Task 1

$Q_{Nshields} = A\sigma(T_1^4 - T_2^4)/(N+1)\,[(1/\varepsilon_1) + (1/\varepsilon_2) - 1] = [1/(N+1)]Q_{no\ shields}$

When $Q_{Nshields} = 1\%\ Q_{no\ shields}$

$1/(N+1) = 1\%$

$N = 99$

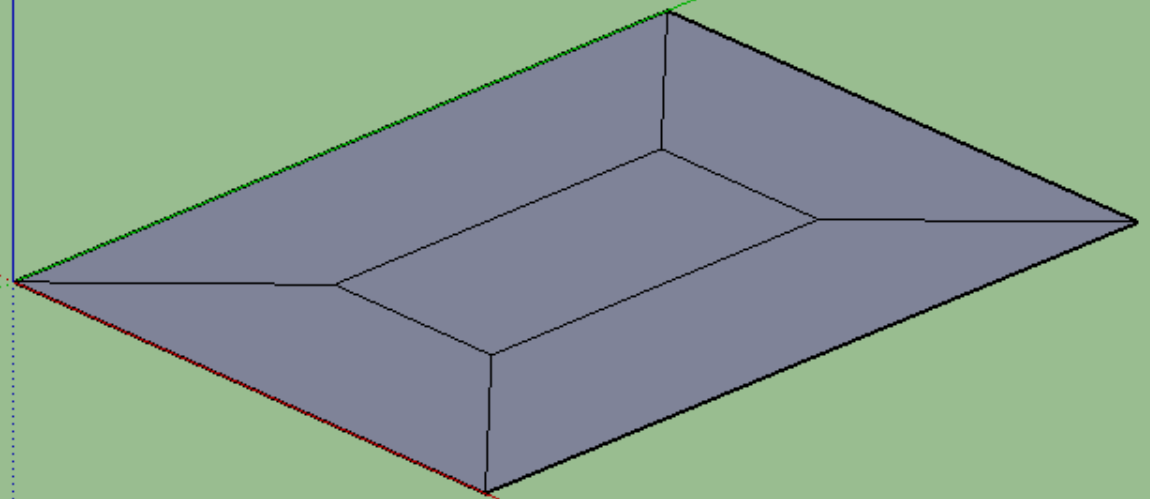
So, we need add 99 shields in order to have the new heat transfer rate to be 1% of the case without shields.

week6_YLIU - SketchUp Make 2016

File Edit View Camera Draw Tools Window Extensions Help

Scene 1

Create the shape of proposed building.



