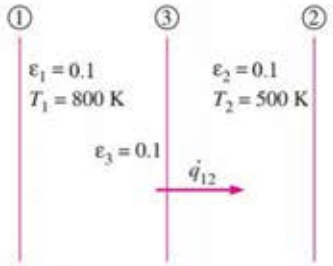
** Task 1** Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields ?



$$q_{net_{1-2}} = \frac{\dot{Q}_{net_{1-2}}}{A} = \frac{A\sigma\,(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} \div A = \frac{\sigma\,(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} = \frac{5.67\times10^{-8}\times(800^4 - 500^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1}\frac{W}{m^2} \approx 1035.82\frac{W}{m^2}$$

The new heat transfer rate should be 1% of the $q_{net_{1-2}}$

$$i.e., q_{net_{1-2}} = q_{net_{1-2},nshields} = \frac{1}{100}\times q_{net_{1-2}},$$

$$q_{net_{1-2},nshields} = \frac{\dot{Q}_{net_{1-2},nshields}}{A} = \frac{A\sigma(T_2^4 - T_1^4)}{(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1) + (\frac{1}{\varepsilon_{3,1}} + \frac{1}{\varepsilon_{3,2}} - 1) + \ldots + (\frac{1}{\varepsilon_{n,1}} + \frac{1}{\varepsilon_{n,2}} - 1)} \div A$$

$$\frac{\sigma(T_2^4 - T_1^4)}{(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1) + (\frac{1}{\varepsilon_{3,1}} + \frac{1}{\varepsilon_{3,2}} - 1) + \ldots + (\frac{1}{\varepsilon_{n,1}} + \frac{1}{\varepsilon_{n,2}} - 1)}$$

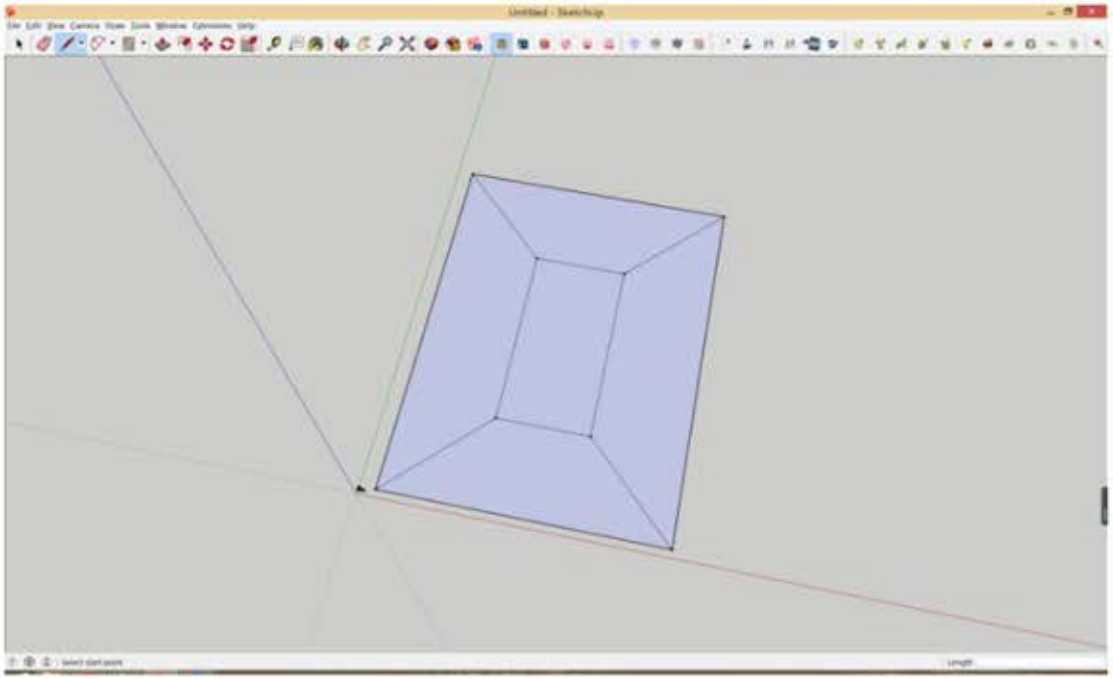
$$Autem, \varepsilon_1 = \varepsilon_2 = \varepsilon_3 = \ldots = \varepsilon_n$$

$$substitute \quad \varepsilon_1, \varepsilon_2, \varepsilon_3, \ldots, \varepsilon_n,$$

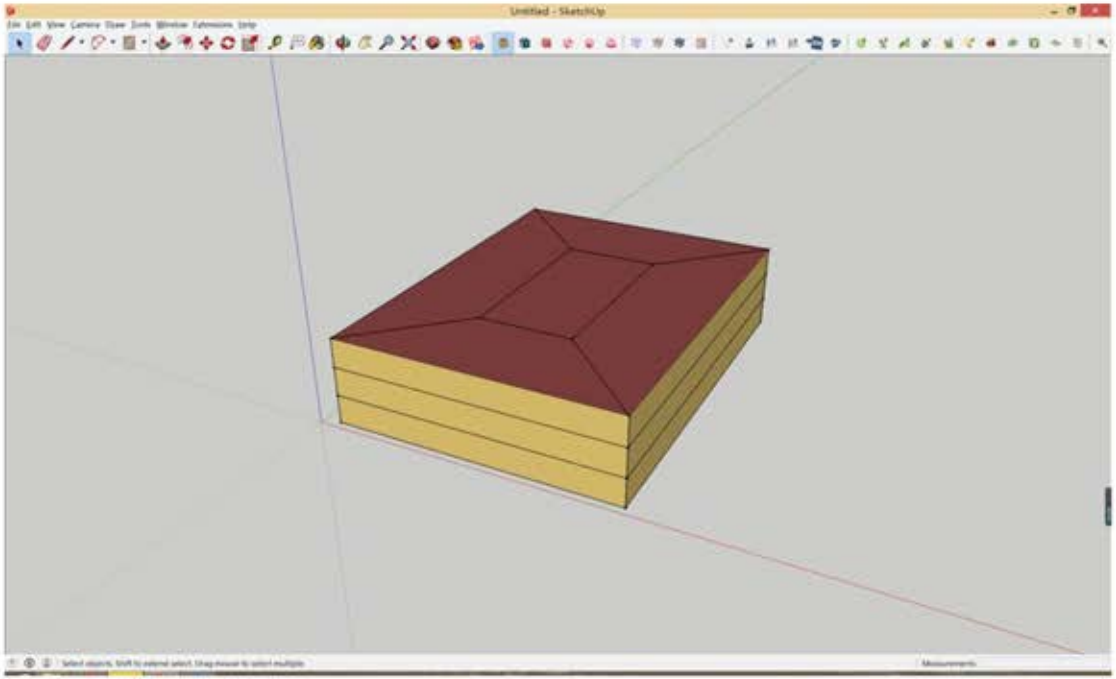
And introduce to the equation:

$$q_{net_{1-2},n,shields} = \frac{\sigma(T_2^4 - T_1^4)}{(n+1)(\frac{1}{\varepsilon} + \frac{1}{\varepsilon} - 1)} = \frac{1}{n+1}\times\frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon} + \frac{1}{\varepsilon} - 1}$$

