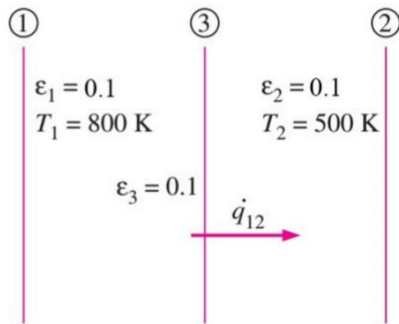


Task 1 Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields?

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



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

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

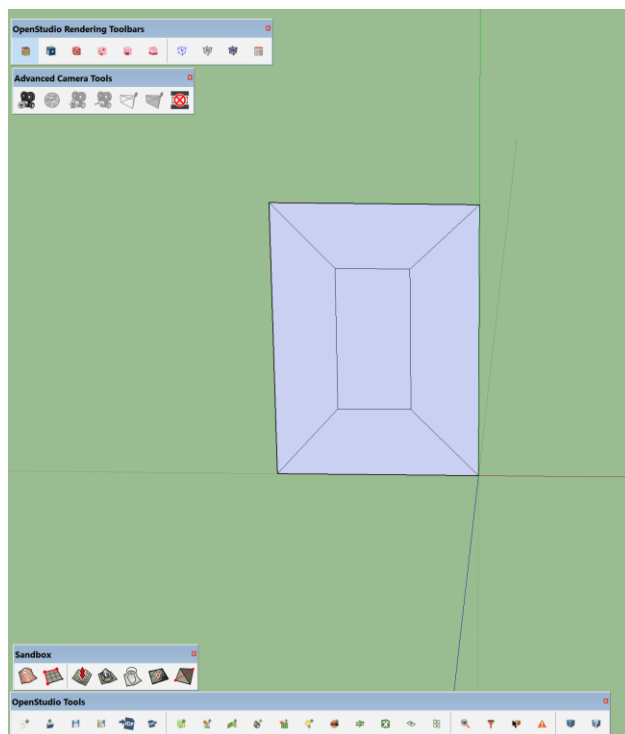
$$\dot{q}'_{\text{net}_{1-2}} = \dot{q}_{\text{net}_{1-2, n \text{ shields}}} = \frac{1}{100} * \dot{q}_{\text{net}_{1-2}}$$

$$\begin{aligned}
\dot{q}_{\text{net}_{1-2,n \text{ shields}}} &= \frac{\dot{Q}_{\text{net}_{1-2,n \text{ shields}}}}{A} \\
&= \frac{\sigma A (T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1\right) \dots \left(\frac{1}{\epsilon_{n,1}} + \frac{1}{\epsilon_{n,2}} - 1\right)} * \frac{1}{A} \\
&= \frac{\sigma (T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1\right) \dots \left(\frac{1}{\epsilon_{n,1}} + \frac{1}{\epsilon_{n,2}} - 1\right)} \\
\epsilon_1 = 0.2 \quad \epsilon_2 = 0.7 \quad \epsilon_3 = \dots = \epsilon_n = 0.1 \\
\rightarrow 36.254 &= \frac{(5.67 \cdot 10^{-8}) * (800^4 - 500^4)}{\left(\frac{1}{0.2} + \frac{1}{0.7} - 1\right) + n \left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)} \\
\rightarrow n &= 28
\end{aligned}$$

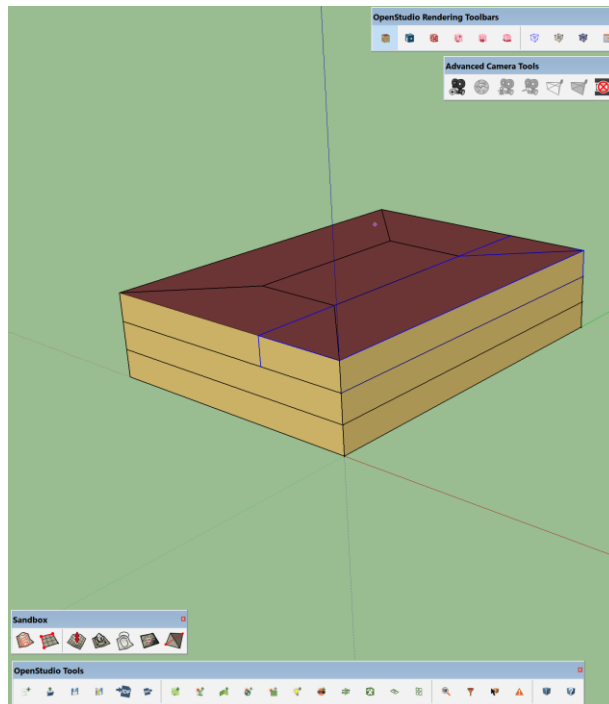
To have the new heat transfer rate be 1% of the previous rate without any shields, we need 28 shields, which $\epsilon = 0.1$.

