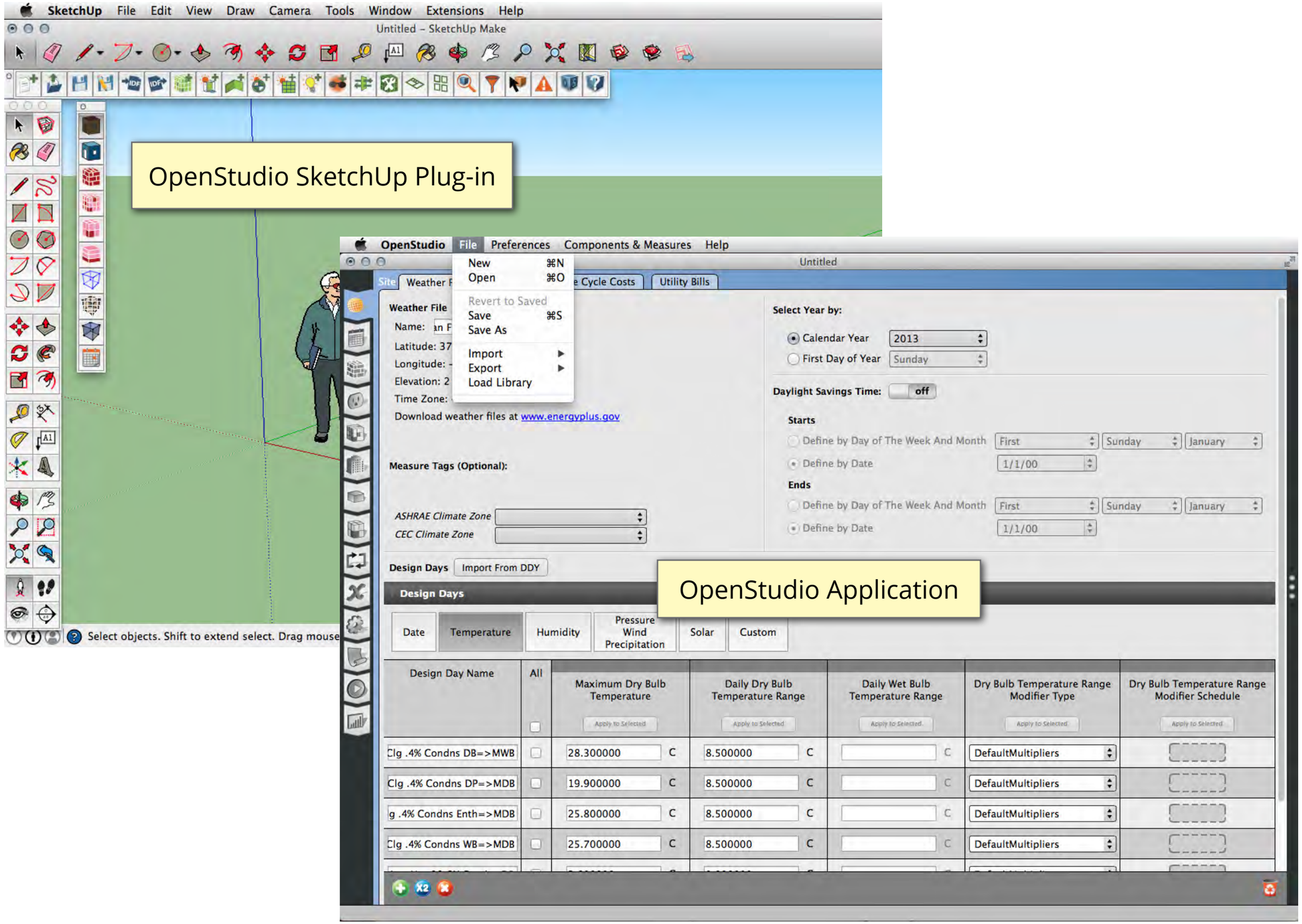
OpenStudio 1.9.0 Basic Workflow Guide (September 2015)

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.



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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

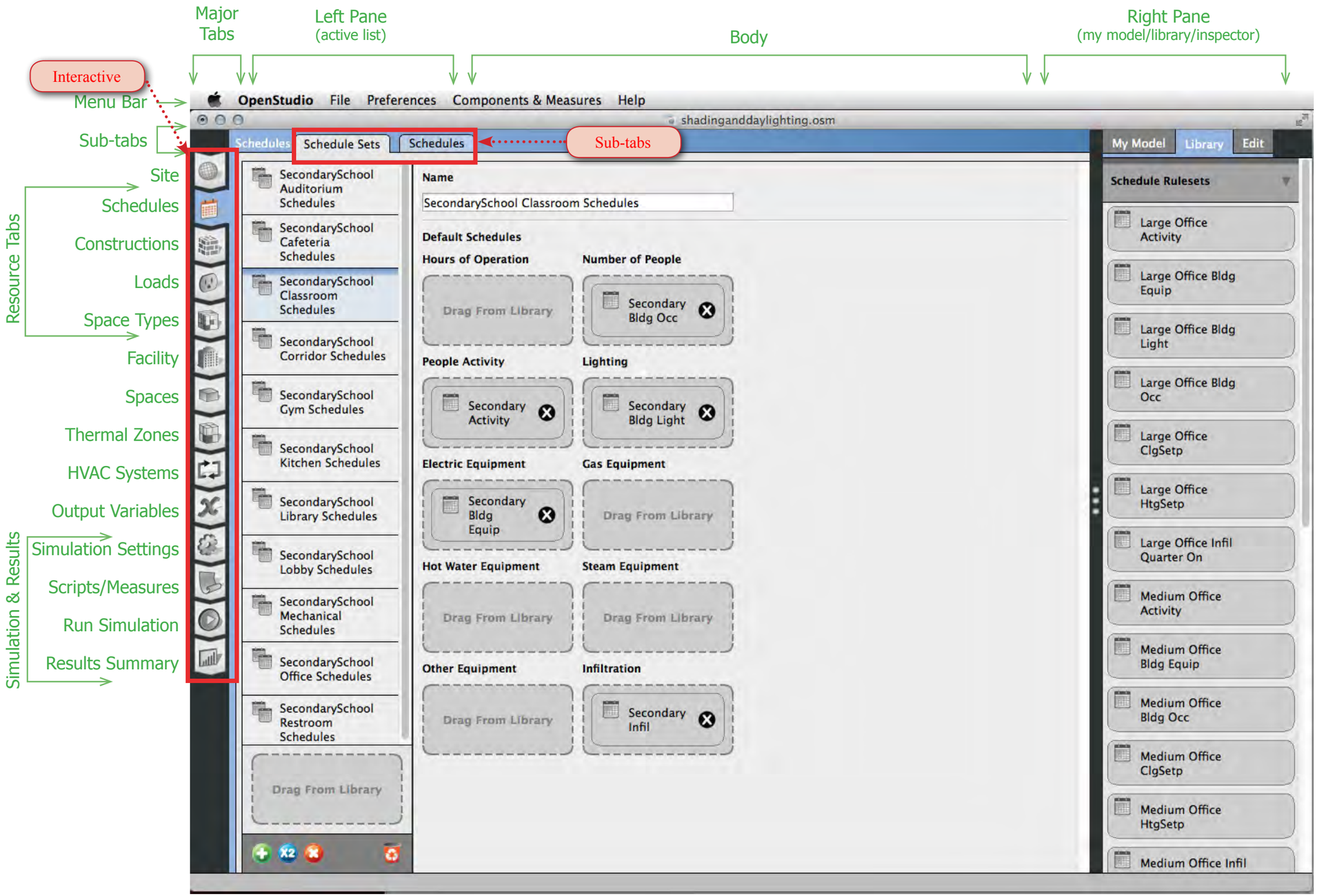
Results Summary

Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes



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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

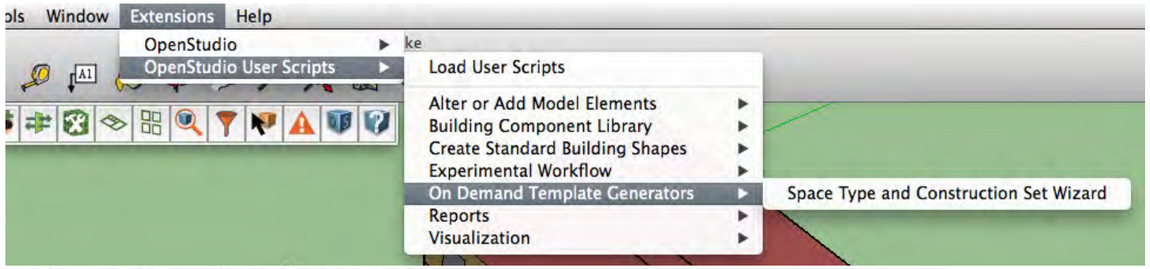
Climate Zones:
1-8 (see map)

