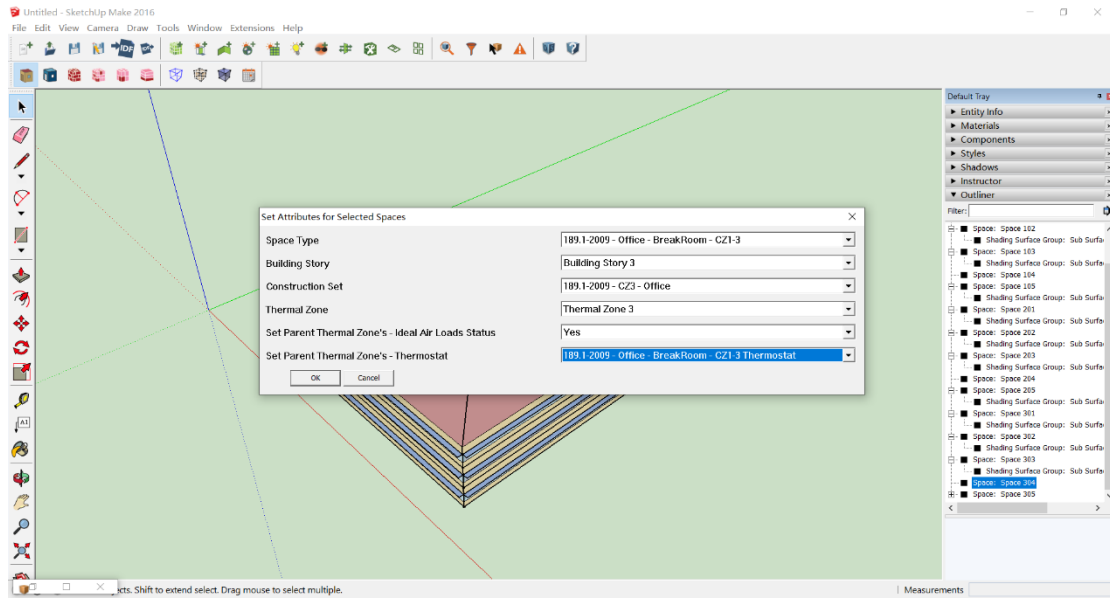


(8) Open Outliner panel to see each thermal zone.

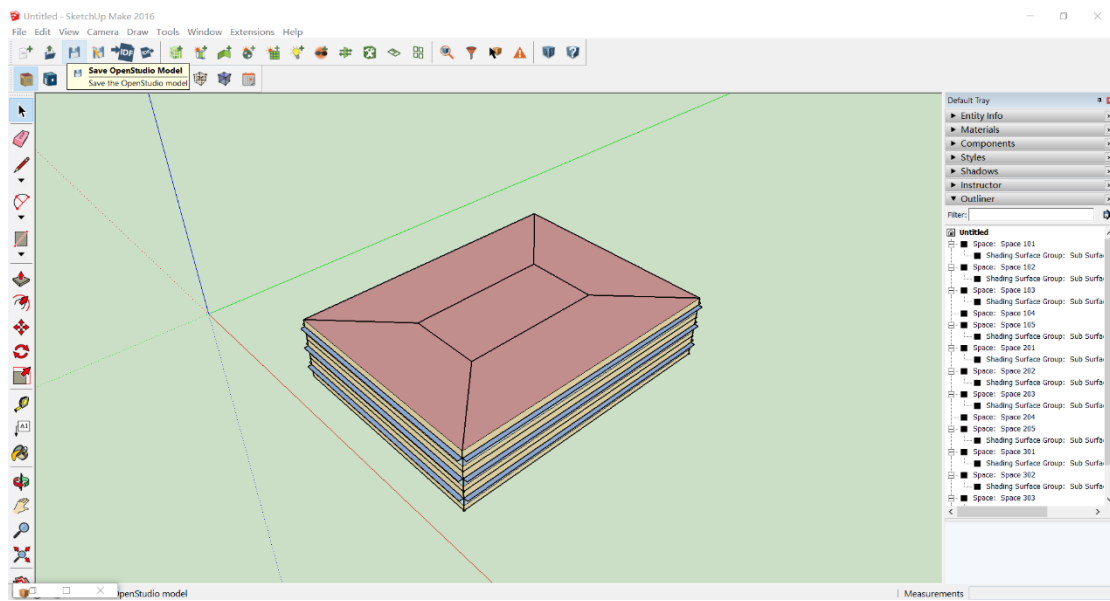


(9) Choose each thermal zone and add specification as following operating.

