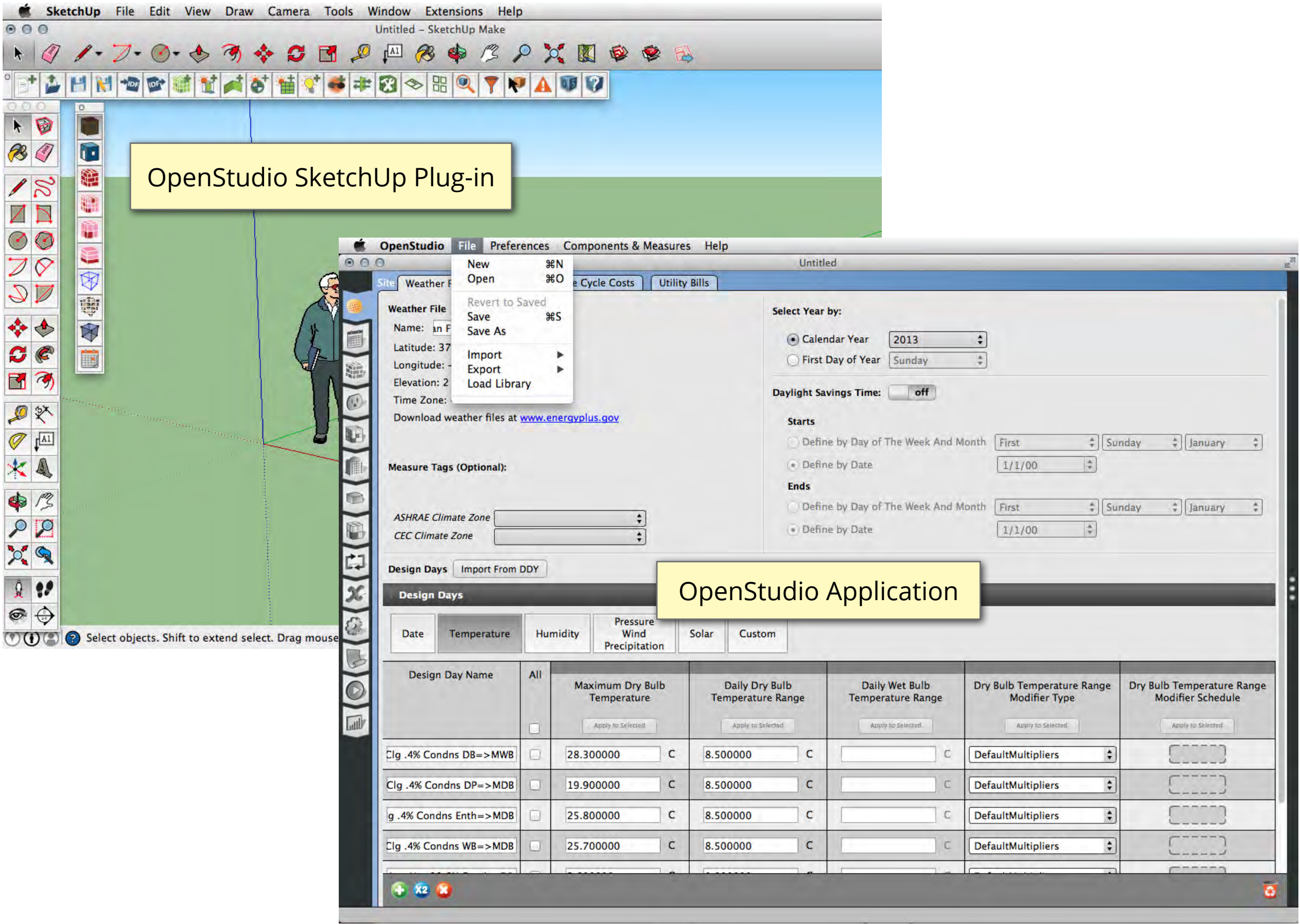


Introduction

Notes

The basic workflow for OpenStudio starts in the SketchUp Plug-in creating the building envelope and assigning space attributes.

Next, the model is loaded in the OpenStudio application, shown on this page. You can step through the tabs from top to bottom.



How to Use this Guide

Notes

This PDF is an interactive guide. Click on the three key SketchUp icons below or the major tab icons at the right to navigate to the appropriate pages.

You can also navigate by using the PDF bookmarks.

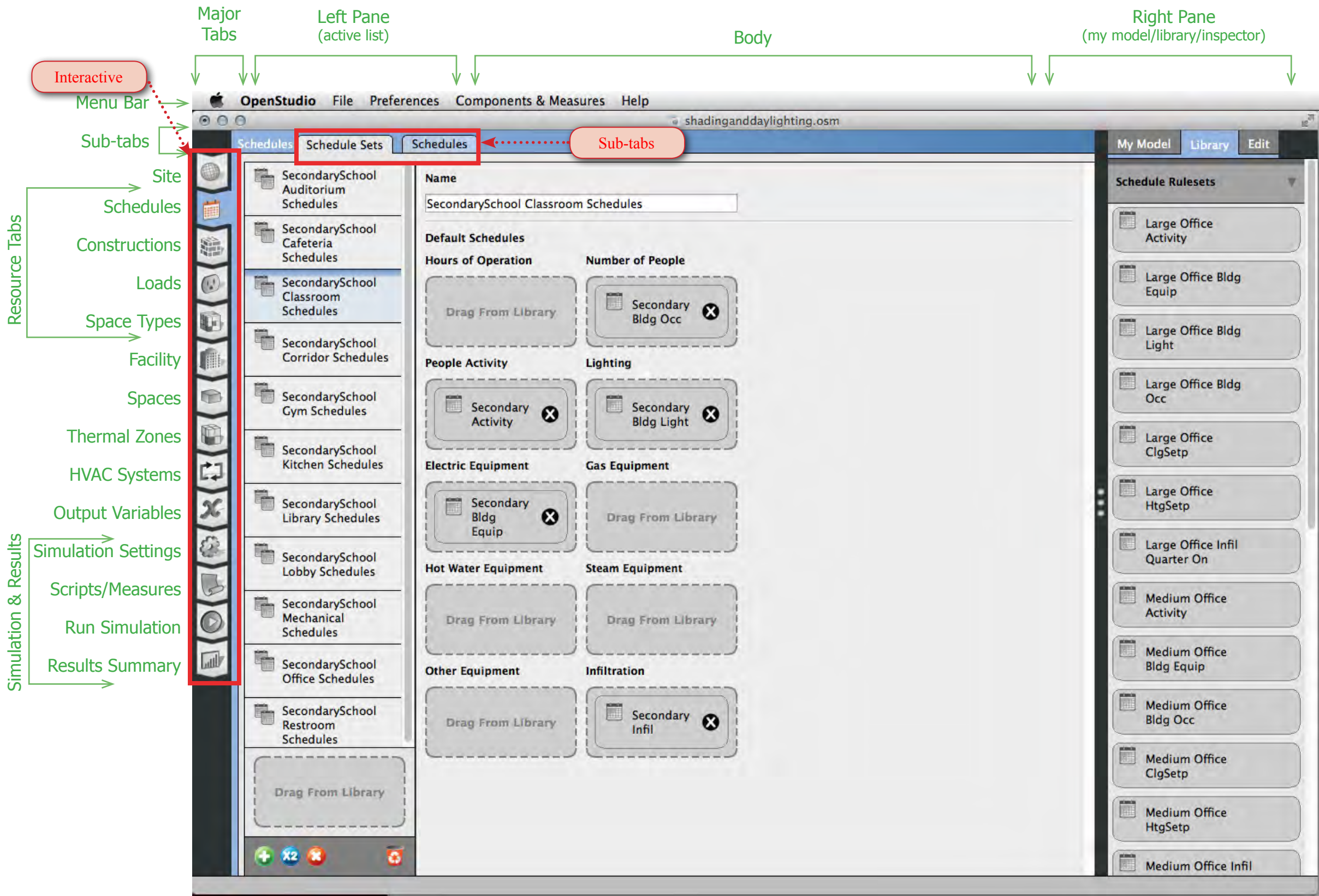
Minimal Workflow Through OpenStudio Application

Site
Thermal Zones
HVAC Systems
Run Simulation
Results Summary



Key SketchUp Plug-in Tools

Choose Template
Building Envelope
Surface & Space Attributes



SketchUp — Choose Template

Notes

The Space Type and Construction Set Wizard will dynamically create OpenStudio spaces types from data on the Building Component Library (BCL) website based on user input related to vintage, climate zone, and building type.

The first time you request a specific combination of inputs it will take some time to download the component. The components are saved to your local database; they don't have to be downloaded next time you make the same request.

The first time you use this script or any other BCL functionality you will be prompted for a BCL API key. This PDF has a page that provides [instructions on obtaining a BCL key](#).

Vintages and Climate Zones

- Vintages:**
- DOE Ref Pre-1980
 - DOE Ref 1980-2004
 - DOE Ref 2004
 - 90.1-2010
 - 189.1-2009
 - 90.1-2007

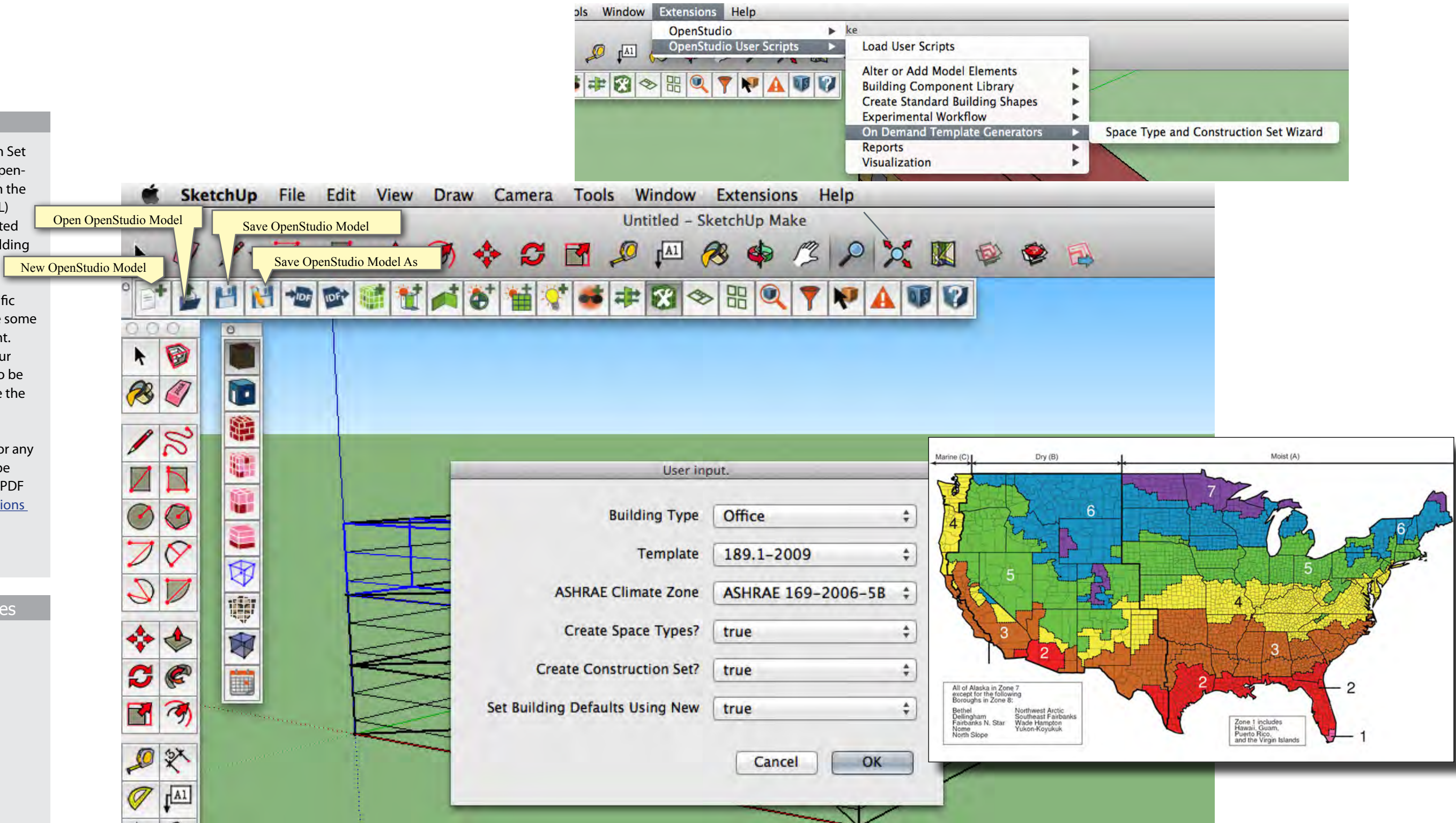
Climate Zones:
1-8 (see map)

Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes



Click for instructions on getting a BCL Auth Key

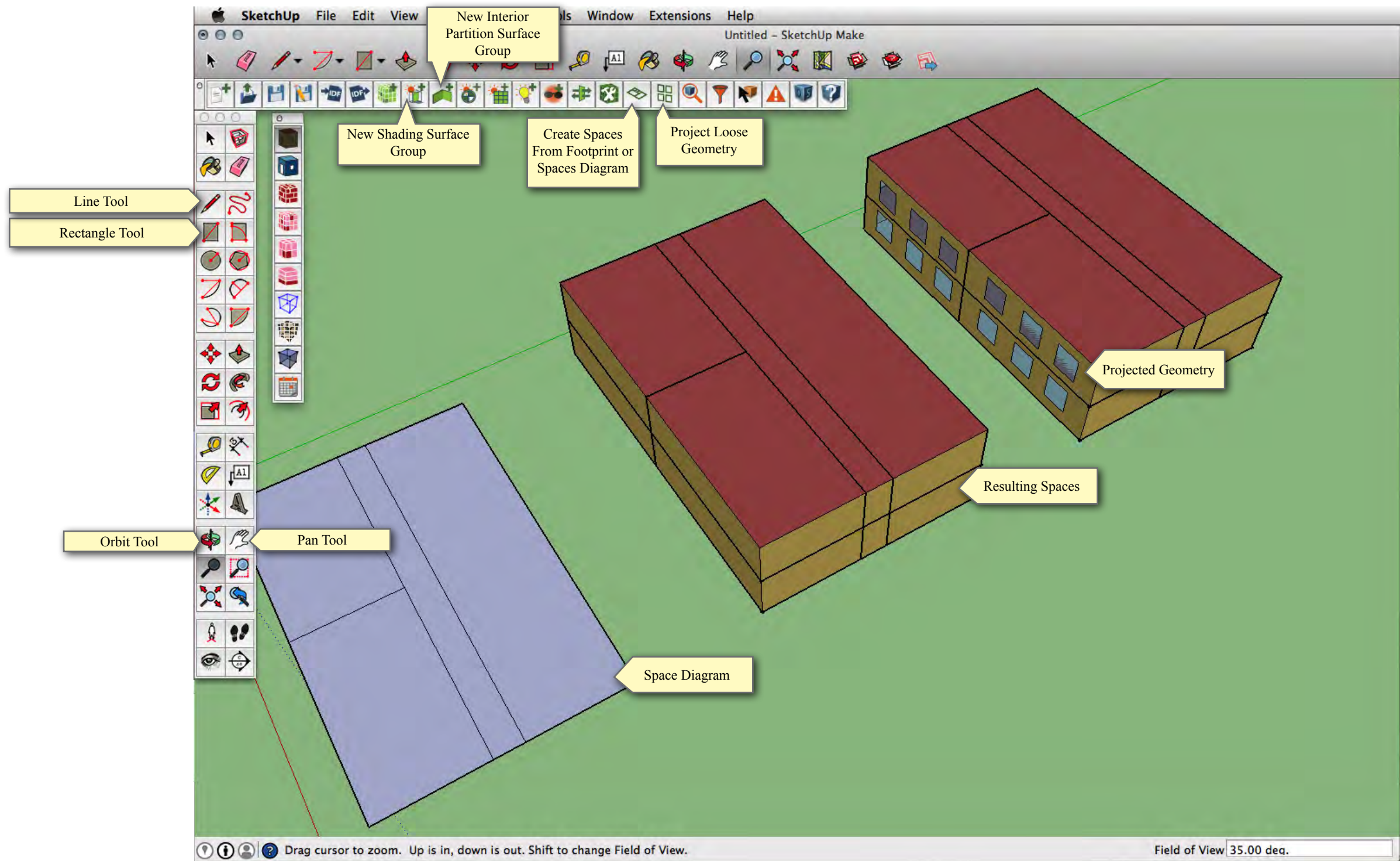
SketchUp — Building Envelope

Notes

After using native SketchUp tools to draw a space outline, you use the Spaces From Diagram tool to project the diagram into a multistory building. Although the geometry is automatically generated from the diagram, you can edit it using standing SketchUp Tools.

You can take a similar approach for fenestration. Again draw loose geometry with native SketchUp tools, but this time use the Project Loose Geometry tool to apply the fenestration to the appropriate spaces. Optionally use the user scripts to create windows based on window to wall ratio or project overhangs based on a projection factor.

You can create additional model geometry using the Shading Surface Tool and the Interior Partition Surface Tool. Spaces can also be imported from gbXML.



Key SketchUp Plug-in Tools

- Choose Template
- Building Envelope
- Surface & Space Attributes

SketchUp — Surface & Space Attributes

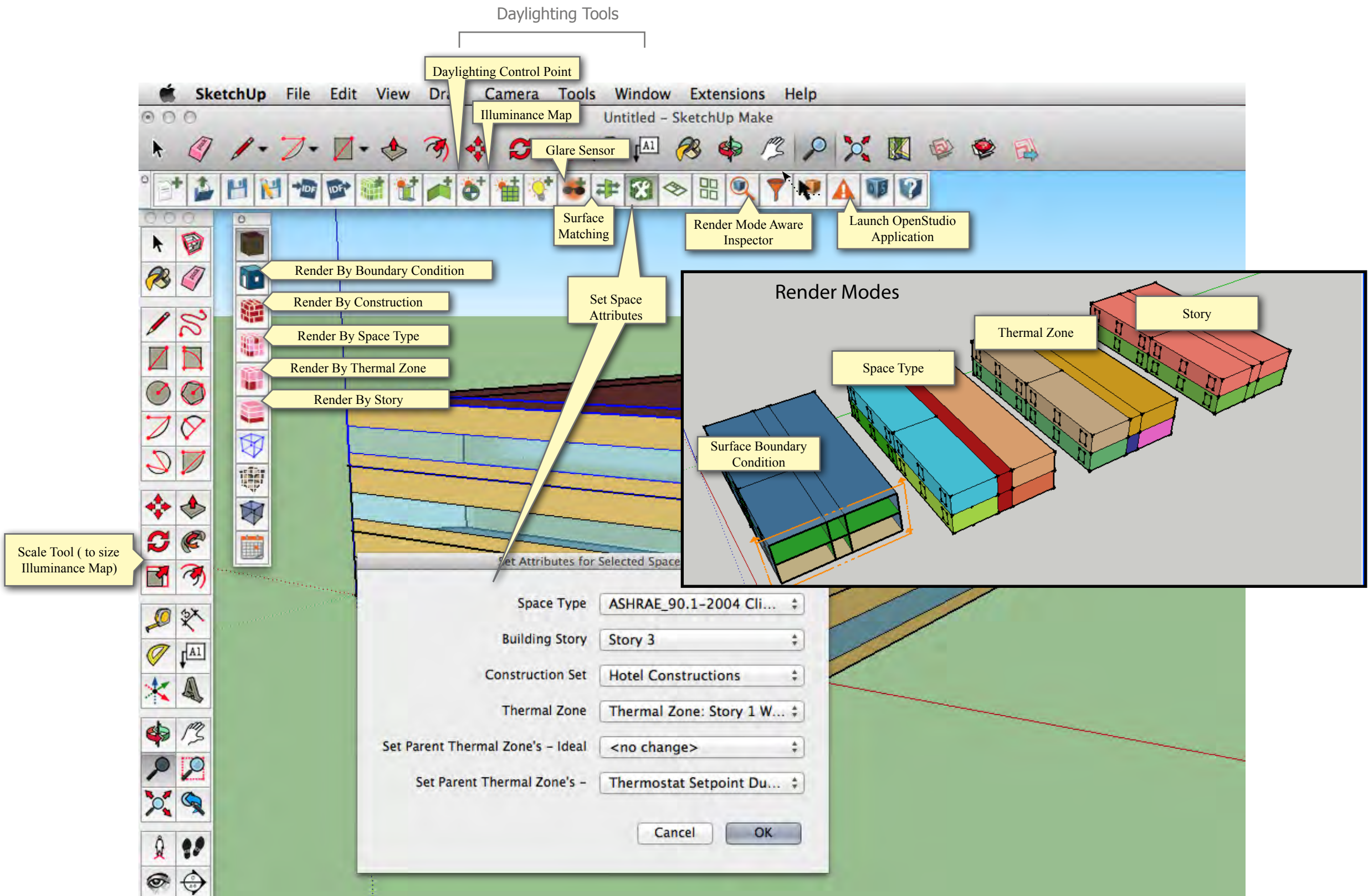
Notes

After defining the building envelope, you use the Surface Matching tool to set the boundary conditions. These will allow thermal connections between spaces and will inform OpenStudio about what construction to apply.

Then you can use the Space Attributes tool to assign various attributes to a space. There is a matching render mode for each space attribute. To apply space attributes, select one or more spaces, and then click the Space Attributes tool.

The image to the right shows a composite of the same model viewed in different render modes. In practice your entire model will render in a single mode at a given time. This example is just to demonstrate the render modes side by side.

To continue developing your model click the “OpenStudio” Button button to launch your model in the OpenStudio application.