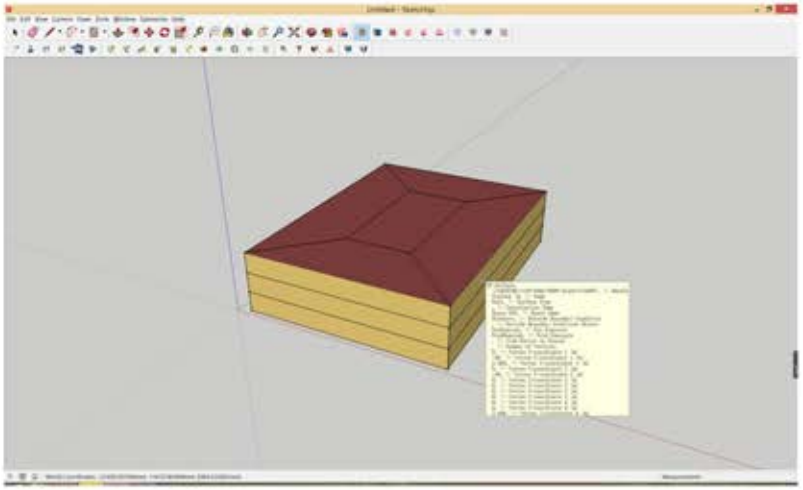
1. Draw the outline and shape of the building in Sketchup.



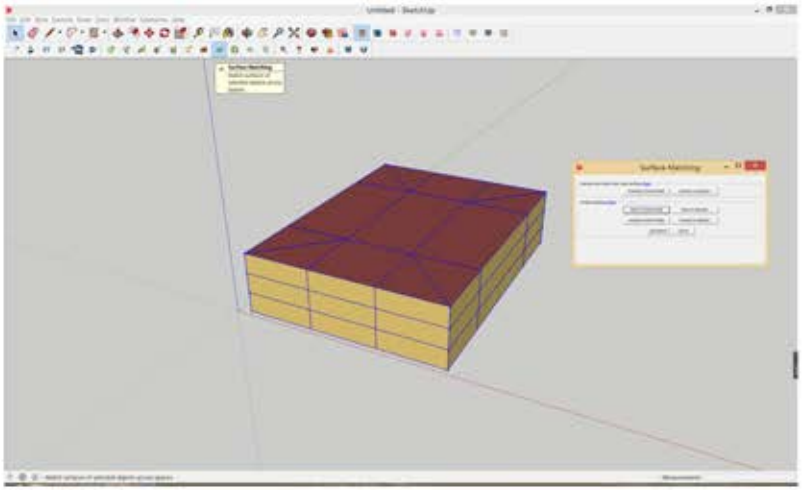
2. Use "Creat spaces from diagram"creat a 3 floor building.



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.