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

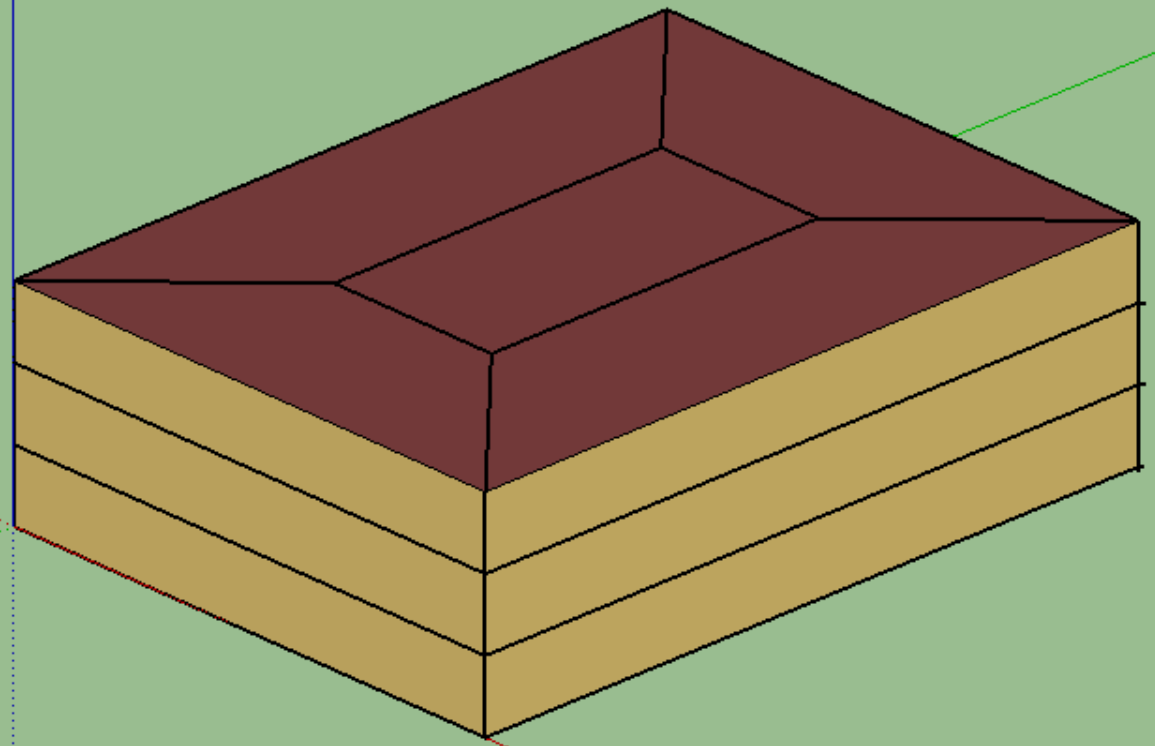
Measurements

week6_YLIU - SketchUp Make 2016

File Edit View Camera Draw Tools Window Extensions Help

Scene 1

Use “Create Spaces from Diagrams” to create the building from the shape .



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

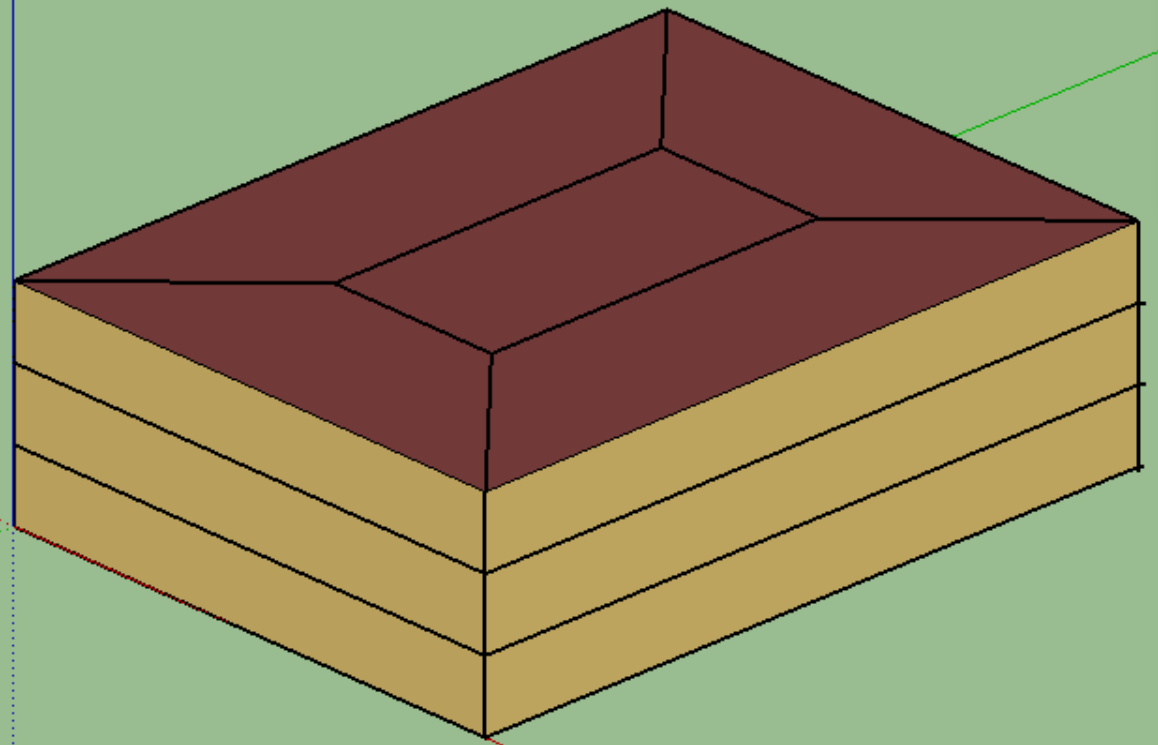
Measurements

week6_YLIU - SketchUp Make 2016

File Edit View Camera Draw Tools Window Extensions Help

Scene 1

Use “Matching tool” to set outside boundary conditions for space surfaces .