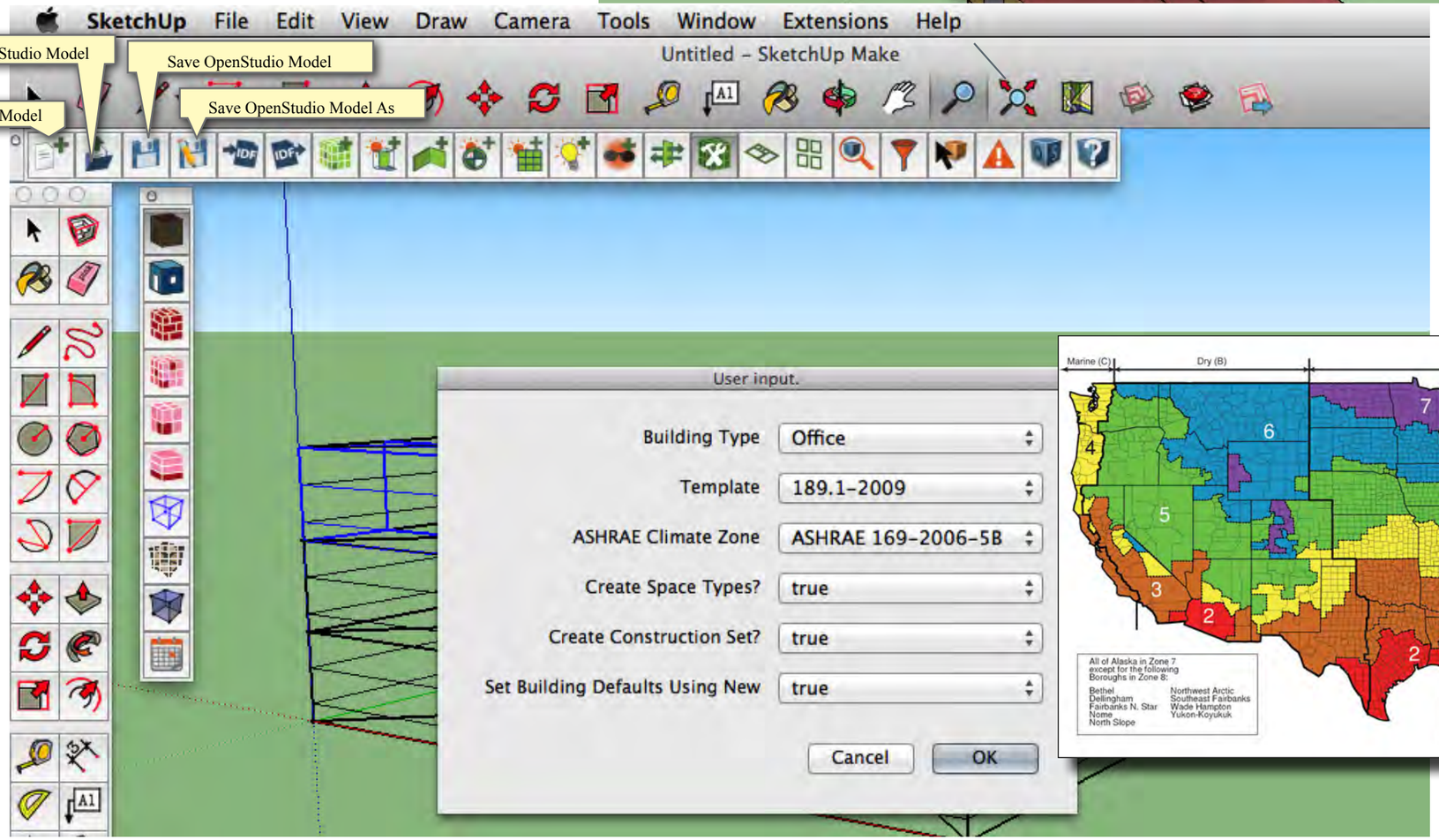
Key SketchUp Plug-in Tools

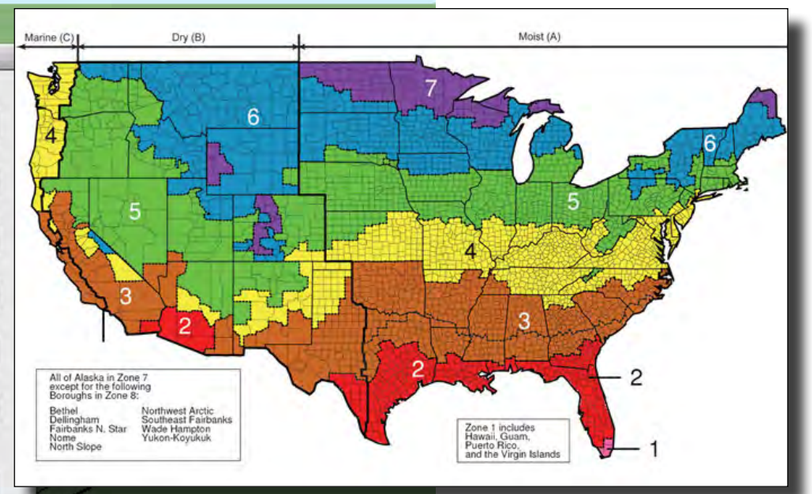
Choose Template

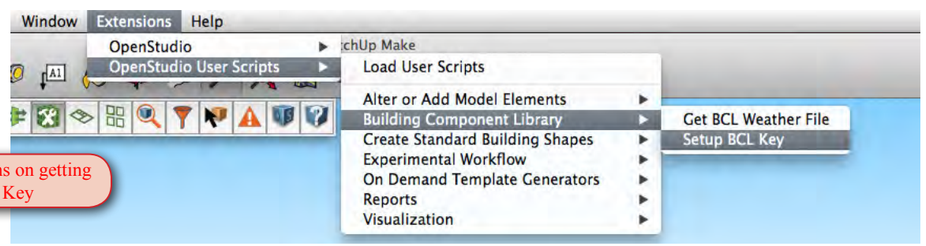
Building Envelope

Surface & Space Attributes









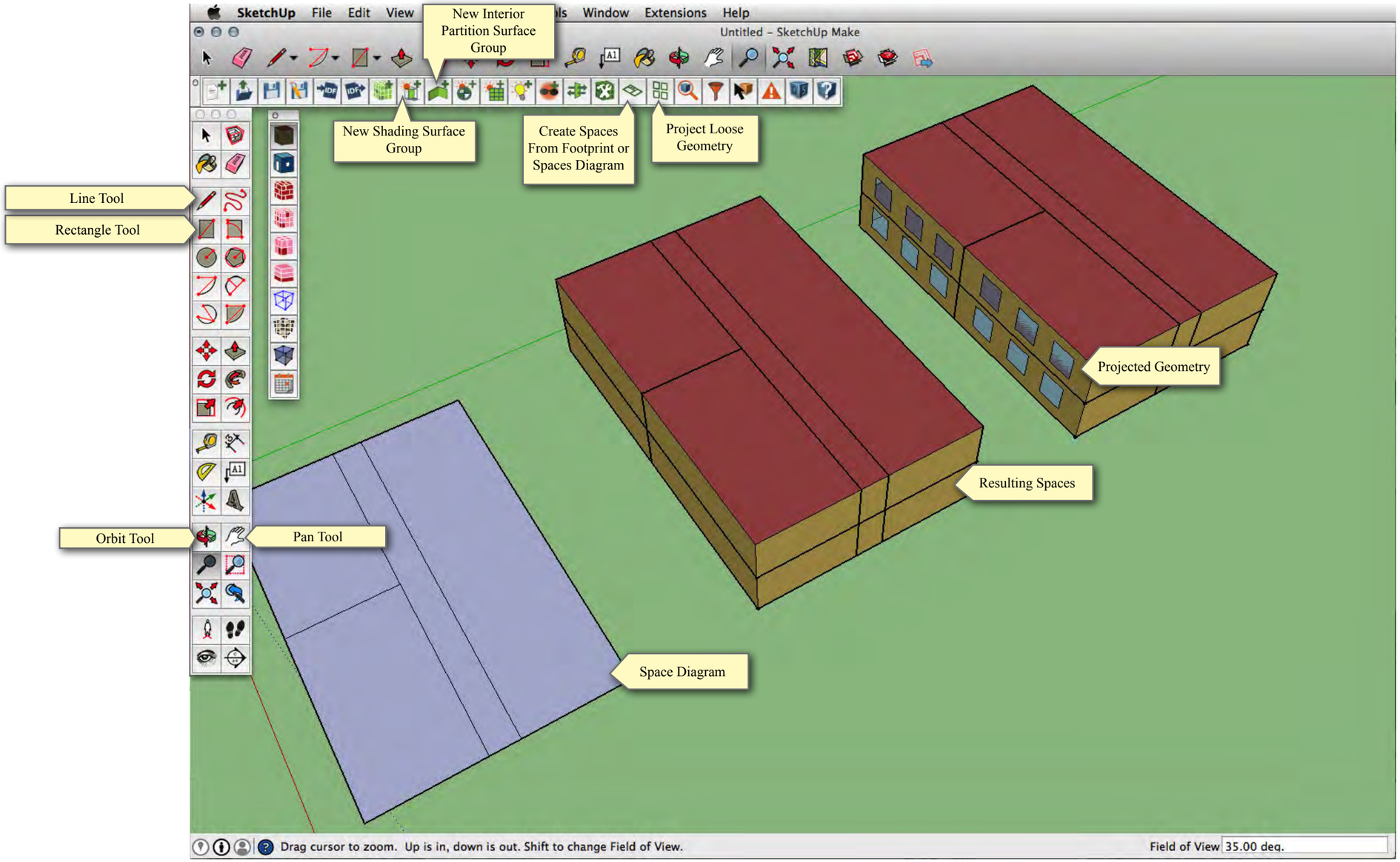
SketchUp — Building Envelope

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

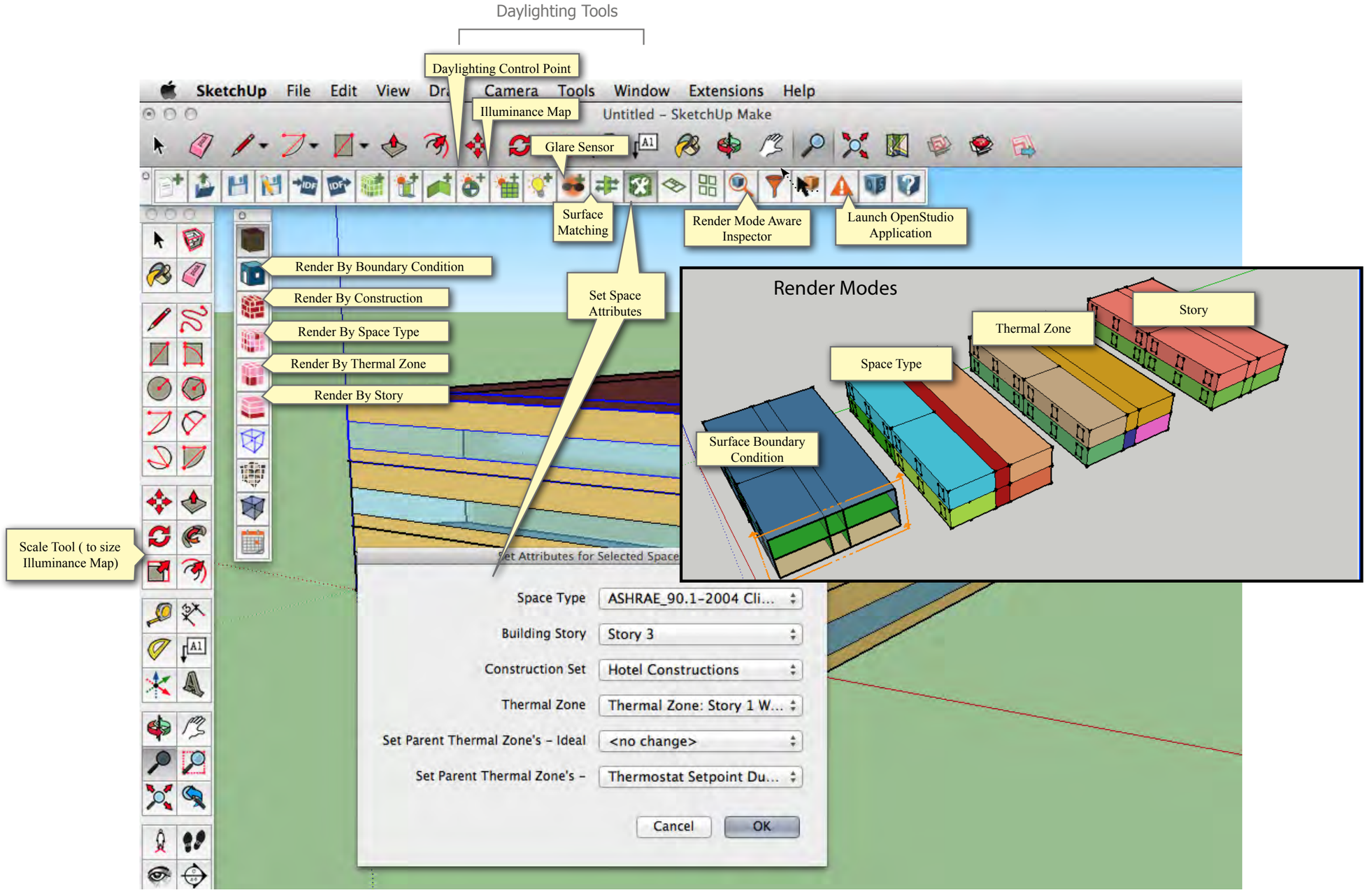
Notes

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

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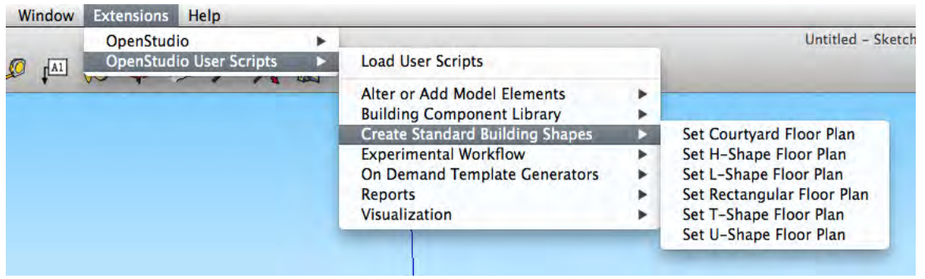
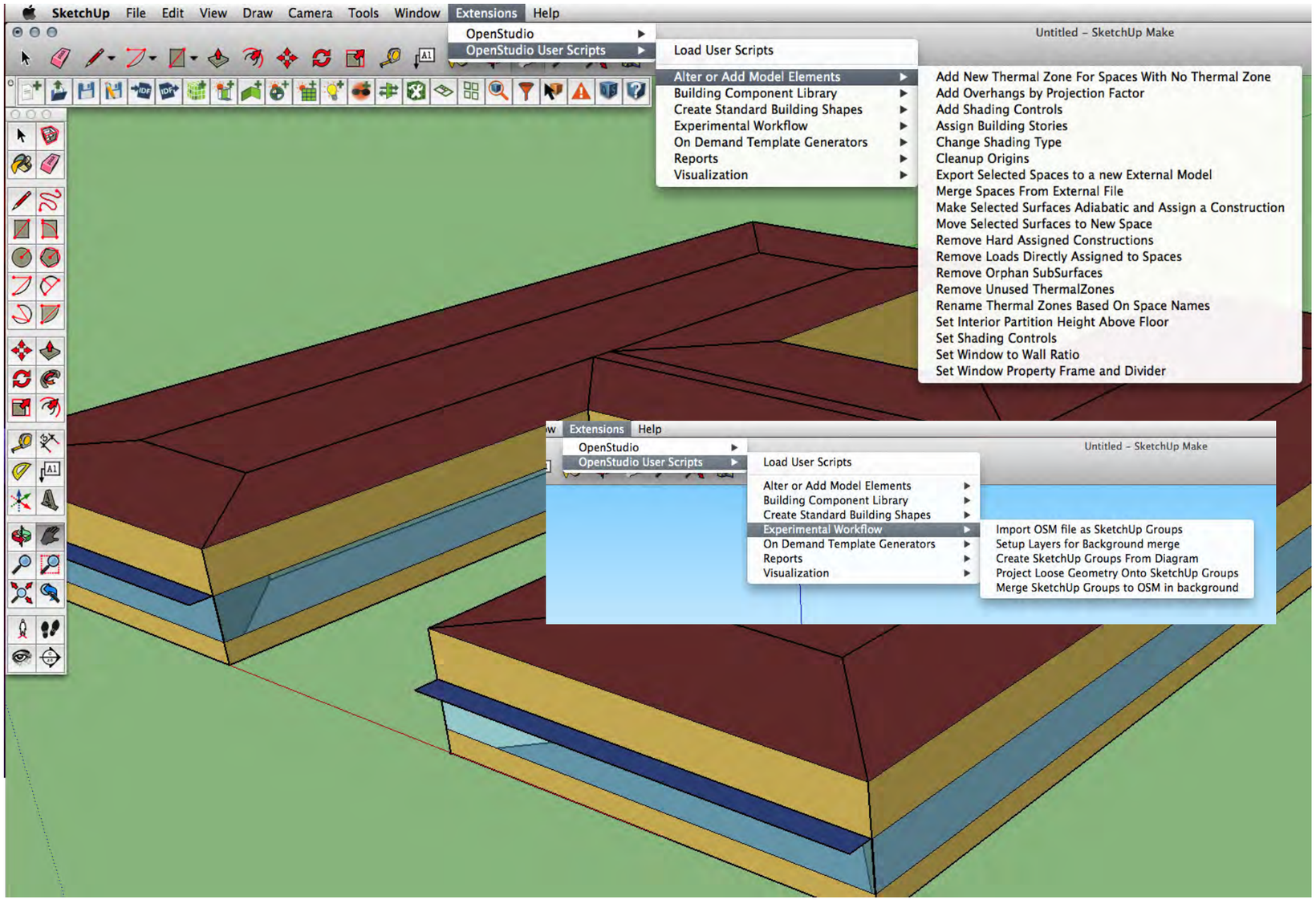
SketchUp — User Scripts