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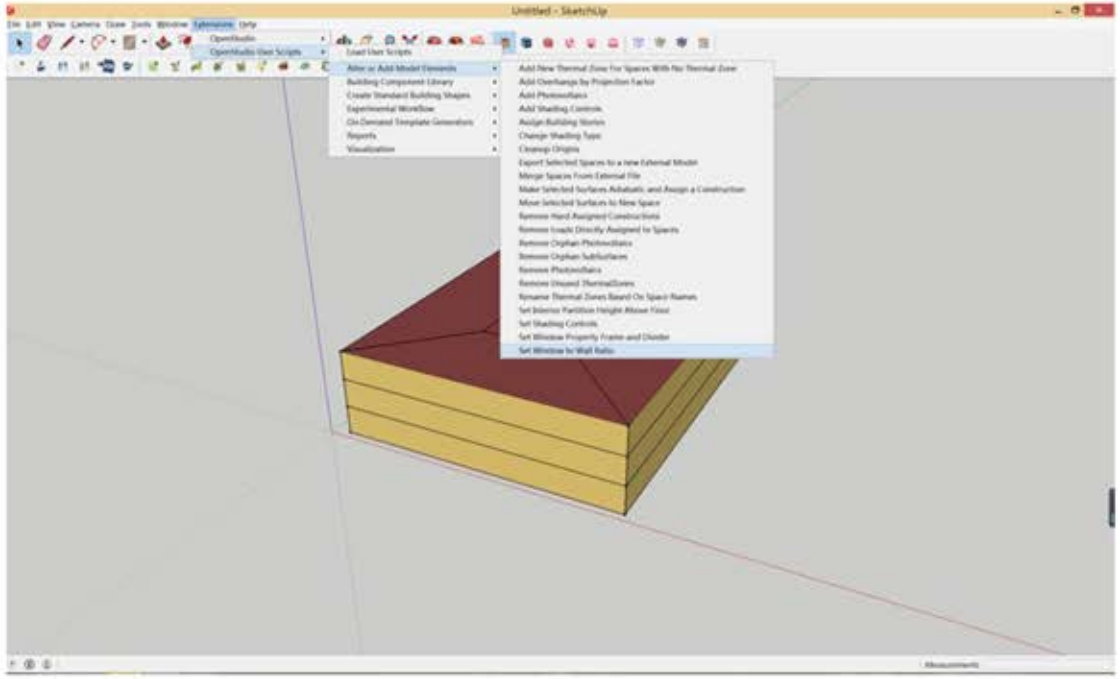
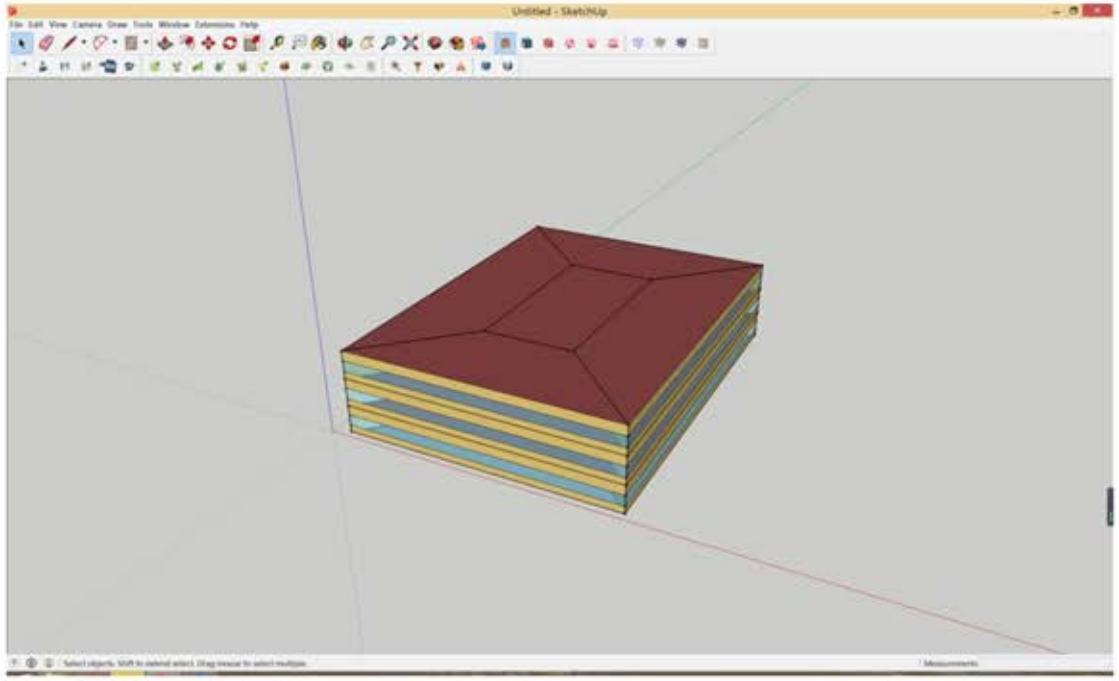
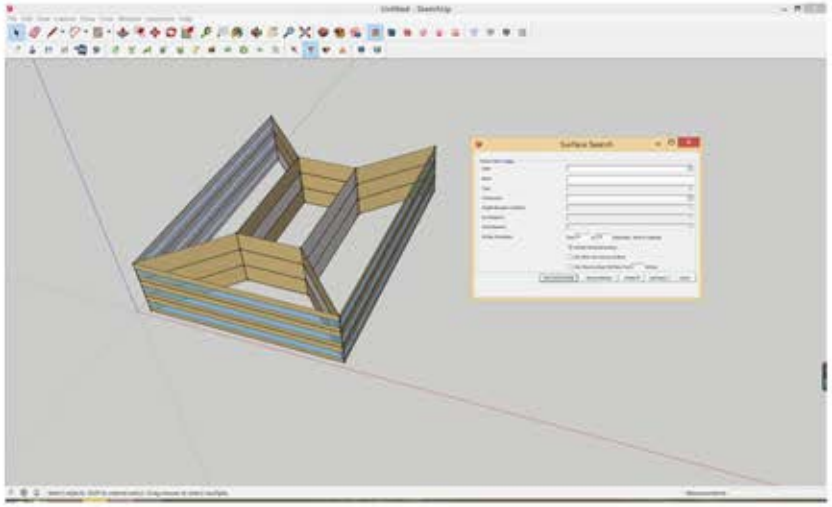
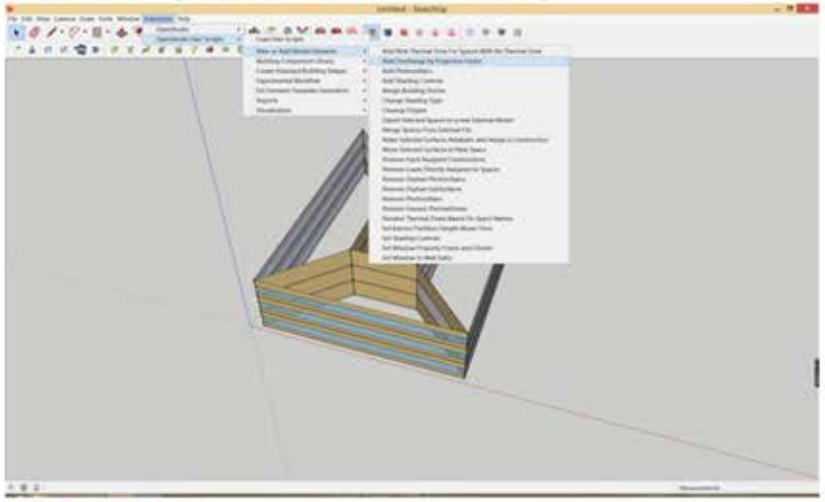