Surface Matching

Intersect and Divide Inter-Zone Surfaces (help)

Intersect in Entire Model | Intersect in Selection

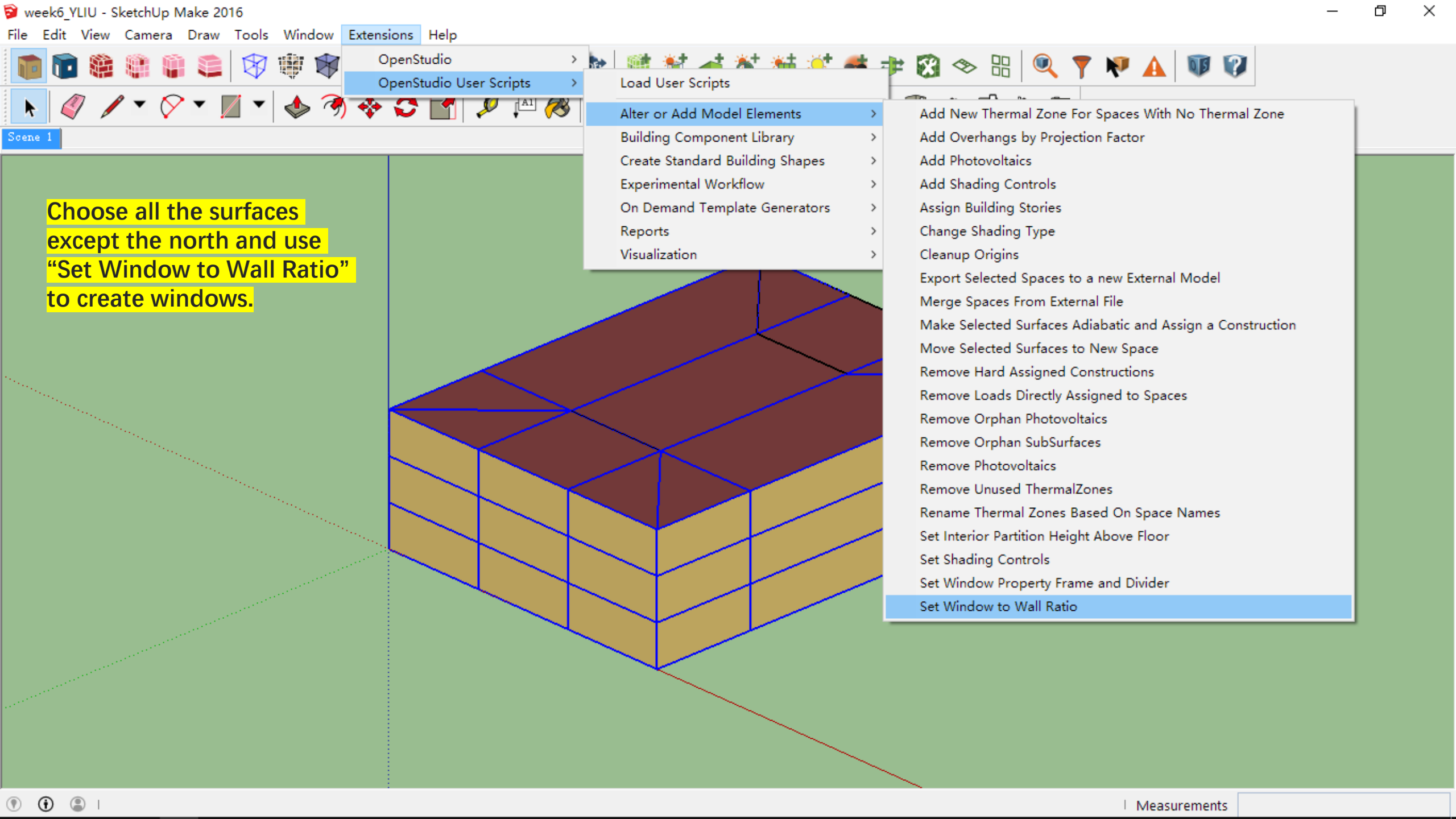
Surface Matching (help)