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

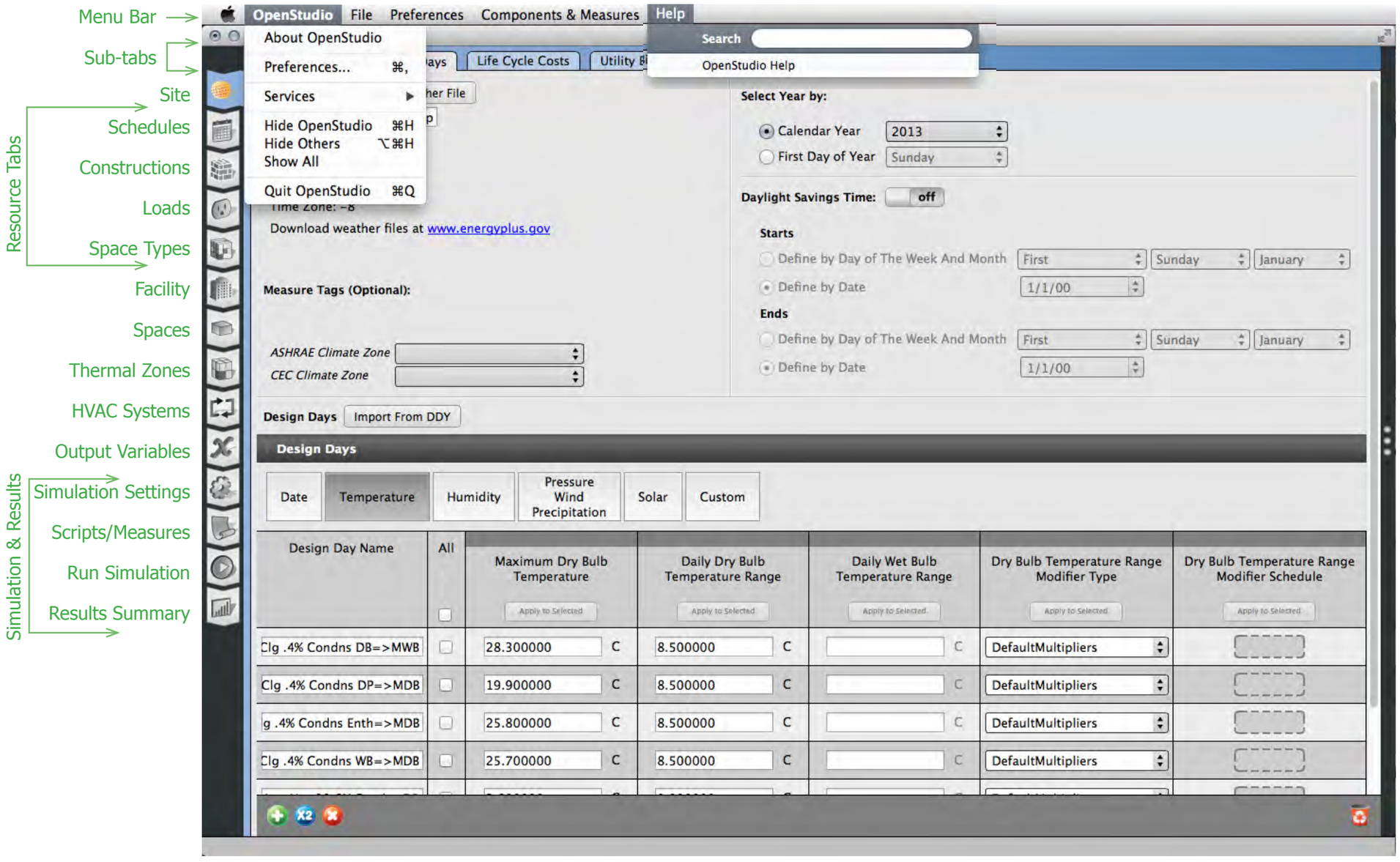
OpenStudio and Help Menu

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.



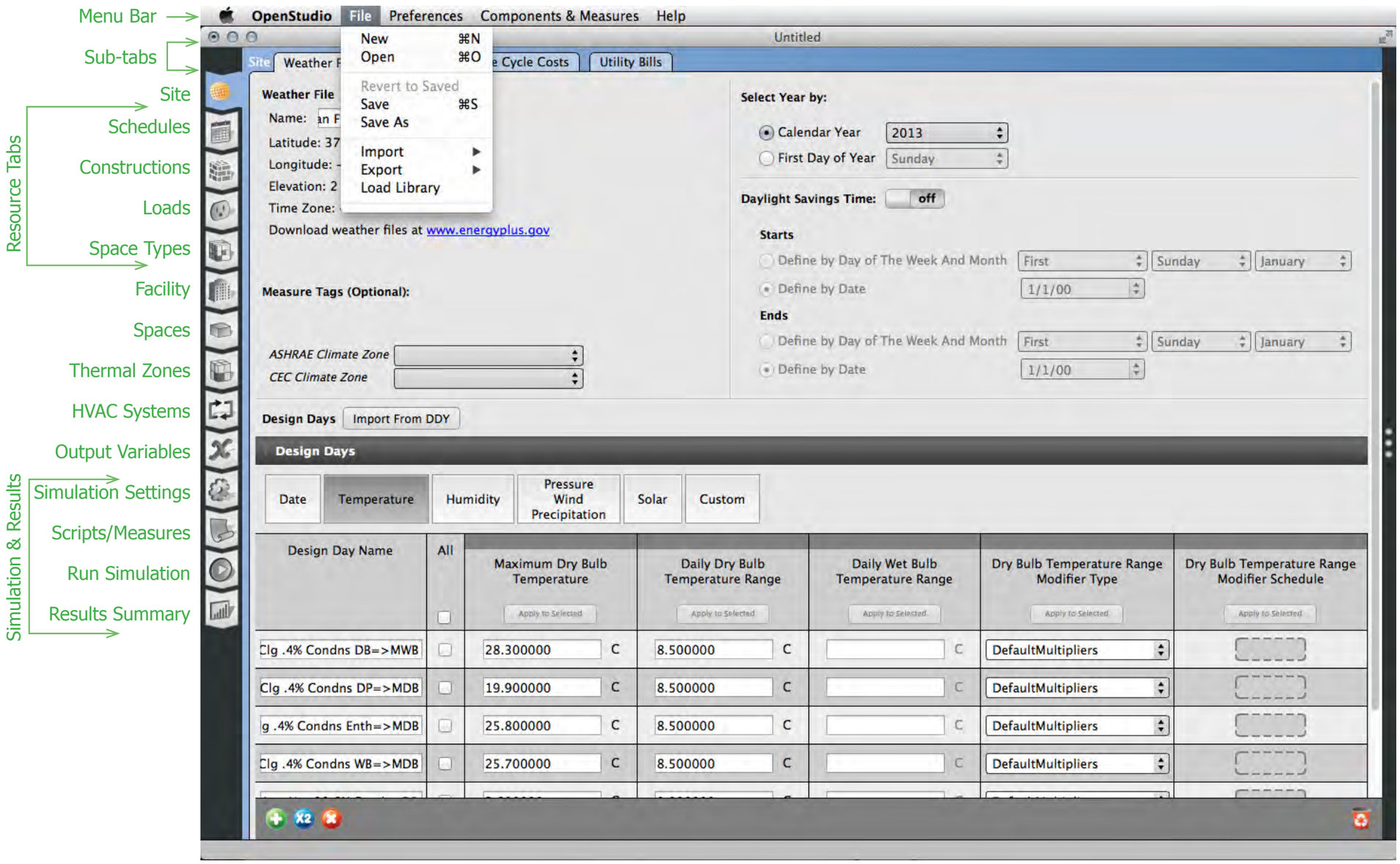
OpenStudio Application File Menu — File

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.



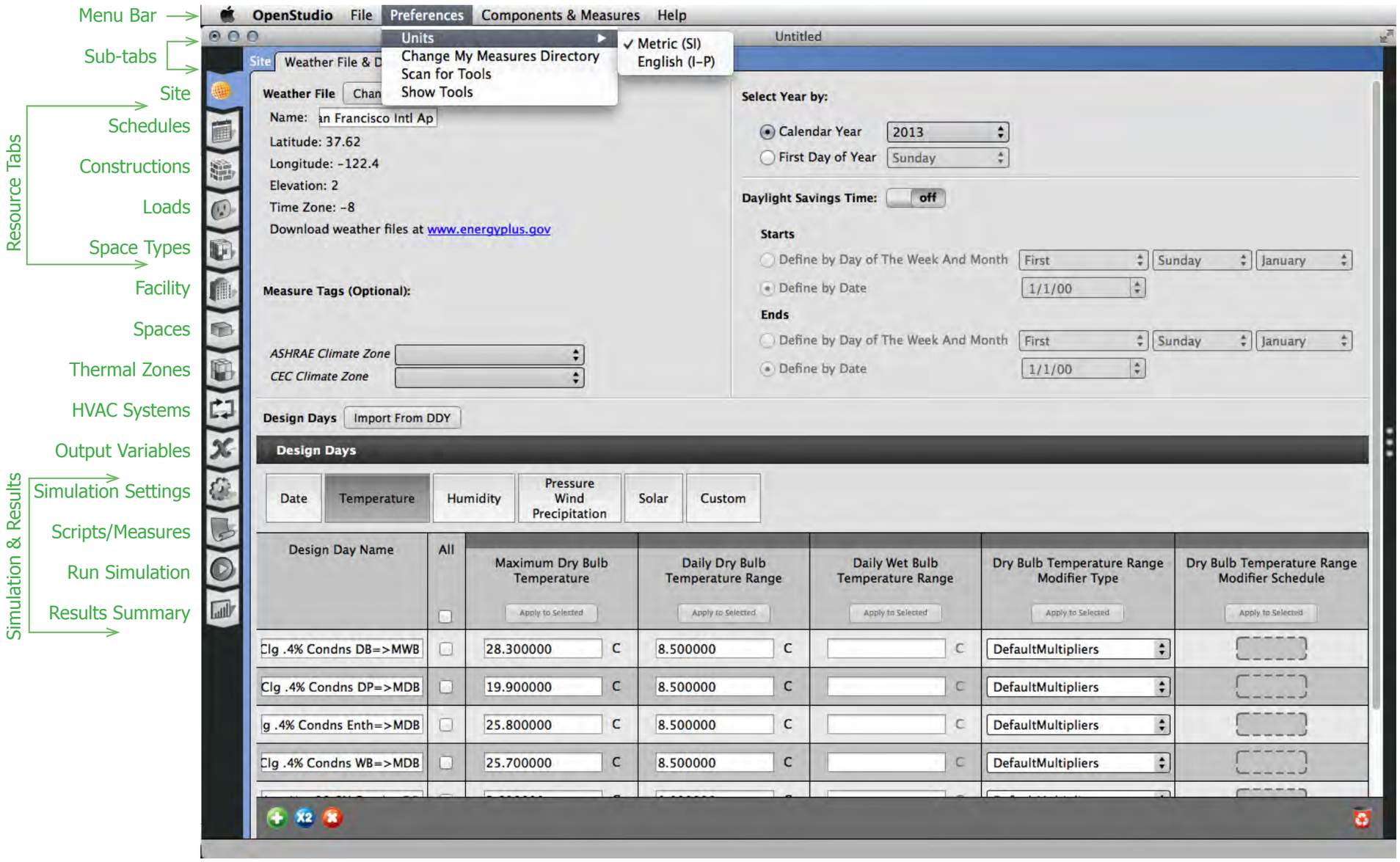
Preferences Menu

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.