Key SketchUp Plug-in Tools

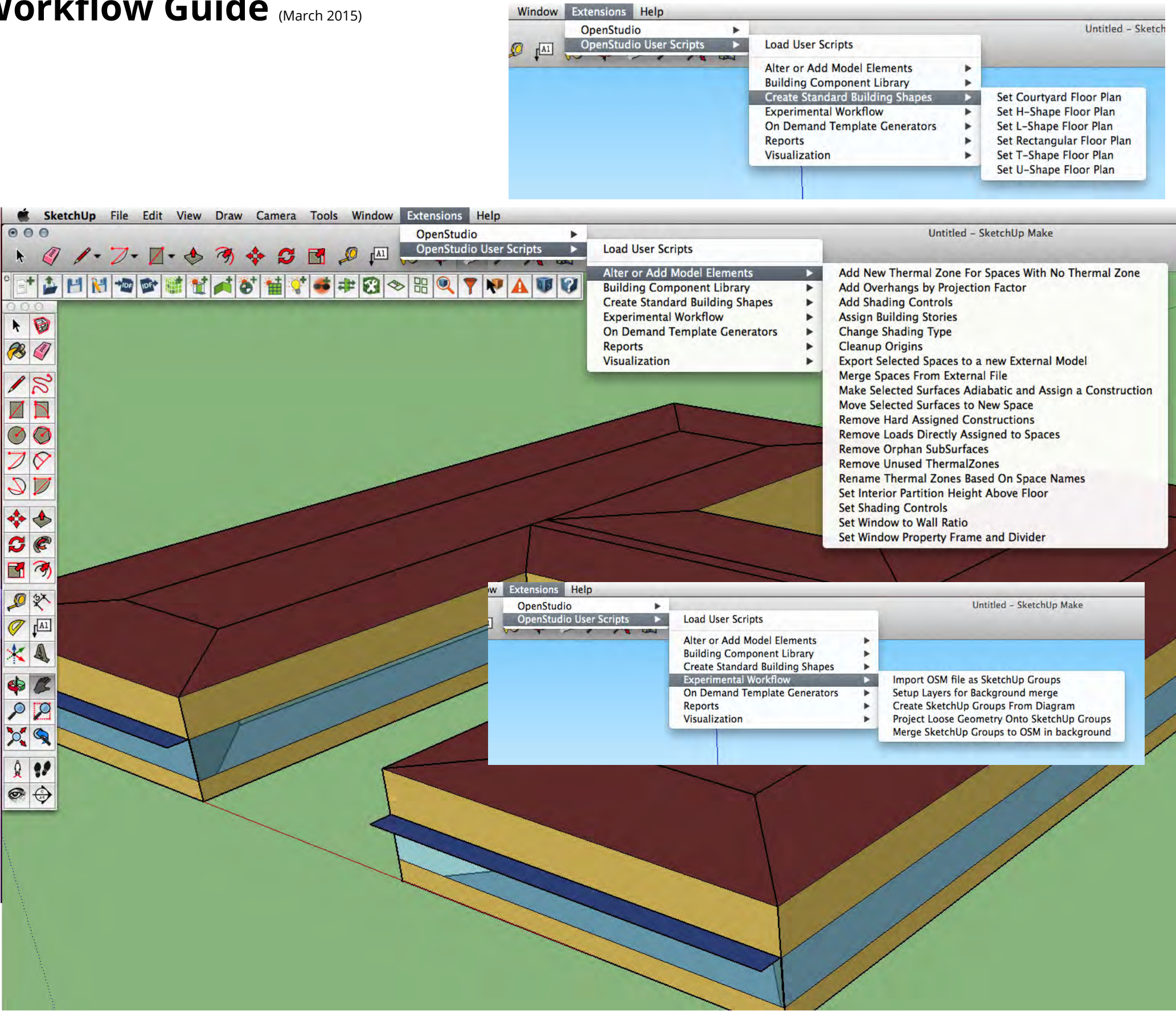
- Choose Template
- Building Envelope
- Surface & Space Attributes

SketchUp — User Scripts

Notes

The OpenStudio user scripts can quickly create your model or alter it. You can find these under “Extensions/ OpenStudio User Scripts.”

The model shown to the right was created using the H-Shaped Floor Plan. Then the windows and overhangs were added with scripts.



Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

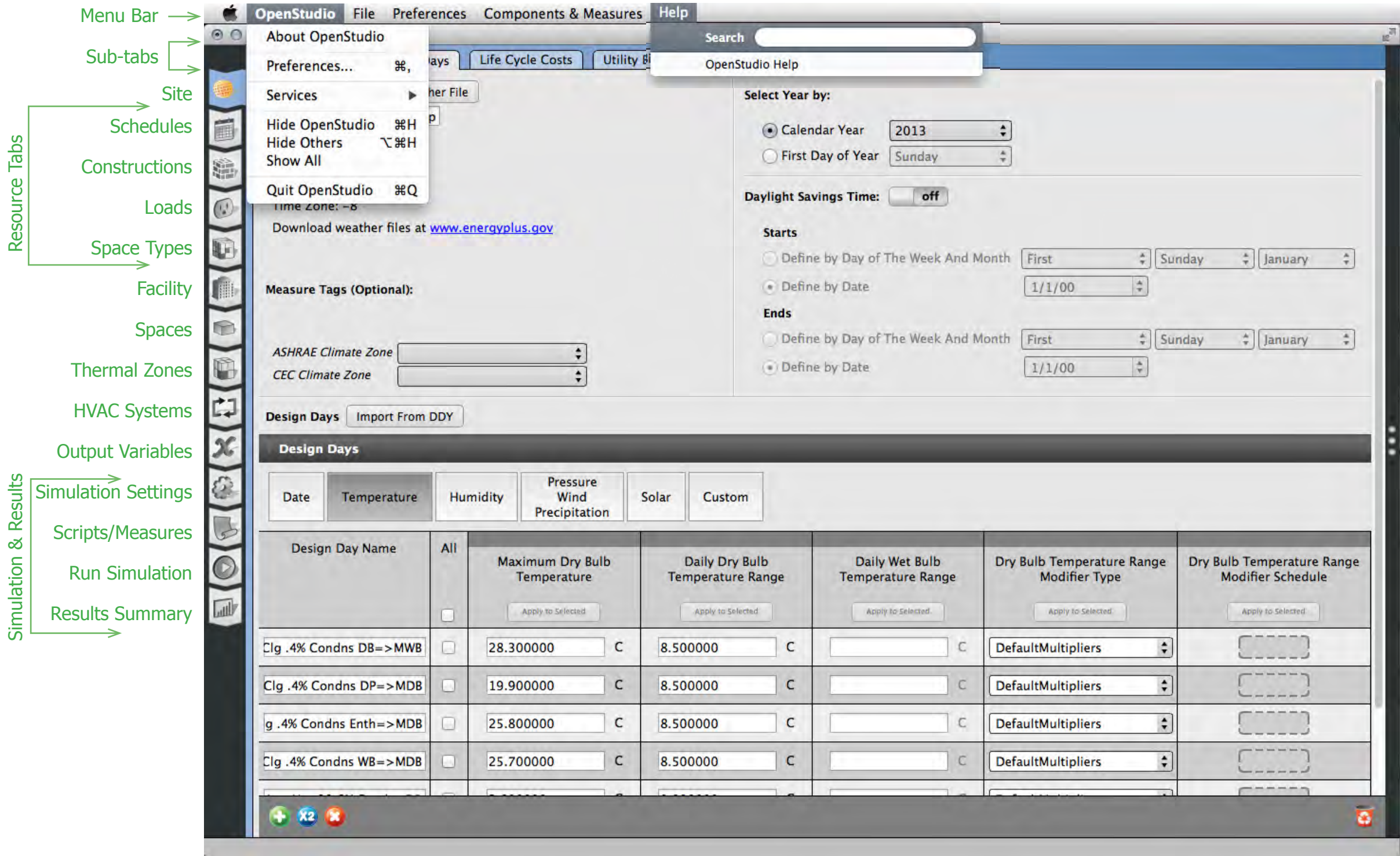
OpenStudio and Help Menu

Notes

The OpenStudio menu contains the about OpenStudio information to check version numbers.

The help menu can take you to the OpenStudio website interface guide.

Explore the site for additional information.



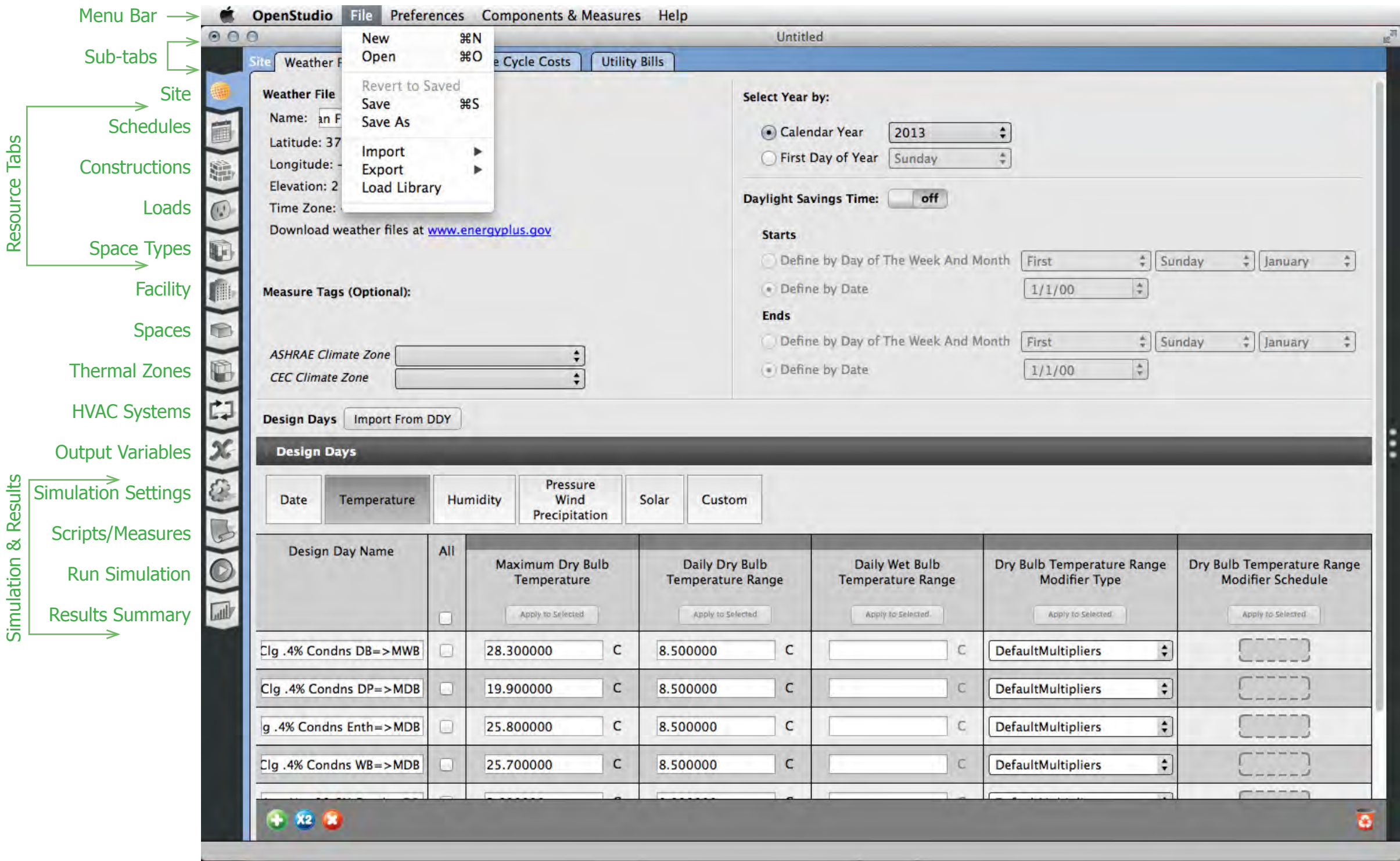
OpenStudio Application File Menu — File

Notes

If you launch the OpenStudio application from the SketchUp Plug-in, your open file will automatically open in the application. But to save the file or open a new file, select file open from the menu.

When you save an OSM model in the OpenStudio Application or the SketchUp Plug-in a folder is saved next to the OSM file. This folder contains external resources such as the weather file, measures, and simulation results.

Load Library is also a very important feature. This allows you to load building component libraries for specific building types. These libraries are the same as those used in the SketchUp Plug-in templates.



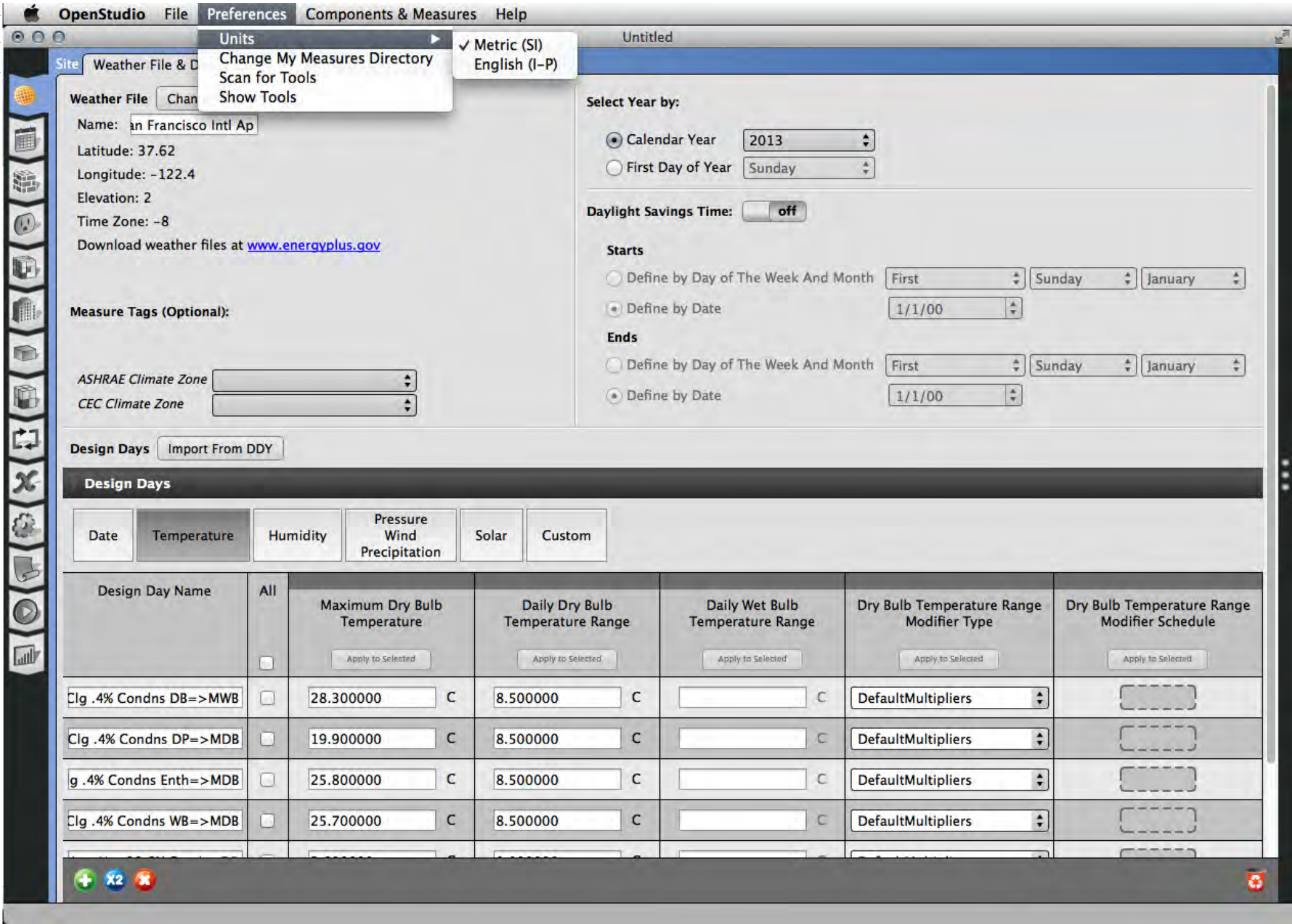
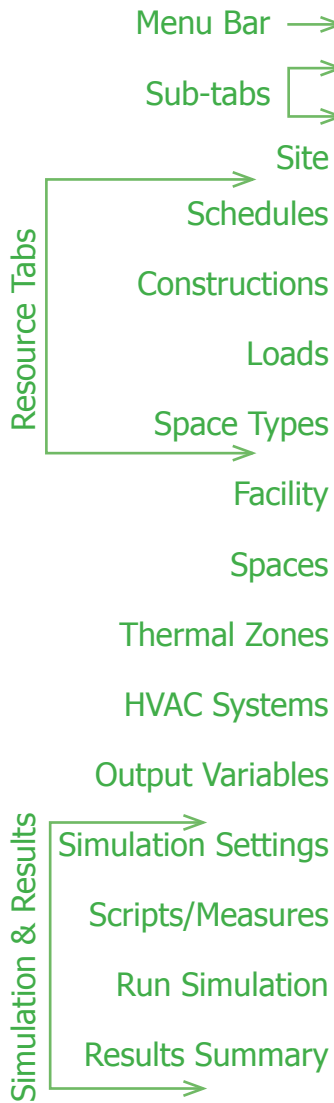
Preferences Menu

Notes

The Units menu lets you switch between SI and IP units. This affects input fields and not the output results.

The SketchUp Plug-in has access to this as well under “Plugins/OpenStudio/Preferences”.

Scan for Tools will look for Radiance, Ruby, and EnergyPlus installations. If you install those applications Prior to installing OpenStudio this shouldn’t be necessary.



Components & Measures

Menu: Apply Measure Now

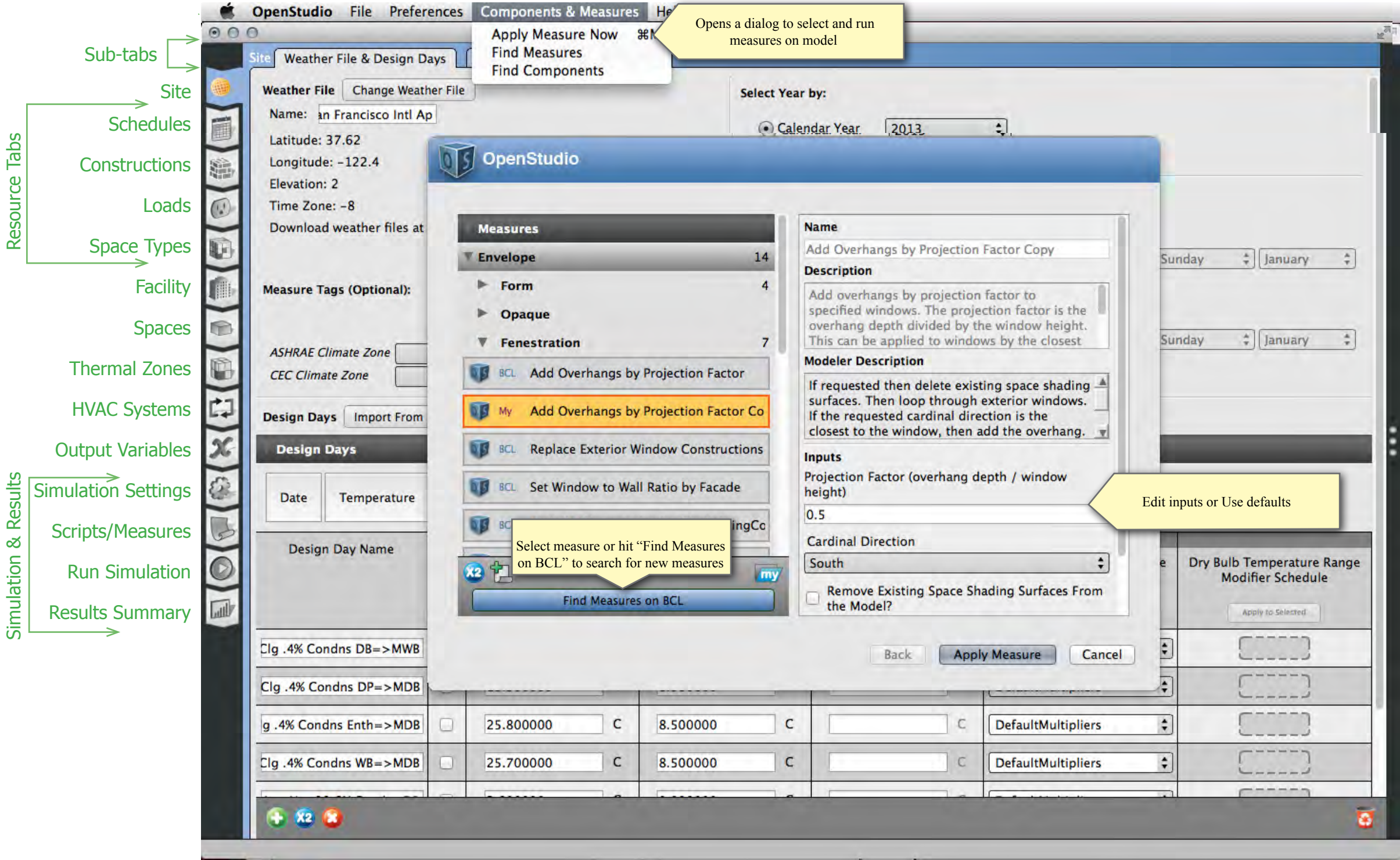
— Select a Measure

Notes

You can apply measures to your model at any time by going to the “Components and Measures” menu and selecting the “Apply Measures Now” option.

This will open a dialog that allows you to choose a measure from the library to apply, go to BCL to find a measure to apply, or even write your own measure and test it.

Once you select a measure you may edit the measure inputs on the right side of the dialog. Hit apply measure to start.



