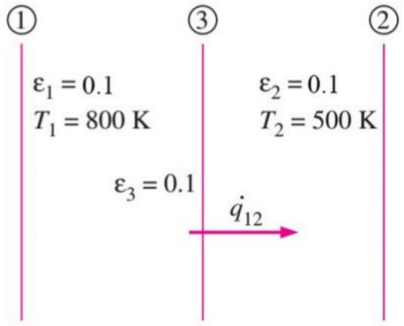
Task 1 Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields?

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



$$\dot{q}_{net_{1-2}}$$

$$= \frac{\dot{Q}_{net_{1-2}}}{A}$$

$$= \frac{\sigma A(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} * \frac{1}{A}$$

$$= \frac{\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} = \frac{(5.67 * 10^{-8}) * (800^4 - 500^4)}{\frac{1}{0.2} + \frac{1}{0.7} - 1}$$

$$= 3625.4 W/m^2$$

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

$$\dot{q}'_{net_{1-2}} = \dot{q}_{net_{1-2,n\ shields}} = \frac{1}{100} * \dot{q}_{net_{1-2}}$$

$$\dot{q}_{net_{1-2,n\ shields}} = \frac{\dot{Q}_{net_{1-2,n\ shields}}}{A}$$

$$= \frac{\sigma A(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1\right) \dots \left(\frac{1}{\epsilon_{n,1}} + \frac{1}{\epsilon_{n,2}} - 1\right)} * \frac{1}{A}$$

$$= \frac{\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1\right) \dots \left(\frac{1}{\epsilon_{n,1}} + \frac{1}{\epsilon_{n,2}} - 1\right)}$$

$\epsilon_1 = 0.2 \ \ \epsilon_2 = 0.7 \ \epsilon_3 = \dots = \epsilon_n = 0.1$

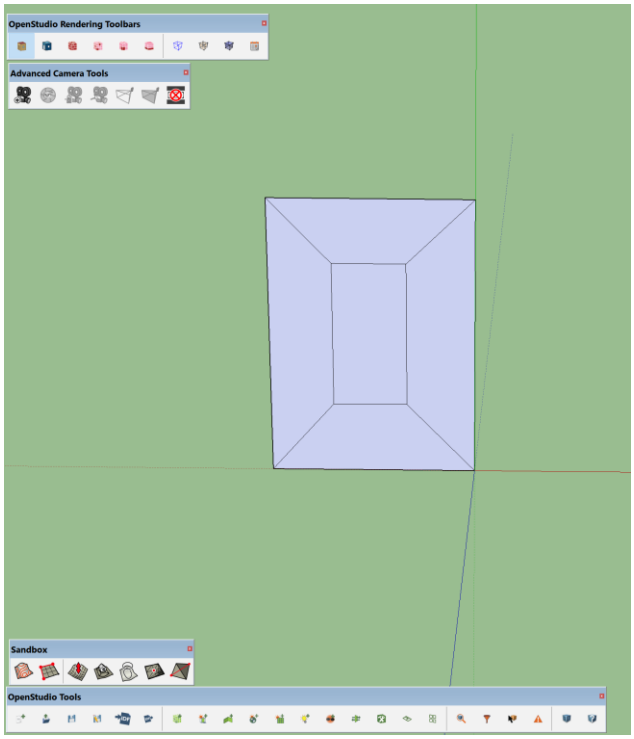
$\rightarrow 36.254 = \frac{(5.67*10^{-8})*(800^4 - 500^4)}{\left(\frac{1}{0.2} + \frac{1}{0.7} - 1\right) + n\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)}$

$\rightarrow n=28$

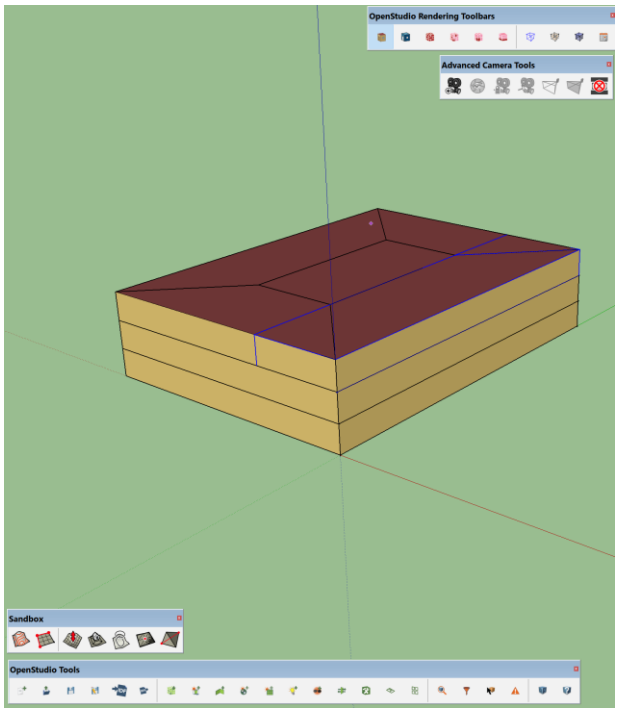
To have the new heat transfer rate be 1% of the previous rate without any shields, we need 28 shields , which $\epsilon = 0.1$.