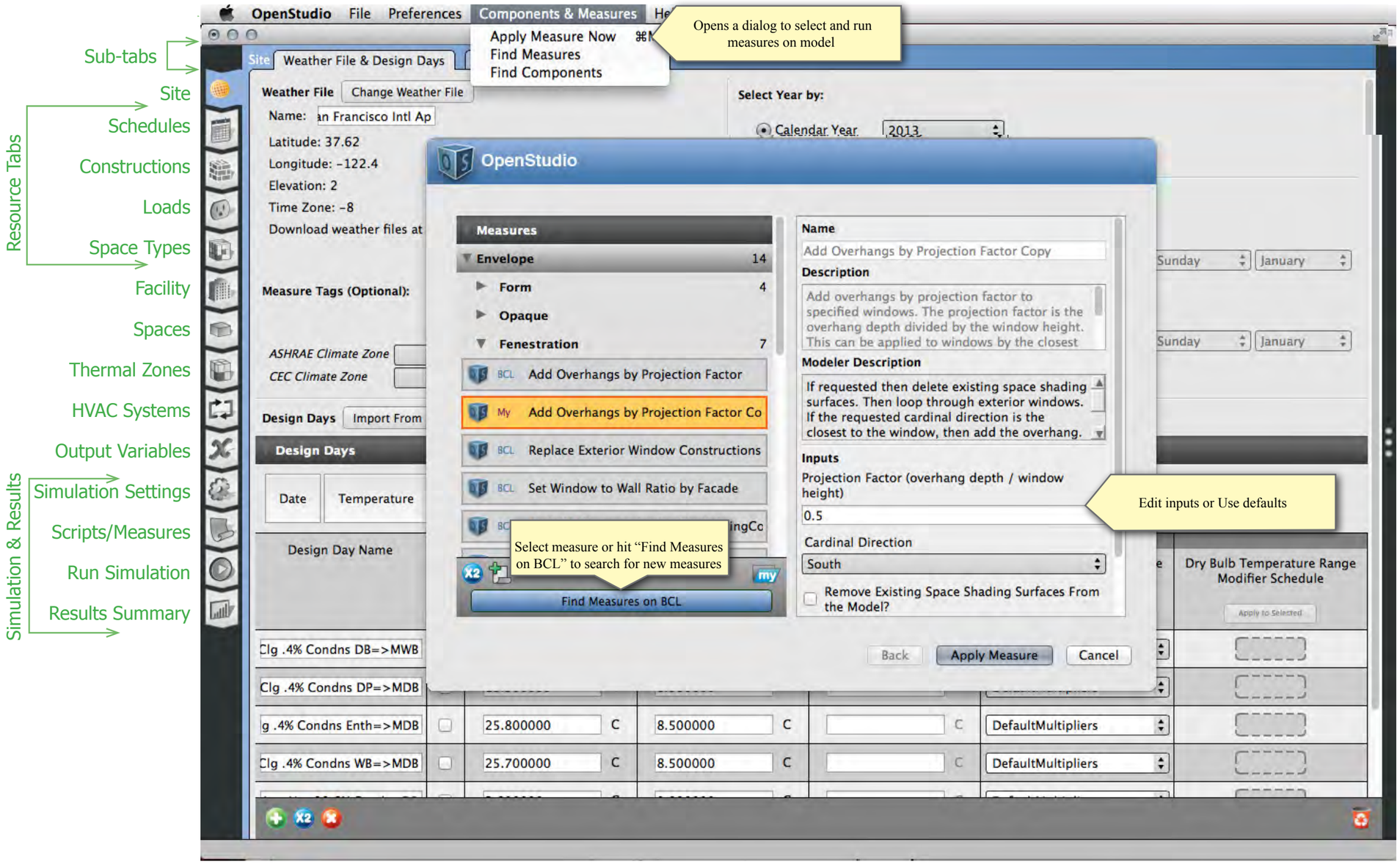
Components & Measures Menu: Apply Measure Now — Select a Measure

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.



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Components & Measures Menu: Apply Measure Now — Accept Changes

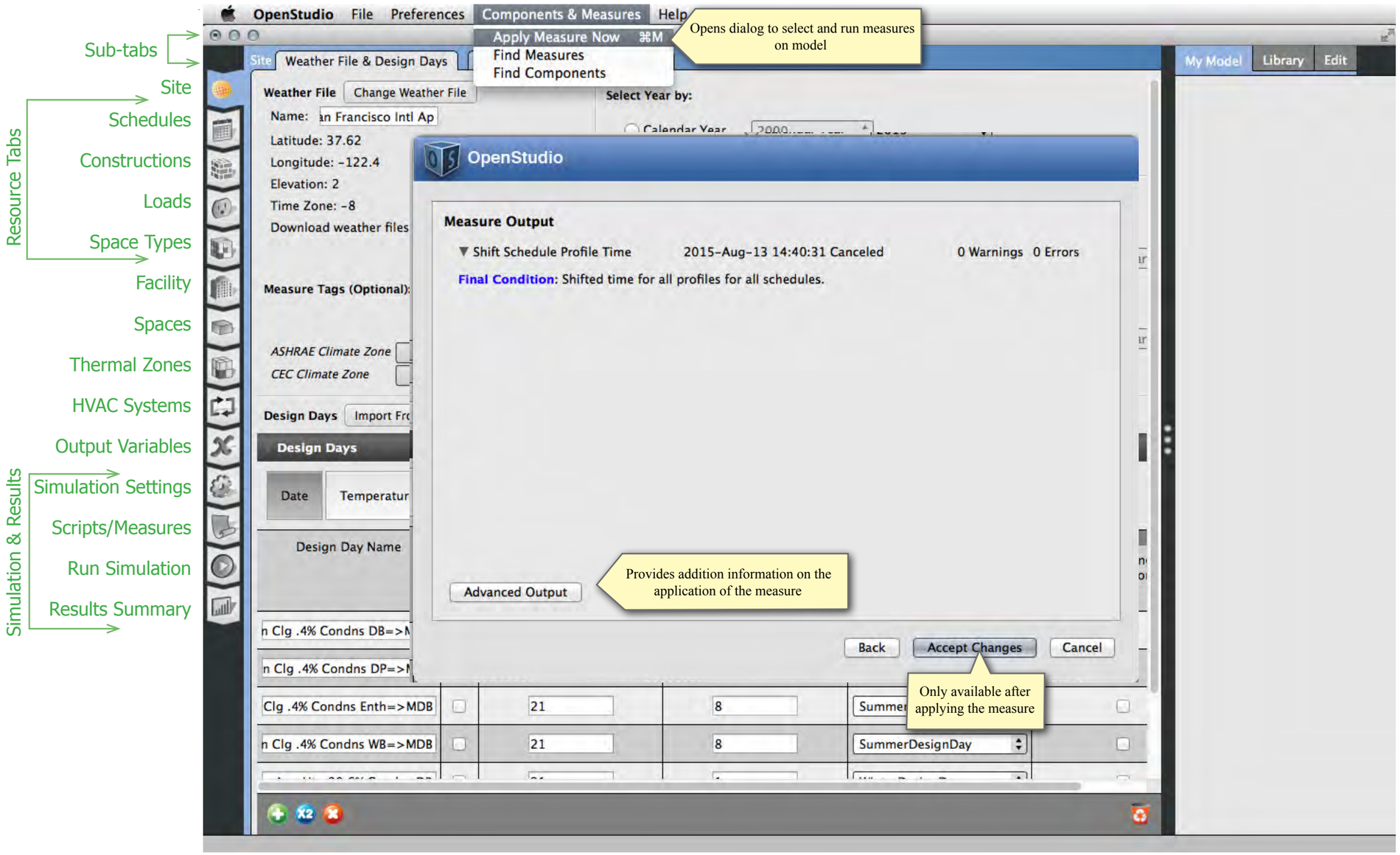
Notes

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.



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Components & Measures Menu: Find Measures or Components

Notes

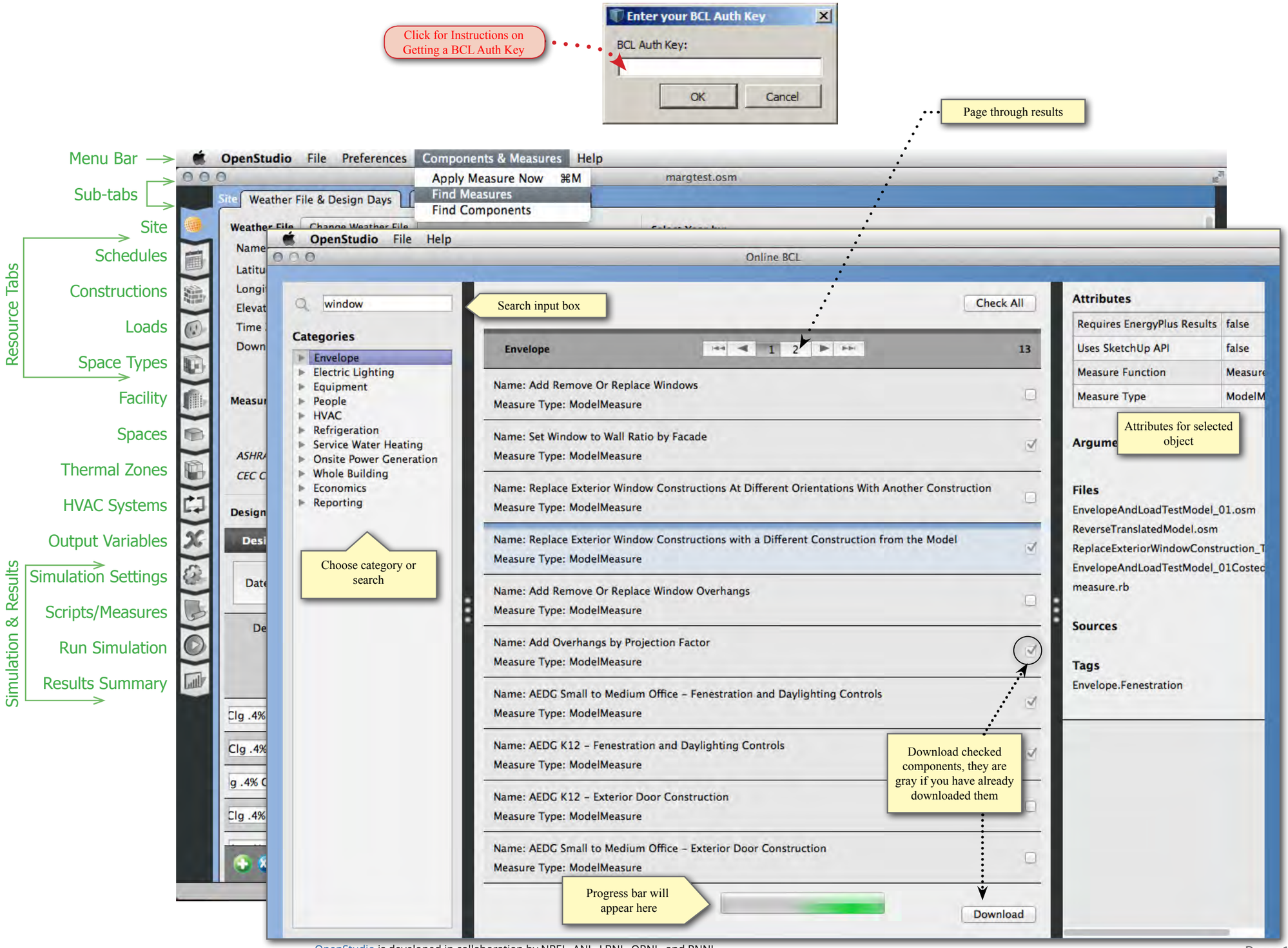
The BCL window gives you access to an online repository of building energy modeling data called the Building Component Library. Although you can access the BCL website on its own, OpenStudio has integrated access to the BCL from within the application. You can access this through the "Components & Measures" 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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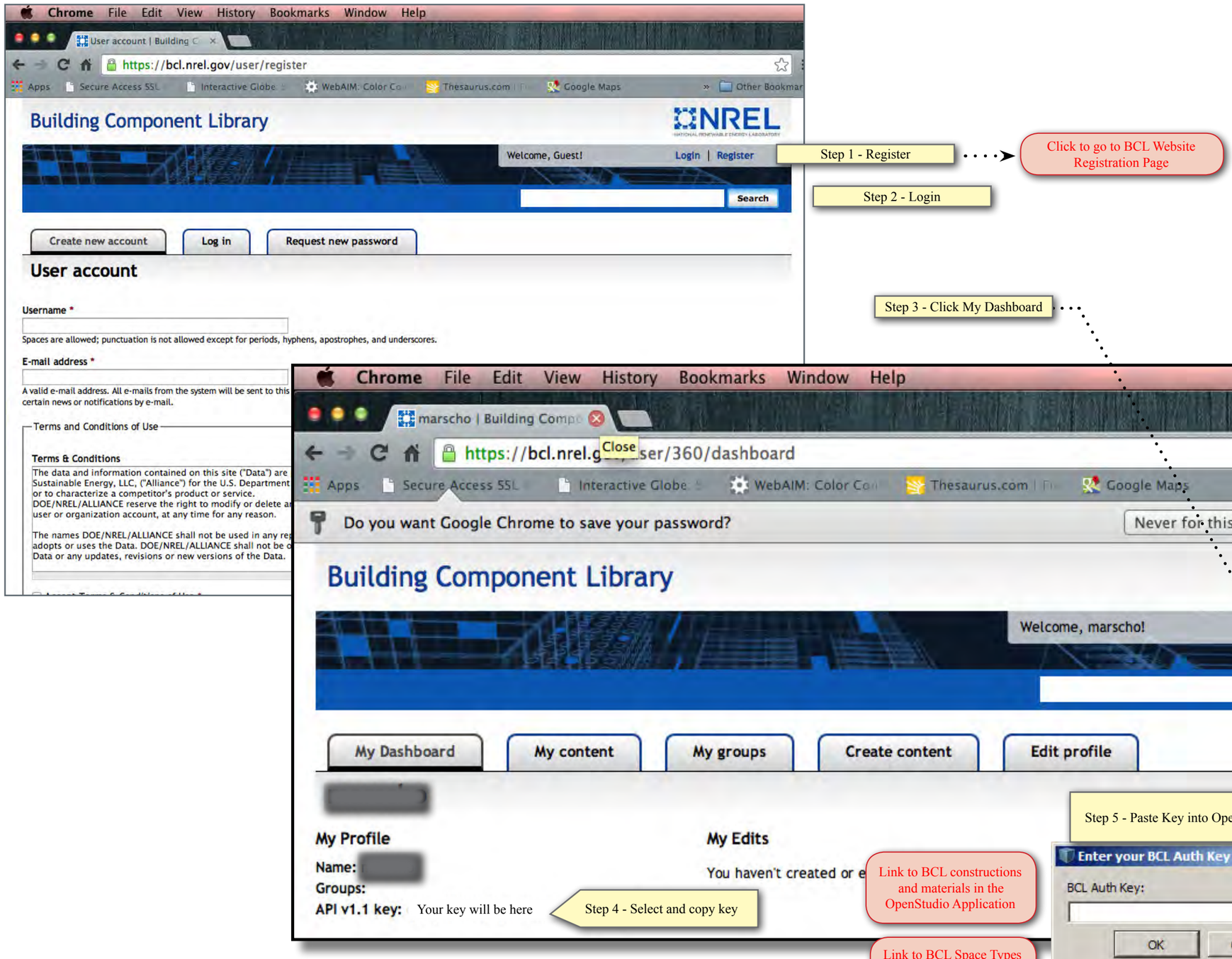
BCL Account Page
bcl.nrel.gov