Components & Measures

Menu: Apply Measure Now

— Accept Changes

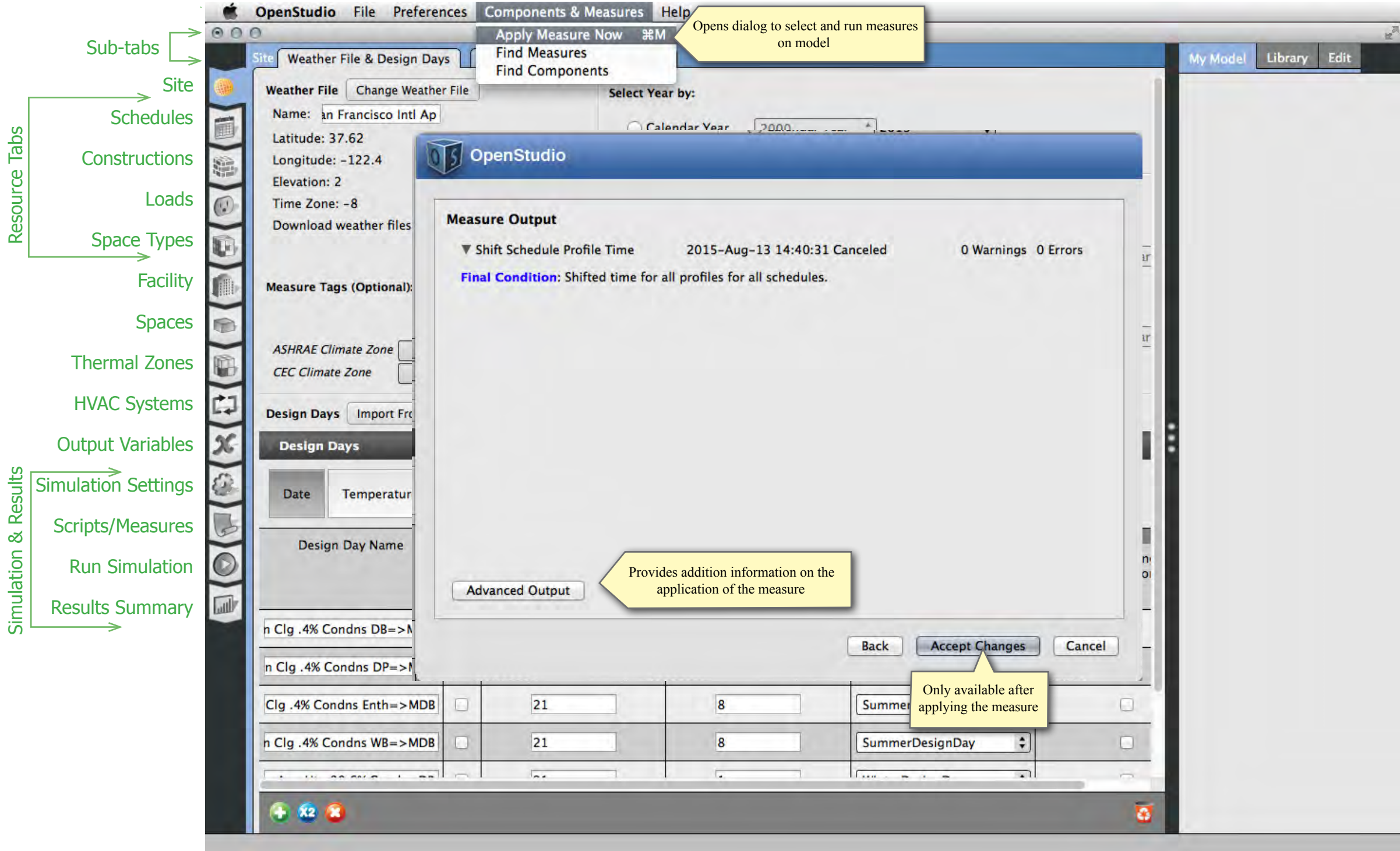
Notes

Once the measure is applied the dialog provides you with information on the changes made to the model.

You can choose to cancel or accept the changes to the model. If you choose to accept the model will be saved and reloaded into the application.

If the measure fails you will see an error log on the dialog.

Advanced output provides additional details.



Components & Measures
Menu: Find Measures or
Components

Notes

The BCL window gives you access to an online repository of building energy modeling data called the Building Component Library. Although you can access the [BCL website](#) on its own, OpenStudio has integrated access to the BCL from within the application. You can access this through the “Components & Measures” menu.

The first time you open this window you will be prompted for an API key, unless you have already used BCL functionality in the SketchUp Plug-in.

If you choose “Find Components” the online BCL window currently exposes constructions, materials, and HVAC components. You can choose a category and search. Next you can check and download one or more of the resulting components. The pane on the right shows attributes for the currently selected component. Once downloaded, these components are stored in a local database on your computer.

Within OpenStudio, components downloaded from the BCL have visual tags to indicate their origins.

Measures are scripts used to create and transform models. You can browse categories or search for measures to download and use on your model.

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Click for Instructions on Getting a BCL Auth Key

Enter your BCL Auth Key

BCL Auth Key:

OK

Cancel

Page through results

Search input box

Check All

13

Choose category or search

Progress bar will appear here

Download checked components, they are gray if you have already downloaded them

Attributes for selected object

Attributes	
Requires EnergyPlus Results	false
Uses SketchUp API	false
Measure Function	Measure
Measure Type	ModelMeasure

Arguments

Files

EnvelopeAndLoadTestModel_01.osm

ReverseTranslatedModel.osm

ReplaceExteriorWindowConstruction_T

EnvelopeAndLoadTestModel_01Costed

measure.rb

Sources

Tags

Envelope.Fenestration

BCL Account Page bcl.nrel.gov

Notes

To use the BCL features in OpenStudio, you need to register on the Building Component Library website and setup an "API Key." This is a separate site from the OpenStudio website. The steps to setup an account and obtain a key follow.

1. Go to <https://bcl.nrel.gov/user/register> and follow the registration instructions.
2. Check your email for the confirmation to activate your account, then login.
3. Click "My Dashboard"
4. Select and copy the Key.
5. Return to OpenStudio and paste the key into the input box.

Your key will be remembered when you Upgrade OpenStudio so you should only have to do this once, unless you get a new computer, then you will have to go through steps 3-6 to retrieve your key.

The image is a composite of two screenshots from a web browser, illustrating the process of creating a BCL account and retrieving an API key. The top screenshot shows the 'Building Component Library' registration page at <https://bcl.nrel.gov/user/register>. It includes fields for 'Username' and 'E-mail address', a 'Search' button, and a 'Create new account' button. A yellow callout 'Step 1 - Register' points to the 'Register' link in the top right. A red callout 'Click to go to BCL Website Registration Page' points to the 'Register' link. The bottom screenshot shows the 'Building Component Library' dashboard at <https://bcl.nrel.gov/user/360/dashboard>. It displays 'Welcome, marscho!' and a 'My Dashboard' button. A yellow callout 'Step 2 - Login' points to the 'Login' link in the top right. A yellow callout 'Step 3 - Click My Dashboard' points to the 'My Dashboard' button. A yellow callout 'Step 4 - Select and copy key' points to the 'API v1.1 key' field in the 'My Profile' section. A red callout 'Link to BCL constructions and materials in the OpenStudio Application' points to the 'My Edits' section. A red callout 'Link to BCL Space Types Generator in SketchUp Plug-in' points to the 'My Edits' section. A yellow callout 'Step 5 - Paste Key into OpenStudio' points to a dialog box titled 'Enter your BCL Auth Key' with a 'BCL Auth Key' input field and 'OK' and 'Cancel' buttons.

Site — Weather File & Design Days

Notes

The Site tab allows you to set the path of the EPW weather file that you want to use for your simulation.

The weather file is stored in the OSM file as a path. When you reopen a model you will see the name of the file selected if the link is still available. If file is no longer linked, you will be prompted to add a weather file.

Design days are a little different. They are imported into your model. You can view and edit the design day settings by clicking through the buttons for

- Temperature
- Humidity
- Pressure, Wind, Precipitation
- Solar
- Custom, this will display columns you have selected.

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Resource Tabs →

Simulation & Results →

Site

Weather File & Design Days

Life Cycle Costs

Utility Bills

Weather File

Change Weather File

EPW file selected

Select Year by:

Calendar Year 2013

First Day of Year Sunday

Daylight Savings Time: off

Starts

Define by Day of The Week And Month First Sunday January

Define by Date 1/1/00

Ends

Define by Day of The Week And Month First Sunday January

Define by Date 1/1/00

Measure Tags (Optional):

Standards Tags used by OpenStudio Measures (Optional)

ASHRAE Climate Zone

CEC Climate Zone

Design Days

Import From DDY

Design Day Files imported and displayed in detail below

Date

Temperature

Humidity

Pressure Wind Precipitation

Solar

Custom

Design Day Name

All

Maximum Dry Bulb Temperature

Daily Dry Bulb Temperature Range

Daily Dry Bulb

Dry Bulb Temperature Range Modifier Type

Dry Bulb Temperature Range Modifier Schedule

Clg .4% Condns DB=>MWB

28.300000

C

8.500000

C

DefaultMultipliers

Clg .4% Condns DP=>MDB

19.900000

C

8.500000

C

DefaultMultipliers

g .4% Condns Enth=>MDB

25.800000

C

8.500000

C

DefaultMultipliers

Clg .4% Condns WB=>MDB

25.700000

C

8.500000

C

DefaultMultipliers

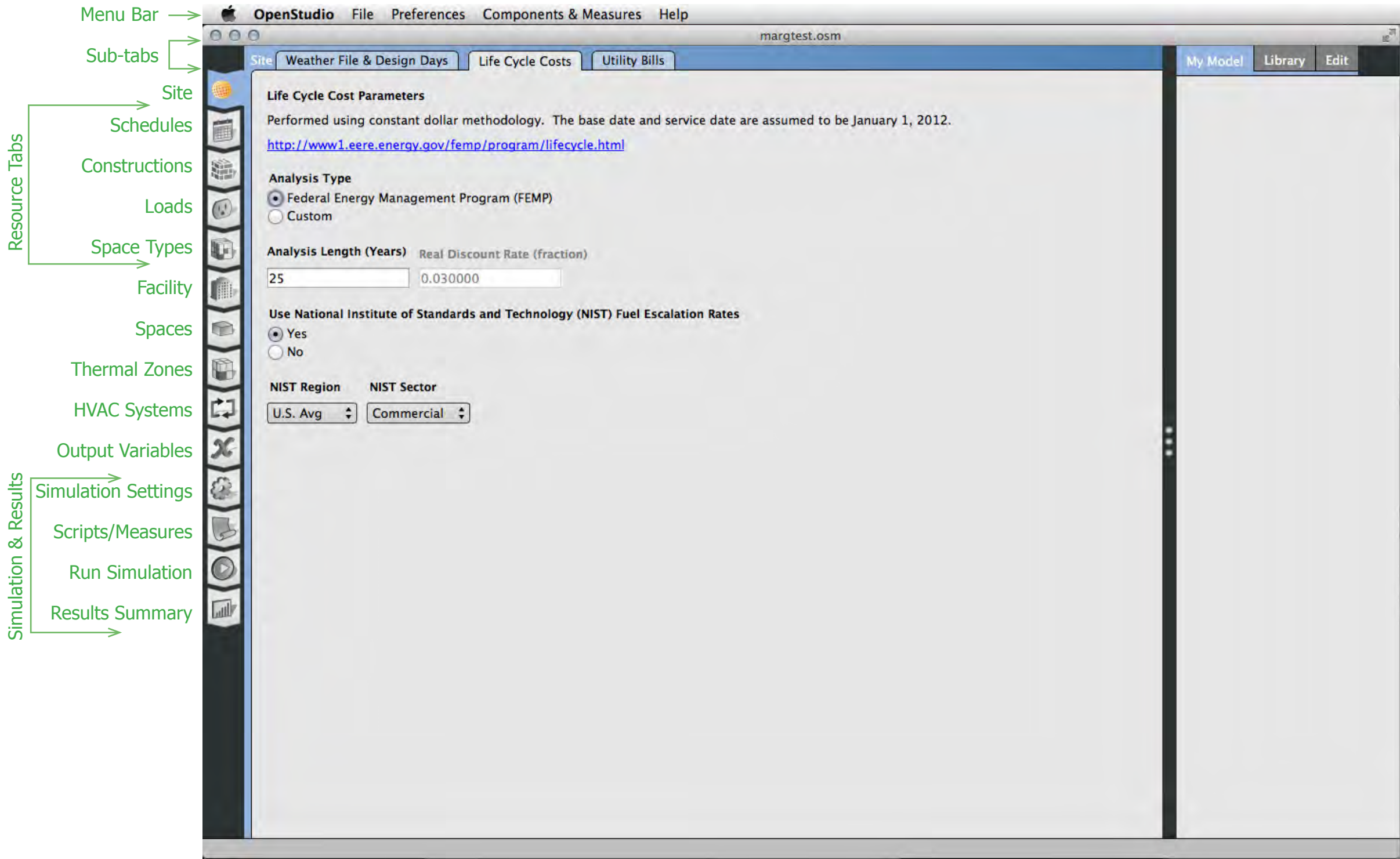
Site — Life Cycle Cost

Notes

The most basic parameters needed for a life cycle cost analysis are the analysis period length and the discount rate. A longer analysis period accumulates more energy cost savings than a shorter period; giving energy conservation measures a better pay back relative to their initial costs. A higher discount rate devalues future energy cost savings relative to money spent on capital improvements in the present; giving energy conservation measures a lower pay back relative to their initial costs. This tab allows users to set these parameters on their baseline model.

In the ParametricAnalysisTool measures, downloaded from BCL, can be used to calculate life cycle costs for different design alternatives.

OpenStudio Life Cycle Costing Examples are available at http://nrel.github.io/OpenStudio-user-documentation/tutorials/life_cycle_costing_examples/



Site — Utility Bills

Notes

Add utility bills for calibration on the Utility Bills Tab under Site.

You must select a weather file and calendar year to enable this feature.

Step 1- select the type of utility on the left.

Step 2- hit the plus button to add bills.

Step 3- name the Bill and complete the units fields.

Step 4- select the billing period inputs and hit the plus sign to add a bill.

To calibrate to the ASHRAE 14-2002 or FEMP standard the file must contain all utility data for one year and real weather data. Check the guidelines for additional requirements.

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Electric Utility Bill

Utility Bill 1

Gas Utility Bill

District Heating Utility Bill

District Cooling Bill

Diesel Utility Bill

Fuel Oil #1 Utility Bill

Fuel Oil #2 Utility Bill

Propane Utility Bill

Water Utility Bill

Steam Utility Bill

Energy Transfer Utility Bill

Name

Utility Bill 1

Consumption Units

kWh

Peak Demand Units

kW

Peak Demand Window Timesteps

1

Run Period

Start Date 1/1/2012

End Date 12/31/2012

Billing Period

Select the best match for you utility bill

Start Date and End Date

Start Date and Number of Days in Billing Period

End Date and Number of Days in Billing Period

Start Date

1/1/12

End Date

1/30/12

Energy Use (kWh)

Peak (kW)

Cost

Add New Billing Period

Add new object

Step 1 - Select type of bill

Step 3- Enter the billing information

Step 4- Select the method of input that matches your bills and hit the “+” button to add dates, energy use, and cost data

Step 2 - Hit the “+” button to add bills

Duplicate selected bill

Delete bills: select an item in the panel above and click delete to remove

Purge unused: removes unused items from your model

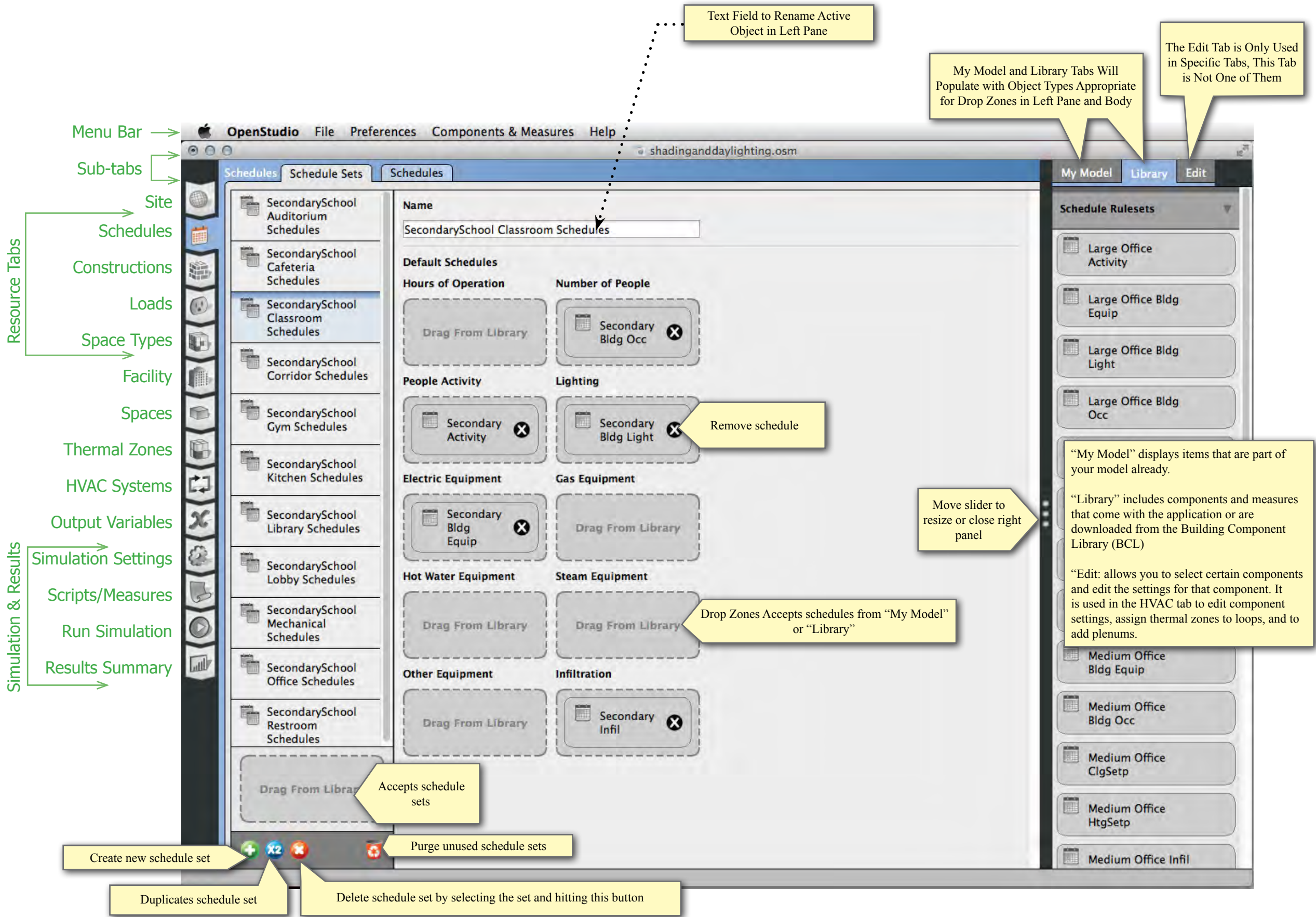
Schedules — Schedule Sets

Notes

A Schedule Set is a collection of schedules for building activities or elements.

A schedule set can be applied to an entire building, a story, a space type, or an individual space.

This sub-tab has two kinds of drop zones. You can drop schedule sets from My Model or Library into the bottom of the left pane, or you can drop individual schedules into the drop zones in the main body.



Schedules — Schedules

Notes

This tab is a visual editor for Ruleset Schedules. As the name implies, a schedule consists of a series of rules. Each rule or profile can be applied for a specific date range and for specific days of the week.

If two rules appear on the same day, the one with a higher priority is used. You can use the rule colors to visually scan the entire year in the calendar on the right of the body to see what rule is applied for a specific day.

A new profile starts as a flat line. Double click to split the profile and then drag one segment up or down. Vertical sections can also be dragged left or right. Click Set Limits to change the vertical limits of your profile. To type precise values for a profile, mouse over the profile and enter a value with your keyboard.

Although you can use Compact and other schedule types in your model, you can visualize and edit only Ruleset Schedules in the OpenStudio application.

The lower profile view is a navigation for when you are zoomed to 15-minute or 1-minute time steps.