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!)

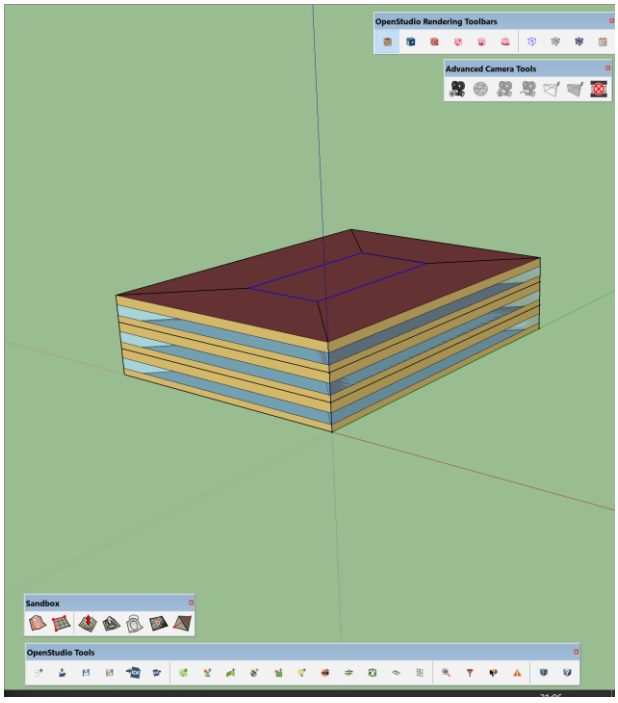
Draw the outline and shape of the building in Sketchup.



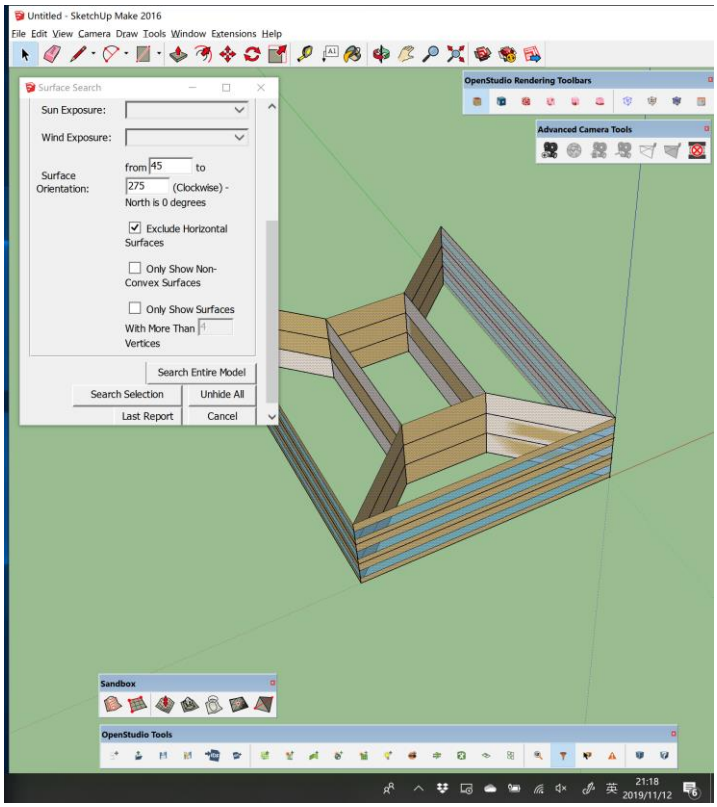
Use “Creat spaces from diagram”creat a 3 floor building.