6. Check other directions besides the north.



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



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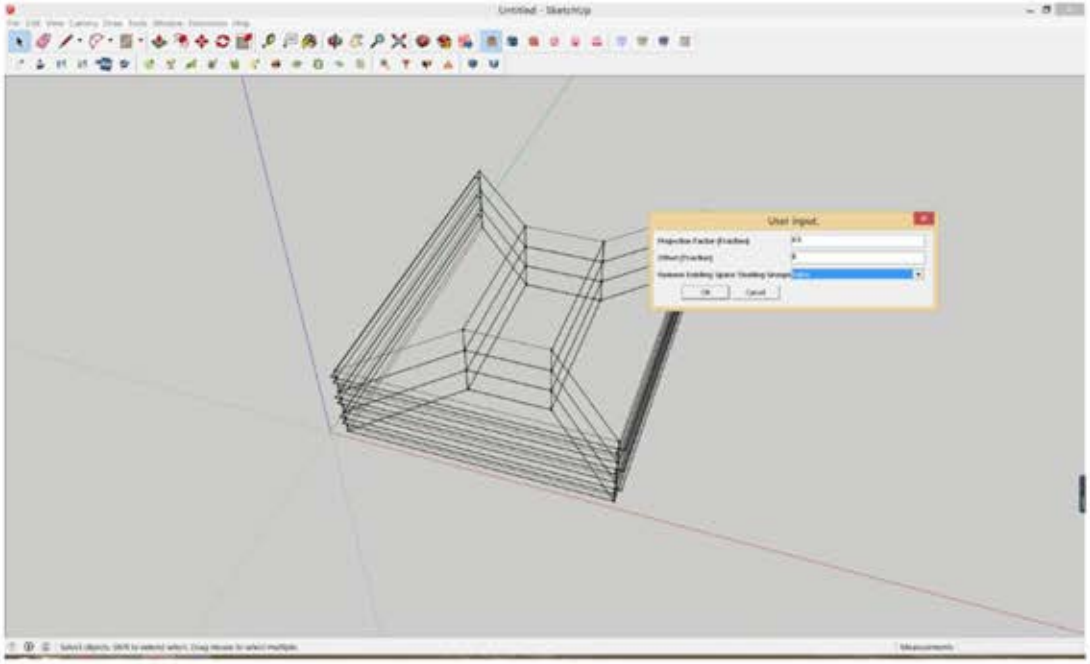
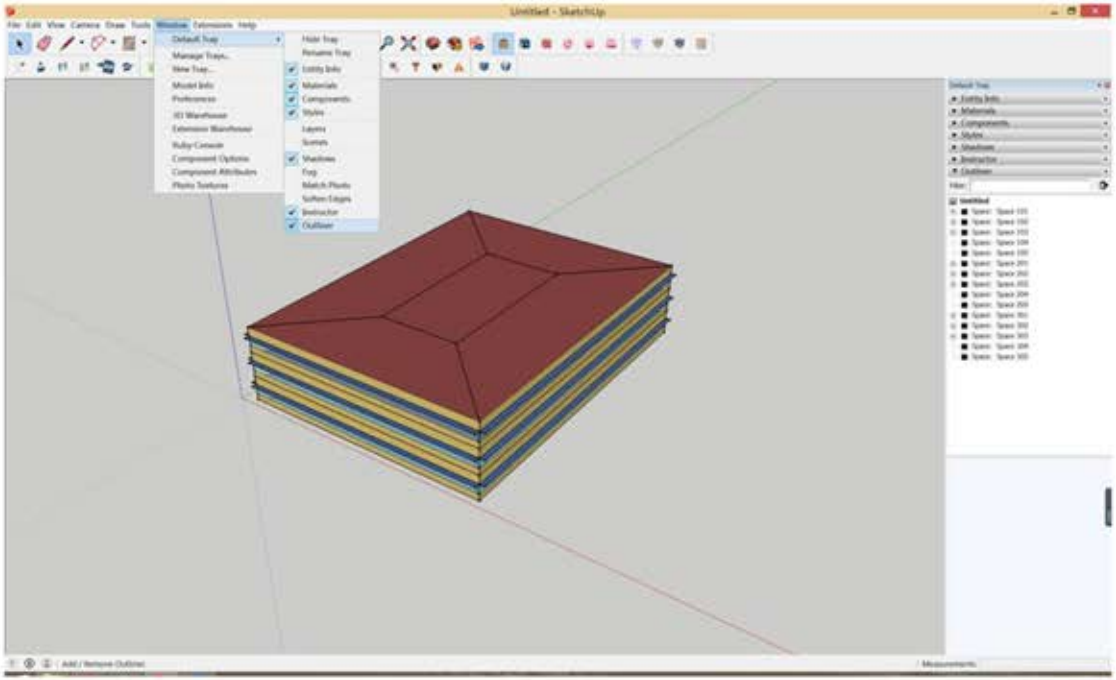
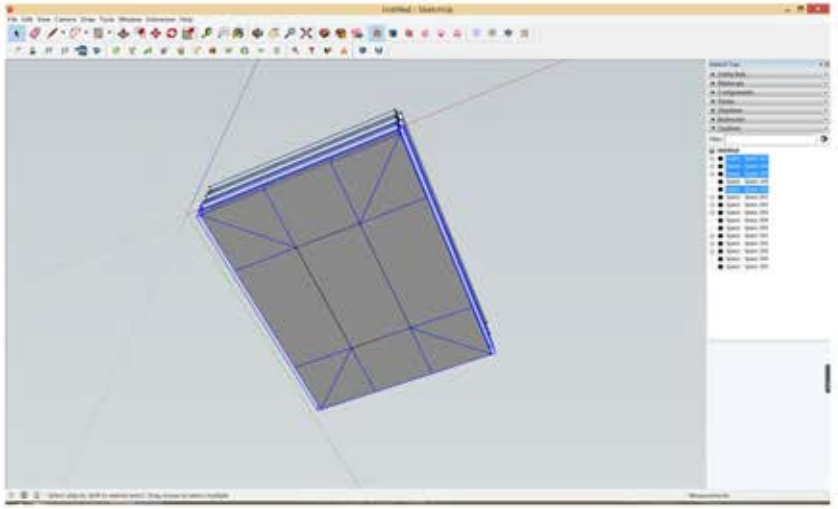
Week 6



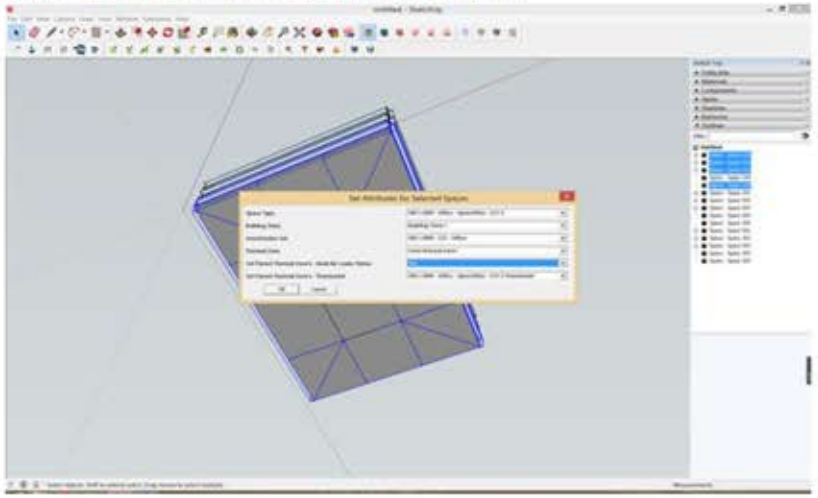
8. Open the"Outliner"



9. Choose the space of each thermal zone.



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



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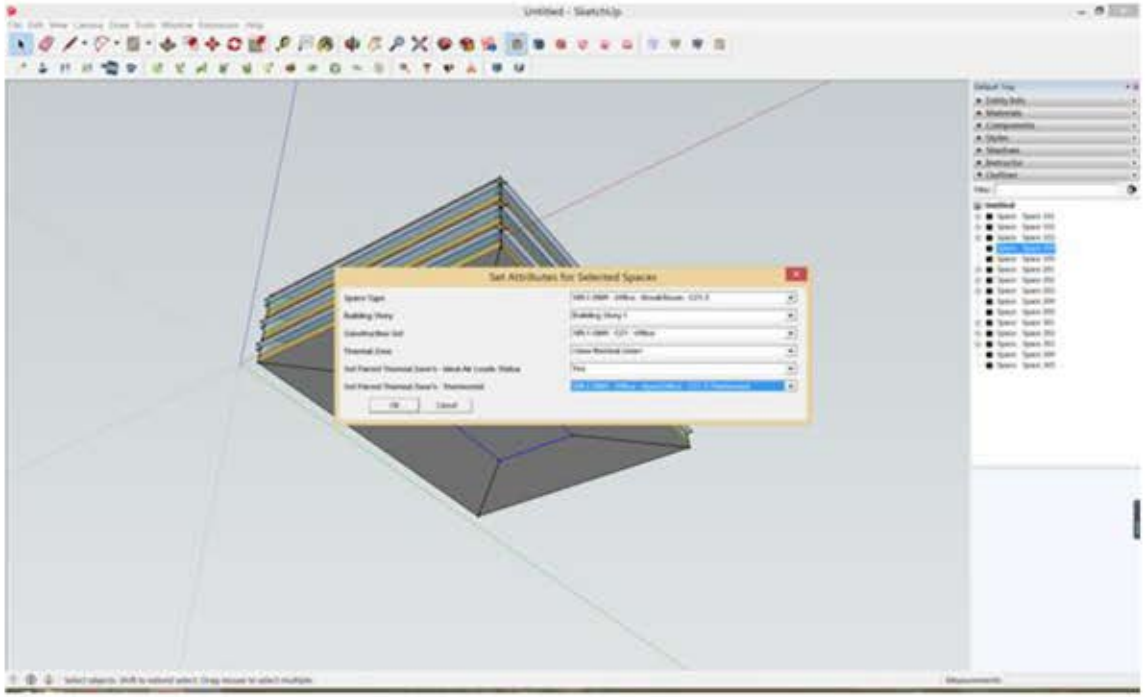