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OpenStudio File Preferences Components & Measures Help

MyBuildingModel.osm

Schedules Schedule Sets Schedules

Bldg lvl cooling setback

Bldg lvl equip

Design Day Profiles

Summer

Winter

Run Period Profiles

Priority 1

Priority 2

Default

Bldg lvl heat

Bldg lvl heat setback

Bldg lvl lights

Bldg lvl occ fire station

Bldg lvl water

Bldg Lvl Water Vehicle Bay

DHW Mixed Water Temperature

Drag From Library

Schedule Name: g lvl equip

Schedule Type: Equipment Schedule

Priority 2

Idg lvl equip Default Weekday Schedule

Date Range: 01/01 12/31

Apply to: S M T W T F S

Lower Limit: 0.00

Upper Limit: 1.00

Delete rule

Days of week and date range for rule

Mouse over horizontal line to set value

Double click on horizontal line to split profile

Double click vertical line To merge profile

Click to edit Bldg lvl equip Default Weekday Schedule

Throughout the application, mousing over an object will display the full name

Visualize Rules on Annual Calendar

Hourly 15 Minutes 1 Minute

Zoom to smaller timestep

When zoomed in drag this box to navigate

Jan

S M T W T F S

2 3 4 5 6 7 8

9 10 11 12 13 14 15

16 17 18 19 20 21 22

23 24 25 26 27 28 29

Feb

S M T W T F S

6 7 8 9 10 11 12

13 14 15 16 17 18 19

20 21 22 23 24 25 26

27 28

Mar

S M T W T F S

6 7 8 9 10 11 12

13 14 15 16 17 18 19

20 21 22 23 24 25 26

27 28 29 30 31

Apr

S M T W T F S

3 4 5 6 7 8 9

10 11 12 13 14 15 16

17 18 19 20 21 22 23

24 25 26 27 28 29 30

May

S M T W T

1 2 3 4 5

8 9 10 11 12

15 16 17 18 19

My Model Library Edit

OS:Schedule:Day

Hour

5

Minute

45

Value Until Time

0.600000023841858

Hour

11

Minute

0

Value Until Time

0.897499978542328

Hour

12

Minute

0

Value Until Time

0.699999988079071

Hour

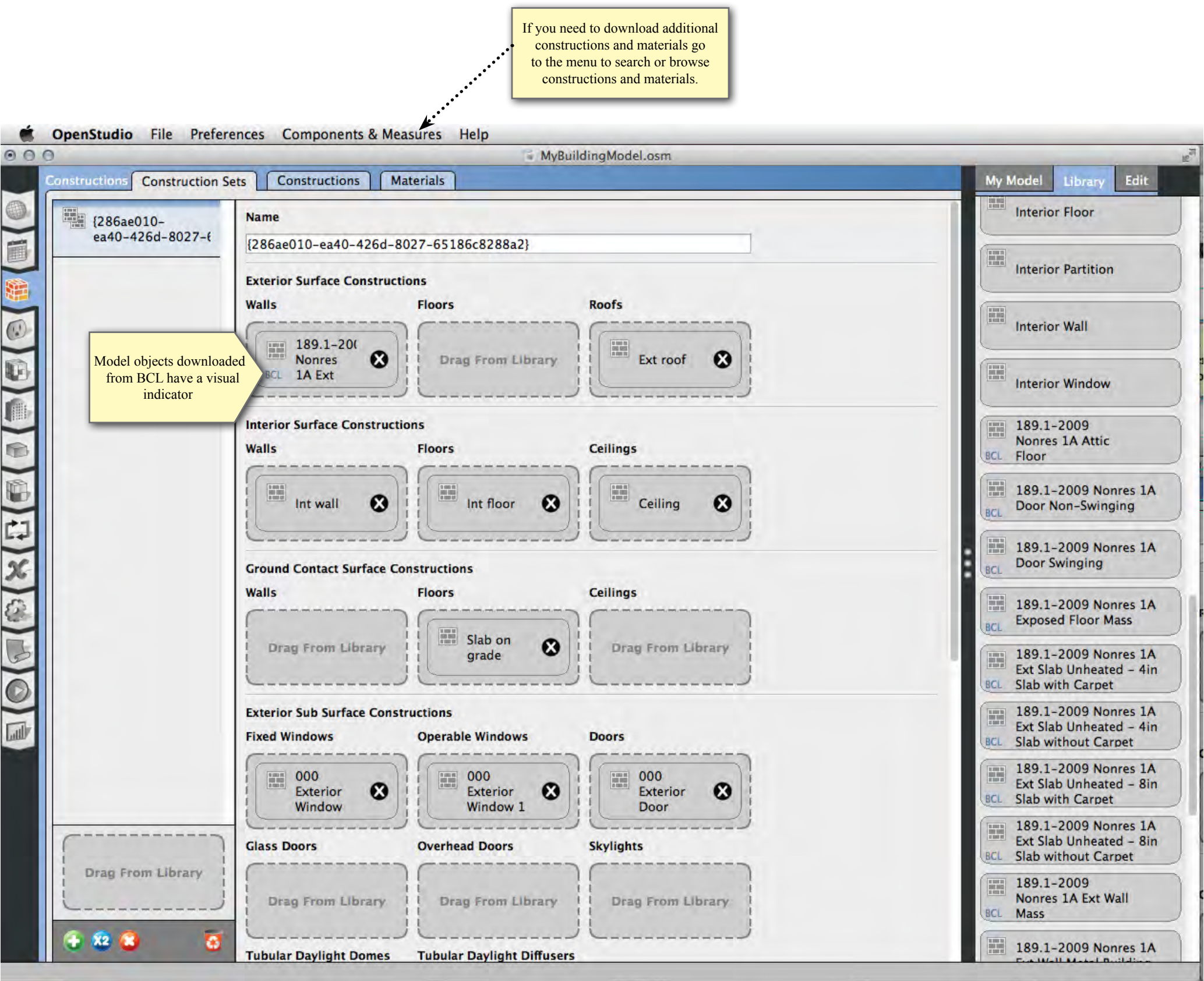
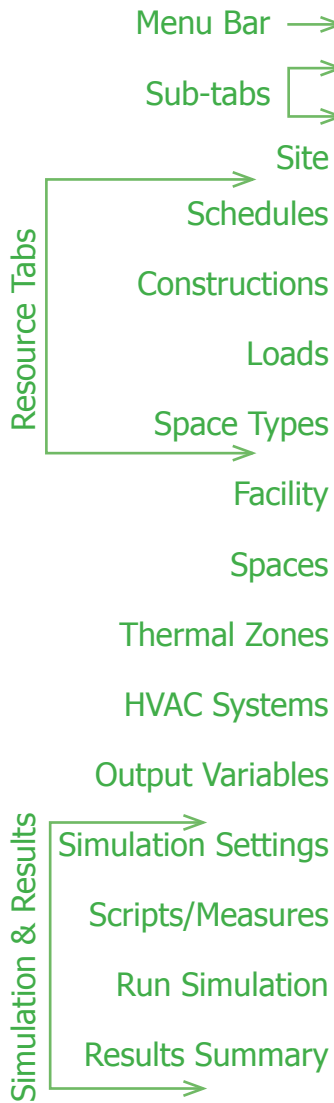
Constructions — Construction Sets

Notes

A Construction Set object is structured very much like the Schedule Set. It can contain constructions for different surface types and boundary conditions.

A construction set can be applied to an entire building, a story, a space type, or an individual space.

Construction sets do not have to be complete sets. For example, you can have a construction set assigned to a story that has only an exterior wall. For the rest of the surface types, constructions will be inherited from the building object.



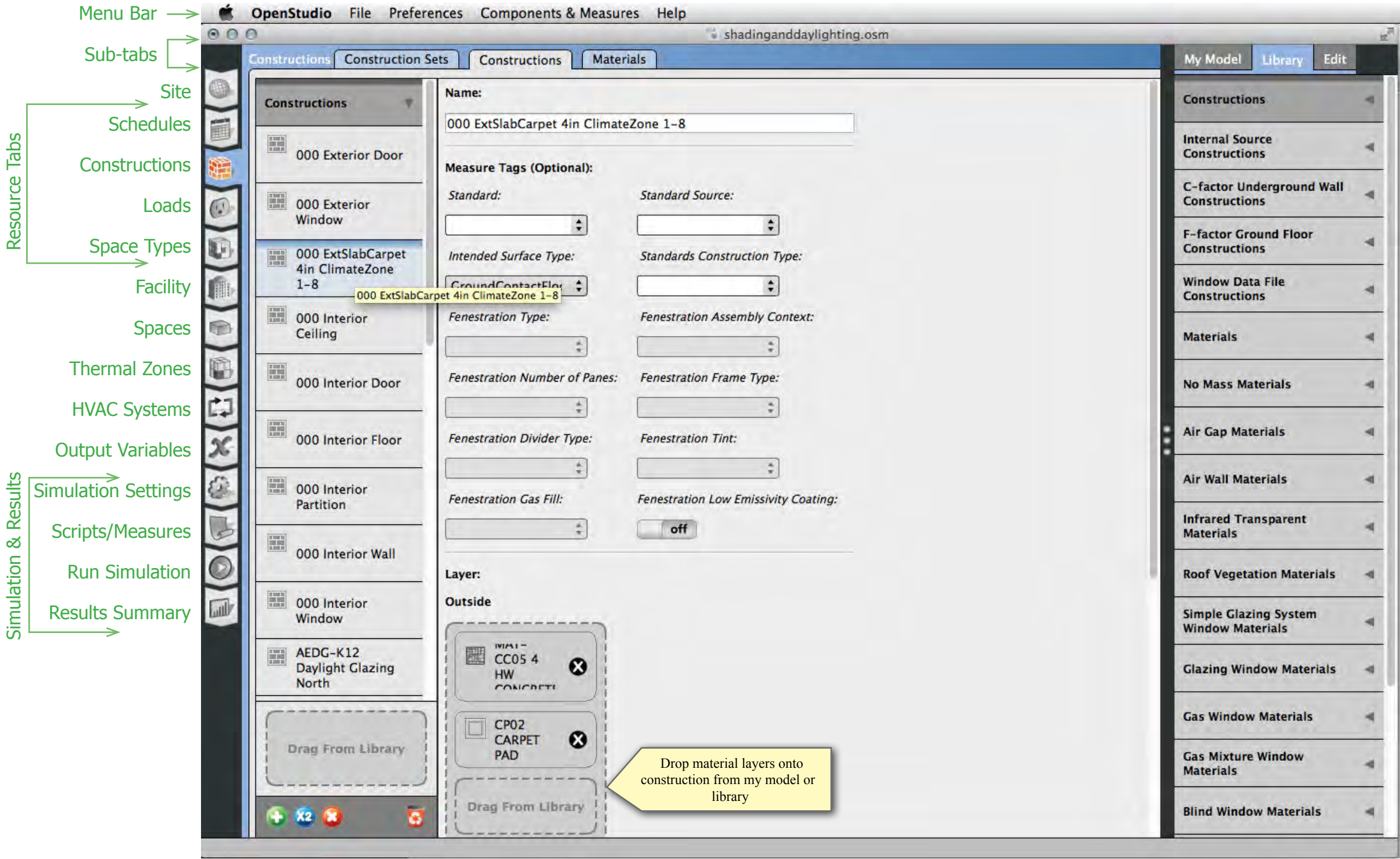
Constructions —

Constructions

Notes

The Constructions sub-tab lists construction objects that are in your model. You can drag additional constructions here from the library. Constructions downloaded using the Online BCL window will appear in the library with a "BCL" flag.

A construction consists of one or more material layers. You can add materials by dragging them from My Model or the Library to the drop zone. You can only add new materials to the bottom which represents the inside of the wall. You can delete any material by clicking the "x" next to the name.



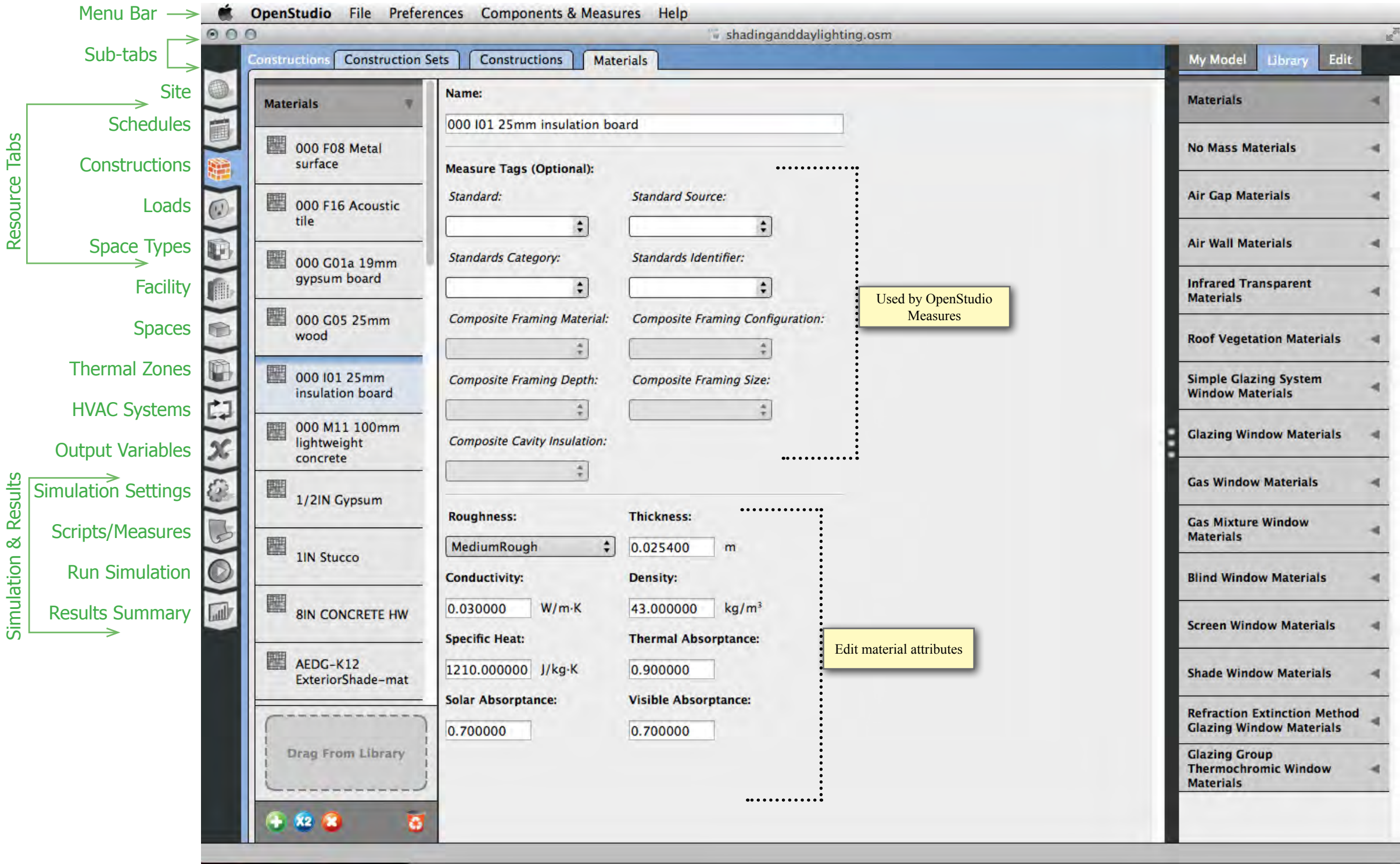
Constructions — Materials

Notes

Constructions are made of one or more layers of materials. The Materials sub-tab lets you inspect and edit those materials.

There are various classes of material objects. When you add a new material, first select the heading for the type of material you want to add and then click the “+” icon at the bottom of the left pane.

Different types of material will have different data fields available.



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Loads

Notes

The Loads tab contains internal load definitions that can be used throughout the model.

The fields in the body will change appropriately when you pick a different type of load.

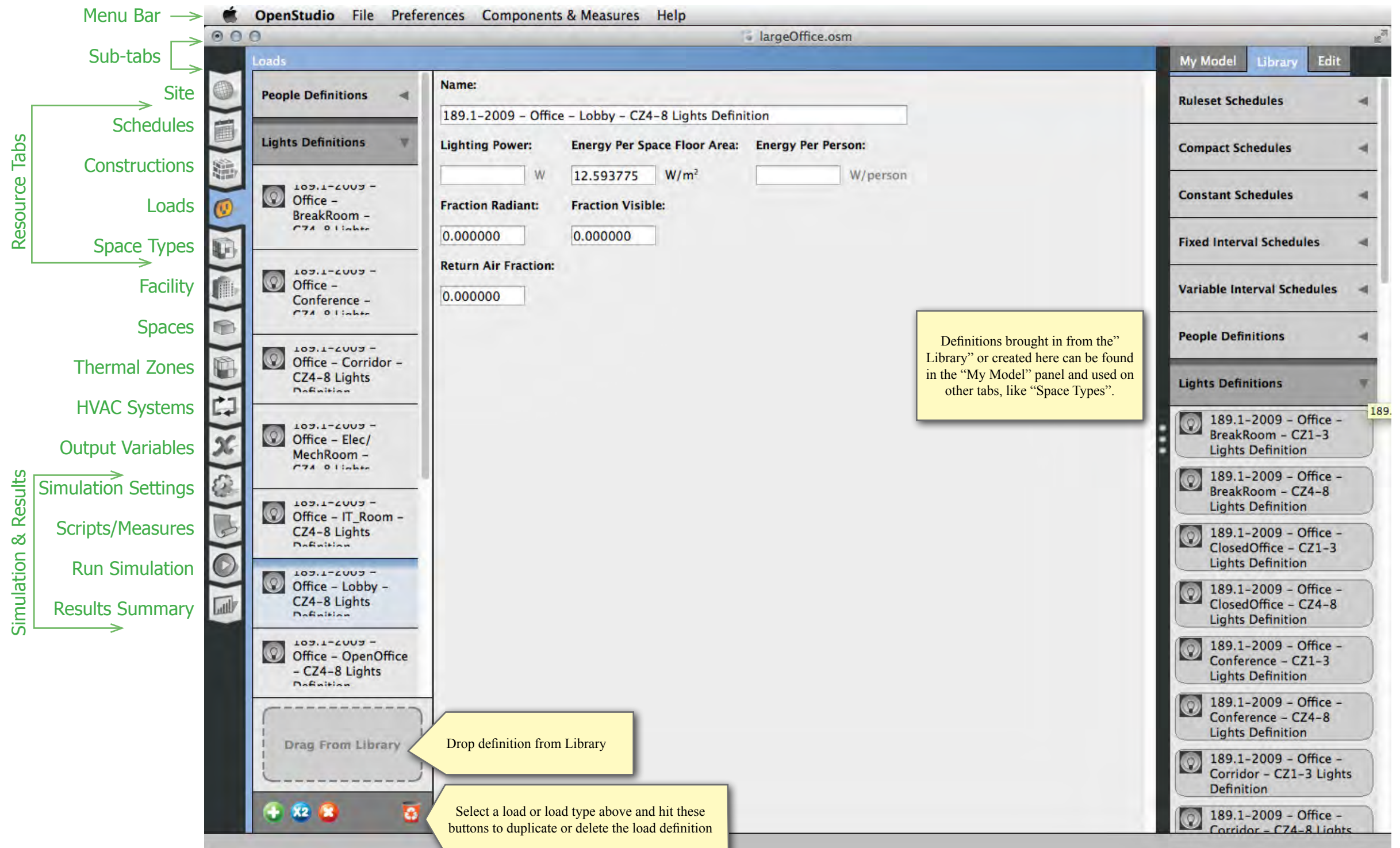
You can assign loads to a space type or directly to a space, except for Water Use Equipment.

The types of loads that can be added in this tab follow.

- People
- Lights
- Luminaires
- Electric Equipment
- Gas Equipment
- Steam Equipment
- Other Equipment
- Internal Mass
- Water Use Equipment

Internal mass is different than the other loads in that it does not use fuel; rather, it stores heat and then dissipates the heat over time. The inputs require a surface area assigned to a construction object.

Water Use Equipment is also unique in that it takes schedules, and is not part of a space type. Water Use Equipment is applied in the HVAC Systems Tab.



Space Types — General

Notes

Space types are the work horses of the resources in OpenStudio. Space types can define internal loads, schedule sets, and construction sets. Space types define specific spaces or groups of specific spaces in your model. The spaces inherit all objects of the space type. If you redefine a space type, or an underlying object, it will affect all spaces using that space type.

The space types tab in the OpenStudio application is organized into a grid view. You can look through all your space types and edit the settings.

The steps for using multi-edit for applying an item to multiple space types are below:

1. After dragging in an item from the library, select it and edit any features you need to in the “Edit” panel on the right.
2. Check the rows you would like to add this same component to. Note that when you check the rows the yellow highlight disappears on the component you edited in step 1.
3. After selecting the rows you would like to apply the component to, then click the text of the item you would like to duplicate. It should turn yellow again.
4. Hit the “Apply to Selected” button at the top of the column containing that component and the yellow highlighted component will be copied to the checked rows.

You can duplicate and delete multiple rows by checking the rows and using the buttons on the bottom left.

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Drop a space type from the Library

Drop Zone

General

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Measure Tags

Custom

Filter: Load Type

Show all loads

Filter only available on the loads sub-button

Select buttons to change the fields available for the space types

Will apply the yellow highlighted item to other checked rows

Click an item and select Edit in the right panel to edit settings.

When selected you can hit the “Apply to Selected” button to add this item to other checked space types

Click to open a dialog and change the rendering color of the space type

Check to select this item and make it available for the multi-edit column buttons and the duplicate row, and delete row features

Delete the single instance of item from grid

Plus: Adds a new space type
2X: Duplicates checked rows
X: Deletes checked rows

Space Type Name	All	Rendering Color	Default Construction Set	Default Schedule Set	Design Specification Outdoor Air	Space Infiltration Design Flow
BreakRoom - CZ4-8	<input type="checkbox"/>		189.1-2009 - CZ1 - C	189.1-2009 - Office -	189.1-2009 - Office -	189.1-2009 - Office - CZ4-8 Infil
Conference - CZ4-8	<input type="checkbox"/>			189.1-2009 - Office -	189.1-2009 - Office -	189.1-2009 - Office - CZ4-8 Infil
Corridor - CZ4-8	<input type="checkbox"/>			189.1-2009 - Office -	189.1-2009 - Office -	189.1-2009 - Office - CZ4-8 Infil
MechRoom - CZ4-8	<input type="checkbox"/>			189.1-2009 - Office -	189.1-2009 - Office -	189.1-2009 - Office - CZ4-8 Infil
IT_Room - CZ4-8	<input checked="" type="checkbox"/>			189.1-2009 - Office -	189.1-2009 - Office -	189.1-2009 - Office - CZ4-8 Infil
Reception - Lobby - CZ4-8	<input type="checkbox"/>			189.1-2009 - Office -	189.1-2009 - Office -	189.1-2009 - Office - CZ4-8 Infil
OpenOffice - CZ4-8	<input type="checkbox"/>			189.1-2009 - Office -	189.1-2009 - Office -	189.1-2009 - Office - CZ4-8 Infil

OS:DefaultScheduleSet

Name

Office - Conference - CZ4-8 Schedule Set

Hours of Operation Schedule Name

Office Misc Occ

Number of People Schedule Name

Office Activity

People Activity Level Schedule Name

Office Bldg Light

Lighting Schedule Name

Office Bldg Equip

Electric Equipment Schedule Name

Office Bldg Equip

Gas Equipment Schedule Name

Hot Water Equipment Schedule Name

Infiltration Schedule Name

Office Infil Quarter On

Steam Equipment Schedule Name

Other Equipment Schedule Name

Space Types — Loads

Notes

If you select the “Loads” button in the Space Type tab, you will see a drop zone to create new loads. You can have multiple loads of the same type.