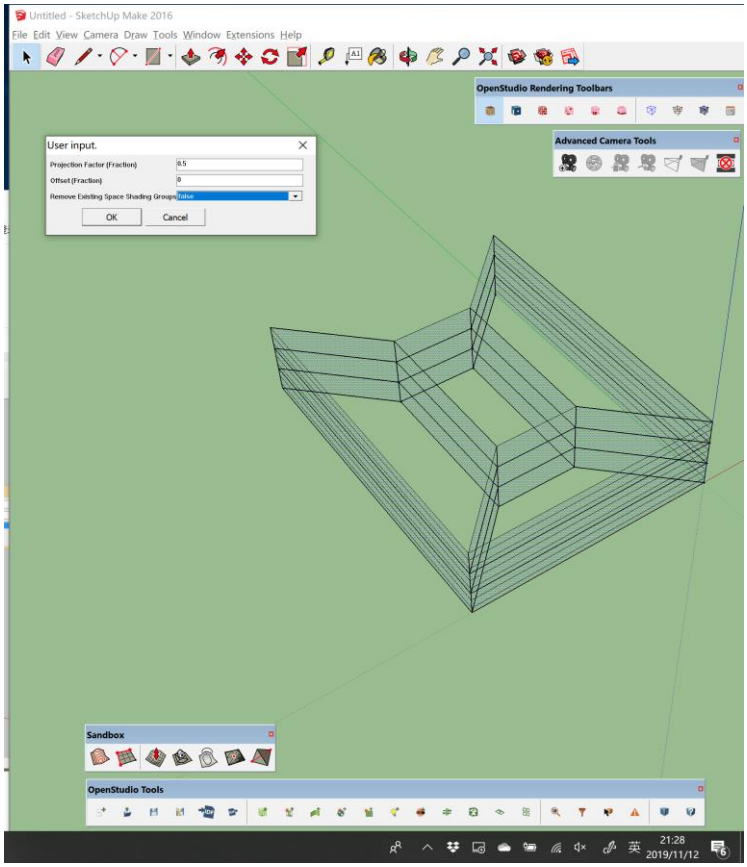
Click”Set Window to Wall Ratio”to built the windows.