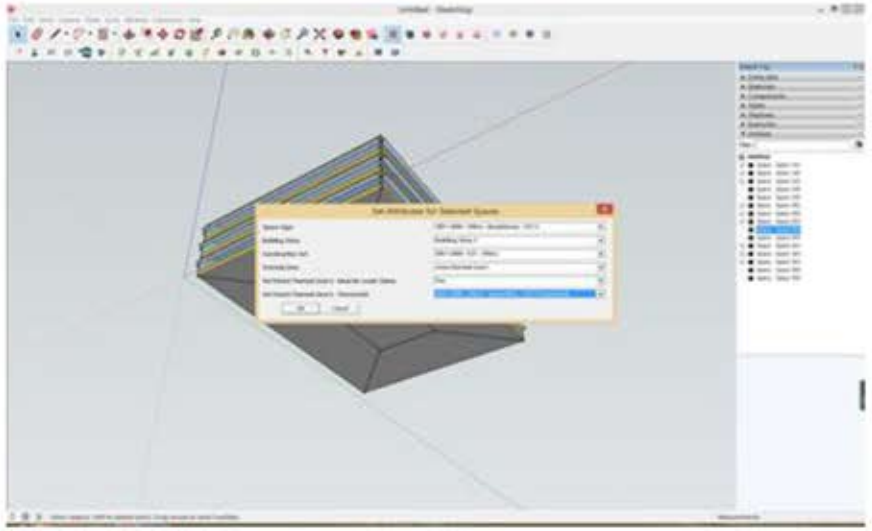

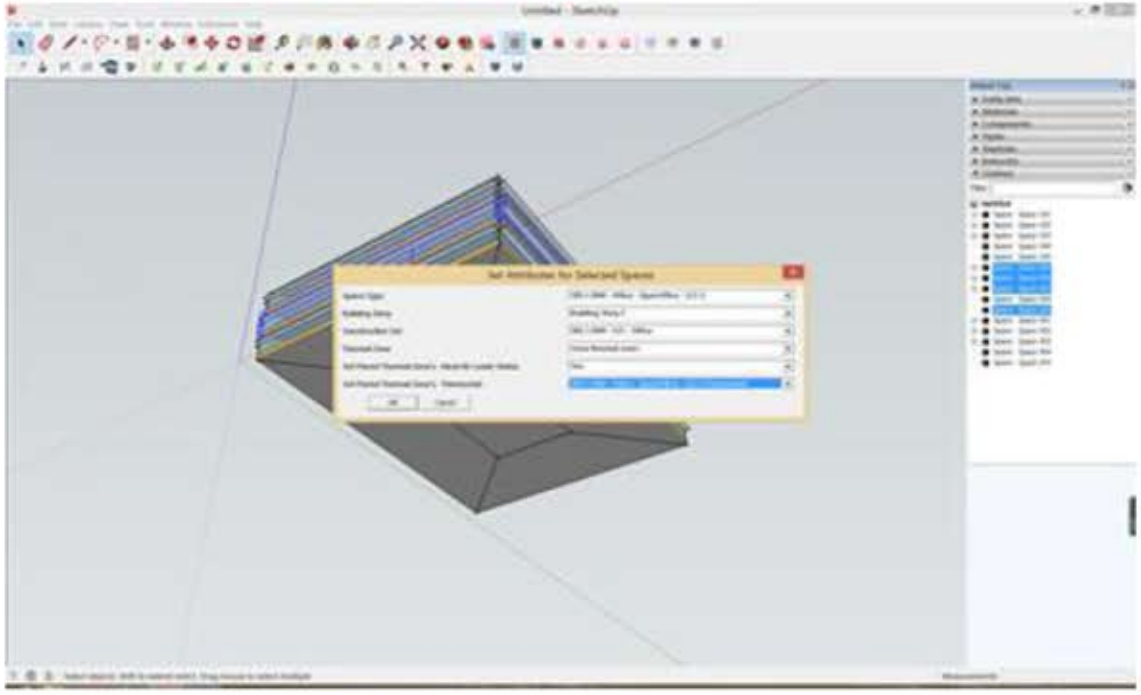

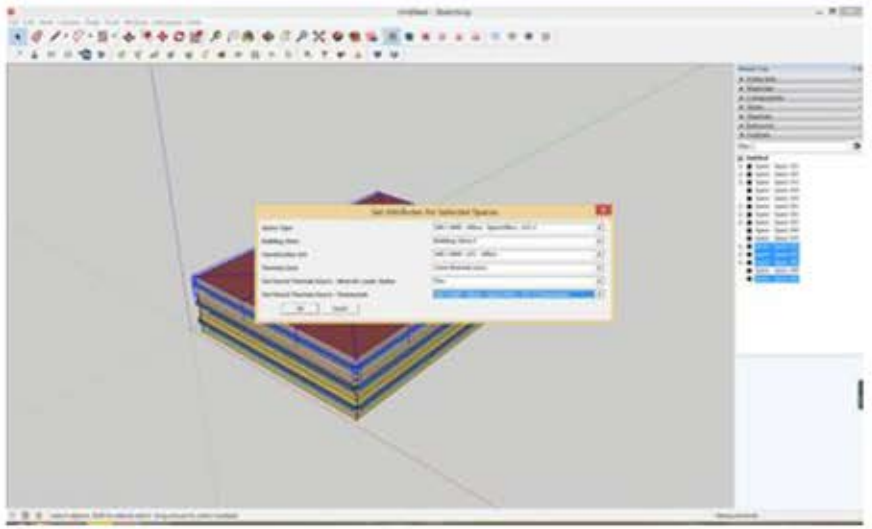

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