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!)

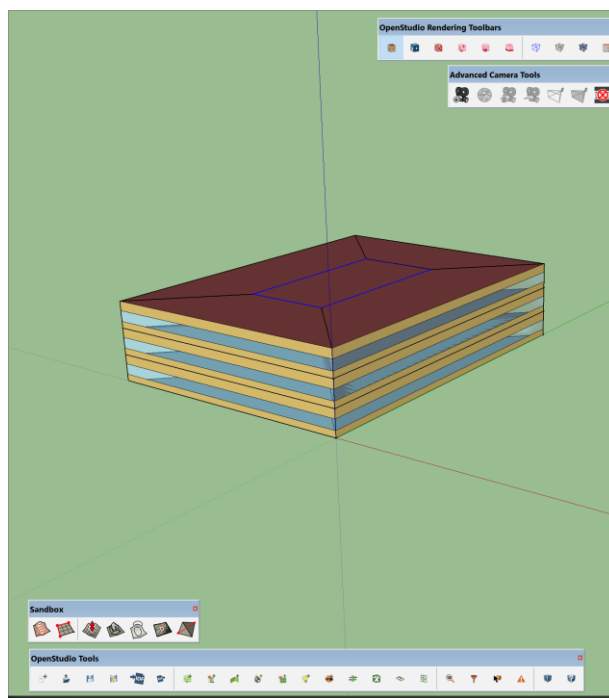
Draw the outline and shape of the building in Sketchup.



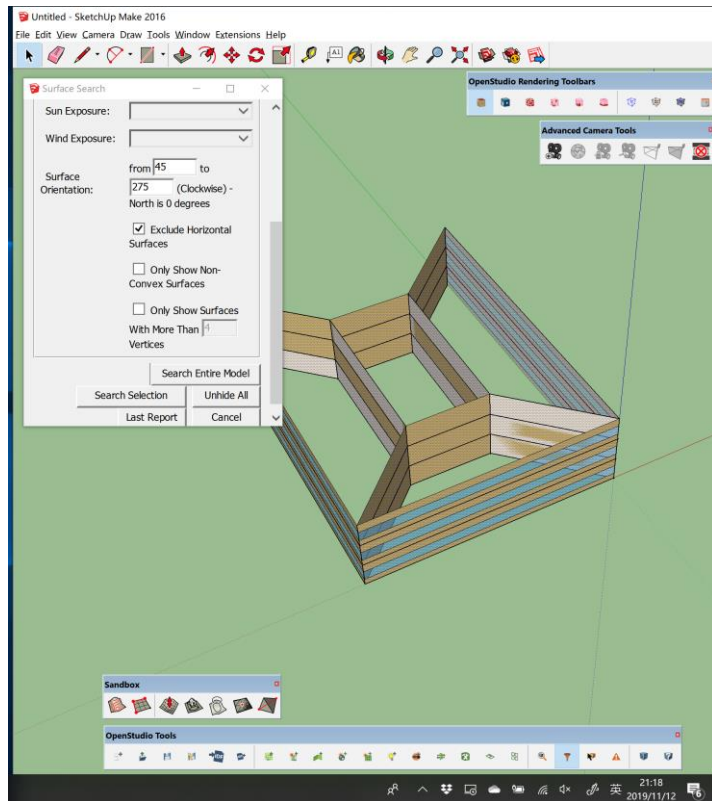
Use “Creat spaces from diagram”creat a 3 floor building.