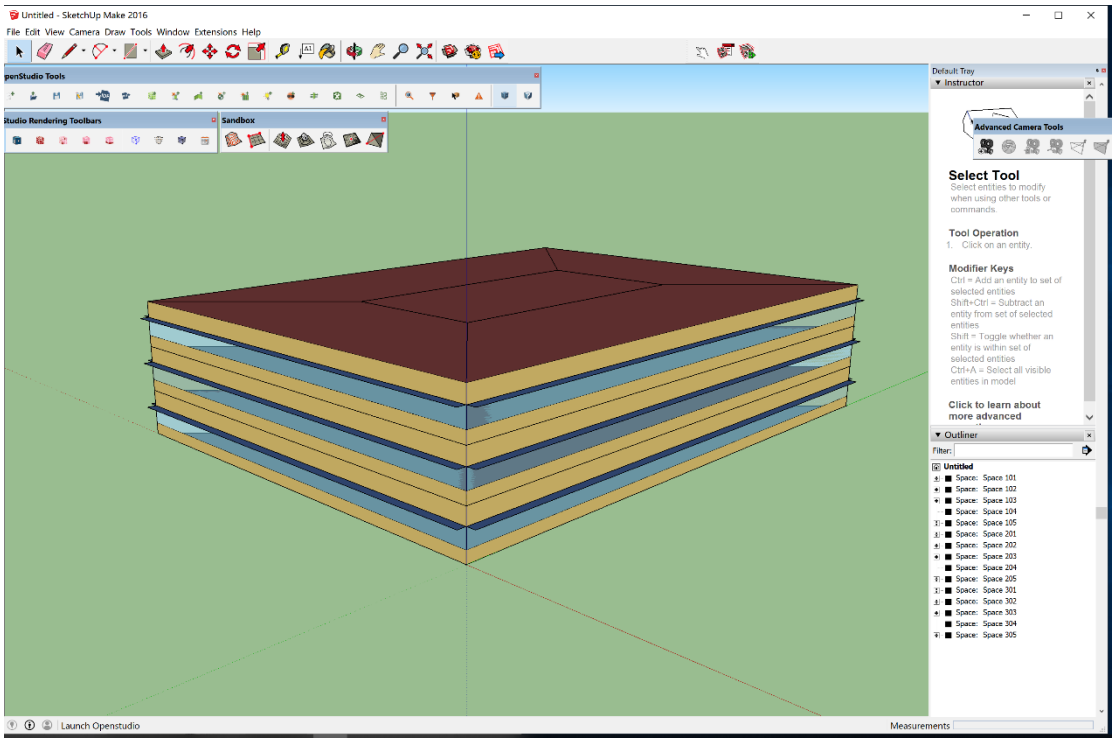


Check other directions besides the north

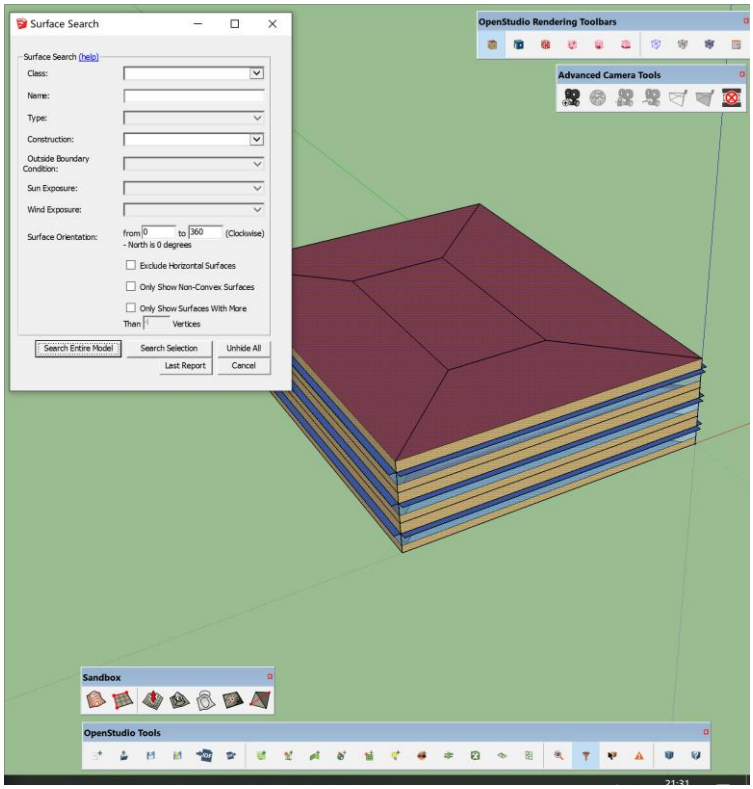


Click"Add Overhanges by Projection Factor"to built overhangs.



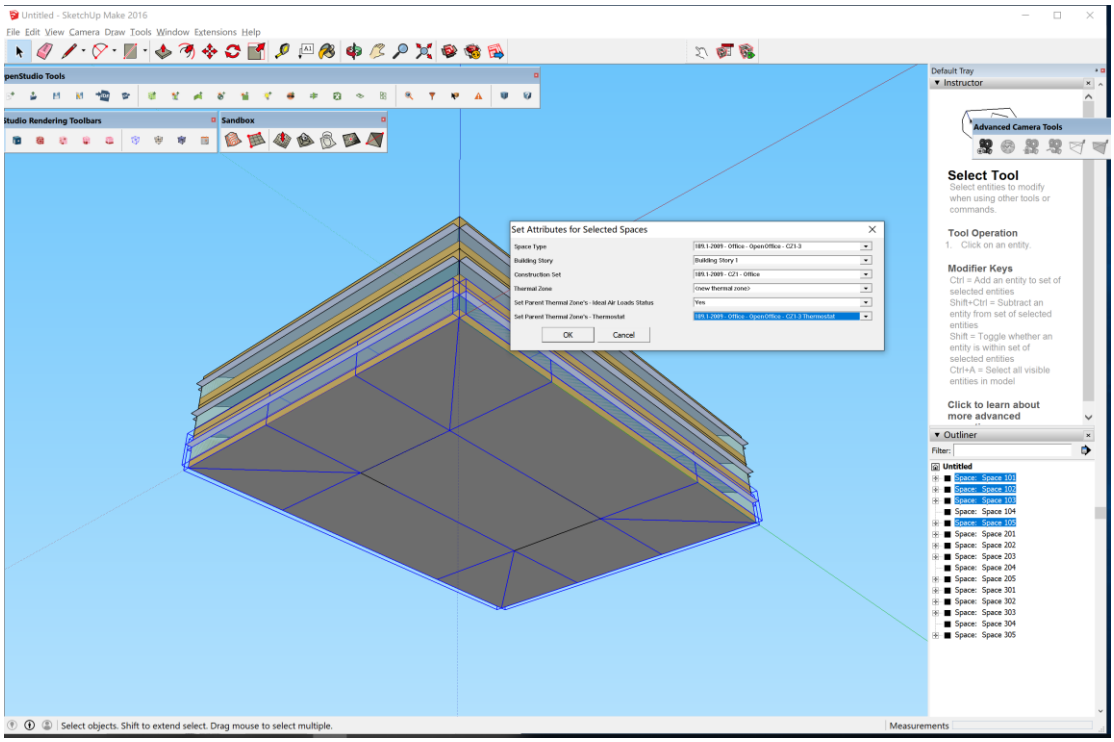


Open the"Outliner"