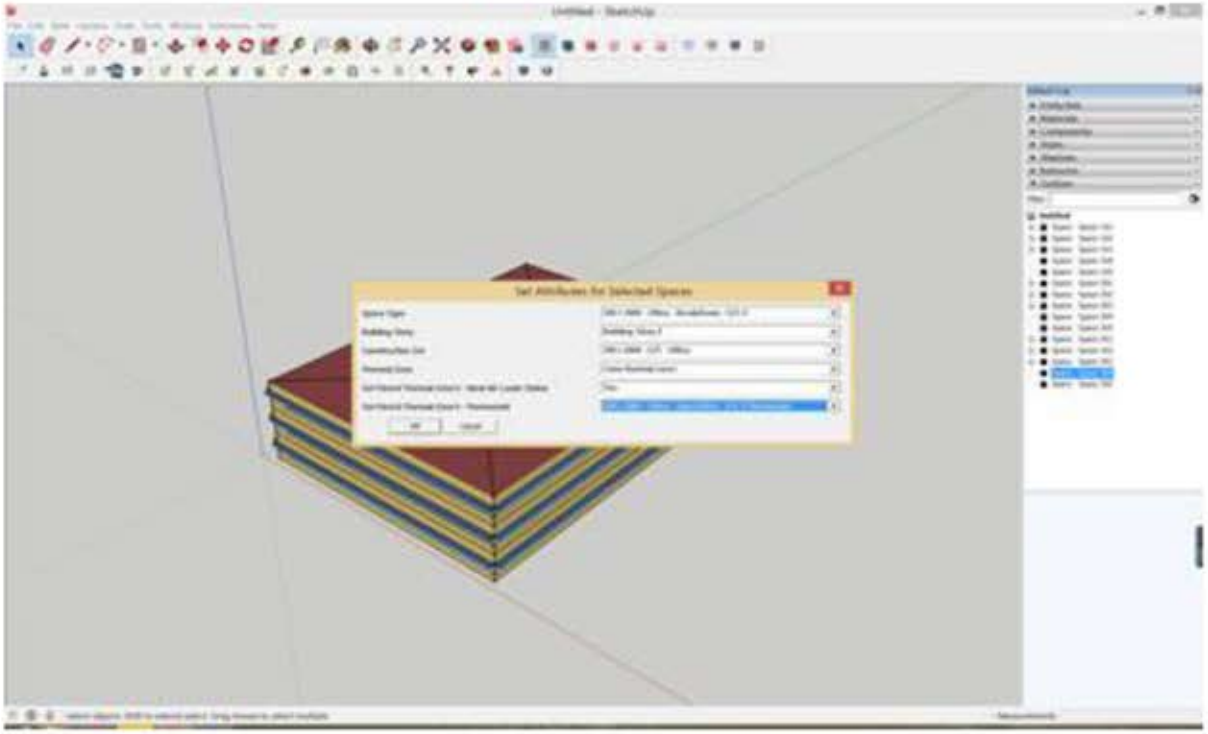
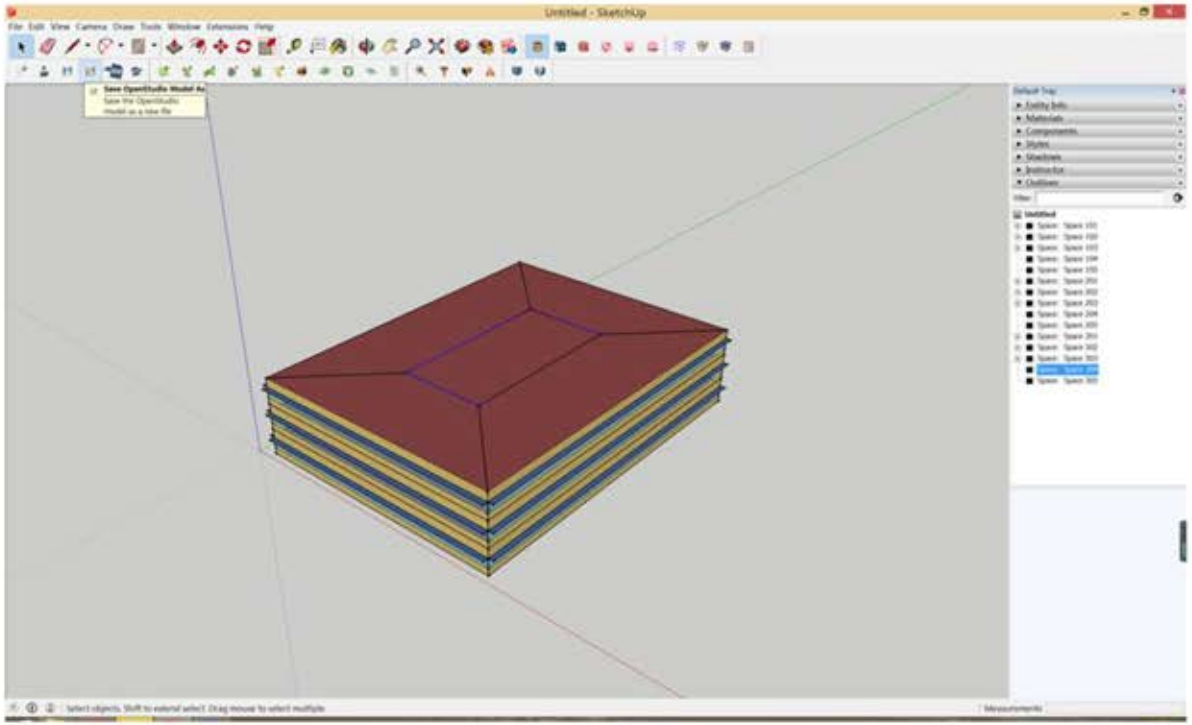
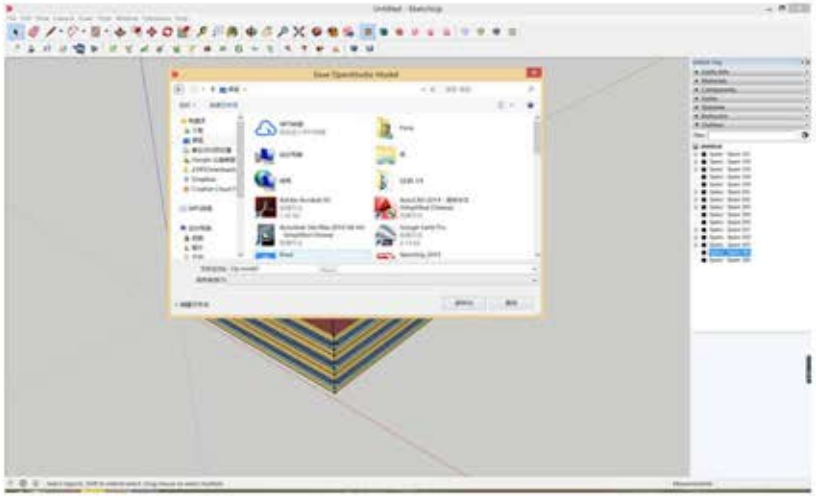
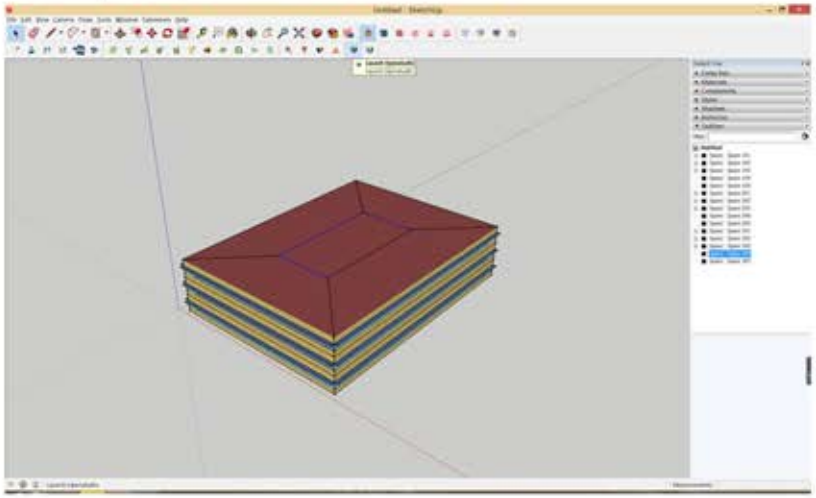