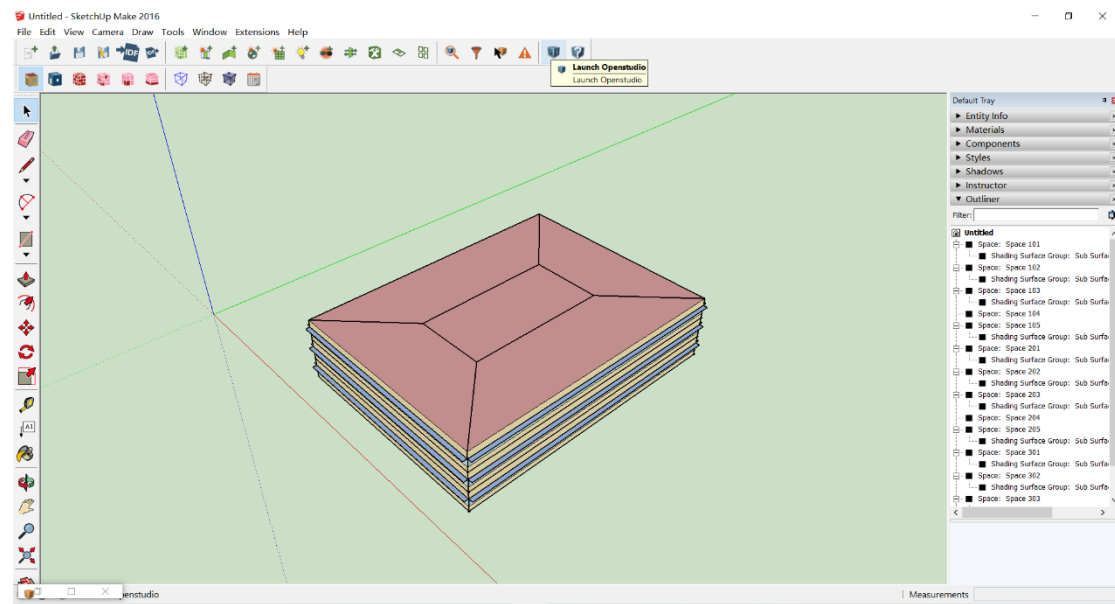




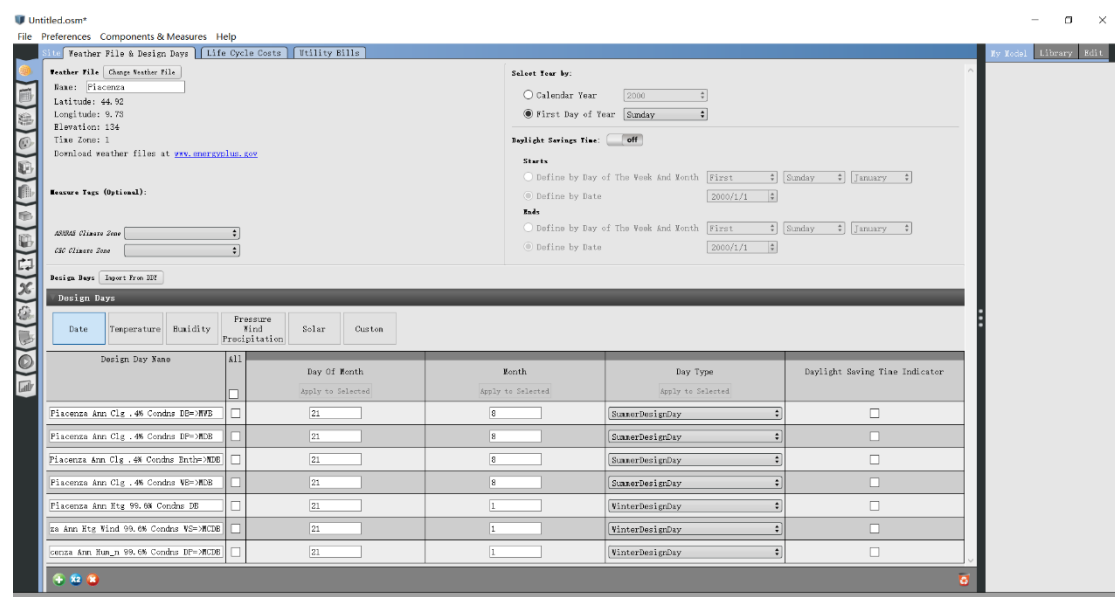
(10) Save the model.