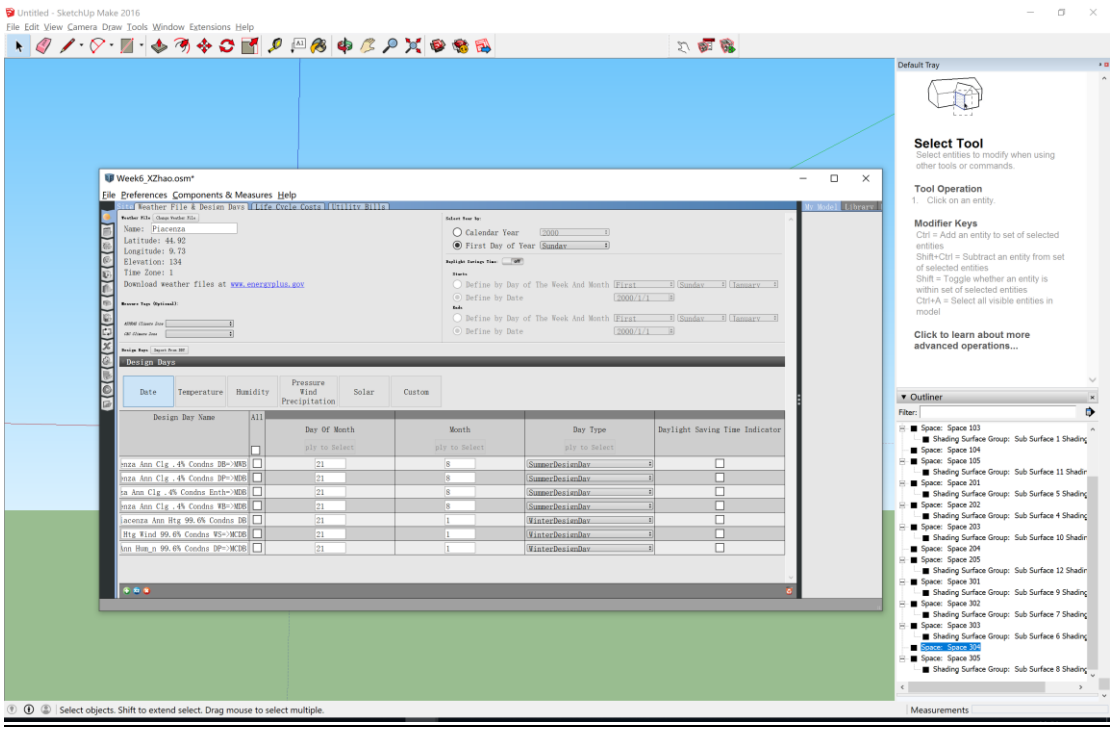


Choose the space of each thermal zone.