11. Save the model.





12. Run the Open studio.



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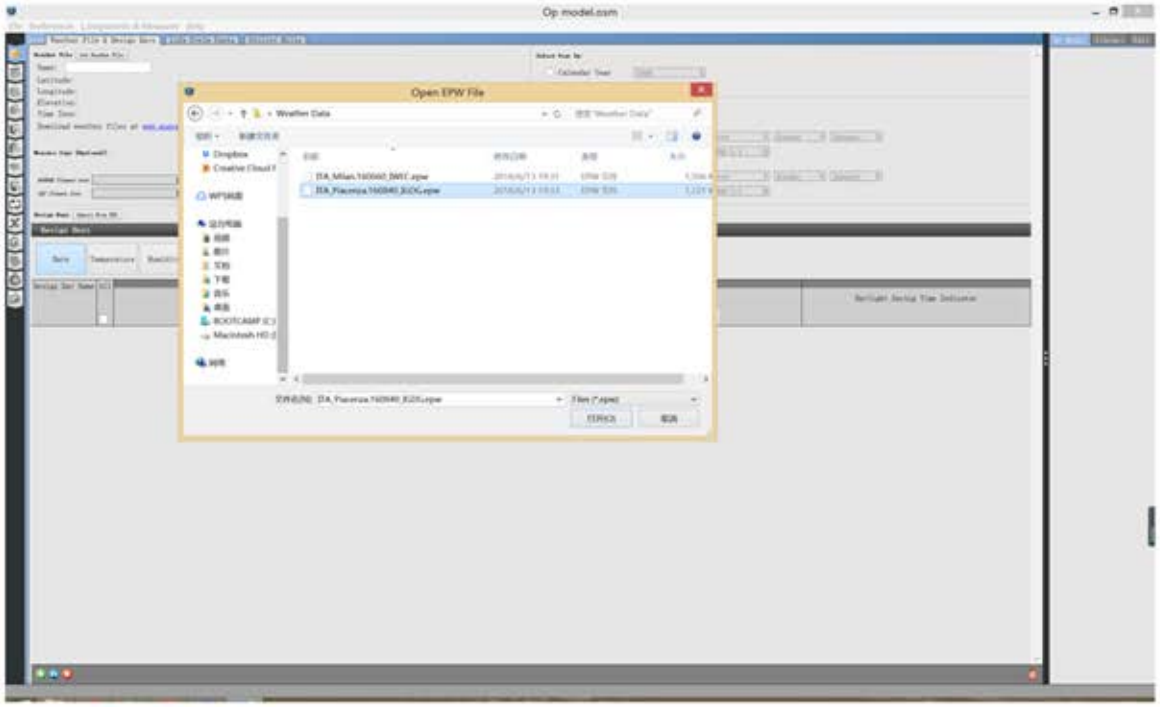
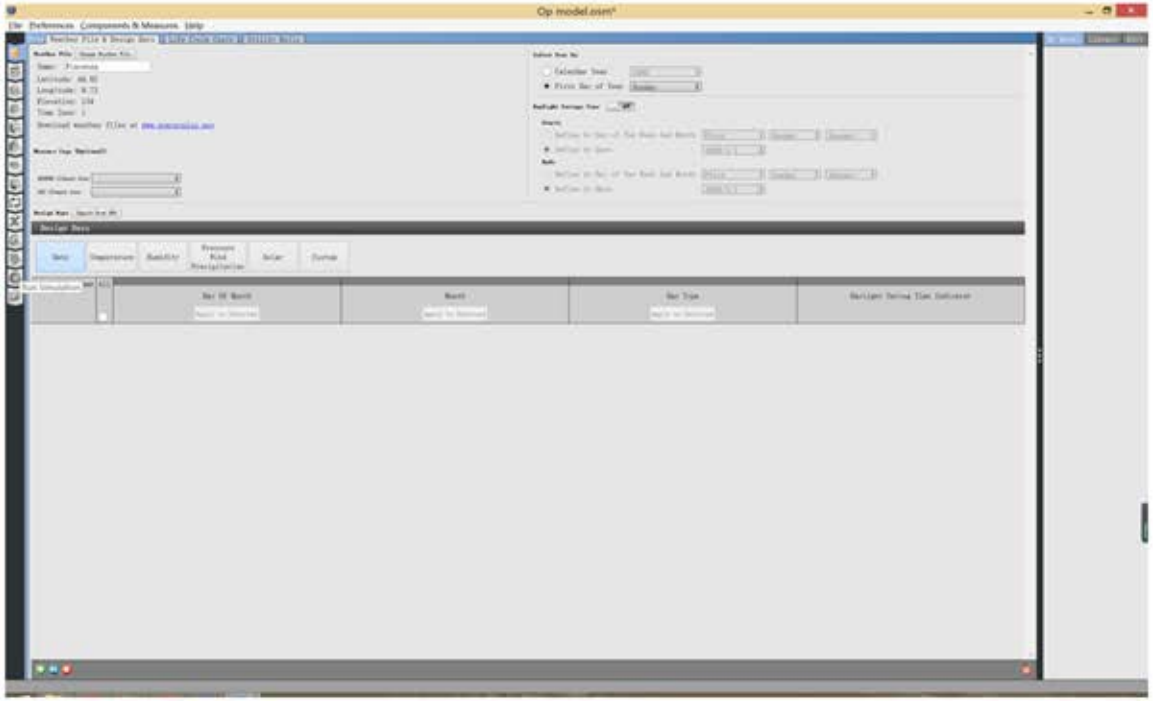
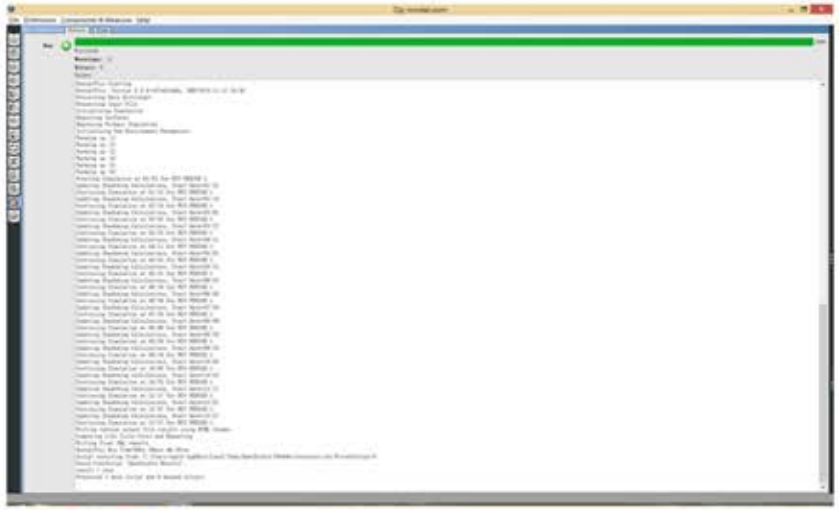
Week 6