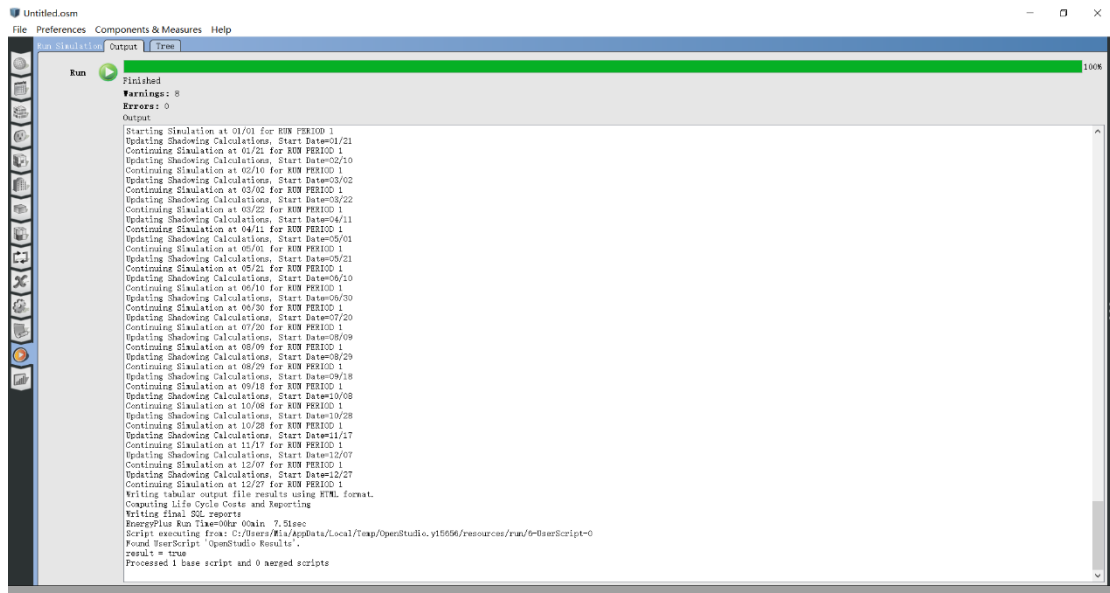
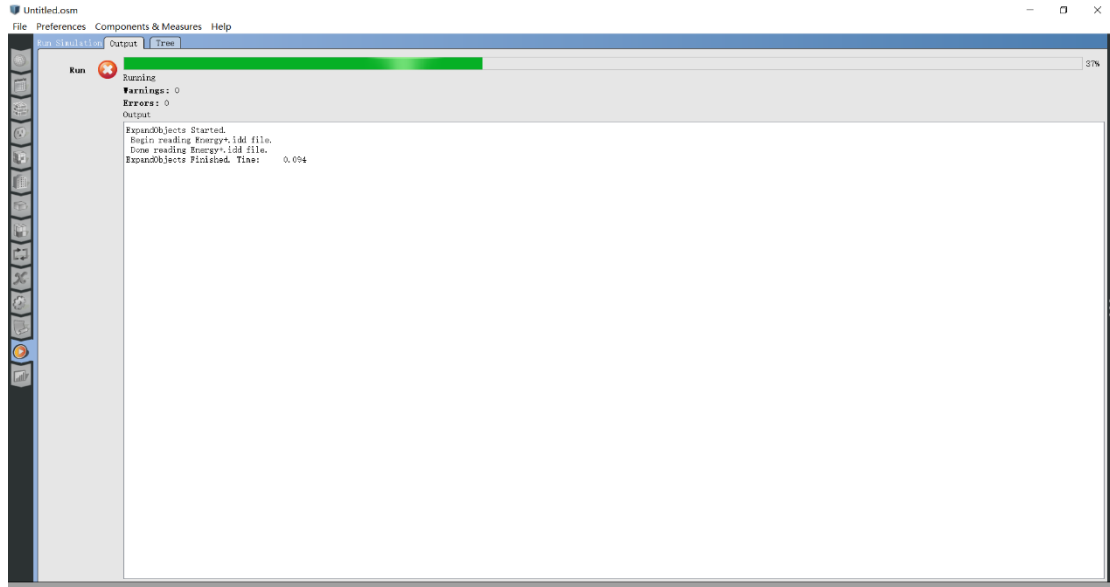


(11)Click the 'Launch Openstudio'.



(12) Add the weather data of Piacenza and run the model.





(13) Review the results in the last tab.

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File Preferences Components & Measures Help

Results Summary

Report to: EnergyPlus Results 2

Open ResultsViewer for Detailed Reports

Table of Contents

Program Version: EnergyPlus, Version 8.5.0 c57e61b44b, YMD-2019.11.12 23:46

Tabular Output Report in Format: HTML

Building: Building 1

Environment: RUN PERIOD 1 -- Placeza - ITA IGDG WMO=160840

Simulation Timestamp: 2019.11.12 23:46:27

Report: Annual Building Utility Performance Summary

Table of Contents

For Entire Facility

Timestamp: 2019-11-12 23:46:27

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	2164.94	601.37	601.37
Net Site Energy	2164.94	601.37	601.37
Total Source Energy	5531.24	1536.46	1536.46
Net Source Energy	5531.24	1536.46	1536.46

Site to Source Energy Conversion Factors

Site to Source Conversion Factor	
Electricity	3.167
Natural Gas	1.084
District Cooling	1.056
District Heating	3.613