

EnergyPlus Exercise Basics 1

Create a Single Zone Building and Run EnergyPlus using Legacy OpenStudio Plugin

Last revised November 2012 for EnergyPlus v7.2.0.006

General Description


Overview

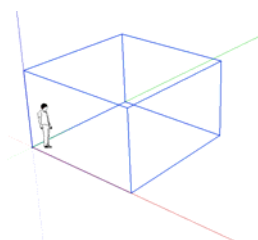
- Create a single zone building in Legacy OpenStudio Plugin
- Run a design-day simulation
- Add a window, run again and compare results
- Run an annual simulation
- Visualize results using color rendering in Legacy OpenStudio Plugin

Instructions

Exercise Basics 1A – Create a Single Zone Building and Run a Simulation

Objective: Learn to use Legacy OpenStudio Plugin in SketchUp to create a zone, run an EnergyPlus simulation, and view output files.

1. Open SketchUp (Start → Programs → SketchUp8).
2. SketchUp has a global setting for units for drawing and displaying dimensions. The opening splash screen has a button to “Choose Template”
Note: You may have unchecked “Always show at Startup”, if so, select Window → Preferences → Template. With this method, after you select a template, you must exit and restart SketchUp.
select one of the following:
 “Engineering – Feet” (or Meters) (white background)
or “Simple Template – Feet and Inches” (or Meters) (sky/grass background)
whichever you prefer. Other template choices will work, if you prefer them.
Note: If you select the Feet and Inches template, a plain number entered as a dimension will be interpreted as inches, add ' to indicate feet.
3. Once SketchUp has finished loading, start a new EnergyPlus zone
 Plugins → Legacy OpenStudio → New Zone Tool or 
4. Click in the drawing to set the zone origin (does not matter where, but near the global origin is convenient). A blue box will appear in the drawing.

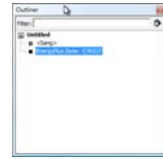


5. It is helpful to use the outliner window to display a list of zones

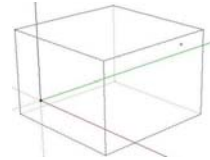
Window → Outliner or



This will display a list showing the new zone.




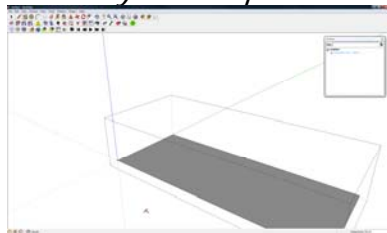
6. At this point, you may wish to click on <Susan> in the list and delete the drawing of a person.
7. Open the zone for editing by double-clicking the zone name in the outliner, or by double-clicking the zone origin. A grey dashed box will appear.




Hint: If you do not see the grey dashed box you are not creating/editing EnergyPlus surfaces.

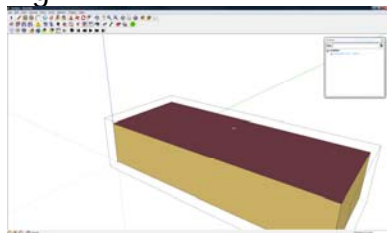
8. Draw the footprint of the zone

- a. Select the rectangle tool  or Draw → Rectangle
- b. Click on or near the global origin and release, then move the mouse towards the right to start the rectangle.
- c. Without clicking again, type 50,25<enter>. This will create a rectangle which is 50ft x 25ft (or m depending on the template you are working in).
- Hint: If your template is feet and inches, type ' after each number.*





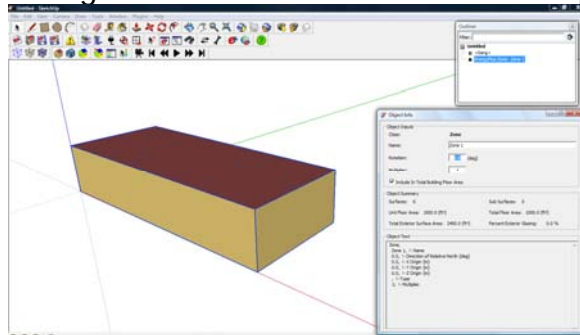
9. Extrude the footprint



- a. Select the Push/Pull tool  or Tools → Push/Pull
- b. Click on the rectangle and release, move the mouse upward to start the extrusion
- c. Without clicking again, type 10<enter> to make the zone 10 ft (or m) high.