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.



Site — Weather File & Design Days

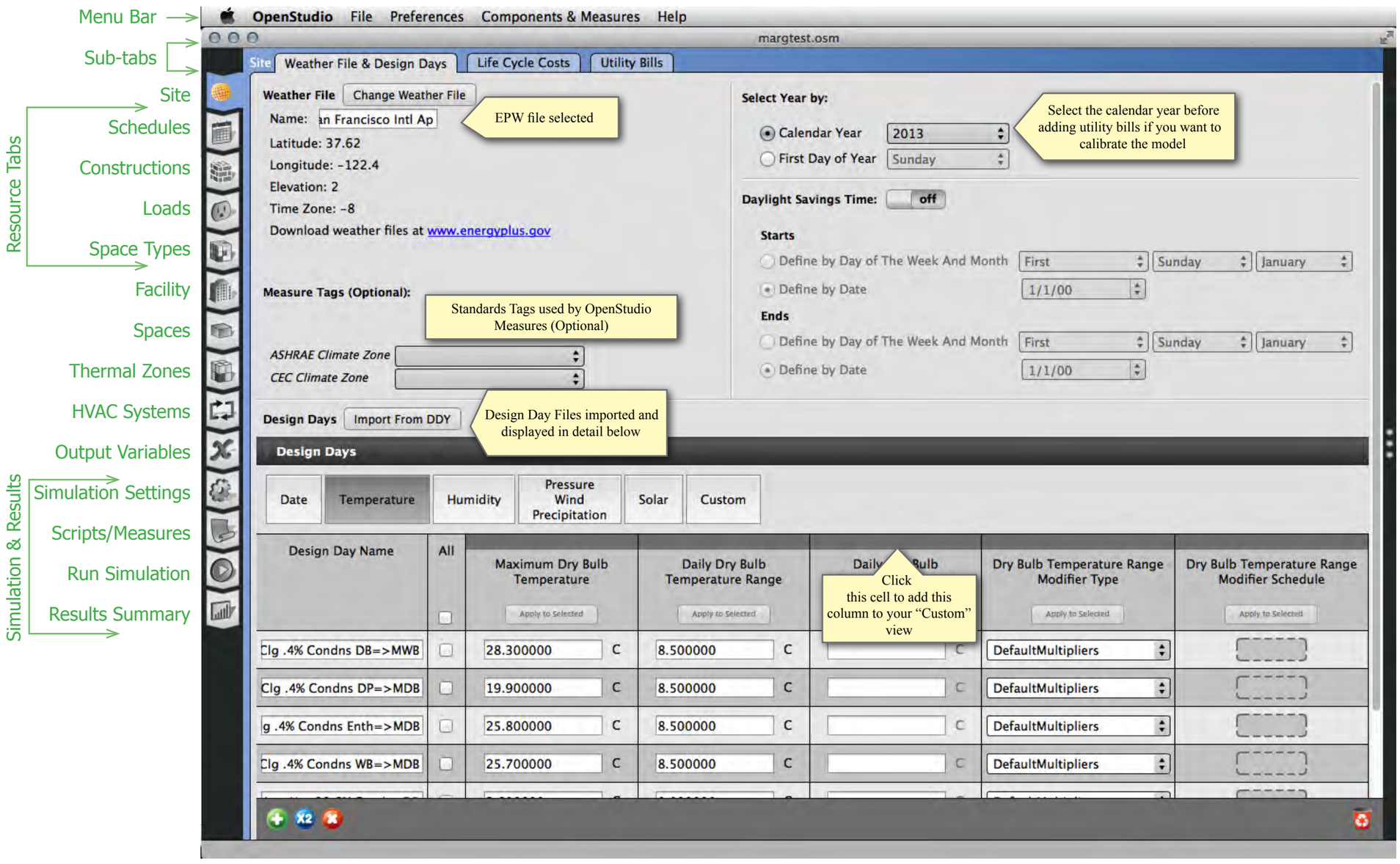
Notes

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.



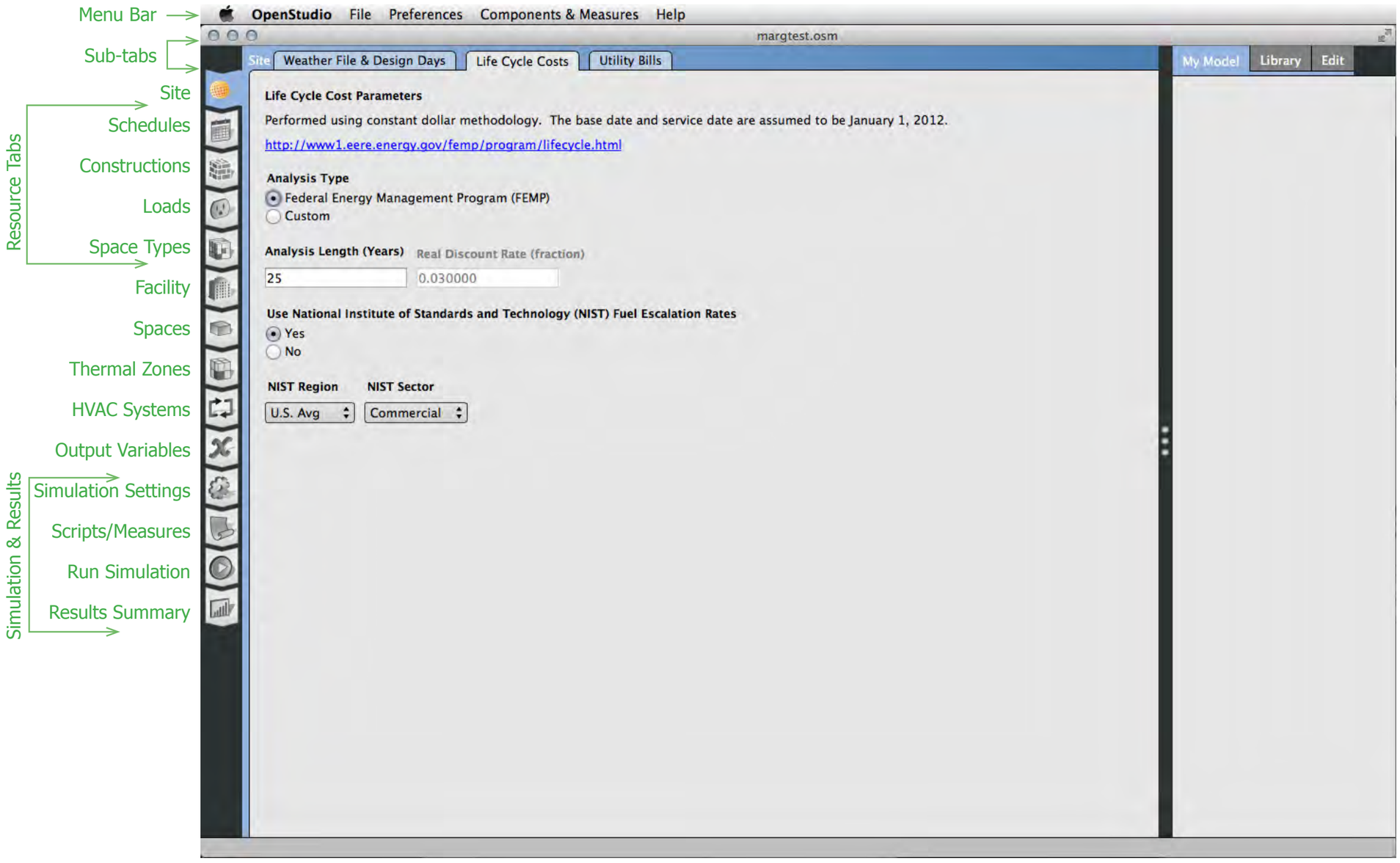
Site — Life Cycle Cost

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.