Match in Entire Model | Match in Selection

Unmatch in Entire Model | Unmatch in Selection

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

Measurements

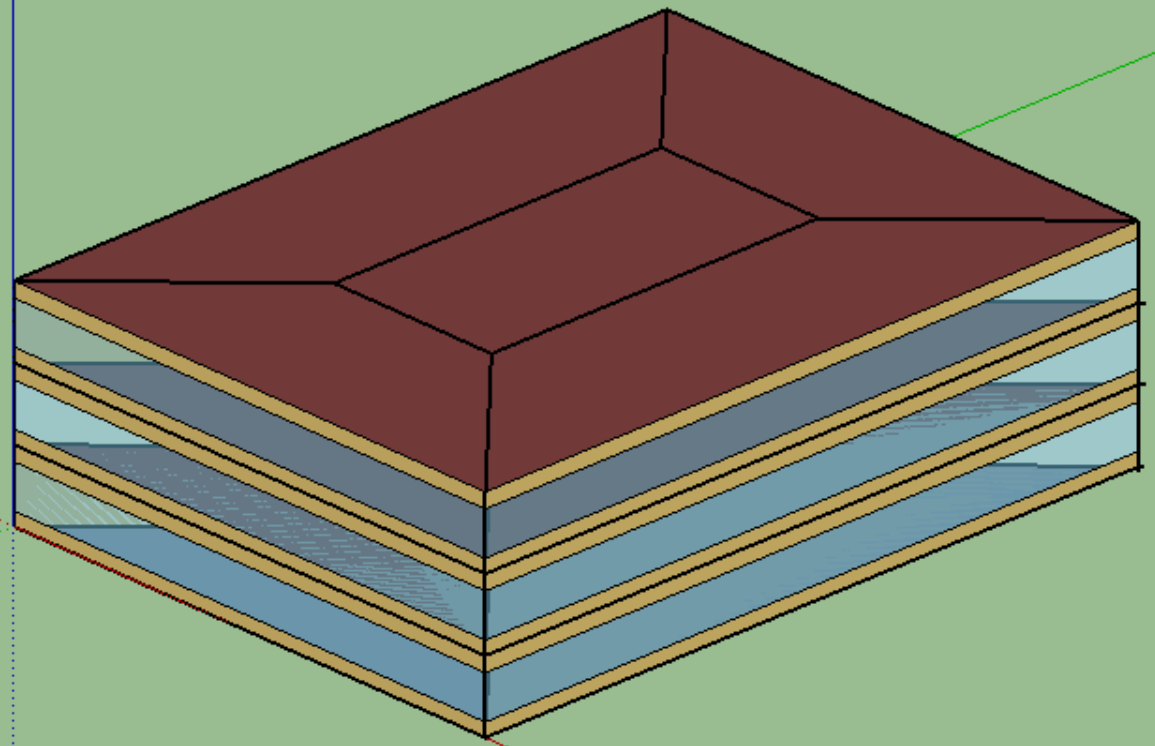

week6_YLIU - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
OpenStudio
OpenStudio User Scripts
Load User Scripts
Alter or Add Model Elements
Building Component Library
Create Standard Building Shapes
Experimental Workflow
On Demand Template Generators
Reports
Visualization
Add New Thermal Zone For Spaces With No Thermal Zone
Add Overhangs by Projection Factor
Add Photovoltaics
Add Shading Controls
Assign Building Stories
Change Shading Type
Cleanup Origins
Export Selected Spaces to a new External Model
Merge Spaces From External File
Make Selected Surfaces Adiabatic and Assign a Construction
Move Selected Surfaces to New Space
Remove Hard Assigned Constructions
Remove Loads Directly Assigned to Spaces
Remove Orphan Photovoltaics
Remove Orphan SubSurfaces
Remove Photovoltaics
Remove Unused ThermalZones
Rename Thermal Zones Based On Space Names
Set Interior Partition Height Above Floor
Set Shading Controls
Set Window Property Frame and Divider
Set Window to Wall Ratio
Scene 1
Choose all the surfaces except the north and use "Set Window to Wall Ratio" to create windows.
Measurements