10. Name the zone and surfaces


- Select the Select tool  or Tools → Select
- Click in the blank area of the drawing to close the zone for editing.
- Click on the zone in the drawing or the zone name in the outline list
- Select the Object Info tool  or Plugins → Legacy OpenStudio → Object Info and a dialog will open showing the zone information.
- Change the zone name to "Zone 1" and press tab to store the name.




- Double-click to open the zone and select each surface, naming them "Zone 1 East Wall", "Zone 1 West Wall" etc.
Hint: Remember to press <tab> after each entry to save the name
Hint: Use the orbit tool  to see the bottom and back side of the zone. Then switch back to the select tool. 

- Click outside the drawing and name the Building "Exercise Basics 1A".

11. Save the file


- Select the Save tool  or Plugins → Legacy OpenStudio → Save
- Browse to select the desired folder to save the file and name it ExerciseBasics1A.idf
Hint: You must type the file extension .idf if it is not showing.

12. Add simple ideal HVAC controls to the zone

- Click on the Zone Loads tool  or Plugins → Legacy OpenStudio → Zone Loads
- Near the bottom of this dialog, check the box labeled "Add HVACTemplate:Zone:IdealLoadsAirSystem"
- Select "Constant Setpoint Thermostat" from the list below that
- Press "Apply to Entire Model", press "OK" when asked about removing objects, then press "OK".



13. Run a simulation

- Click on the Simulation button  or Plugins → Legacy OpenStudio → Run Simulation.
- Uncheck "Run design-day simulations"
- Check "Run weather file simulation"
- Browse to select the Chicago TMY3 weather file
C:/EnergyPlus... /WeatherData/
USA_IL_Chicago-OHare.Intl.AP.725300_TMY3.epw
- Uncheck "Request Results in SQLite Format" in the "Results" section.
- Check all of the other boxes in the "Results" section.
- If desired, select IP units
- Check all of the boxes in the "Actions on Completion" section.
- Press the "Run" button





14. When the simulation is complete, three output files will open automatically:

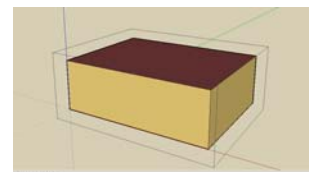
- ExerciseBasics1A.err output file in a text editor. This is the error output file, always a good one to review. *(Leave this file open in the editor.)*
- ExerciseBasics1A.csv in a spreadsheet program. This is where output from Output:Variable and Output:Meter commands is placed. In this example, the reporting is hourly. Review the temperatures and and loads. (To make it easier to read the column headings in Excel, select Row 1, format cells, and turn on wrap text; then select cell B2 and select "freeze panes".) *(Leave this file open for later comparison)*
- ExerciseBasics1A-ABUPS.htm. This is the table report output for the AnnualBuildingUtilityPerformanceSummary. *(Leave this file open.)*

Exercise Basics 1B – Add Windows


Objective: Learn how to add a window using the Legacy OpenStudio Plugin.

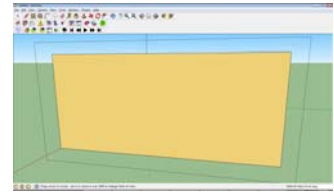
- Return to SketchUp, and select the Save As tool  or Plugins → Legacy OpenStudio → Save As . . . and save to ExerciseBasics1B.idf


- Using the Select tool  double-click on the shoebox to "open" the zone for editing. The display should show a dashed box surrounding the zone group.



- Using the Info tool  hover over the surfaces to find the East wall.

4. To make drawing the window easier, select the orbit tool  and click and drag to rotate the model so that the east wall is facing you.