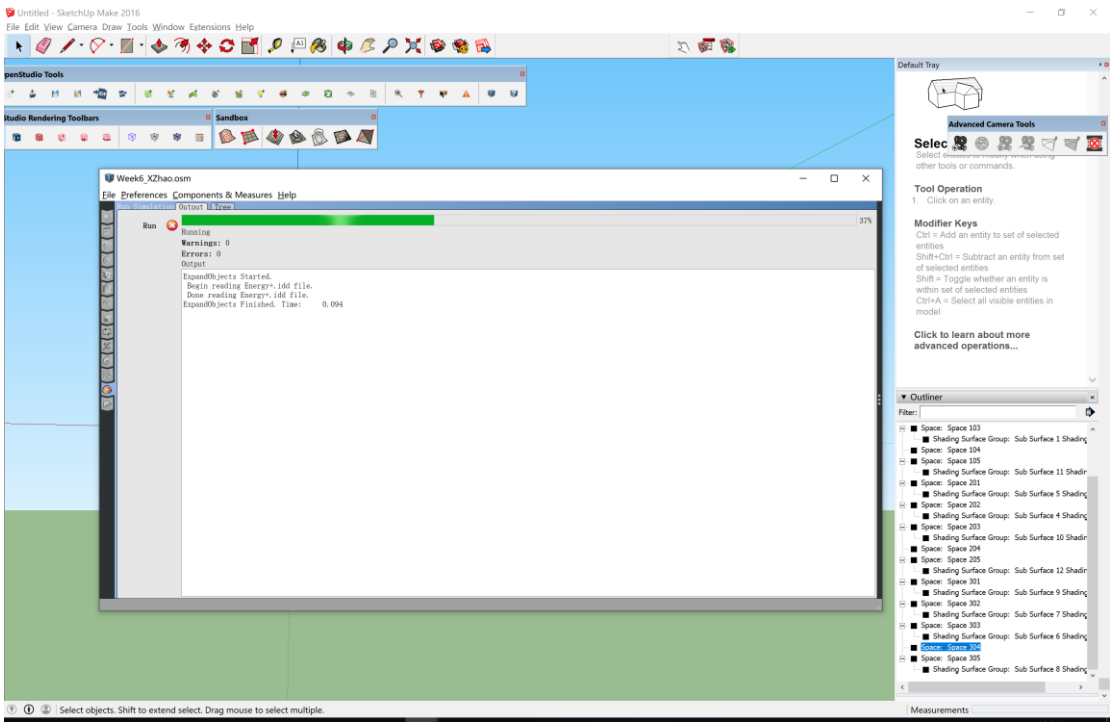
Click "Set Attributes for Selected Space"to set parameters.



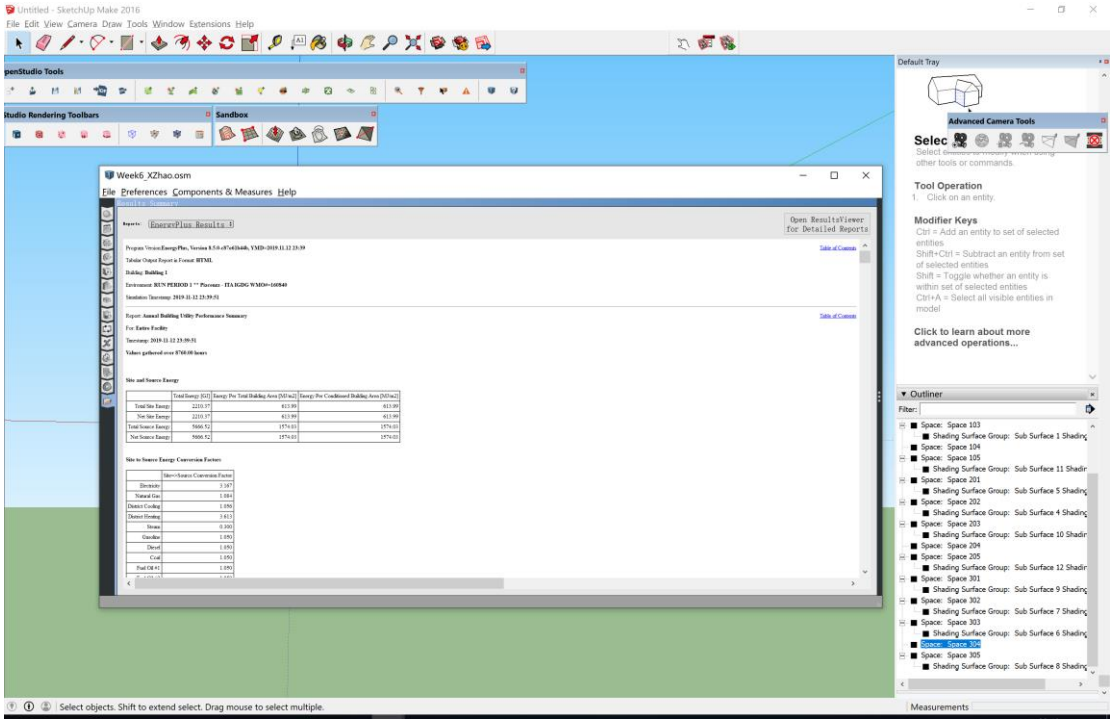
Add the weather data.



Run the analysis.



Show the result


Untitled - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
OpenStudio Tools
Studio Rendering Toolbars
Sandbox
Week6_XZhao.osm
File Preferences Components & Measures Help
Open ResultsViewer for Detailed Reports
Default Tray
Advanced Camera Tools
Tool Operation
Modifier Keys
Click to learn about more advanced operations...
Outliner
Select objects. Shift to extend select. Drag mouse to select multiple.
Measurements