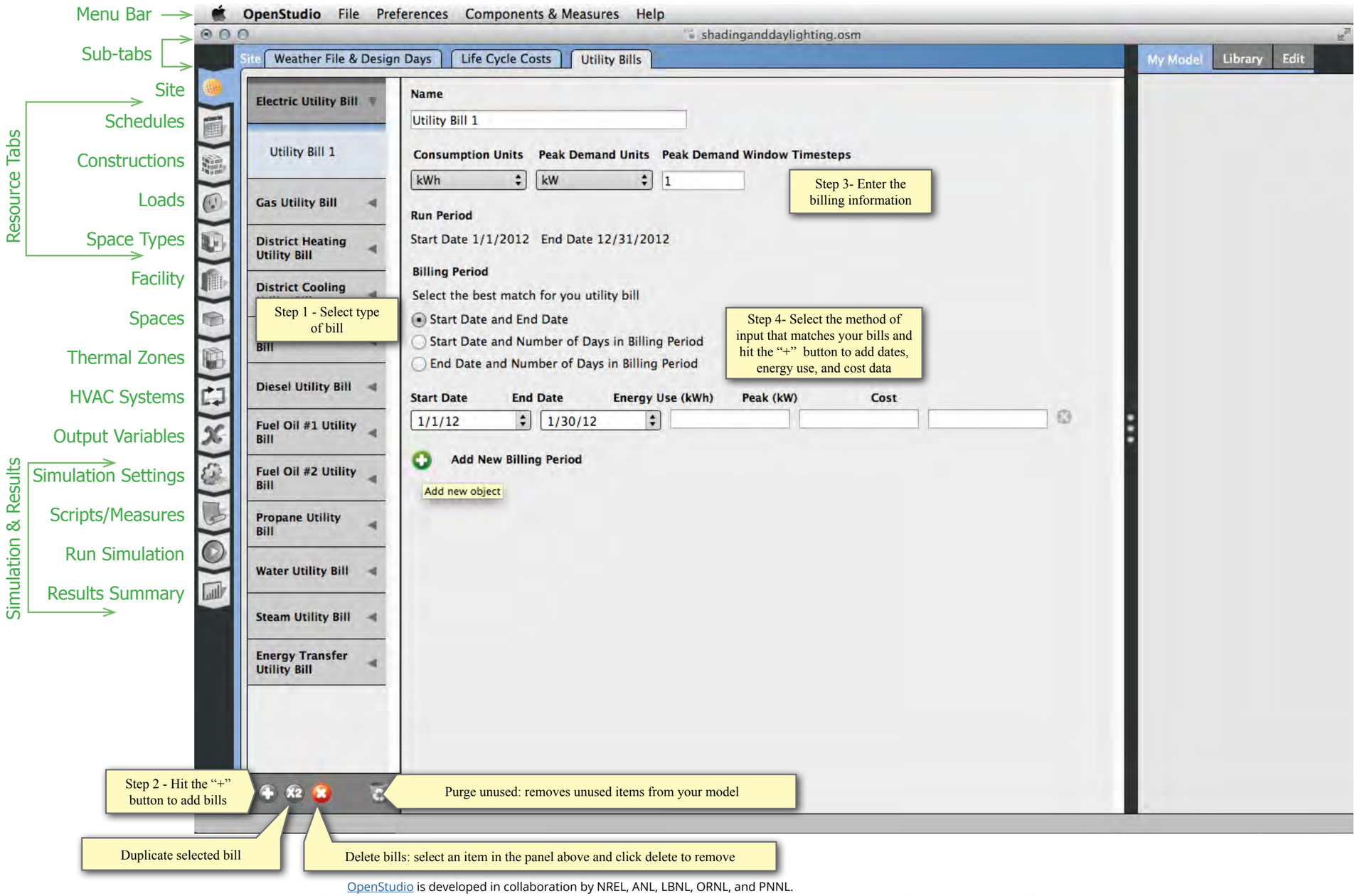
Step 1- select the type of utility on the left.

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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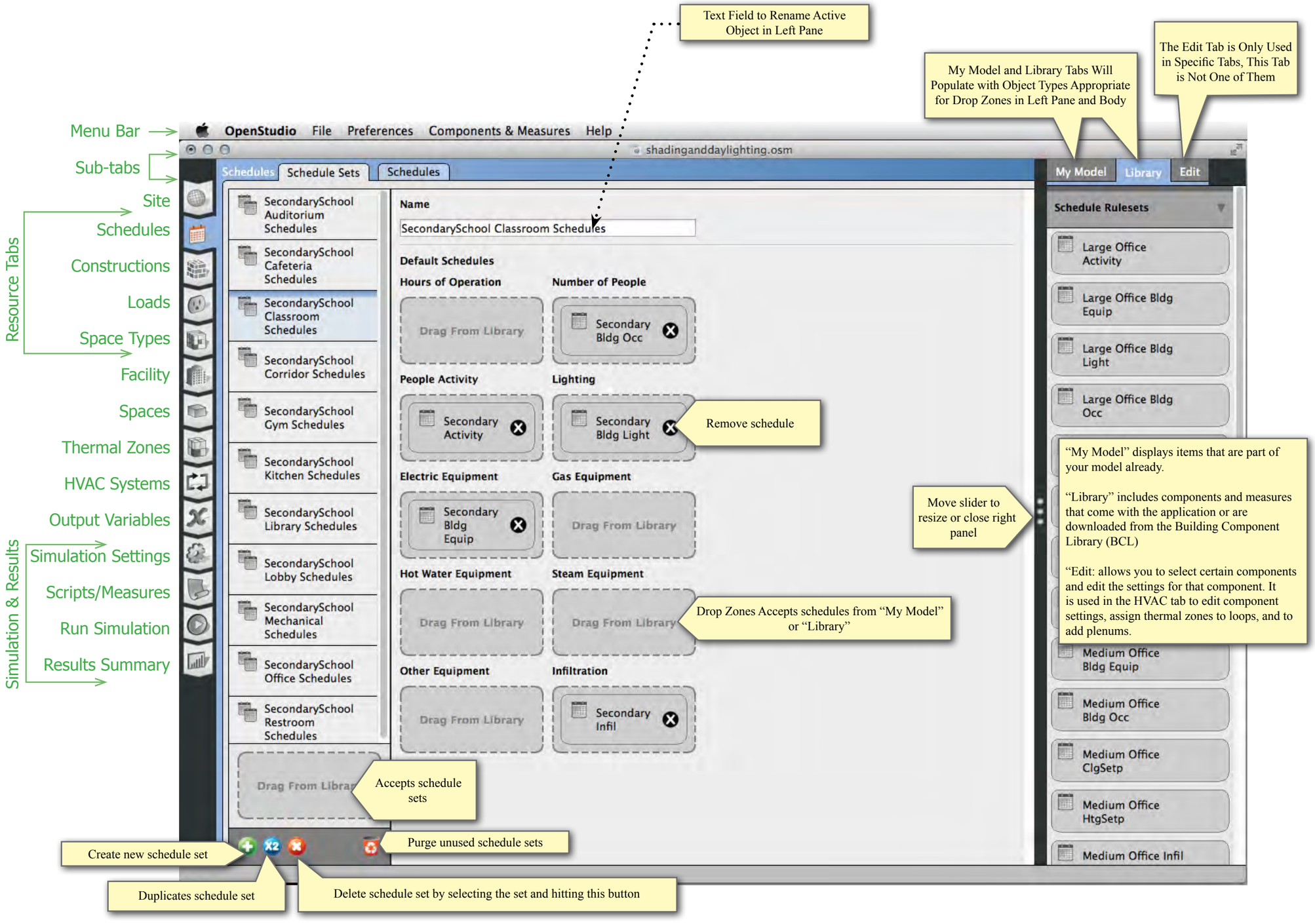
Schedules — Schedule Sets

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

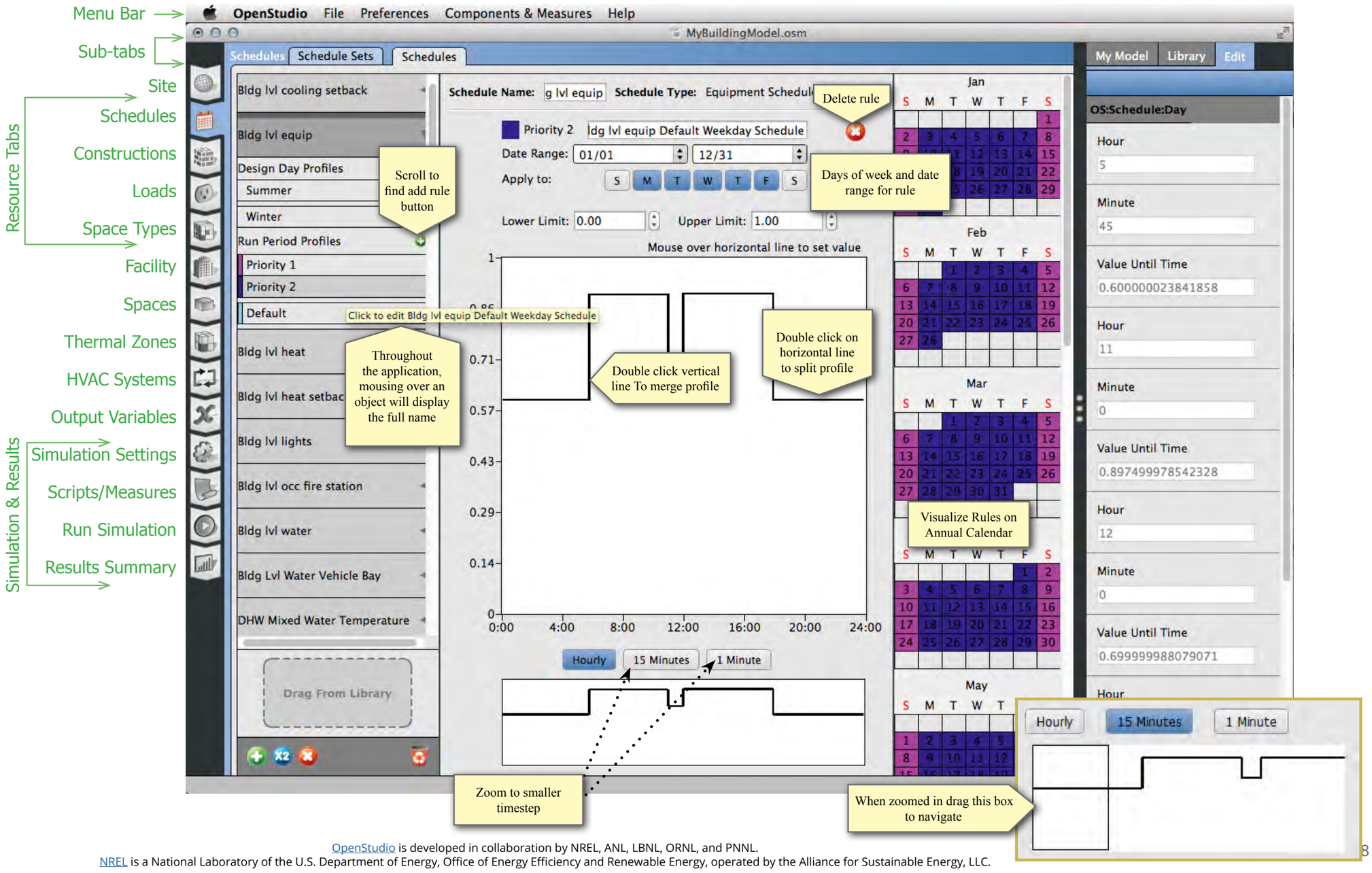
This tab is a visual editor for Ruleset Schedules. As the name implies, a schedule consists of a series of rules. Each rule or profile can be applied for a specific date range and for specific days of the week.

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.



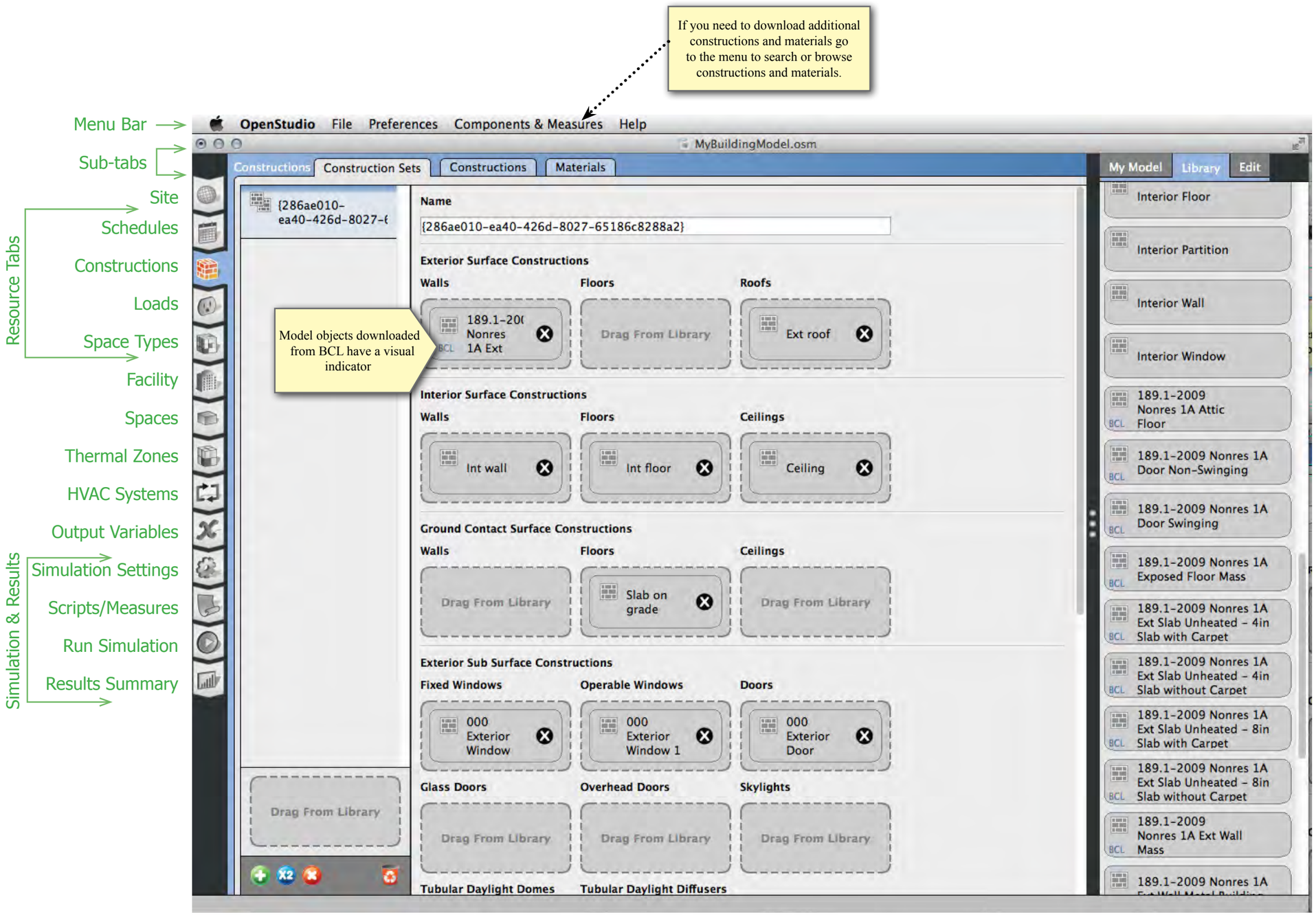
Constructions — Construction Sets

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.