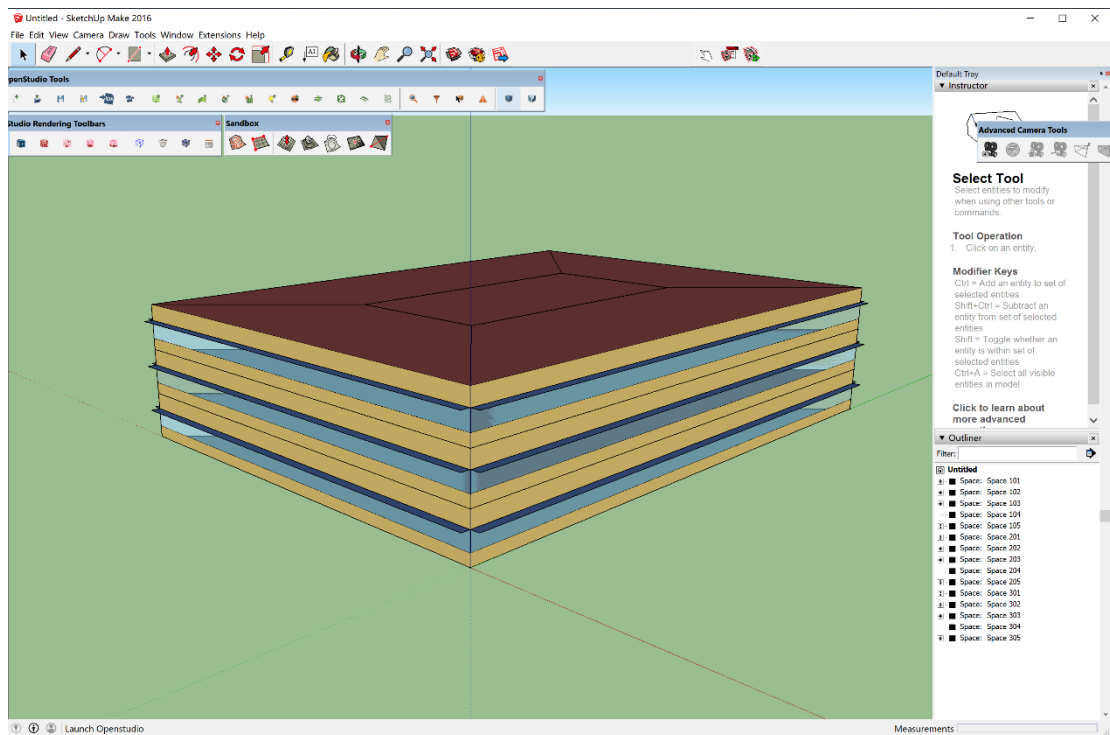
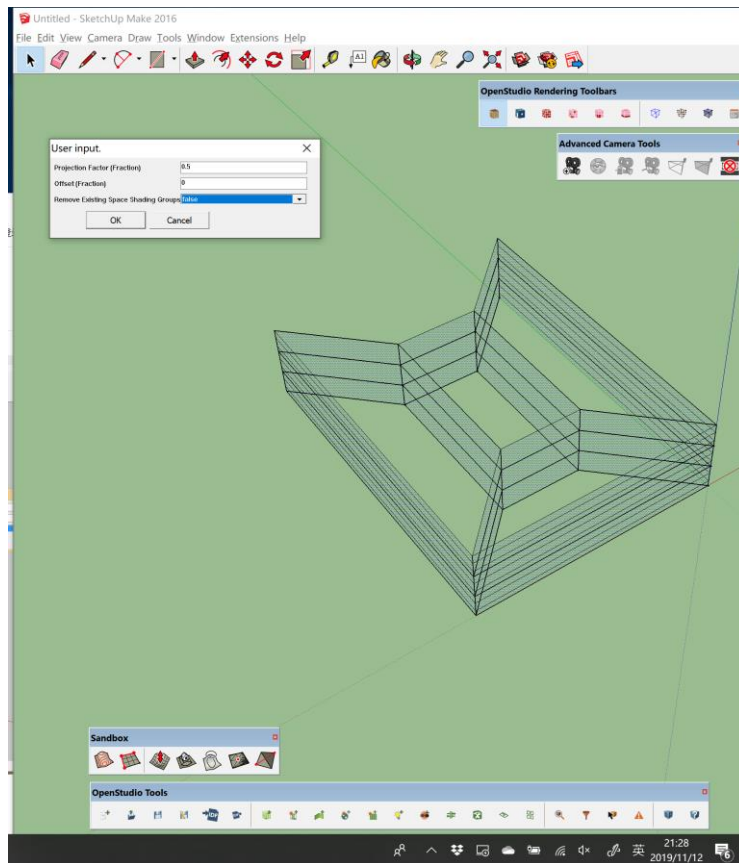
Click“Set Window to Wall Ratio”to built the windows.