week6_YLIU - SketchUp Make 2016

File Edit View Camera Draw Tools Window Extensions Help

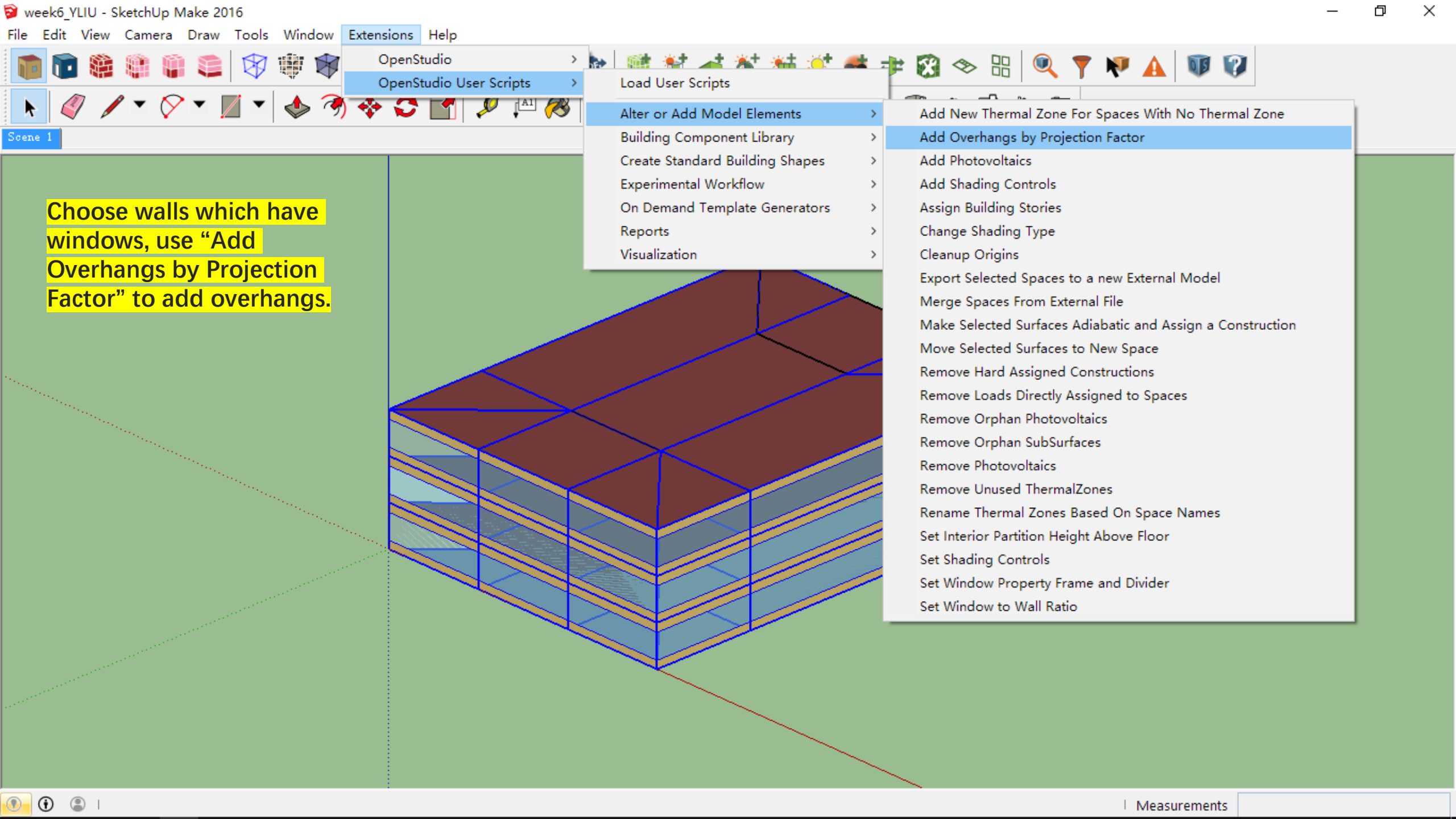
Scene 1

Result



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

Measurements


week6_YLIU - SketchUp Make 2016
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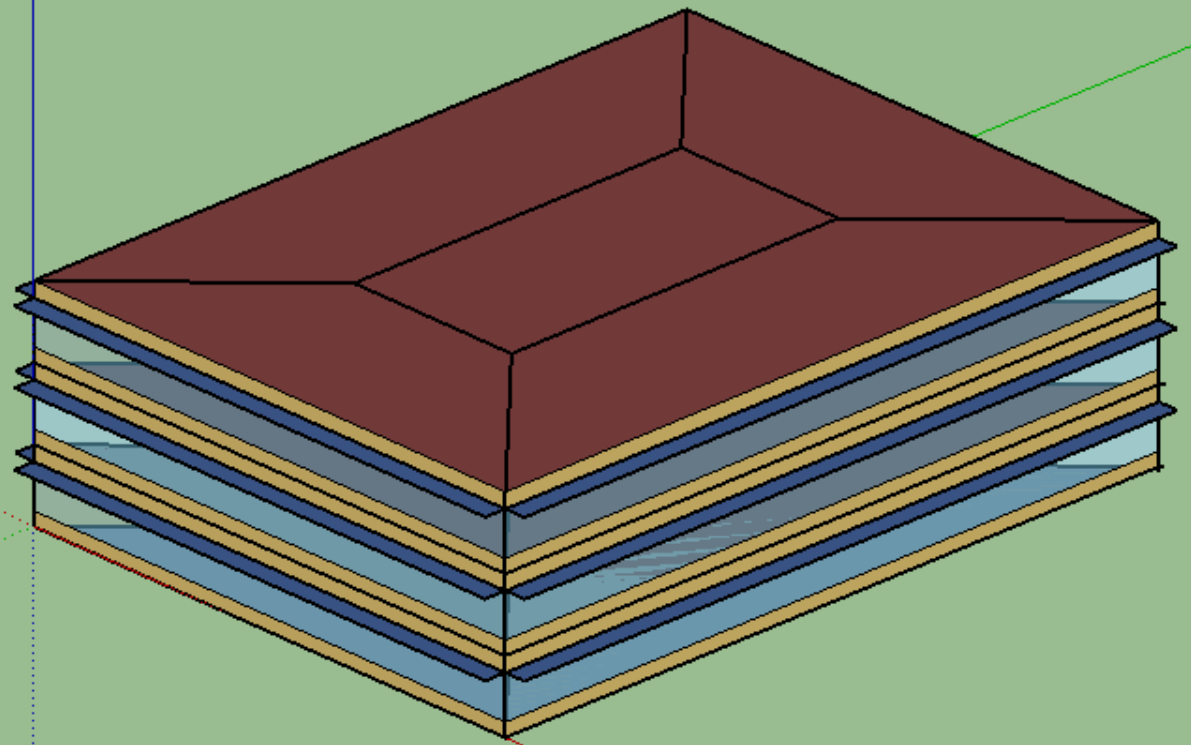
Make Selected Surfaces Adiabatic and Assign a Construction
Move Selected Surfaces to New Space
Remove Hard Assigned Constructions
Remove Loads Directly Assigned to Spaces
Remove Orphan Photovoltaics
Remove Orphan SubSurfaces
Remove Photovoltaics
Remove Unused ThermalZones
Rename Thermal Zones Based On Space Names
Set Interior Partition Height Above Floor
Set Shading Controls
Set Window Property Frame and Divider
Set Window to Wall Ratio
Scene 1
Choose walls which have windows, use “Add Overhangs by Projection Factor” to add overhangs.
Measurements