The space types define loads such as lighting or electric equipment as simple area weighted power densities (e.g., W/ft²). However, you can add loads in several possible ways. For example, a space type could contain multiple types of lighting. You might define one lighting load for general lighting using a W/ft² and then add another lighting load for task lighting using W/person.

You can filter the type of loads to show all or only certain types of loads like people.

You can also select an item in the grid and apply it to other space types. Check the space types you want to add that item to and then select the item by clicking on the text (the item should be highlighted in yellow) and hit the “Apply to Selected” for that column.

You can duplicate and delete multiple rows by checking the rows and using the buttons on the bottom left.

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Drop a space type from the Library

Select buttons to change the fields available for the space types

View all loads or filter to just the ones you want to edit

Drag in a load definition from My Model or the Library

Check to select this item and make it available for the multi-edit, duplicate row, and delete row features

Plus: Adds a new space type
2X: Duplicates checked rows
X: Deletes checked rows

Space Type Name	All	Load Name	Multiplier	Definition	Schedule	Activity Schedule (People Only)
	<input type="checkbox"/>		<input type="text" value="1.000000"/>		<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Auditorium PeoplInst	<input type="text" value="1.000000"/>	Auditorium PeopDef	<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Auditorium LightsInst	<input type="text" value="1.000000"/>	Auditorium LightsDef	<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Auditorium ElecInst	<input type="text" value="1.000000"/>	Auditorium ElecDef	<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Pool Auditorium Infil	<input type="text" value="1.000000"/>		<input type="text" value="SecondarySchool Infil"/>	<input type="text" value="SecondarySchool Activ"/>
SecondarySchool Auditorium	<input type="checkbox"/>		<input type="text" value="1.000000"/>		<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Cafeteria PeoplInst	<input type="text" value="1.000000"/>	Cafeteria PeopDef	<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Cafeteria LightsInst	<input type="text" value="1.000000"/>	Cafeteria LightsDef	<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Pool Cafeteria ElecInst	<input type="text" value="1.000000"/>	Pool Cafeteria ElecDef	<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Pool Cafeteria Infil	<input type="text" value="1.000000"/>		<input type="text" value="SecondarySchool Infil"/>	<input type="text" value="SecondarySchool Activ"/>
SecondarySchool Classroom	<input type="checkbox"/>		<input type="text" value="1.000000"/>		<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Classroom PeoplInst	<input type="text" value="1.000000"/>	Classroom PeopDef	<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Classroom LightsInst	<input type="text" value="1.000000"/>	Classroom LightsDef	<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Classroom ElecInst	<input type="text" value="1.000000"/>	Classroom ElecDef	<input type="text" value="SecondarySchool Bldg"/>	<input type="text" value="SecondarySchool Activ"/>
	<input type="checkbox"/>	Pool Classroom Infil	<input type="text" value="1.000000"/>		<input type="text" value="SecondarySchool Infil"/>	<input type="text" value="SecondarySchool Activ"/>

Facility — Building

Notes

On the “Facility” you pick the Building object. This contains top level construction, schedule, or space type assignments, and sets the rotation for the building.

The “Stories” tab lets you add and edit the constructions and schedules by story.

“Shading” is the spot where you can view building level shading groups you created with the SketchUp Plug-in.

“Exterior Equipment” is the spot to add exterior lighting.

Measure tags do not alter the model, but are used by OpenStudio measures

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Facility Building Stories Shading Exterior Equipment

Name:

3 story hotel

Measure Tags (Optional):

Standards Building Type:

Relocatable:

false

Nominal Floor to Ceiling Height:

m

Nominal Floor to Floor Height:

m

Standards Number of Stories:

Standards Number of Above Ground Stories:

Standards Number of Living Units:

North Axis:

0.000000

deg

Space Type:

ASHRAE_3 ClimateZo 1-8 LargeHotel

Default Construction Set:

Hotel Constructi

Default Schedule Set:

Drag From Library

Drop Story

General Custom

Filters: Nominal Z Coordinate > Nominal Z Coordinate <

Story Name	All	Group Rendering Name	Nominal Z Coordinate	Nominal Floor to Floor Height	Nominal Floor to Ceiling Height	Def Constr Na
Story 1	<input type="checkbox"/>		0.000000 m	3.800000 m		
Story 2	<input type="checkbox"/>		3.800000 m	3.800000 m		
Story 3	<input type="checkbox"/>		7.600000 m	3.800000 m		

Space — Properties

Notes

View all the spaces in your model at once or filter down to just the ones you want to edit. You can filter by story, thermal zone, and space type.

The sub-tabs allow you to dig down to the subsurfaces of each space and edit and view properties of each space:

- **Properties** provides general space settings like thermal zone, constructions, and schedules.
- **Loads** is where you can add and edit loads for that individual space.
- **Surfaces** displays the surfaces associated with each space and you can filter and edit the surfaces.
- **Subsurfaces** are shown by the space they are in and also the parent surface. You can filter and edit subsurfaces.
- **Interior Partitions** created in SketchUp with the Plug-in can be viewed on this subtab.
- **Shading** groups created in SketchUp using the Plug-in will be viewable.

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Use the filters to narrow down the display if you are looking for particular spaces

Select individual items to inspect and edit them in the "Edit" panel on the right

Check boxes work to enable the buttons below and the multi-edit option

Thermal Zones

Notes

The Thermal Zones tab has four main functions.

- 1. Turn ideal air loads on and off. This is a basic way to get heating and cooling load set points without having to define a detailed HVAC system.
- 2. Attach zone equipment to your zone, for example a Packaged Terminal Air Conditioner.
- 3. Assign thermostats to your thermal zone.
- 4. Set Sizing Parameters

The steps for using multi-edit for adding a copy of an item to other thermal zones are below:

- 1. After dragging in an item from the library, select it and edit any features you need to in the “Edit” panel on the right.
- 2. Check the rows you would like to add this same component to. Note that when you check the rows the yellow highlight disappears on the component you edited in step 1.
- 3. After selecting the rows you would like to apply the component to, then click the text of the item you would like to duplicate. It should turn yellow again.
- 4. Hit the “Apply to Selected” button at the top of the column containing that component and the yellow highlighted component will be copied to the checked rows.

You can duplicate and delete multiple rows by checking the rows and using the buttons on the bottom left.

Tip

A Thermal Zone can’t have ideal air loads on and have an Air Loop or Zone Equipment at the same time. If you try to use both, the previously selected system will be disabled.

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Thermal Zones

HVAC Systems

Cooling Sizing Parameters

Heating Sizing Parameters

Custom

Name	All	Turn On Ideal Air Loads	Air Loop Name	Zone Equipment	Cooling Thermostat Schedule	Heating Thermostat Schedule	Hu
Story 1 Core Space	<input type="checkbox"/>	<input type="checkbox"/>	1 VAV with Reheat	Duct VAV Reheat 8	Cooling Setpoint	Heating Setpoint	
ast Perimeter Space	<input type="checkbox"/>	<input type="checkbox"/>	1 VAV with Reheat	Duct VAV Reheat 5	Cooling Setpoint	Heating Setpoint	
th Perimeter Space	<input type="checkbox"/>	<input type="checkbox"/>	1 VAV with Reheat	Duct VAV Reheat 6	Cooling Setpoint	Heating Setpoint	
th Perimeter Space	<input type="checkbox"/>	<input type="checkbox"/>	1 VAV with Reheat	Duct VAV Reheat 4	Cooling Setpoint	Heating Setpoint	
est Perimeter Space	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1 VAV with Reheat	Duct VAV Reheat 7	Cooling Setpoint	Heating Setpoint	
Story 2 Core Space	<input type="checkbox"/>	<input type="checkbox"/>	2 VAV with Reheat	Duct VAV Reheat 10	Cooling Setpoint	Heating Setpoint	
ast Perimeter Space	<input type="checkbox"/>	<input type="checkbox"/>	2 VAV with Reheat	Duct VAV Reheat 9	Cooling Setpoint	Heating Setpoint	
th Perimeter Space	<input type="checkbox"/>	<input type="checkbox"/>	2 VAV with Reheat	Duct VAV Reheat 11	Cooling Setpoint	Heating Setpoint	

+

2X

X

Plus: Adds a new thermal zone

2X: Duplicates checked rows

X: Deletes checked rows

My Model

Library

Edit

OS:AirTerminal:SingleDuct:VAV:Reheat

Name

Air Terminal Single Duct VAV Reheat 6

Maximum Air Flow Rate

Hard Sized

Autocalculate

m³/s

Autosized

Autosize

Zone Minimum Air Flow Input Method

Constant

Constant Minimum Air Flow Fraction

0.3

Fixed Minimum Air Flow Rate

0

m³/s

Minimum Air Flow Fraction Schedule Name

Maximum Hot Water or Steam Flow Rate

Hard Sized

Autocalculate

m³/s

Autosized

Autosize

Minimum Hot Water or Steam Flow Rate

0

m³/s

Convergence Tolerance

0.001

Damper Heating Action

If Thermal Zone is on an air loop, Ideal Air Loads will be turned off

Select this check box to add it to the Custom button option above

Select buttons to change the fields available for the thermal zones

“Apply to Selected” button at top of column will apply the yellow highlighted item to other checked rows highlighted in blue

Check to select this item and make it available for the multi-edit column buttons and the duplicate row, and delete row features

Multiple zone equipment objects can be attached to a thermal zone

Delete the single instance of item from grid

Edit the yellow highlighted item here

HVAC Systems — Air Loop

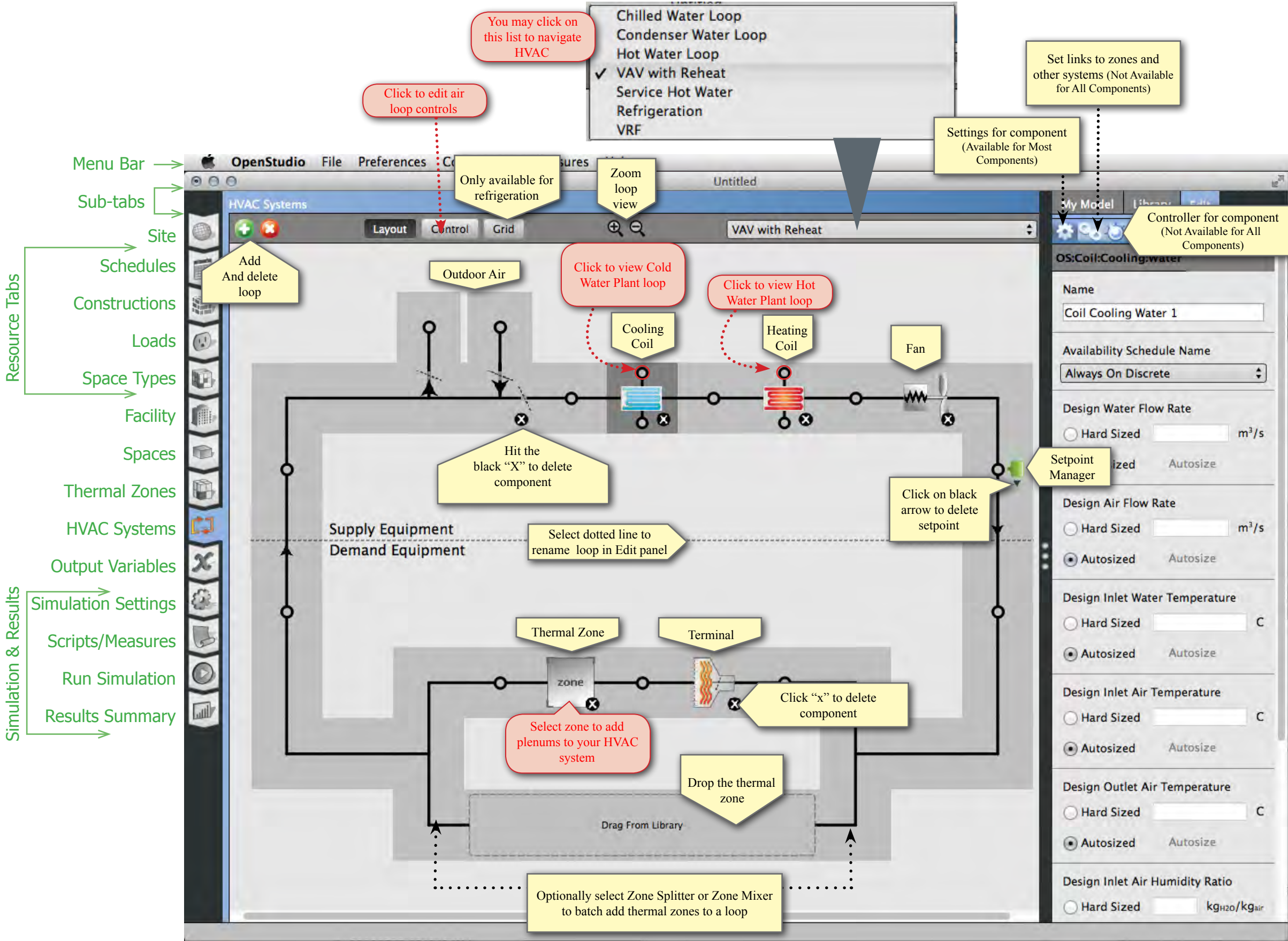
Notes

The HVAC Systems tab is used to create, inspect, and edit air and plant loops. The green “+” at the top left is used to add template or empty loops, and the “x” next to it will delete them. The pull-down at the top right of the body is to select which loop or system to display.

The top half of the loop is for supply-side objects, the bottom half is for demand. Thermal Zones and other objects can be dragged onto drop zones or nodes. Optionally you can select the splitter or mixer to bring up a list of Thermal Zones, checking the ones you want included in the loop.

When adding a template loop, there are four images within the icon. From left to right they represent the type of cooling, heating, fan, and terminal unit, in the template. The example below has cold and hot water, a variable speed fan, and a hot water reheat terminal unit.

To delete a setpoint manager click the black arrow to bring up the delete option.

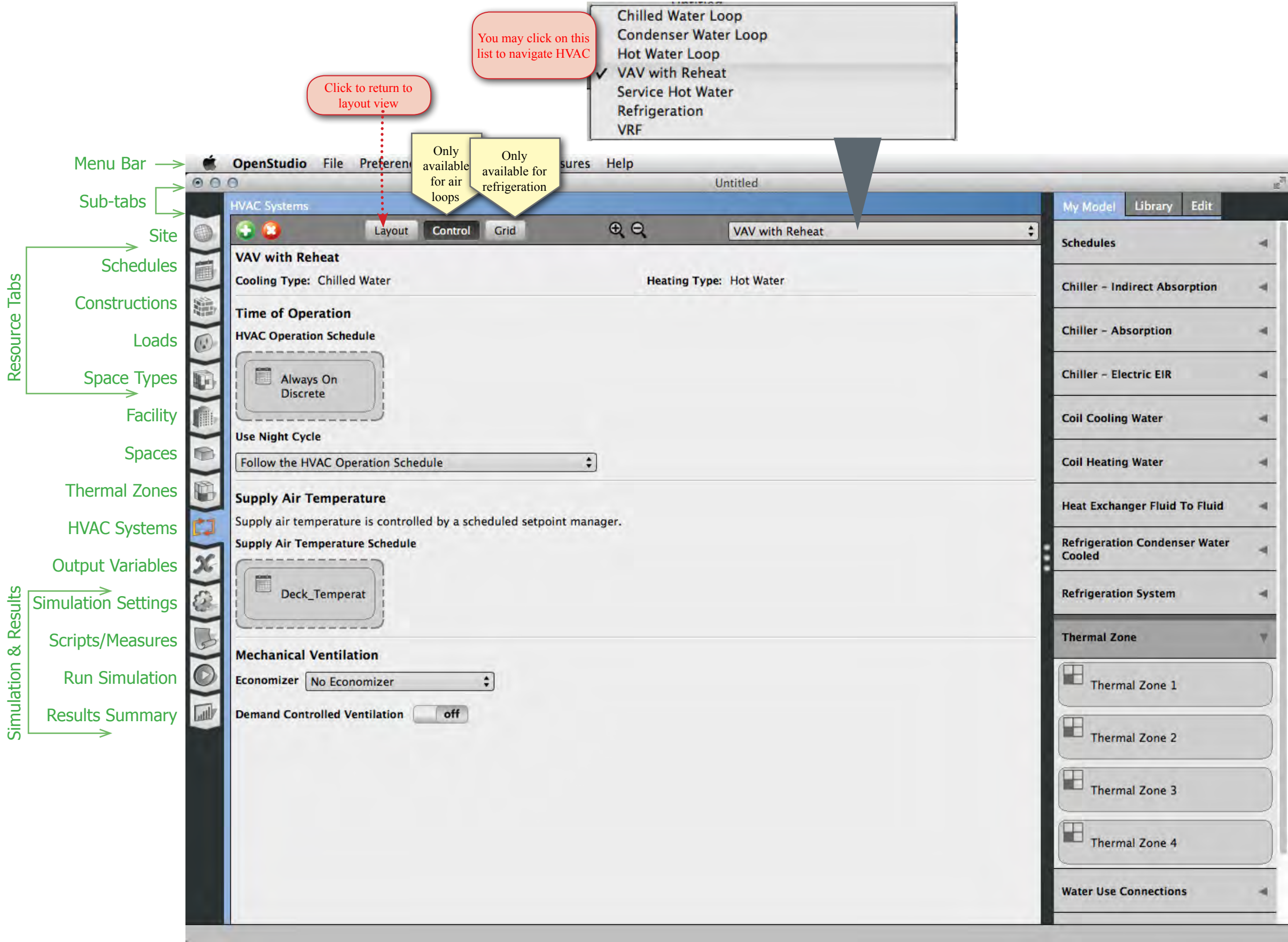


HVAC Systems — Controls View

Notes

The controls view is only available for the air loops. With an air loop selected in “Layout” view you can switched to “Control” view.

In this view you can edit the time of operation, night cycle, supply air temperature, and mechanical ventilation.



HVAC Systems — Cold Water Loop

Notes

In the cold water loop the cooling coil that had been a supply side object on the air loop is now a demand object.

The supply side has a pump and a water cooled chiller. The adiabatic pipes are a necessary part of the loop. There are no attributes to set for the pipes.

You can click on the chiller to drill down further to the condenser loop. Or you can click on the cooling coil to go back to the air loop.



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Only available for air loops

Only available for refrigeration

Add and delete air and plant loops

Zoom Loop View

Click to View Condenser Loop

Click to view air loop

Select dotted line to rename and edit loop

Chilled Water Loop

Condenser Water Loop

Hot Water Loop

VAV with Reheat

Service Hot Water

Refrigeration

VRF

Changing the plant name in the "Edit" panel will change the default name in the dropdown

Most loop components can be edited

Setpoint Manager

OS:PlantLoop

Name

Chilled Water Loop

Fluid Type

Water

User Defined Fluid Type

Loop Temperature Setpoint Node Name

Node 32

Maximum Loop Temperature

100.0

C

Minimum Loop Temperature

0.0

C

Maximum Loop Flow Rate

Hard Sized

Autosized

Autosize

m³/s

Minimum Loop Flow Rate

0.0

m³/s

Plant Loop Volume

Autocalculate

m³

OS:Sizing:Plant

Loop Type

Cooling

HVAC Systems —
Condenser Loop

Notes

In the condenser loop the chiller that had been a supply side object on the cold water loop is now a demand object.

The supply side has a pump and a cooling tower. As with the cold water loop the adiabatic pipes are a necessary part of the loop.

You can click on the chiller to drill to go back to the cold water loop.

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You May Click on This List to Navigate HVAC

Chilled Water Loop

Condenser Water Loop

Hot Water Loop

VAV with Reheat

Service Hot Water

Refrigeration

VRF

Only available for air loops

Zoom loop view

Only available for refrigeration

Add and delete air and plant loops

Cooling tower

Adiabatic pipe

Setpoint manager

Click to View Cold Water Plant Loop

Chiller

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Condenser Water Loop

My Model

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Edit

OS: CoolingTower:SingleSpeed

Name

Cooling Tower Single Speed 1

Design Water Flow Rate

Hard Sized

Autosized

Design Air Flow Rate

Hard Sized

Autosized

Fan Power at Design Air Flow Rate

Hard Sized

Autosized

U-Factor Times Area Value at Design Air Flow Rate

Hard Sized

Autosized

Air Flow Rate in Free Convection Regime

Hard Sized

Autosized

U-Factor Times Area Value at Free Convection Air Flow Rate

Hard Sized

Autosized

HVAC Systems —
Hot Water Loop


Notes

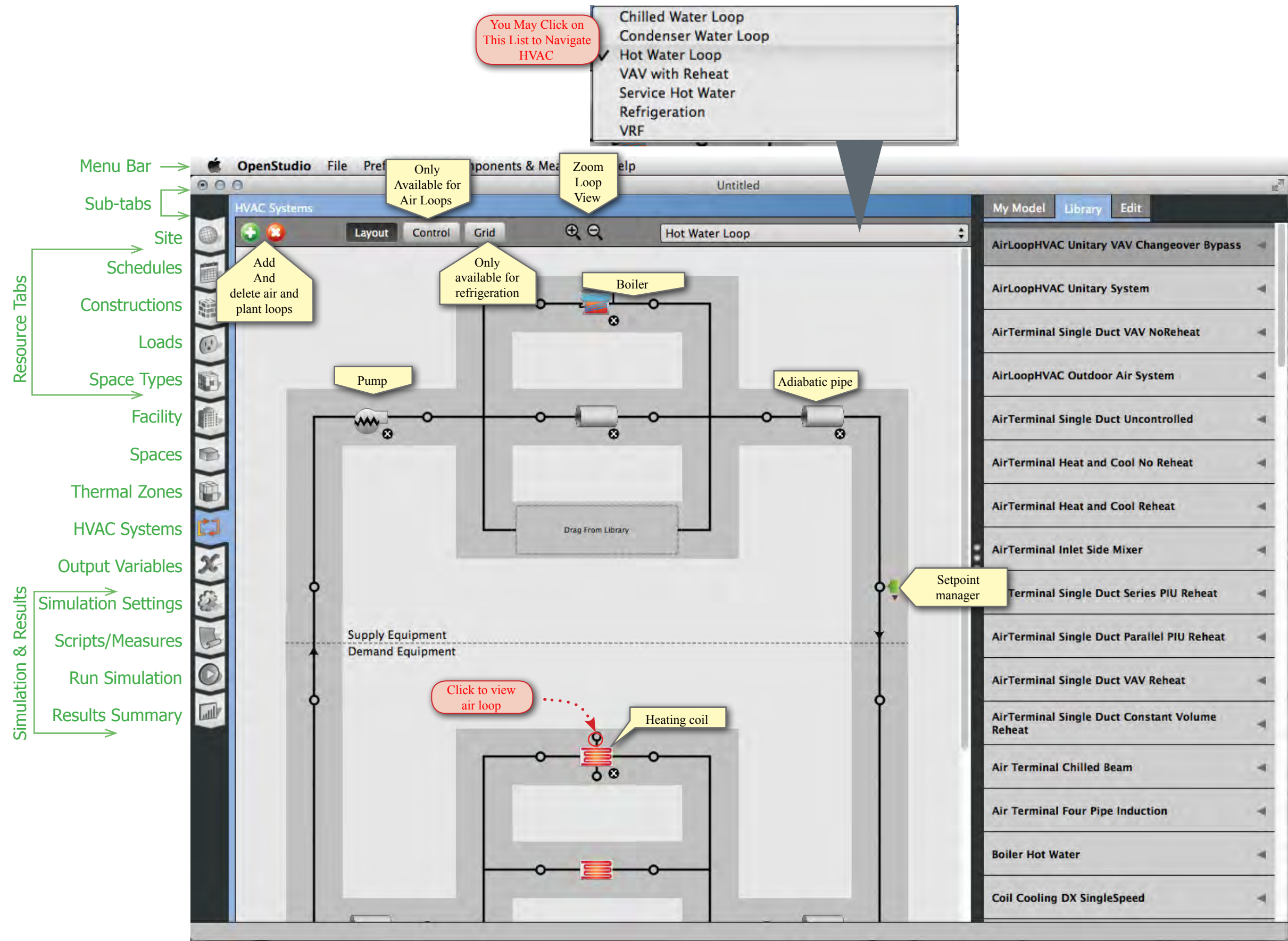
In the hot water loop the heating coil that had been a supply side object on the air loop is now a demand object.