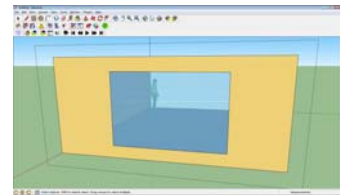
5. Using the Rectangle tool  Add a window to the East wall, 10ft wide by 6ft high (or m), approximately centered on the wall.



From the Legacy OpenStudio Plugin User Guide

(Plugins → Legacy OpenStudio → UserGuide):


One way to create a window sub surface is to use the rectangle tool to draw a face inside of another face (usually a wall). The plugin automatically recognizes the new face as a window sub surface (transparent blue colored) as long as it shares no more than one edge with the base surface and is otherwise completely contained by the base surface and lies in the same plane.

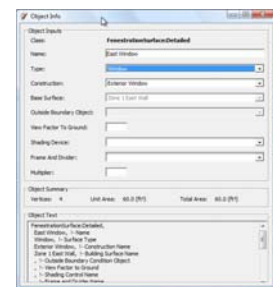
As you draw the rectangle, the dimensions will show in the lower right corner. To specify exact dimensions, click to place one corner of the window, release button and slide mouse to approximately place the other corner of the window, then type "10,6" and press <Enter> (in Windows version of SketchUp). The window should size to the entered dimensions.



6. To center the window, select the Move/Copy tool , hover over the window (it should be shaded grey to indicate it is active), then click and drag.
For the purposes of this exercise, it is not necessary to place the window exactly. This can be done with practice, or by editing the resulting idf file later.
7. To prevent moving again by mistake, deactivate the Move/Copy tool by pressing the Select tool button. 


8. Name the window

- a. Select the Object Info tool .
- b. Then click on the Window.
- c. Rename the window as "East Window" and press <tab>




9. Name the Building
 - a. Click outside the drawing
 - b. Name the building "Exercise Basics 1B" and press <tab>

10. Save  the input file

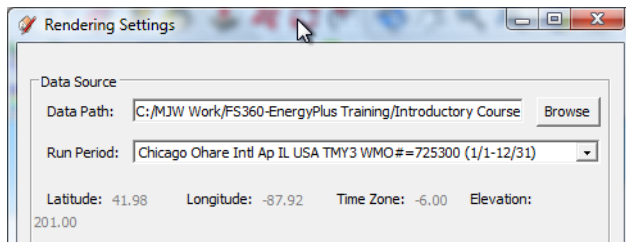
11. Run  the simulation and compare the results for ExerciseBasics1B with ExerciseBasics1A.


Exercise 1C – Visualize Results

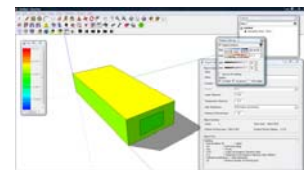
Objective: Learn how to view results by color.

1. Return to SketchUp and click on the plugin “Rendering Settings” button.  or Plugins → Legacy OpenStudio → Rendering → Settings
2. Click on the “browse” button for Data Path, and select “ExerciseBasics1B.eso”.
*Note: You may need to stretch the dialog box to see all of the options.
The eso output file is the raw output from EnergyPlus which becomes the csv spreadsheet file after post-processing.*

Wait a few moments for OpenStudio to read in the data. When it is complete, the “Run Period” should show “Chicago Ohare ... (1/1-12/31)”.



3. In the Data Variables section for Outside Variable name, select “Surface Outside Temperature”, then press OK.
4. Click on the plugin “Render by Data Value” button  and the surfaces should change to show temperatures.
5. In the SketchUp “Window” menu, select “Shadows” to display the “Shadow Settings” dialog. Use the controls here to select date/time for the temperature display. Also check the “Use Sun for Shading” box. If shadows do not show on the ground, in the “View” menu, select “Shadows”.
6. Legacy OpenStudio has buttons for “Color Scale” and “Data Tool”. When the Data Tool is selected, hover over a surface to see the surface name, variable name, and value.
7. You may also wish to experiment with the animation settings.



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