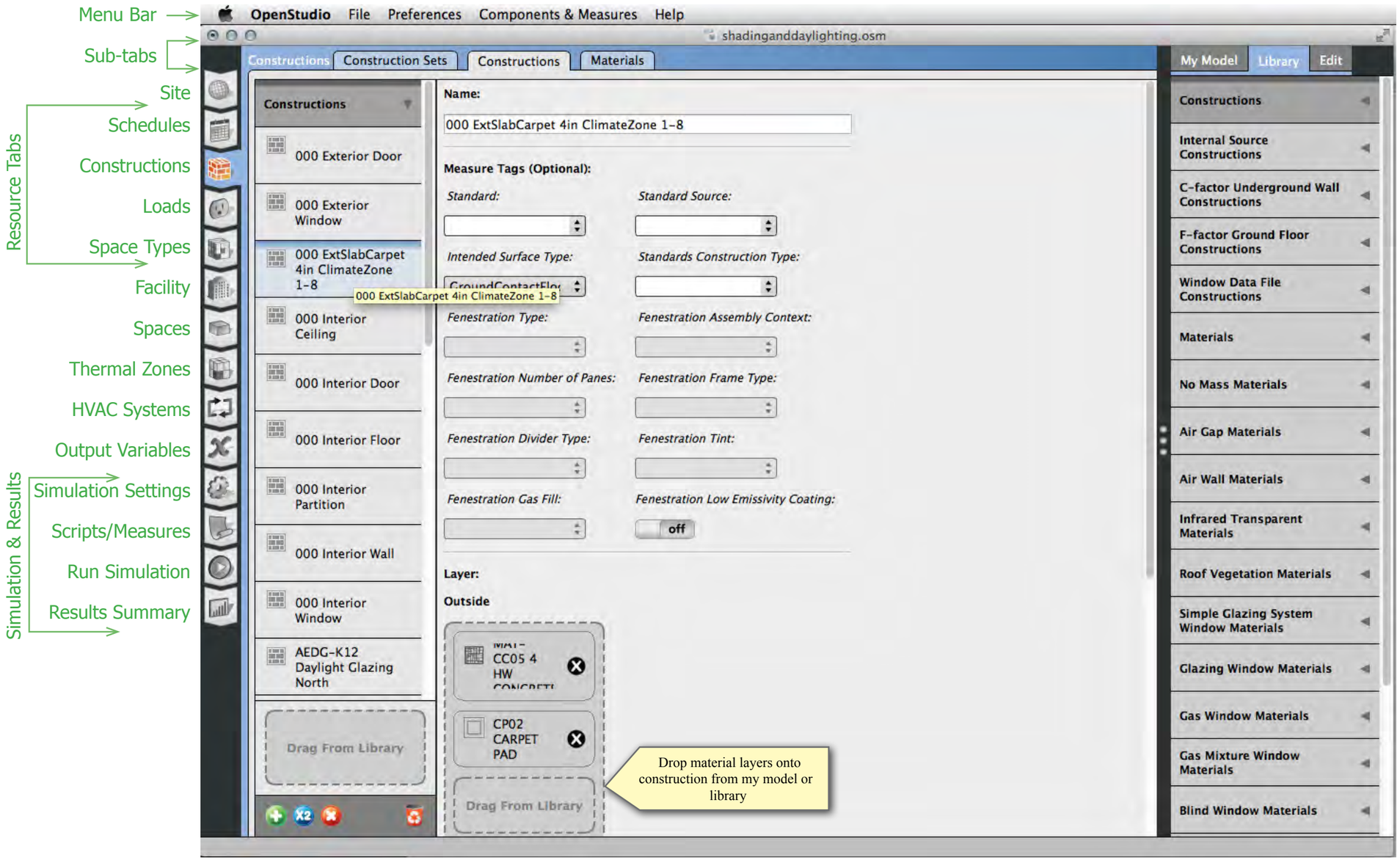


Constructions — Constructions

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.



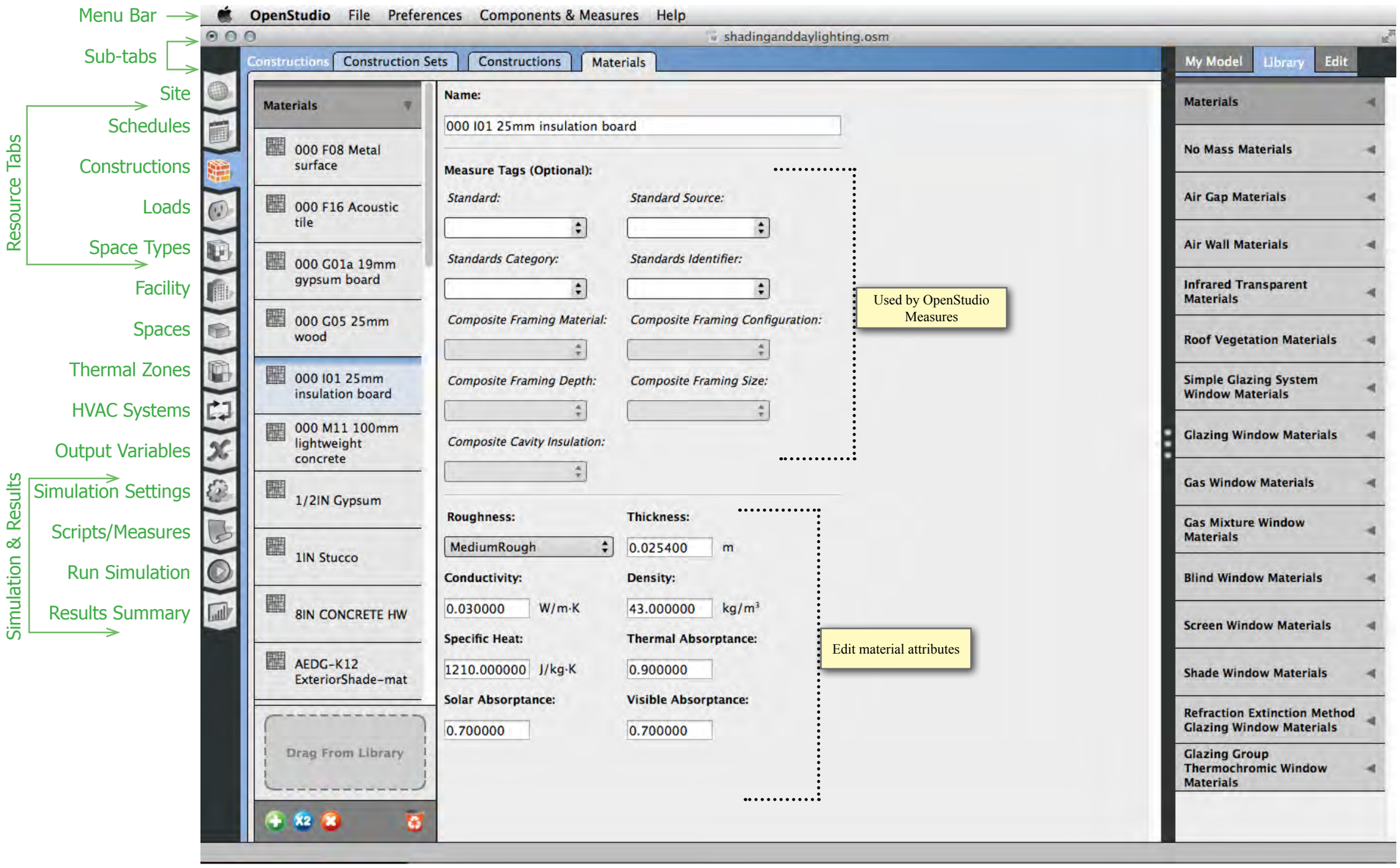
Constructions — Materials

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.



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.

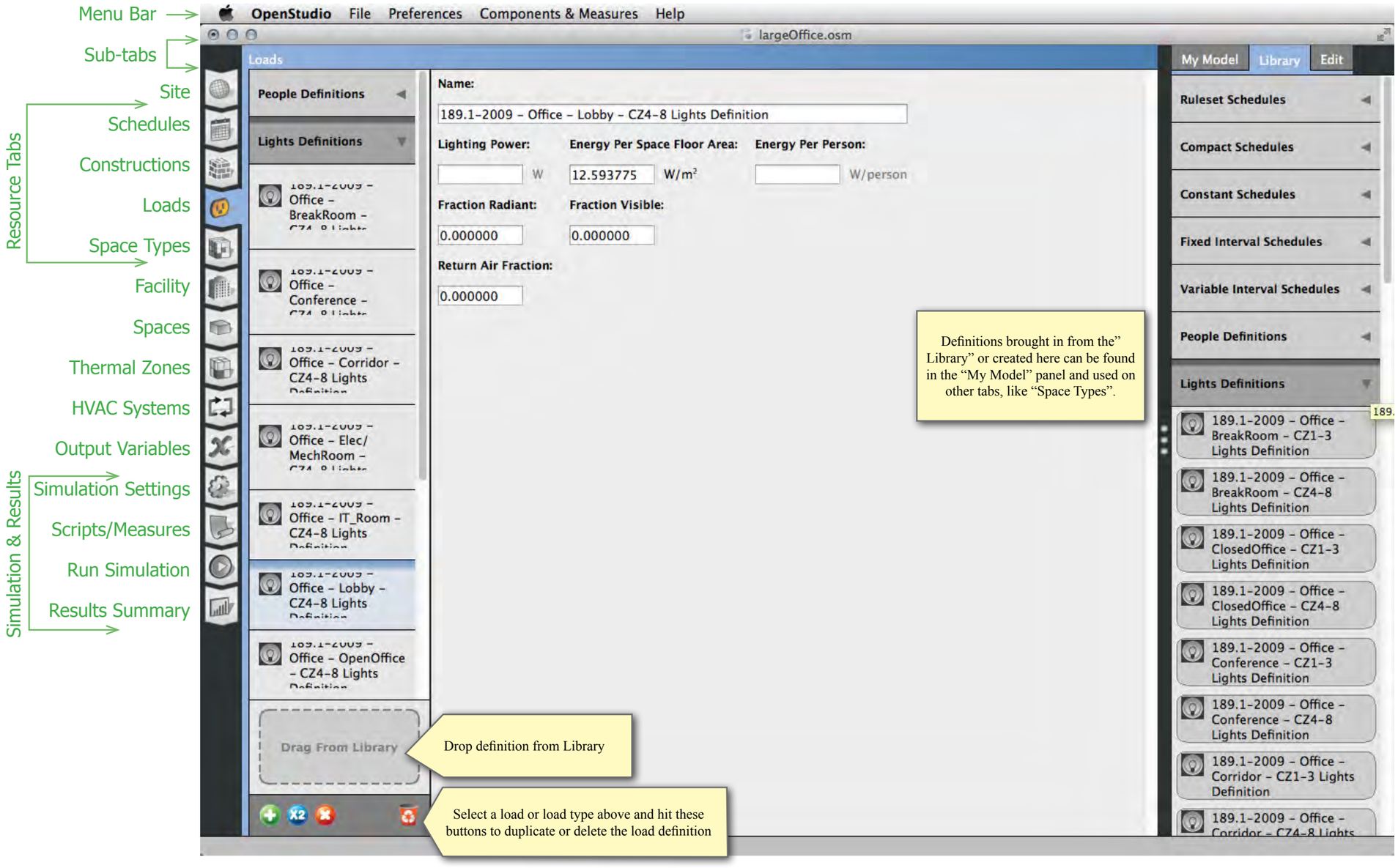
You can assign loads to a space type or directly to a space, except for Water Use Equipment.