The supply side has a pump and a boiler. The boiler can use a variety of fuels. The adiabatic pipes are a necessary part of the loop. There are no attributes to set for the pipes.

You can click on the heating coil to go back to the air loop.

The heating coils without links represent the reheat terminals for each connected thermal zone.





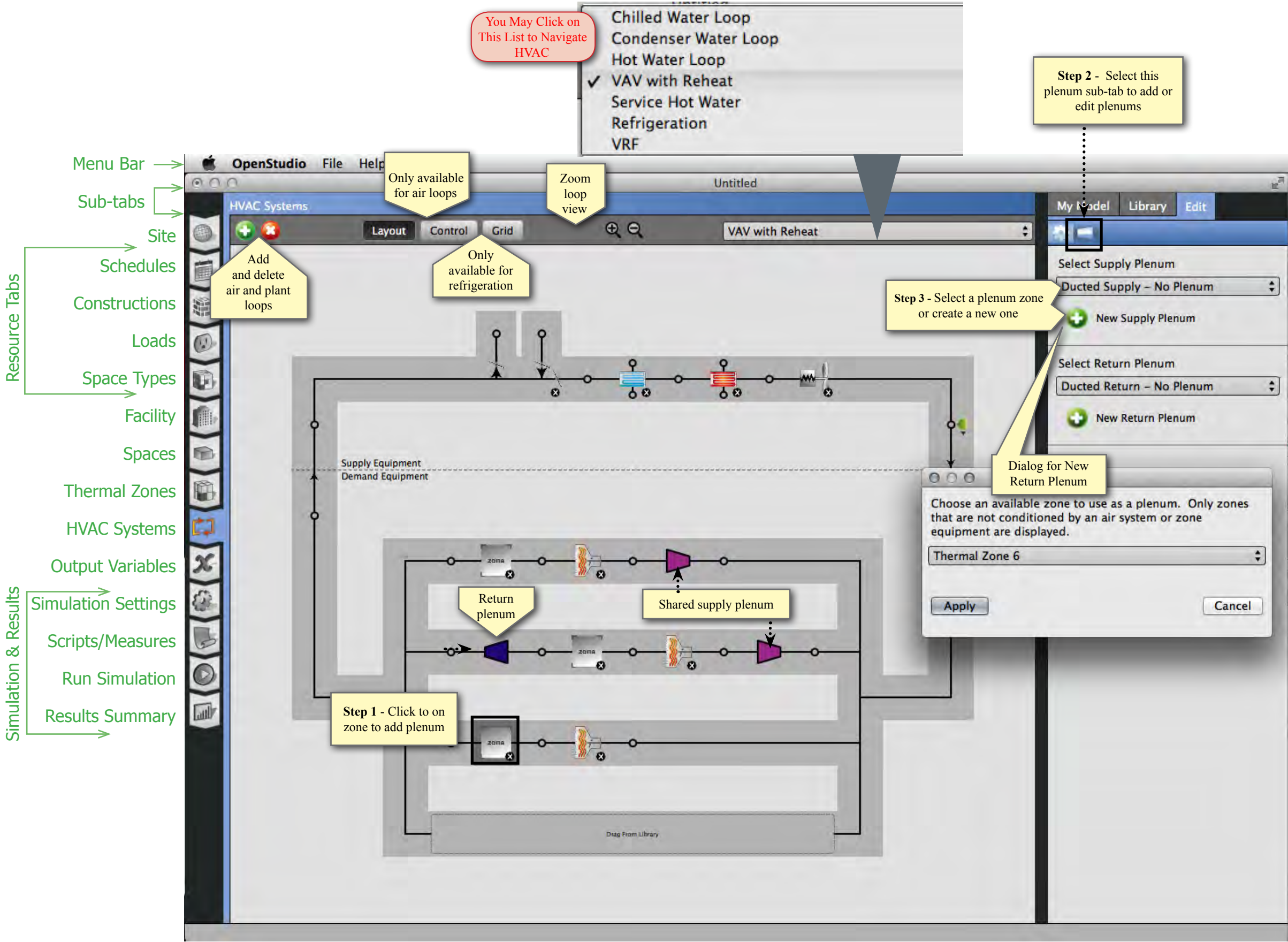
HVAC Systems — Plenums

Notes

To add supply and return plenum zones:

- 1. To access the plenum editor, select the zone on the layout view.
- 2. Select the Edit tab on the right panel and click on the plenum icon on the blue bar.
- 3. Choose a plenum from the drop down list or create a new plenum zone but selecting the green add button. The zones available to be plenums will be selectable in a dialog. Create new zones for plenums in the Thermal Zones tab on the left.

Shared plenums will be colored the same and will match the color selected for the plenum zone on the Thermal Zones tab.



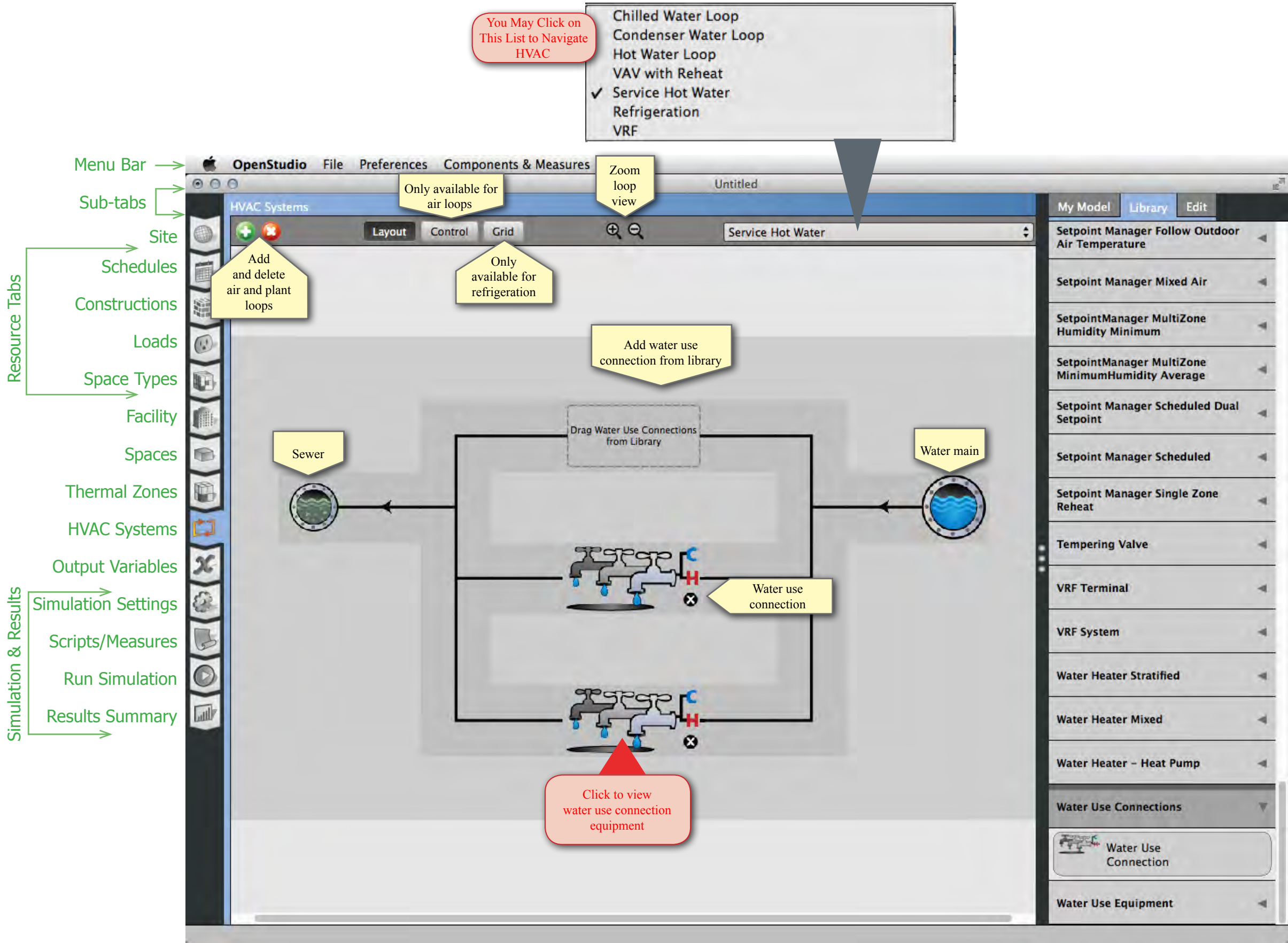
HVAC Systems —Water Mains Editor

Notes

The first view into the HVAC tab will be the water mains editor, which shows as “Service Water” on loops pulldown list.

Water enters the system at the right and leave at the Sewer on the left. One or more water use connections can be added in the middle.

Clicking a water use connection will take you to a model window where you can add water use equipment.



HVAC Systems — Water Use Connection

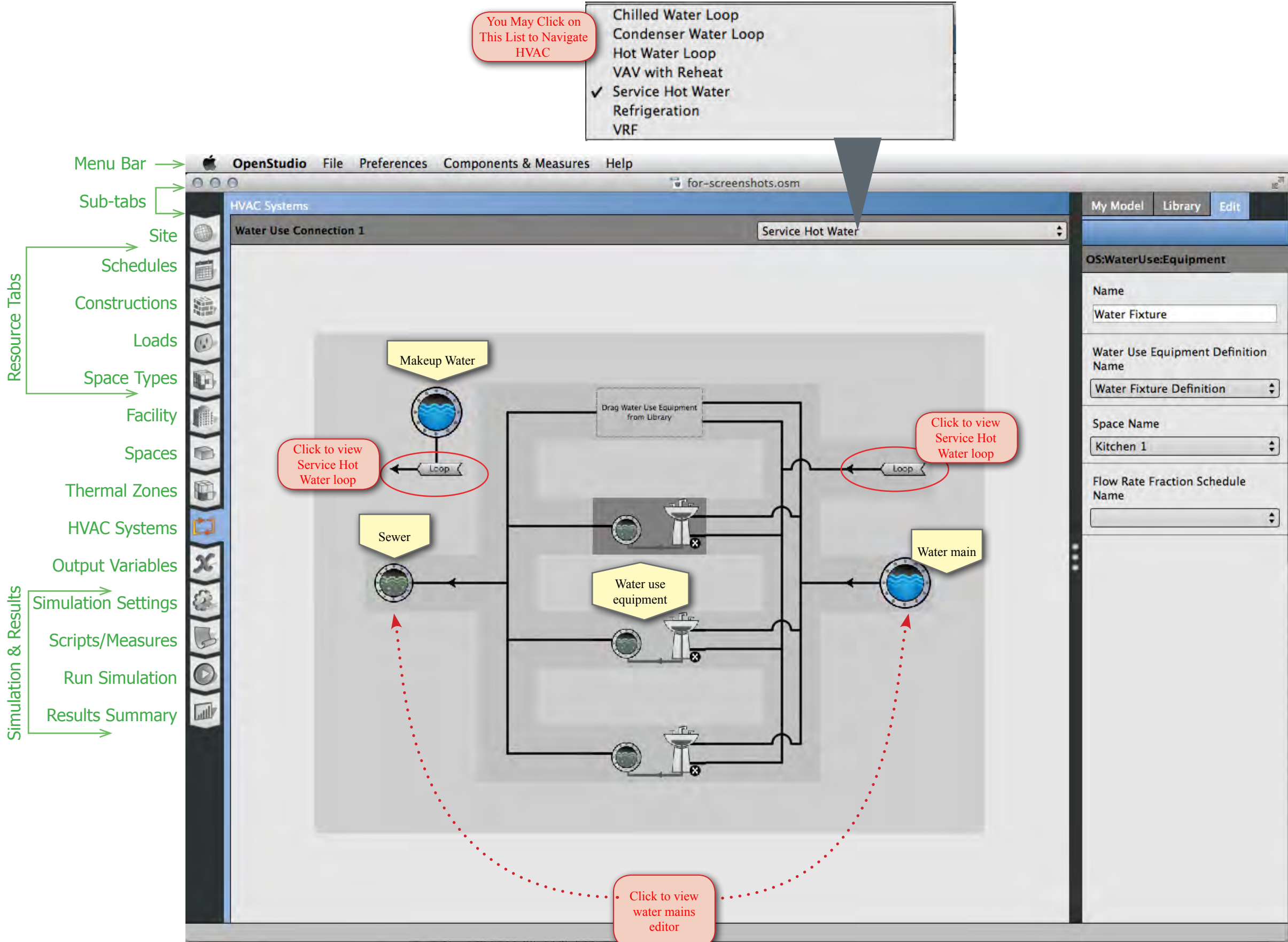
Notes

Dragging a water use equipment object into the water use connection will create an instance of that definition. Much like lights, people and other loads, there is a fractional schedule to define usage patterns.

Optionally you can associate the equipment with a space. There is no direct energy use to the space, but heat from the equipment will be added to the space.

The equipment can be anything that uses water, hot or cold. The definition contains a peak flow rate and a target temperature schedule. Hot and cold water will mix to reach the target temperature at the fixture.

Click the water main, sewer, or makeup water to go back to the water mains editor. If you have a plant loop associated with the water use connection the "Loop" button will take you to the loop.



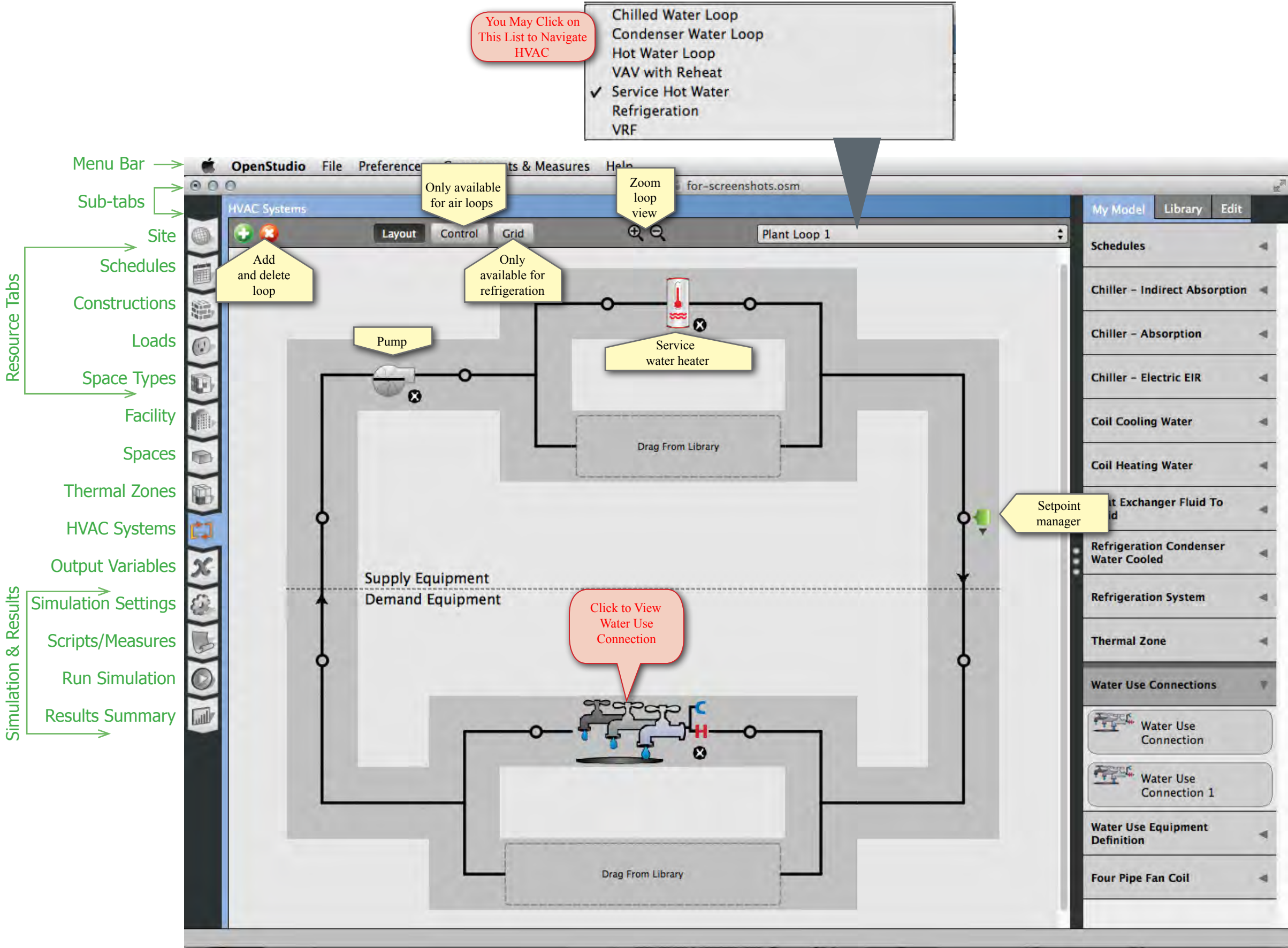
HVAC — Service Water Heater Loop

Notes

The service water heater loop starts off just like any other plant loop, but unlike the ones serving an air loop, this plant loop as water use connections on the demand side, and a hot water heater, vs. a boiler on the supply side. A pump and setpoint manager are also necessary.

Both the hot water heater and the setpoint manager require a temperature schedule. Generally these should use the same schedule, which should have a temperature high enough to meet the setpoints at the water use equipment objects.

The energy that goes into the hot water heater will show up in the results page as "Water Systems". The pump is not included in this. The results page does not show water usage, but you can look at the Annual Building Utility Performance Summary (ABUPS) report in ResultsViewer to see water usage.



HVAC — Add Refrigeration System

Notes

The refrigeration system interface can be accessed by selecting refrigeration from the drop down menu.

To add a refrigeration system select one from the library and add drag it to the drop zone.

Click on the zoom button by the name of the refrigeration system to go to a view of that system, add components from the library.