week6_YLIU - SketchUp Make 2016

File Edit View Camera Draw Tools Window Extensions Help

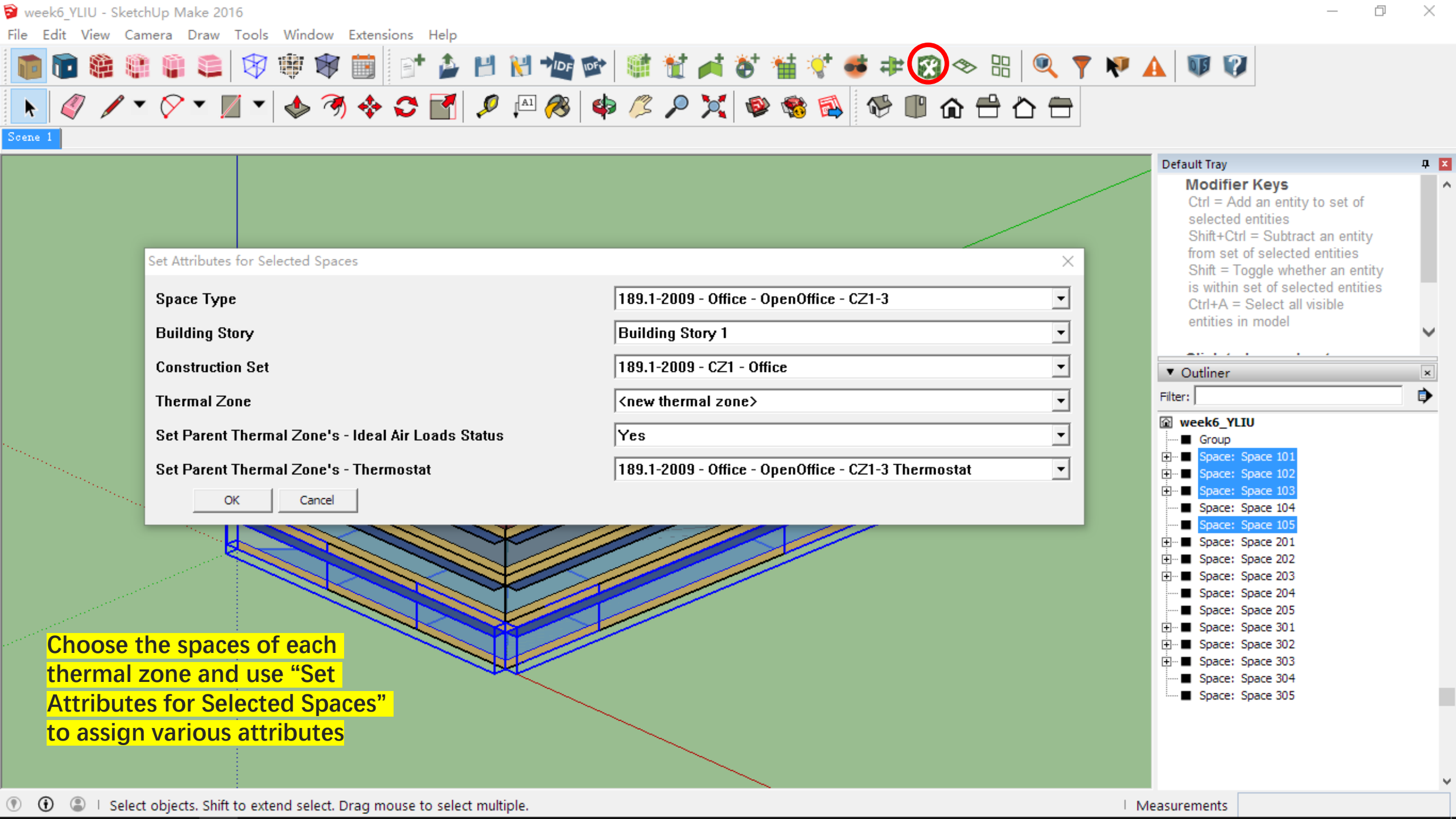
Scene 1

Result



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

Measurements


week6_YLIU - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
Scene 1
Set Attributes for Selected Spaces
Space Type
189.1-2009 - Office - OpenOffice - CZ1-3
Building Story
Building Story 1
Construction Set
189.1-2009 - CZ1 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
189.1-2009 - Office - OpenOffice - CZ1-3 Thermostat
OK
Cancel
Default Tray
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
Outliner
Filter:
week6_YLIU
Group
Space: Space 101
Space: Space 102
Space: Space 103
Space: Space 104
Space: Space 105
Space: Space 201
Space: Space 202
Space: Space 203
Space: Space 204
Space: Space 205
Space: Space 301
Space: Space 302
Space: Space 303
Space: Space 304
Space: Space 305
Choose the spaces of each thermal zone and use “Set Attributes for Selected Spaces” to assign various attributes
Select objects. Shift to extend select. Drag mouse to select multiple.
Measurements

week6_YLIU.osm*

File Preferences Components & Measures Help

Site | Weather File & Design Days | Life Cycle Costs | Utility Bills

My Model | Library | Edit

Weather File Change Weather File

Name: Piacenza

Latitude: 44.92

Longitude: 9.73

Elevation: 134

Time Zone: 1

Download weather files at www.energyplus.gov

Measure Tags (Optional):

ASHRAE Climate Zone

CEC Climate Zone

Select Year by:

Calendar Year 2000

First Day of Year Sunday

Daylight Savings Time: off

Starts

Define by Day of The Week And Month First Sunday January

Define by Date 2000/1/1

Ends

Define by Day of The Week And Month First Sunday January

Define by Date 2000/1/1

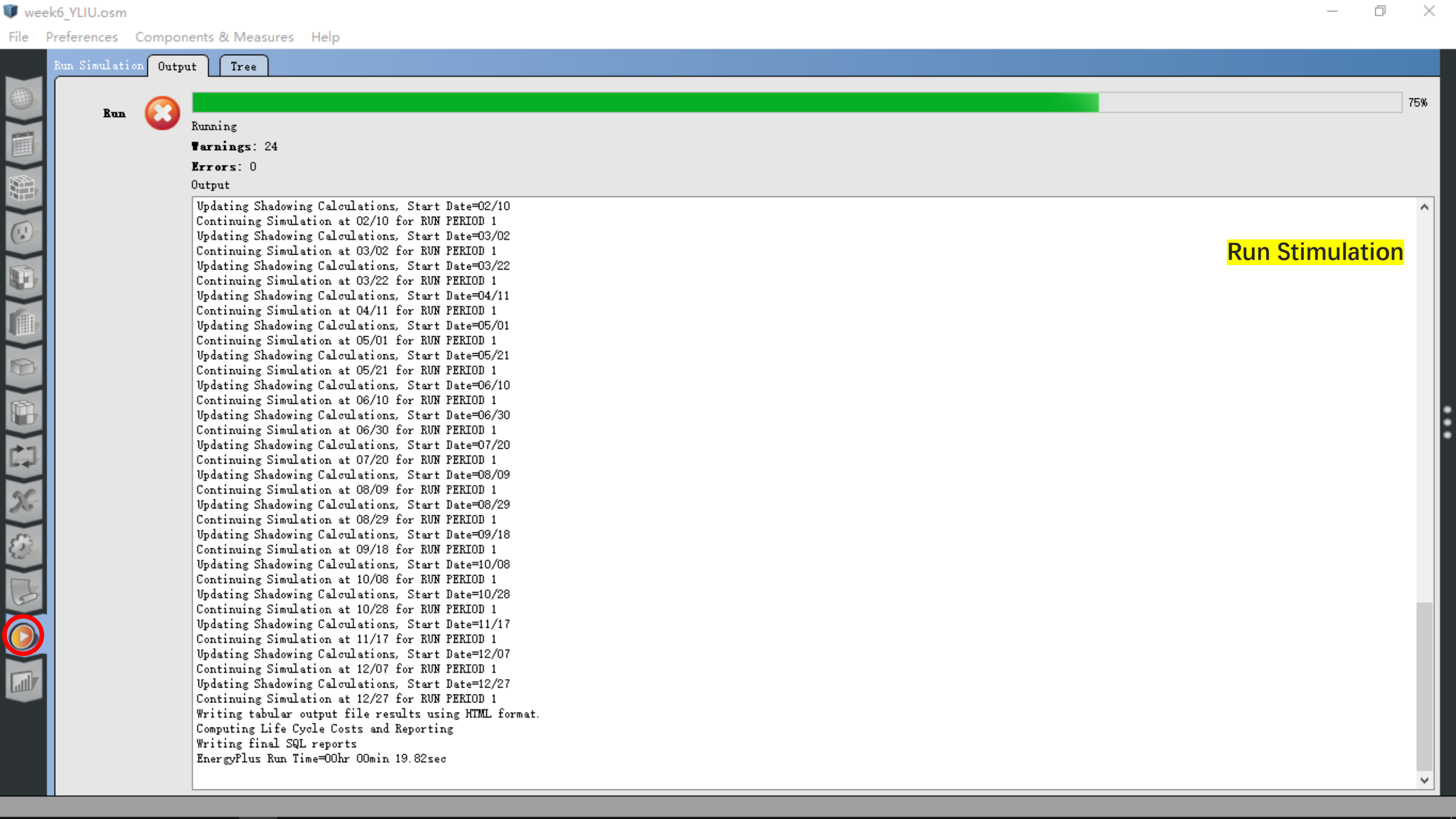
Design Days Import From DDY

Design Days

Date | Temperature | Humidity | Pressure Wind Precipitation | Solar | Custom

Design Day Name	All	Day Of Month	Month	Day Type	Daylight Saving Time Indicator
		Apply to Selected	Apply to Selected	Apply to Selected	

Then launch OpenStudio and add weather file.


week6_YLIU.osm
File
Preferences
Components & Measures
Help
Run Simulation
Output
Tree
Run
75%
Running
Warnings: 24
Errors: 0
Output
Updating Shadowing Calculations, Start Date=02/10
Continuing Simulation at 02/10 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=03/02
Continuing Simulation at 03/02 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=03/22
Continuing Simulation at 03/22 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=04/11
Continuing Simulation at 04/11 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=05/01
Continuing Simulation at 05/01 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=05/21
Continuing Simulation at 05/21 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=06/10
Continuing Simulation at 06/10 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=06/30
Continuing Simulation at 06/30 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=07/20
Continuing Simulation at 07/20 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=08/09
Continuing Simulation at 08/09 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=08/29
Continuing Simulation at 08/29 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=09/18
Continuing Simulation at 09/18 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=10/08
Continuing Simulation at 10/08 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=10/28
Continuing Simulation at 10/28 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=11/17
Continuing Simulation at 11/17 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=12/07
Continuing Simulation at 12/07 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=12/27
Continuing Simulation at 12/27 for RUN PERIOD 1
Writing tabular output file results using HTML format.
Computing Life Cycle Costs and Reporting
Writing final SQL reports
EnergyPlus Run Time=00hr 00min 19.82sec
Run Stimulation

Reports: EnergyPlus Results

Open ResultsViewer for Detailed Reports

Program Version:**EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.08 16:32**

Table of Contents

Tabular Output Report in Format: **HTML**

Building: **Building 1**

Environment: **RUN PERIOD 1 ** Piacenza - ITA IGDG WMO#=160840**

Simulation Timestamp: **2019-11-08 16:32:10**

Result

Report: **Annual Building Utility Performance Summary**

Table of Contents

For: **Entire Facility**

Timestamp: **2019-11-08 16:32:10**

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	1599.10	533.03	533.03
Net Site Energy	1599.10	533.03	533.03
Total Source Energy	4677.80	1559.27	1559.27
Net Source Energy	4677.80	1559.27	1559.27