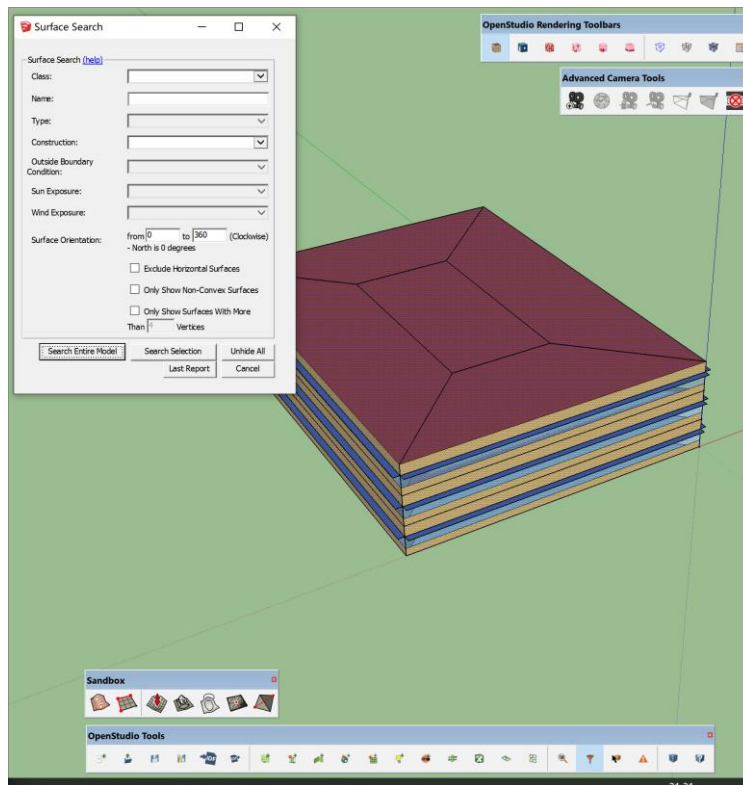
Check other directions besides the north