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Grid View of Refrigeration

Not used in refrigeration

Only available for air loops

Add by Dragging a Refrigeration System from Library

Zoom in to Single Refrigeration System

Delete Refrigeration System

Summary View of Cases

Chilled Water Loop

Condenser Water Loop

Hot Water Loop

VAV with Reheat

Service Hot Water

Refrigeration

VRF

Drop Refrigeration System

Cascade System

Refrigeration System

Refrigeration System 1

Refrigeration System Template

Cascade System

Refrigeration System

Refrigeration Walkin

Setpoint Manager Warmest Temp and Flow

HVAC — Edit Refrigeration System in Layout View

Notes

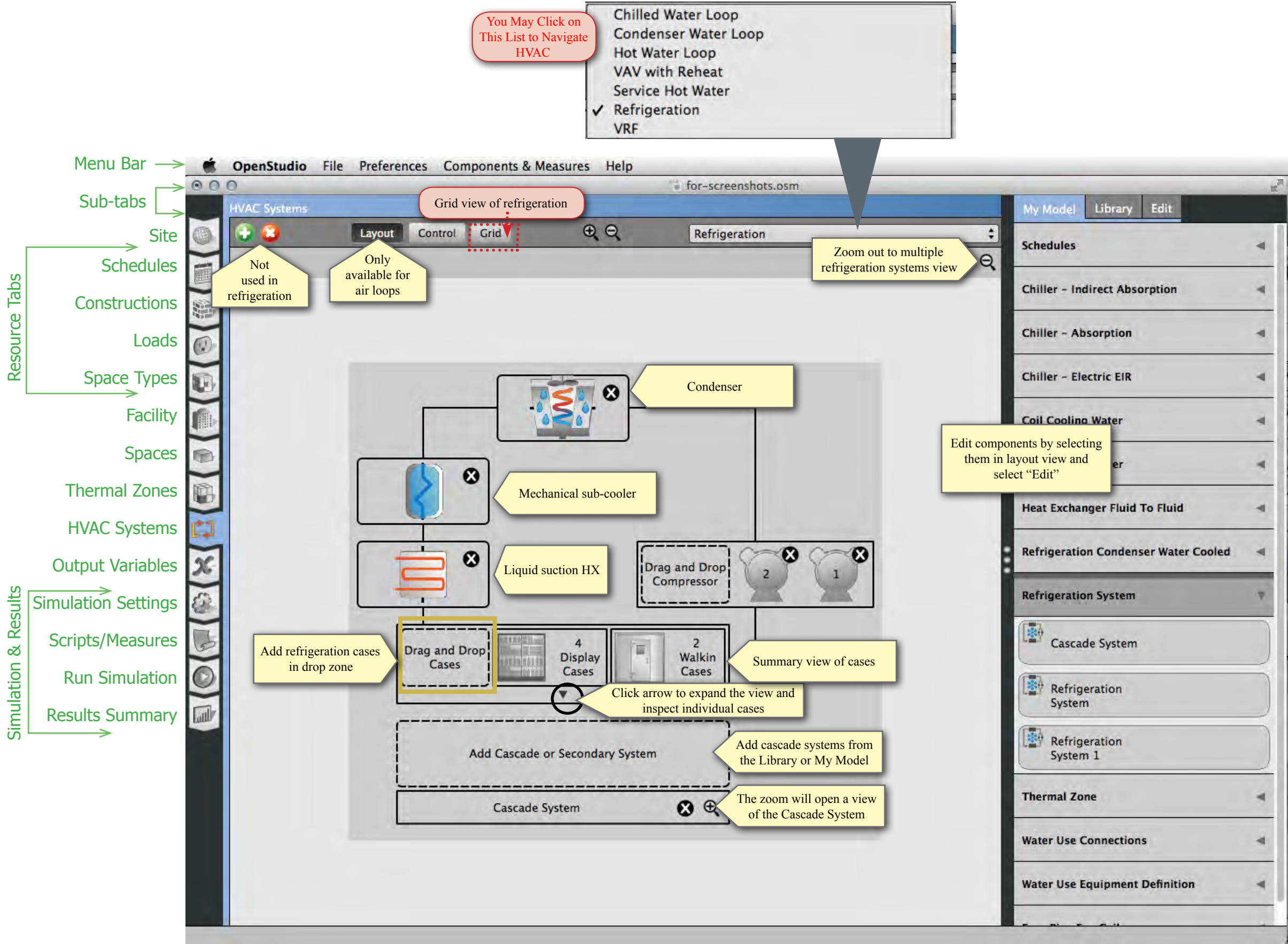
This zoomed in view provides the layout view of one refrigeration rack. You may add cases by dragging them on to the "Drag and Drop Cases" drop zone.

Drop zones are provided to accommodate systems with a mechanical subcooler and a Suction Line Heat Exchanger (SLHX).

The small arrow at the bottom of the refrigeration case summary will open and expanded view of cases. Each case can be selected and edited in the Edit panel on the right.

Cascade systems can be added by dragging the from "My Model" or the "Library."

An alternate view of the refrigeration systems is provided by the grid view.



HVAC — Edit Refrigeration Systems in Grid View

Notes

The refrigeration grid view provides a method for entering case settings in a spreadsheet style. Cases can be added, assigned to racks, and edited in this view.

There are two major divisions, one for Display Cases and another for Walk-ins. Under each division a drop box is available to add new cases. There are also buttons to move through the case settings and enter the data on each case.

Create your own custom view of this information by checking the box on the right of the column header. Checked columns will show up under the Custom button.

In this version you have to delete cases in the layout view.

Tips

User-selected, custom fields will be saved when the application is closed, and will automatically load when the application is next started.

Cases must be can be deleted from the layout view but not the grid view.

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Drop cases here to add to add new cases to a system

Return to Layout view of refrigeration

You May Click on This List to Navigate HVAC

Chilled Water Loop
Condenser Water Loop
Hot Water Loop
VAV with Reheat
Service Hot Water
✓ Refrigeration
VRF

Click on the buttons to fill in the inputs for that section. The darker button is the one selected.

Select this cell at the top of a column to make this column show up in the Custom section

When selecting a model object in a combo box, the available list of model objects has been filtered to only list valid objects for that particular application.

Assign cases to racks under the General Section

Drop walk-in cases here to add to add new cases to a system

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Display Cases

Drop Case

General

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Cooling Capacity

Fan

Lighting

Case Anti-Sweat Heaters

Defrost And Restocking

Custom

Name	All	Rack	Thermal Zone	Case Length
Refrigerated Case	<input type="checkbox"/>	Cascade System	Thermal Zone 1	3.660000 m
Refrigerated Case 1	<input type="checkbox"/>	Cascade System	Thermal Zone 1	3.660000 m
Refrigerated Case 2	<input type="checkbox"/>	Cascade System	Thermal Zone 1	3.660000 m
Refrigerated Case 3	<input type="checkbox"/>	Cascade System	Thermal Zone 1	3.660000 m
Refrigerated Case 4	<input type="checkbox"/>	Cascade System	Thermal Zone 2	3.660000 m
Refrigerated Case 5	<input type="checkbox"/>	Cascade System	Thermal Zone 2	3.660000 m
Refrigerated Case 6	<input type="checkbox"/>	Refrigeration System	Thermal Zone 2	3.660000 m
Refrigerated Case 7	<input type="checkbox"/>	Refrigeration System	Thermal Zone 2	3.660000 m

Walk Ins

Drop Walk In

General

Dimensions

Construction

Operation

Fans

Lighting

Heating

Defrost

Restocking

Custom

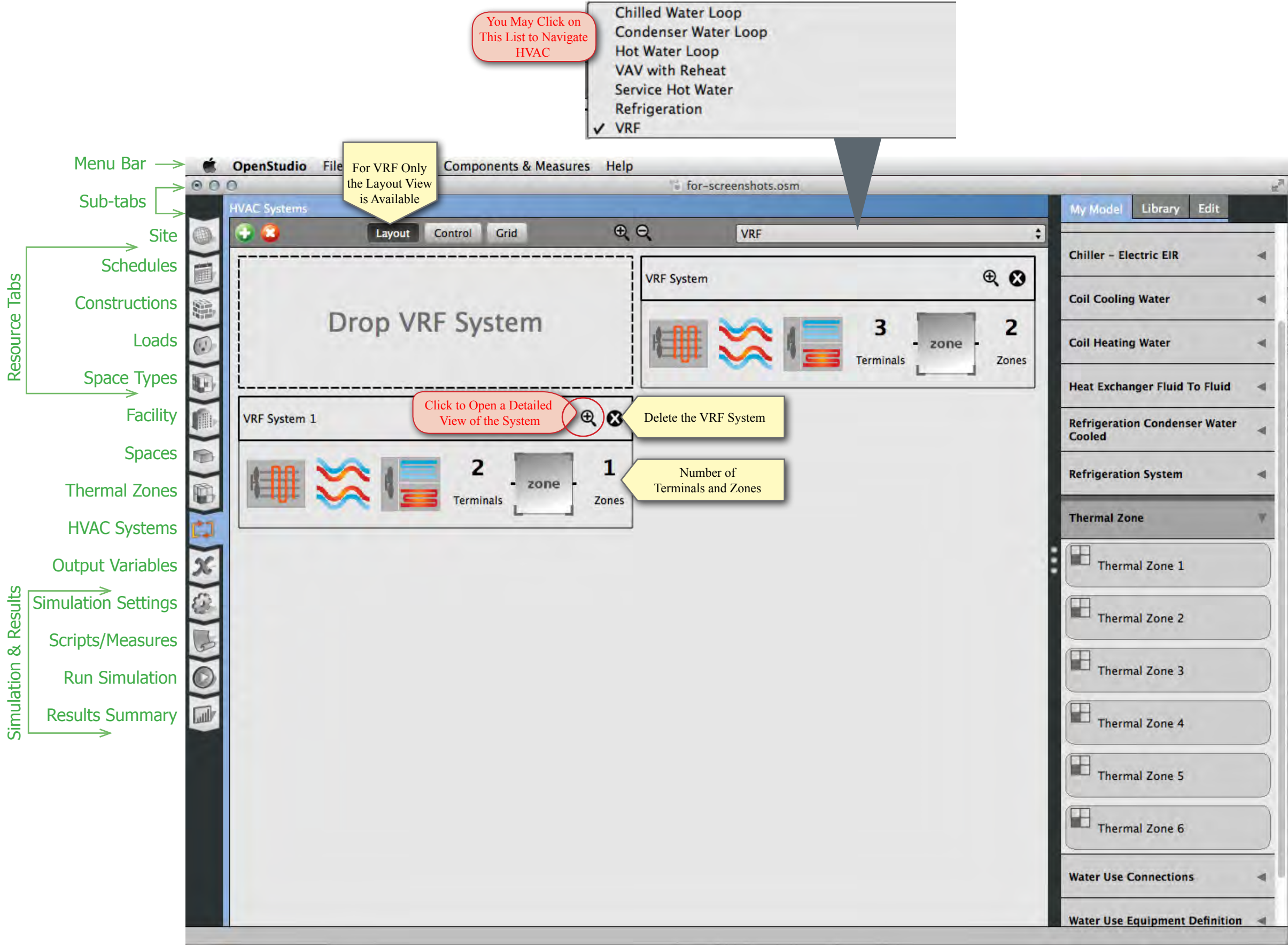
Name	All	Rack	Thermal Zone
Walk In Cooler	<input type="checkbox"/>	Cascade System	

HVAC — Add Variable Refrigerant Flow (VRF) System

Notes

Variable refrigerant flow (VRF) systems can be added by dragging them onto the large drop zone from the library.

This view provides a view of all the VRF systems in the model. The zoom icon by the name of the system will open a detailed view of that system. This single system view is shown on the next page.



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HVAC — Edit Variable Refrigerant Flow (VRF)

Notes

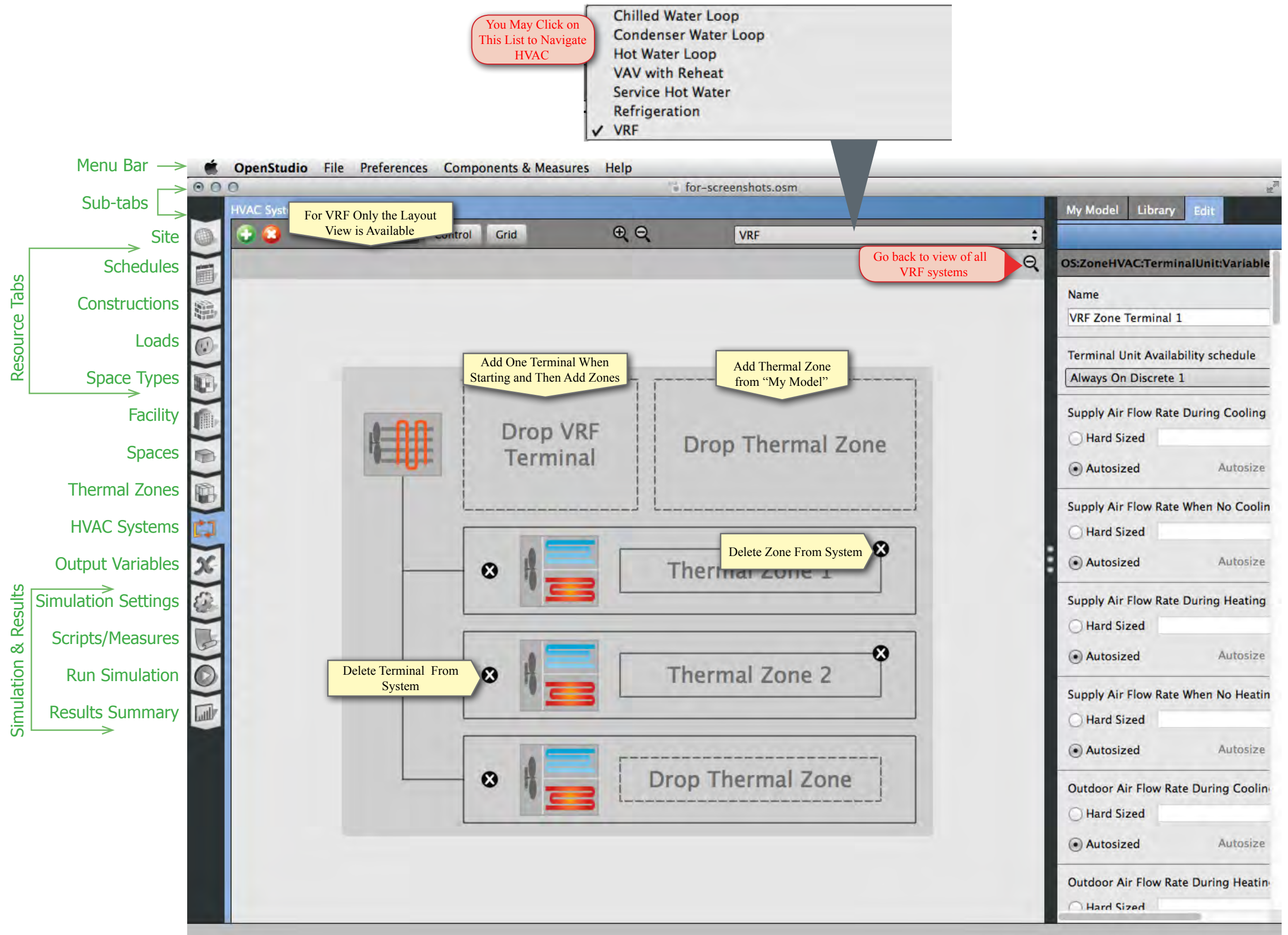
To create your VRF system, start by dropping a terminal from the “Library” onto the drop zone. Then add thermal zones from “My Model.” When a thermal zone is added a new VRF terminal will automatically be created.

Set the terminal settings by selecting the terminal and editing in the “Edit” tab on the right.

More than one terminal can connect with the same zone. Just drag the zone to the drop area again to add another connection.

Tip

Add one thermal zone and edit the settings in the “Edit” tab and when you add a new zone to the system, the settings from that terminal will be applied to the new one.



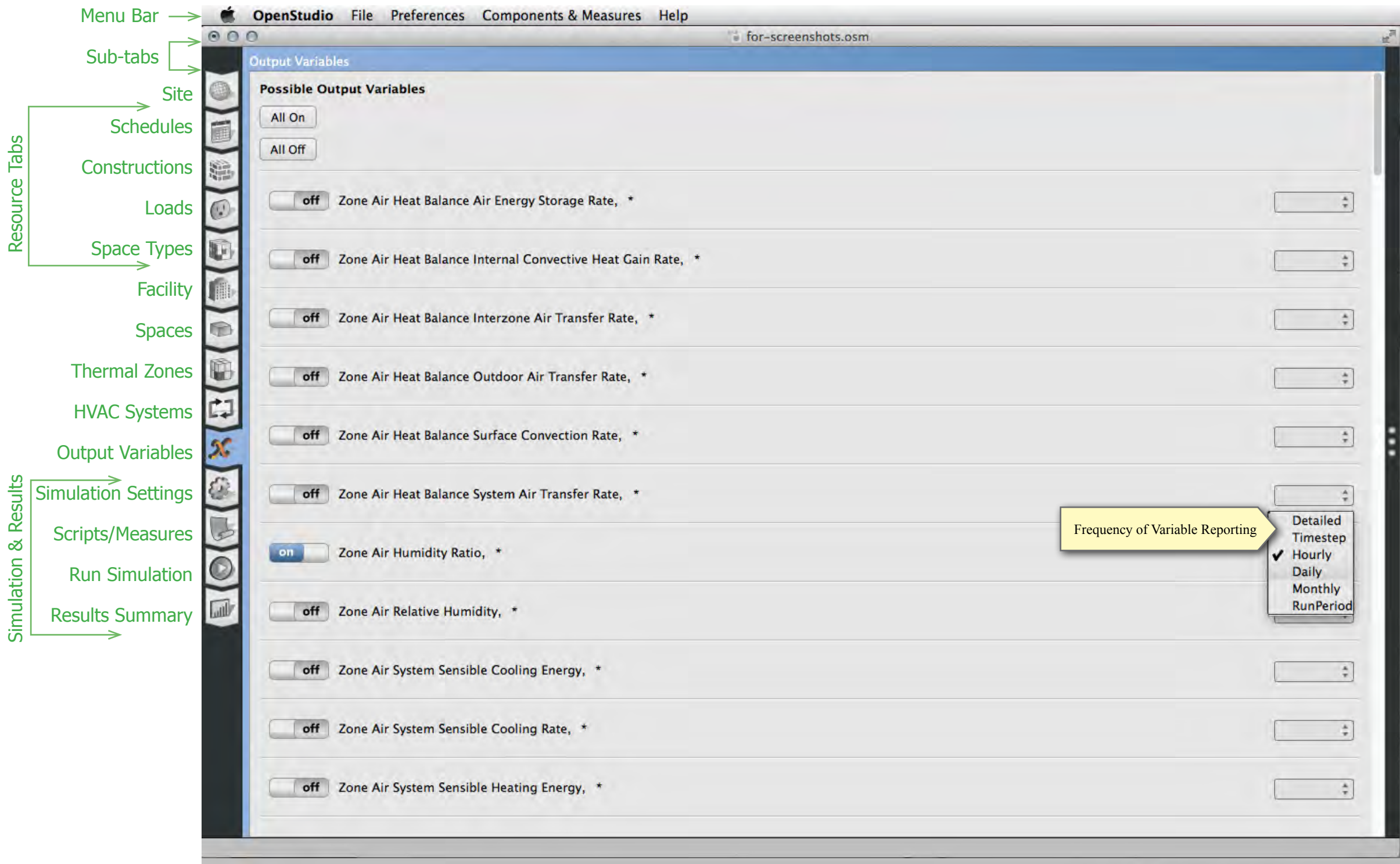
Output Variables

Notes

The Output Variables tab creates a list of variables based on the type of objects you have in your model. You can then turn them on or off and set the frequency of reporting.

These variables populate the SQL file generated by EnergyPlus with annual time series results data. You can view them in ResultsViewer. The Results Summary tab in this application is not affected by the variable requests.

It will not offer a comprehensive list of variables. If you want to add a variable that is not here or name a specific object to report, you can accomplish this by using the "Add Output Variable" measure from the Building Component Library (<http://bcl.nrel.gov/node/37843>).

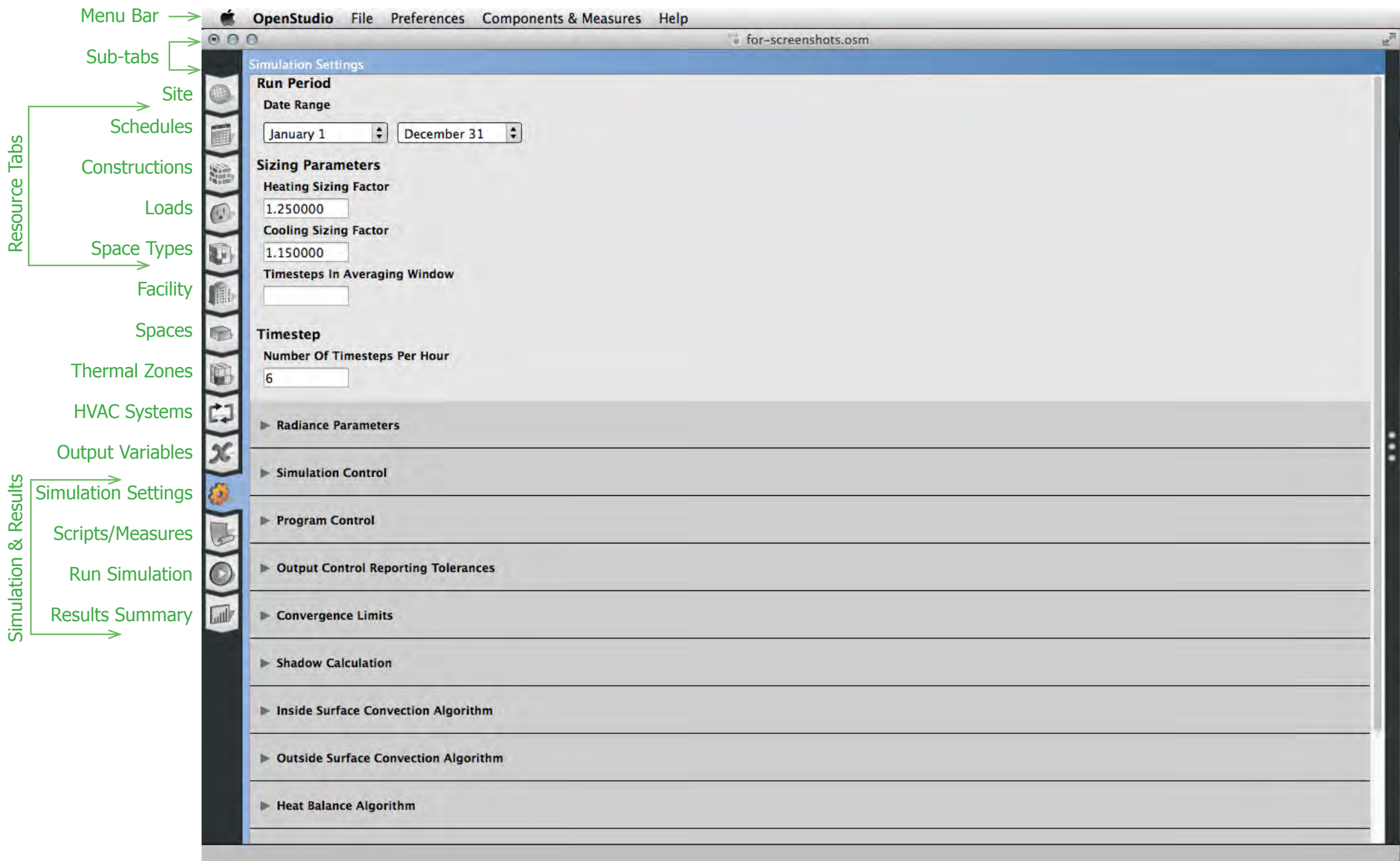


Simulation Settings

Notes

The Simulation Settings tab lets you inspect and customize many of the simulation settings used by EnergyPlus.