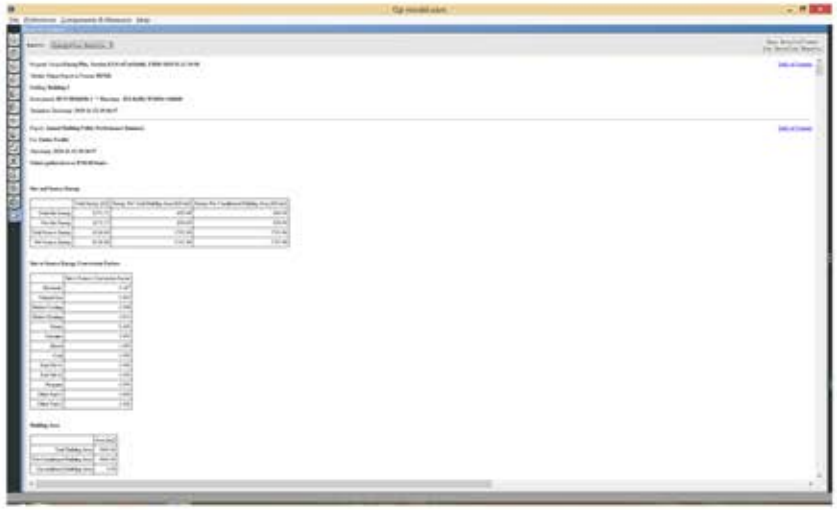


14. Run the analysis.





15. Show the result.



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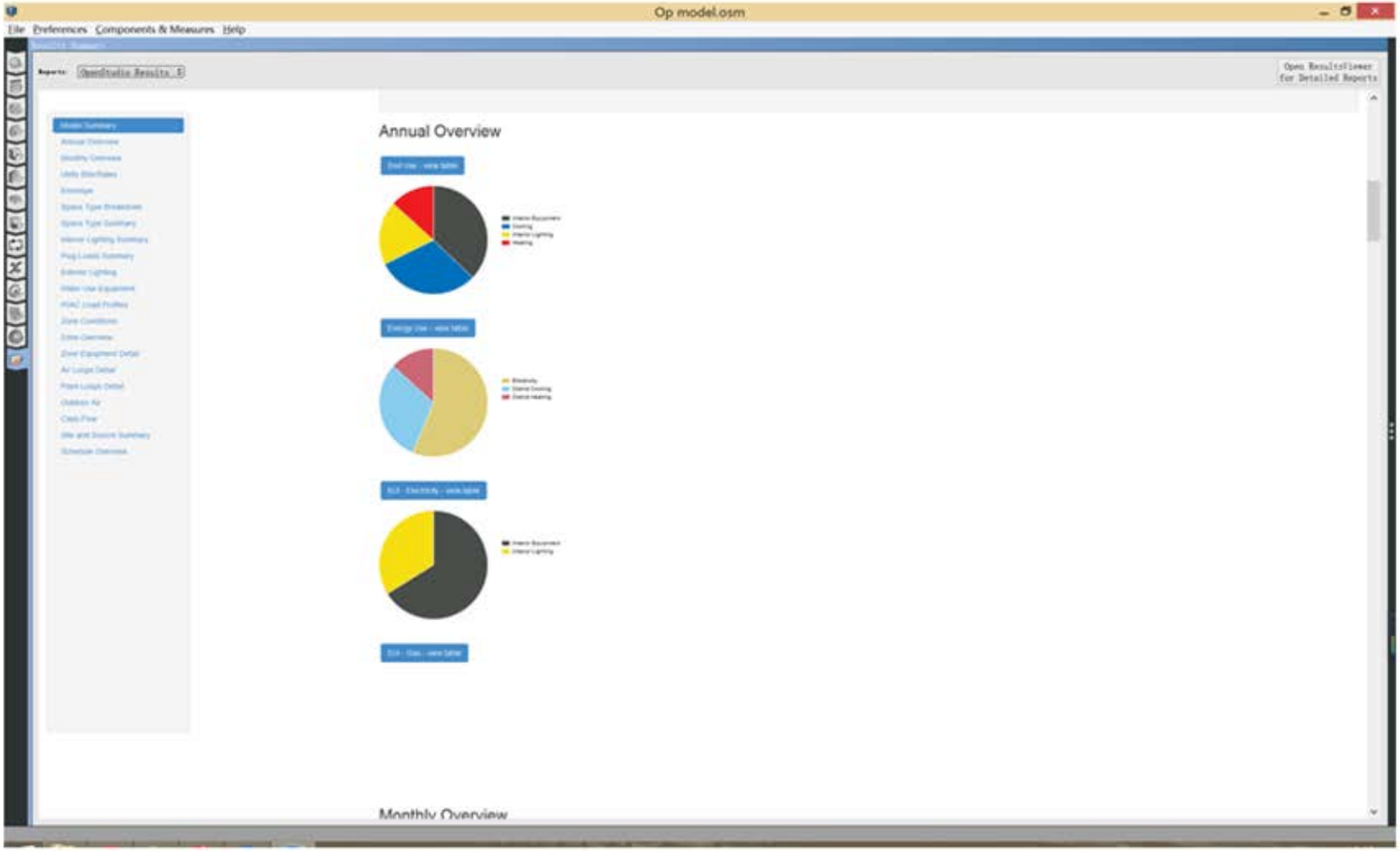

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