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

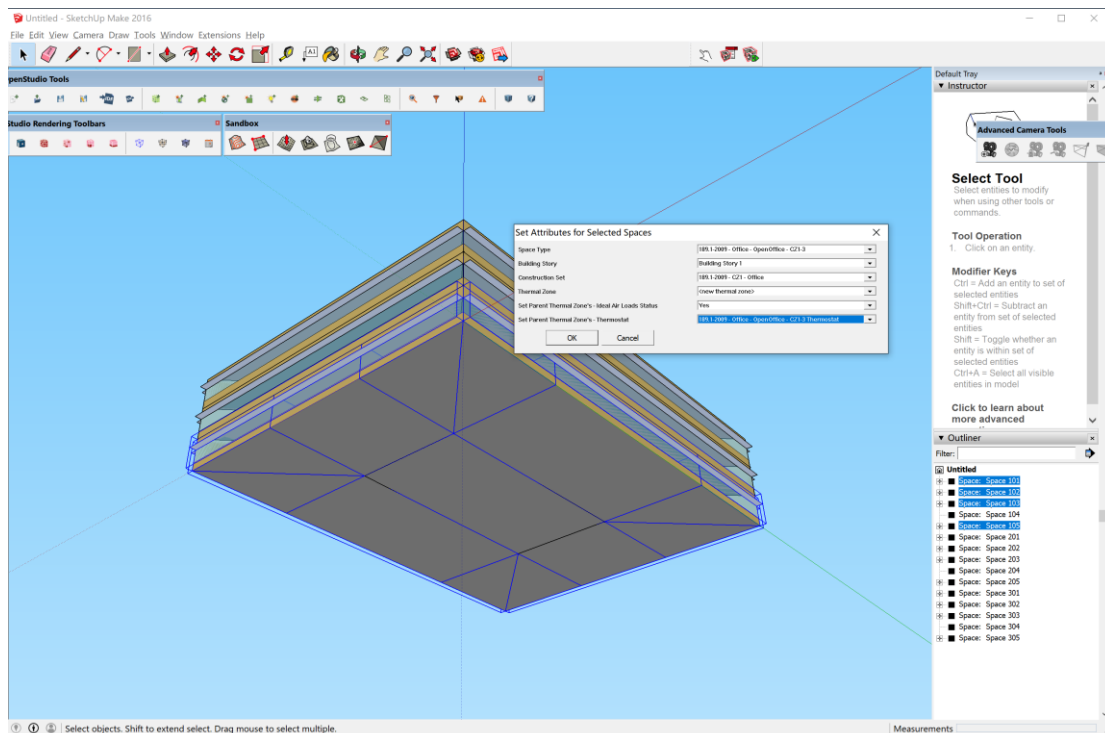


Open the "Outliner"



Choose the space of each thermal zone.

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



Add the weather data.

Untitled - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help

penStudio Tools

Studio Rendering Toolbars

Sandbox

Week5_XZhao.com

File Preferences Components & Measures Help

Reports: EnergyPlus Results.R

Project: Yantai Energy Plus, Version 8.5.0-64bit, YMD-2019.11.12 15:36

Model: EnergyPlus v8.5.0-64bit, YMD-2019.11.12 15:36

Building: Building 1

Environment: SUN PERIOD: 1 *** Process: ITA KONG W/MON-00000

Simulation: Simulation: 2019.11.12 15:36:01

Report: Annual Building 100% Performance Summary

For: Energy Facility

Simulation: 2019.11.12 15:36:01

Values gathered over 8760 hours

Site and Source Energy

	Total Energy (kWh)	Energy Per Total Building Area (kWh/m2)	Energy Per Conditioned Building Area (kWh/m2)
Total Site Energy	2210.17	81.01	81.01
Total Source Energy	2210.17	81.01	81.01
Total Source Energy	1866.52	67.61	67.61
Total Source Energy	1866.52	67.61	67.61

Site to Source Energy Conversion Factors

	Site to Source Conversion Factor
Electricity	2.247
Natural Gas	1.094
District Cooling	1.478
District Heating	2.617
Steam	0.102
Gasoline	1.075
Oil	1.075
Coal	1.075
Propane	1.075
Other	1.075

Default Tray

Advanced Camera Tools

Select

Tool Operation

1. Click on an entity.

Modifier Keys

Ctrl = Add an entity to set of selected entities.

Shift+Ctrl = Subtract an entity from set of selected entities.

Shift = Toggle whether an entity is within set of selected entities.

Ctrl+A = Select all visible entities in model.

Click to learn about more advanced operations...

Outliner

Filter:

Space: Space 103

Shading Surface Group: Sub Surface 1 Shading

Space: Space 104

Space: Space 105

Shading Surface Group: Sub Surface 11 Shading

Space: Space 201

Shading Surface Group: Sub Surface 5 Shading

Space: Space 202

Shading Surface Group: Sub Surface 4 Shading

Space: Space 203

Shading Surface Group: Sub Surface 10 Shading

Space: Space 204

Space: Space 205

Shading Surface Group: Sub Surface 12 Shading

Space: Space 301

Shading Surface Group: Sub Surface 9 Shading

Space: Space 302

Shading Surface Group: Sub Surface 7 Shading

Space: Space 303

Shading Surface Group: Sub Surface 6 Shading

Space: Space 305

Shading Surface Group: Sub Surface 8 Shading

Measurements

Select objects. Shift to extend select. Drag mouse to select multiple.