- RunPeriod
- SimulationControl
- SizingParameters
- ProgramControl
- Timestep
- OutputControlReportingTolerances
- ConvergenceLimits
- ShadowCalculation
- SurfaceConvectionAlgorithmInside
- SurfaceConvectionAlgorithmOutside
- HeatBalanceAlgorithm
- ZoneAirHeatBalanceAlgorithm
- ZoneAirContaminantBalance
- ZoneCapacitanceMultipleResearchSpecial



Measures — Add to Simulation Workflow

Notes

Download measures from The [Building Component Library \(BCL\)](#). Drag measures from the library to the central panel.

- There are three types of measures:
- **OpenStudio Measures** are run on the OSM model before it is converted to an IDF.
 - **EnergyPlus Measures** can be run on the IDF file before it is handed to EnergyPlus.
 - **Reporting measures** produce reports to chart results, provide quality assurance, and quality control on models.

By selecting the measure and selecting the right “Edit” tab, inputs for the measure can be entered and adjusted.

The screenshot displays the OpenStudio 1.9.0 application window. The interface is divided into several key areas, each annotated with green arrows and labels:

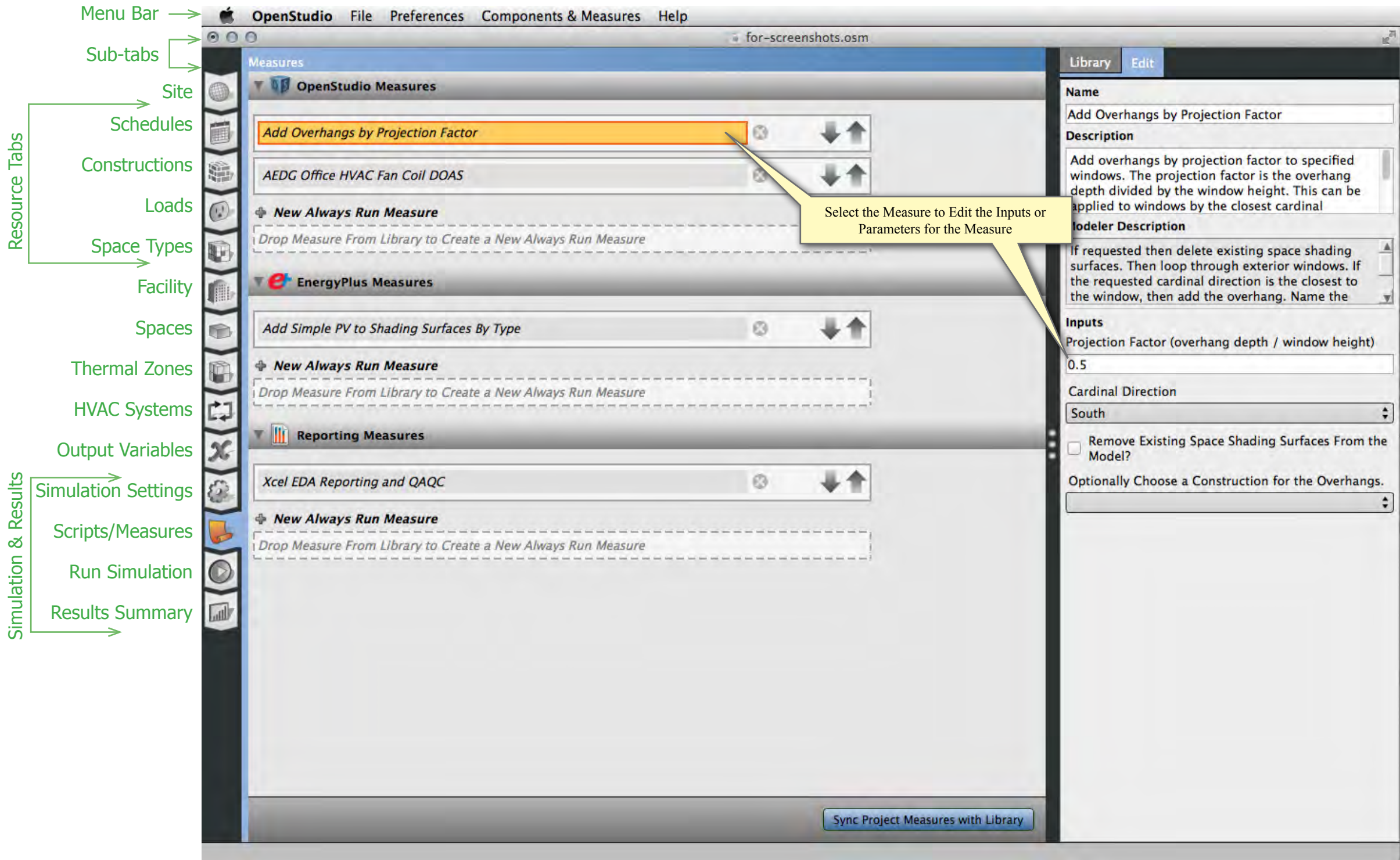
- Menu Bar:** Located at the top, containing 'OpenStudio', 'File', 'Preferences', 'Components & Measures', and 'Help'.
- Sub-tabs:** Located below the menu bar, including 'Measures', 'Library', and 'Edit'.
- Resource Tabs:** A vertical sidebar on the left containing icons and labels for 'Site', 'Schedules', 'Constructions', 'Loads', 'Space Types', 'Facility', 'Spaces', 'Thermal Zones', 'HVAC Systems', 'Output Variables', 'Simulation Settings', 'Scripts/Measures', 'Run Simulation', and 'Results Summary'.
- Measures Panel:** The central workspace showing a list of measures categorized into 'OpenStudio Measures', 'EnergyPlus Measures', and 'Reporting Measures'. Annotations include:
 - 'Move Measure Up or Down In Order of Application to Model' pointing to up/down arrows.
 - 'Select a Measure to Edit Inputs' pointing to a measure entry.
 - 'Drag measures here to apply to model' pointing to a dashed box for creating new always-run measures.
- Library Panel:** A sidebar on the right showing a hierarchical list of components from the Building Component Library (BCL), such as 'Electric Lighting', 'Equipment', 'HVAC', and 'Refrigeration'. An annotation 'Open your measure folder' points to the 'my' folder icon at the bottom.
- Bottom Bar:** Contains buttons for 'Sync Project Measures with Library' (annotated with 'Updates the Current Instances of Measures Used in Current Project') and 'Find Measures on BCL' (annotated with 'Download Measures from the Online BCL'). A '+x2' button is also present, annotated with 'Creates a new measure' and 'Duplicates A Measure For You To Edit To Create Your Own Measure'.

Measures — Edit Inputs

Notes

By selecting the measure and selecting the right “Edit” tab, inputs for the measure can be entered and adjusted.

Write your own measures by studying the guide on the OpenStudio site at: http://nrel.github.io/OpenStudio-user-documentation/reference/measure_writing_guide/.



Run Simulation — Output

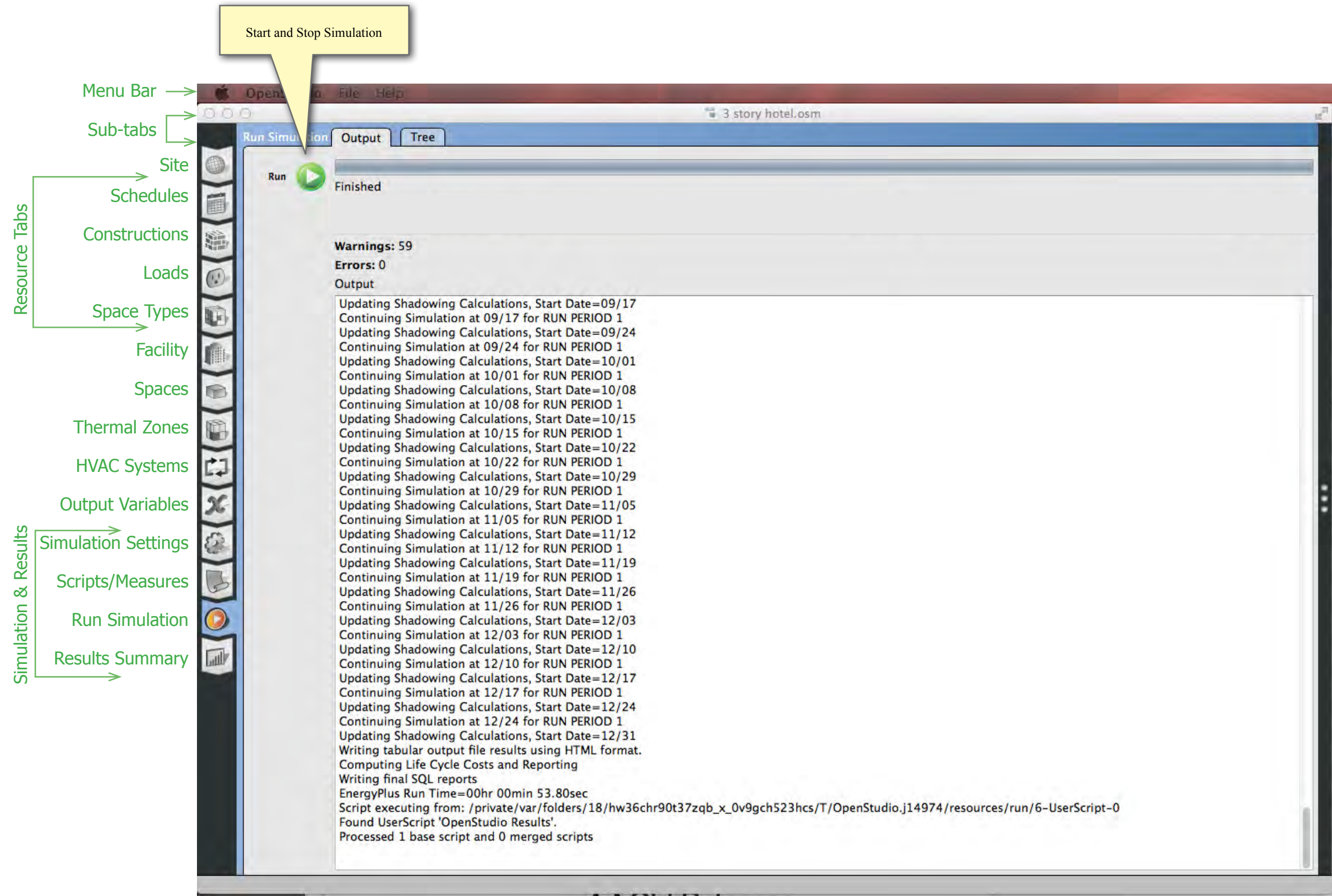
Notes

The Run Simulation tab is used to run a simulation. Clicking the green arrow starts the simulation. When the progress bar reaches 100% it is done.

With OpenStudio 1.9.0 to use Radiance for daylighting calculations you must add the Radiance measure on the Measures tab.

The output windows shows standard output that you can look at to follow the simulation's progress.

Click the Tree sub-tab in the screenshot to the right to see the RunManager job workflow and to see how to access results files.



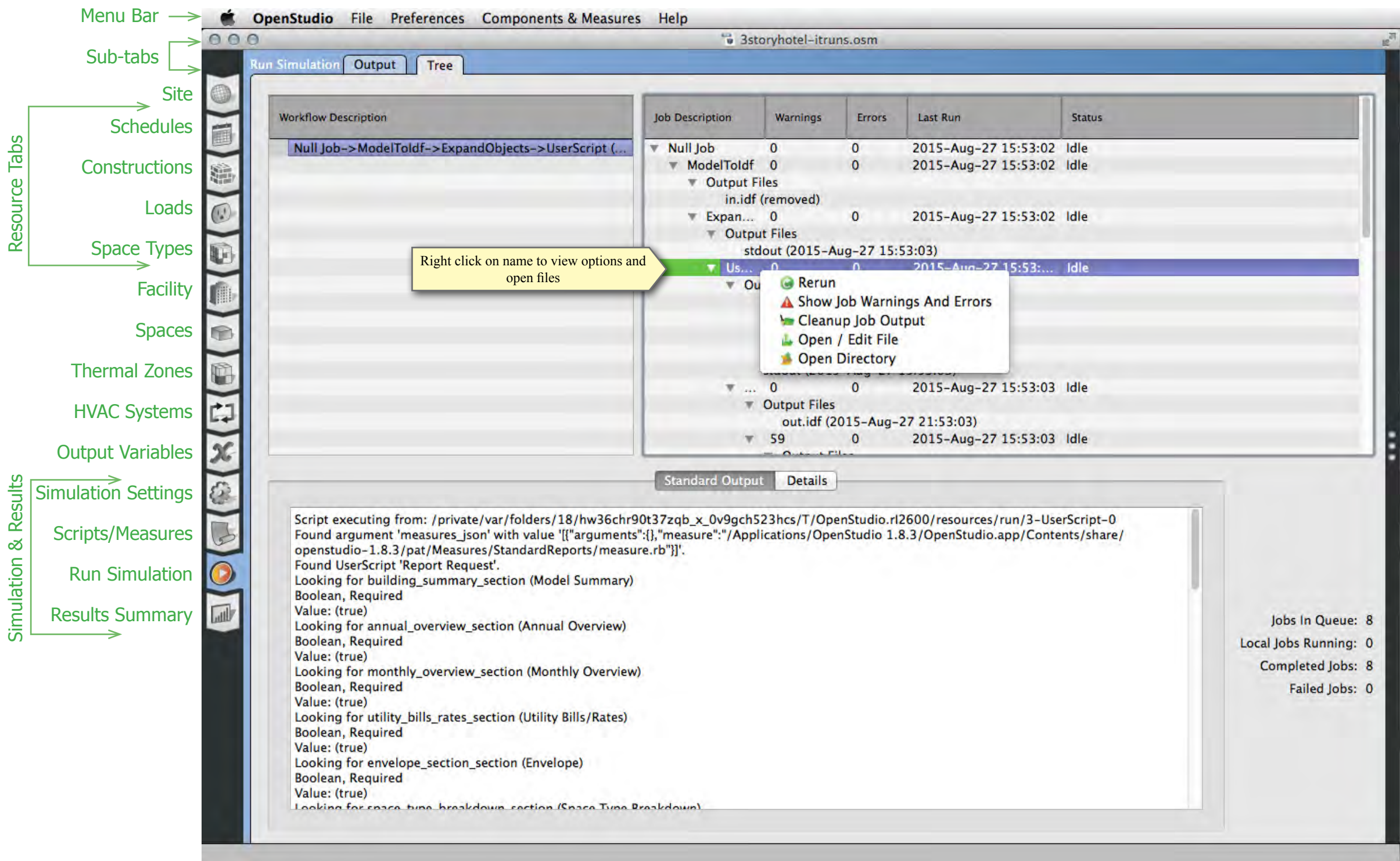
Run Simulation — Tree

Notes

The top right table in the screenshot shows the jobs that ran as part of the simulation run.

If you have any measures in your workflow, they will show on this tree. At the end are a few EnergyPlus jobs, the last of which generated the output files.

You can right click on the EnergyPlus job to open the directory containing the output files.



Results Summary —
OpenStudio Results

Notes

The Results Summary tab is populated with data after you run a simulation. The standard reports available are:

- Results | OpenStudio
- Calibration | OpenStudio
- EnergyPlus Results

You can create custom reporting measures. Check out the measure writing guide at http://nrel.github.io/OpenStudio-user-documentation/reference/measure_writing_guide/

The “Results | OpenStudio Results” has a list of items on the left to click on and view parts of the report. The charts and tables have been designed to help you troubleshoot your model.

The button at the top right corner of the interface will load the SQL file in the OpenStudio ResultsViewer application. ResultsViewer allows you to create time series line and flood plots for variables that you requested in the Output Variables tab.

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✓ Results | OpenStudio
Calibration | OpenStudio
EnergyPlus Results

OpenStudio File Preferences Components & Measures Help

3 story hotel.osm

Results Summary

Reports: OpenStudio Results

Select the Report Type Here

Launch ResultsViewer to View Time Series Variables

Open ResultsViewer for Detailed Reports

Model Summary
Annual Overview
Monthly Overview
Utility Bills/Rates
Envelope
Space Type Breakdown
Space Type Summary
Interior Lighting Summary
Plug Loads Summary
Exterior Lighting
Water Use Equipment
HVAC Load Profiles
Zone Conditions
Zone Overview
Zone Equipment Detail
Air Loops Detail
Plant Loops Detail
Outdoor Air
Cash Flow

OpenStudio Results

Model Summary

Building Summary

Information	Value
Building Name	3 story hotel
Net Site Energy	5,185,669
Total Building Area	52,500
EUI	98.77

Weather Summary

	Value
Weather File	Denver-Stapleton CO US
Latitude	39.76
Longitude	-104.9
Elevation	1611.00
Time Zone	-7.0
North Axis Angle	0.00

Model Summary
Annual Overview
Monthly Overview
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Space Type Breakdown
Space Type Summary
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Air Loops Detail
Plant Loops Detail
Outdoor Air
Cash Flow

HVAC Load Profiles

Monthly Load Profiles - view table

Month	Heating (MBtu)	Cooling (MBtu)	Mean (MBtu)
Jan	160	10	85
Feb	130	10	70
Mar	100	10	55
Apr	60	20	40
May	20	140	80
Jun	10	150	130
Jul	5	160	155
Aug	5	150	140
Sep	10	130	120
Oct	60	50	55
Nov	110	20	65
Dec	150	10	80

Zone Conditions

Temperature (Table values represent hours spent in each temperature range)

Zone	Unmet Heating (hr)	< 56 (F)	56-61 (F)	61-66 (F)	66-70 (F)	70-72 (F)	72-74 (F)	74-76 (F)	76-78 (F)	78-80 (F)	>= 80 (F)	Unmet Cooling (hr)	Mean Temp (F)
THERMAL ZONE: STORY 1 CORE SPACE	73	0	0	454	1860	4887	1403	555	1	0	0	0	69.3 (F)
THERMAL ZONE: STORY 1 EAST PERIMETER SPACE	32	0	1437	1708	361	3726	767	253	457	17	34	0	67.3 (F)
THERMAL ZONE: STORY 1 NORTH PERIMETER SPACE	14	0	108	1201	679	3754	1449	1079	476	14	0	0	69.5 (F)
THERMAL ZONE: STORY 1 SOUTH PERIMETER SPACE	0	0	23	2077	150	0	64	305	4924	207	1170	0	72.8 (F)
THERMAL ZONE: STORY 1 WEST PERIMETER SPACE	44	0	1502	1793	319	1128	461	225	310	16	6	0	67.0 (F)
THERMAL ZONE: STORY 2 CORE SPACE	37	0	0	442	1194	3769	1689	1044	605	17	0	0	70.0 (F)
THERMAL ZONE: STORY 2 EAST PERIMETER SPACE	37	0	1327	1367	552	3467	706	707	598	25	19	0	67.9 (F)
THERMAL ZONE: STORY 2 NORTH PERIMETER SPACE	34	0	1290	1189	466	3866	878	674	387	8	0	0	67.9 (F)

OpenStudio is developed in collaboration by NREL, ANL, LBNL, ORNL, and PNNL.

NREL is a National Laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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Results Summary: Calibration

Notes

To calibrate to the ASHRAE 14-2002 or FEMP standard the file must contain all utility data for one year and real weather data. Check the guidelines for additional requirements.

By selecting the "Calibration | OpenStudio" report you can compare the model and actual utility bills.

The report provides ASHRAE 14-2002 calibration standard and the FEMP calibration standard options.

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Results | OpenStudio

✓ Calibration | OpenStudio

EnergyPlus Results

Launch ResultsViewer to View Time Series Variables

Open ResultsViewer for Detailed Reports

Reports: Calibration | OpenStudio

Select the Report Type Here

Calibration Method

✓ ASHRAE 14-2002

FEMP

NBME of 5% or less and CV(RMSE) of 15% relative to monthly data. Must contain all utility data for one year and real weather data. Check the guideline for additional requirements.

Electricity Consumption (kWh)

CV(RMSE) = 6.77

NMBE = 0.87

Model

Actual

1	2	3	4	5	6	7	8	9	10	11	12	
Start	1/1	2/1	3/1	4/1	5/1	6/1	7/1	8/1	9/1	10/1	11/1	12/1
End	1/31	2/28	3/31	4/30	5/31	6/30	7/31	8/31	9/30	10/31	11/30	12/31

Results Summary: EnergyPlus Results

Notes

The HTML view of the EnergyPlus report is available through the drop down report menu.

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✓ EnergyPlus Results

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3 story hotel.osm

Results Summary

Reports: EnergyPlus Results

Select the Report Type Here

Launch ResultsViewer to View Time Series Variables

Open ResultsViewer for Detailed Reports

Program Version:EnergyPlus, Version 8.3.0-6d97d074ea, YMD=2015.08.27 09:56

Tabular Output Report in Format: HTML

Building: 3 story hotel

Environment: RUN PERIOD 1 ** Denver-Stapleton CO USA TMY--23062 WMO#=724690

Simulation Timestamp: 2015-08-27 09:56:06

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Report: Annual Building Utility Performance Summary

For: Entire Facility

Timestamp: 2015-08-27 09:56:06

Values gathered over 8760.00 hours

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Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	5471.17	1121.74	1121.74
Net Site Energy	5471.17	1121.74	1121.74
Total Source Energy	11100.33	2275.87	2275.87
Net Source Energy	11100.33	2275.87	2275.87

Site to Source Energy Conversion Factors

	Site=>Source Conversion Factor
Electricity	3.167
Natural Gas	1.084
District Cooling	1.056
District Heating	3.613