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

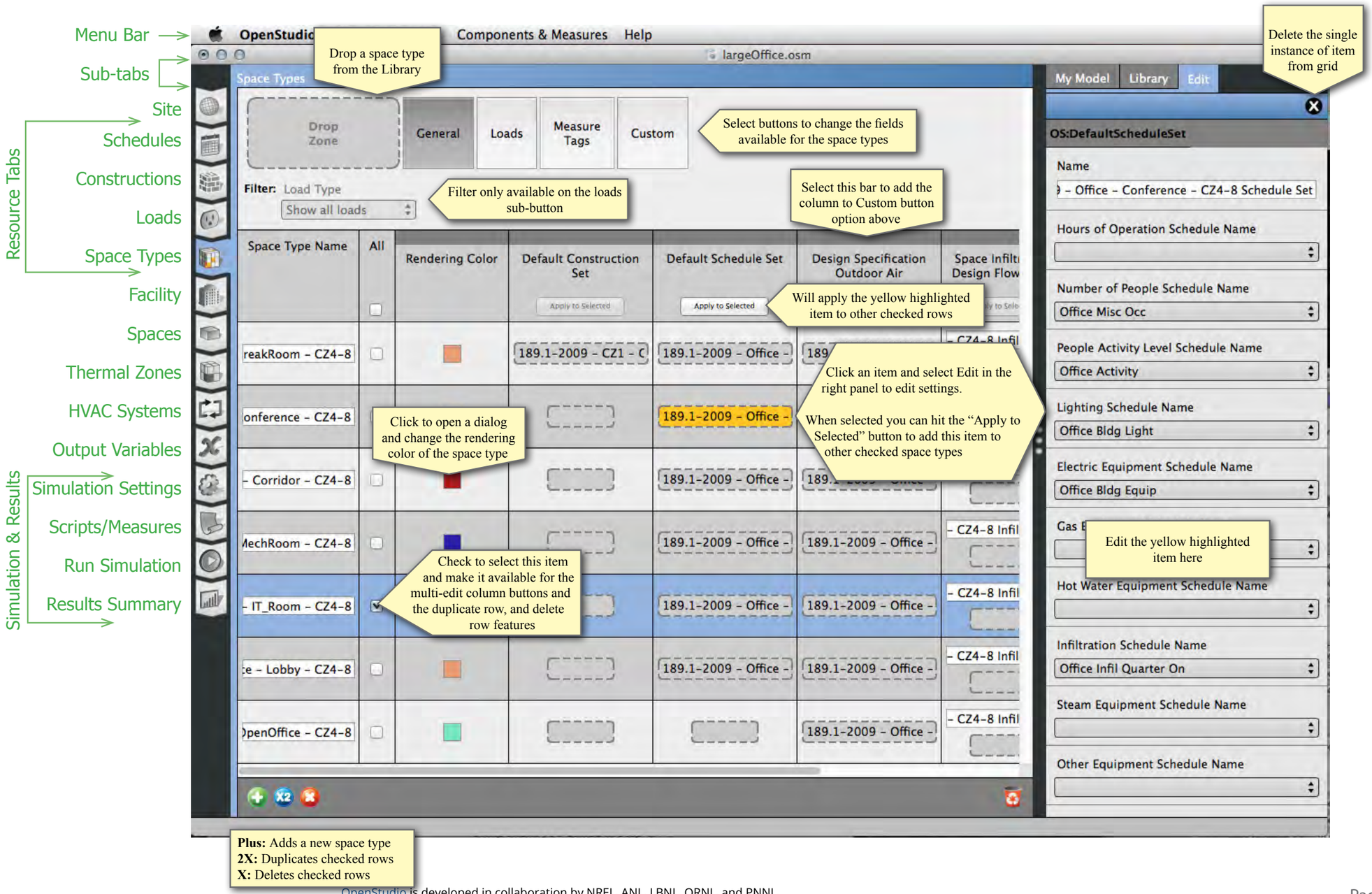
Space types are the work horses of the resources in OpenStudio. Space types can define internal loads, schedule sets, and construction sets. Space types define specific spaces or groups of specific spaces in your model. The spaces inherit all objects of the space type. If you redefine a space type, or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



Space Types — Loads

Notes

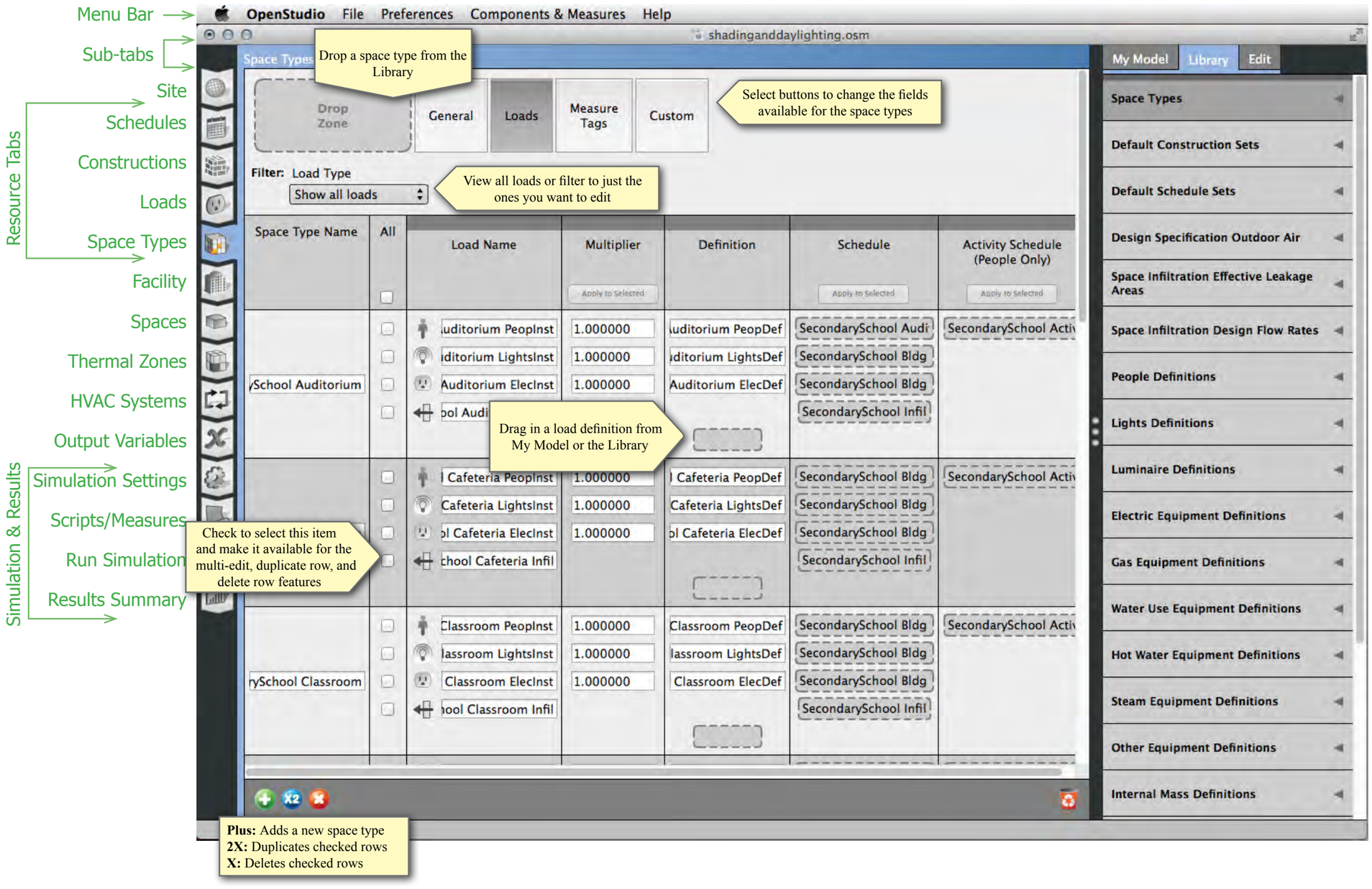
If you select the "Loads" button in the Space Type tab, you will see a drop zone to create new loads. You can have multiple loads of the same type.

The space types define loads such as lighting or electric equipment as simple area weighted power densities (e.g., W/ft^2). 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/ft^2 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.



Facility — Building

Notes

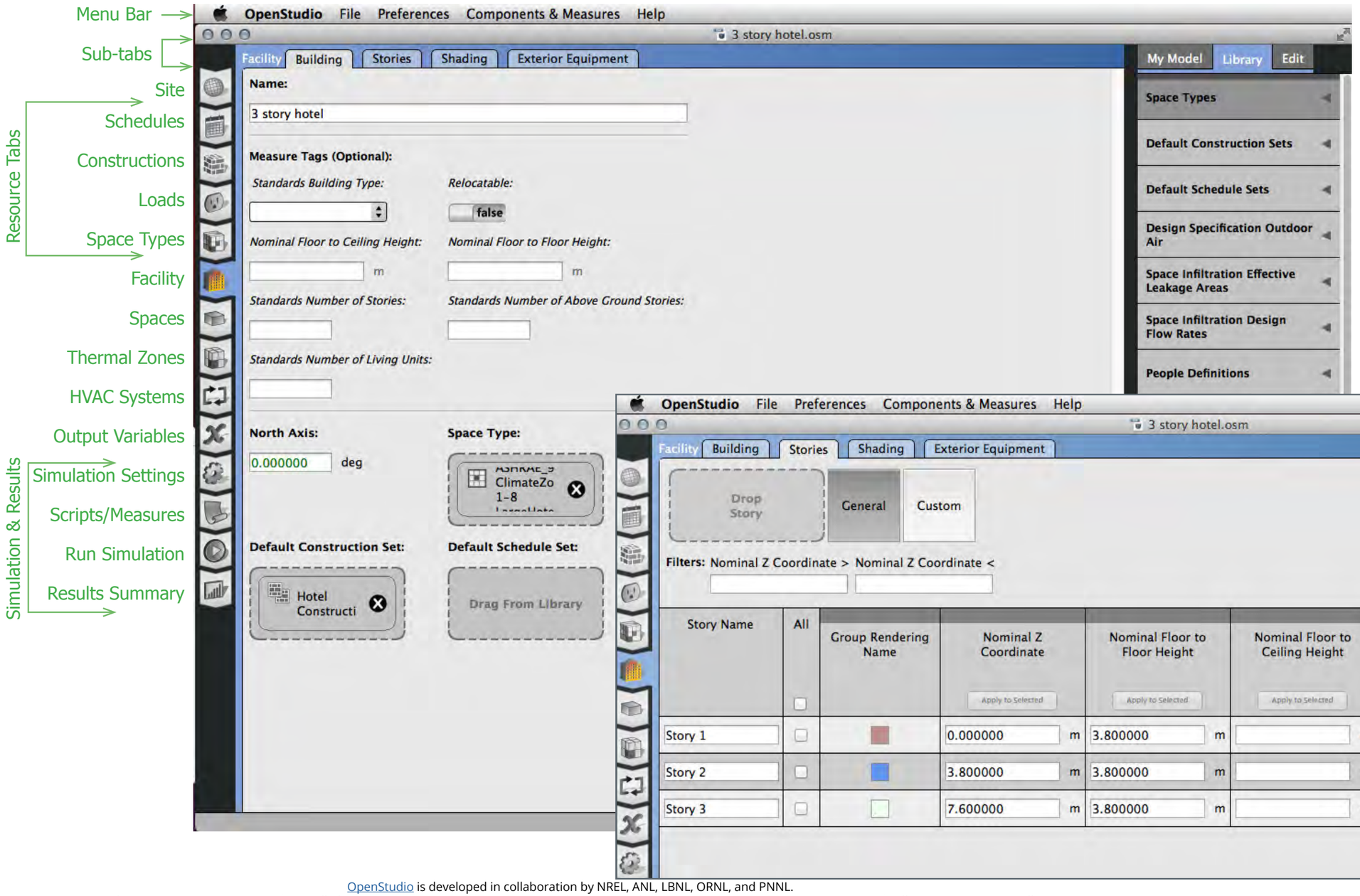
On the "Facility" you pick the Building object. This contains top level construction, schedule, or space type assignments, and sets the rotation for the building.

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 .



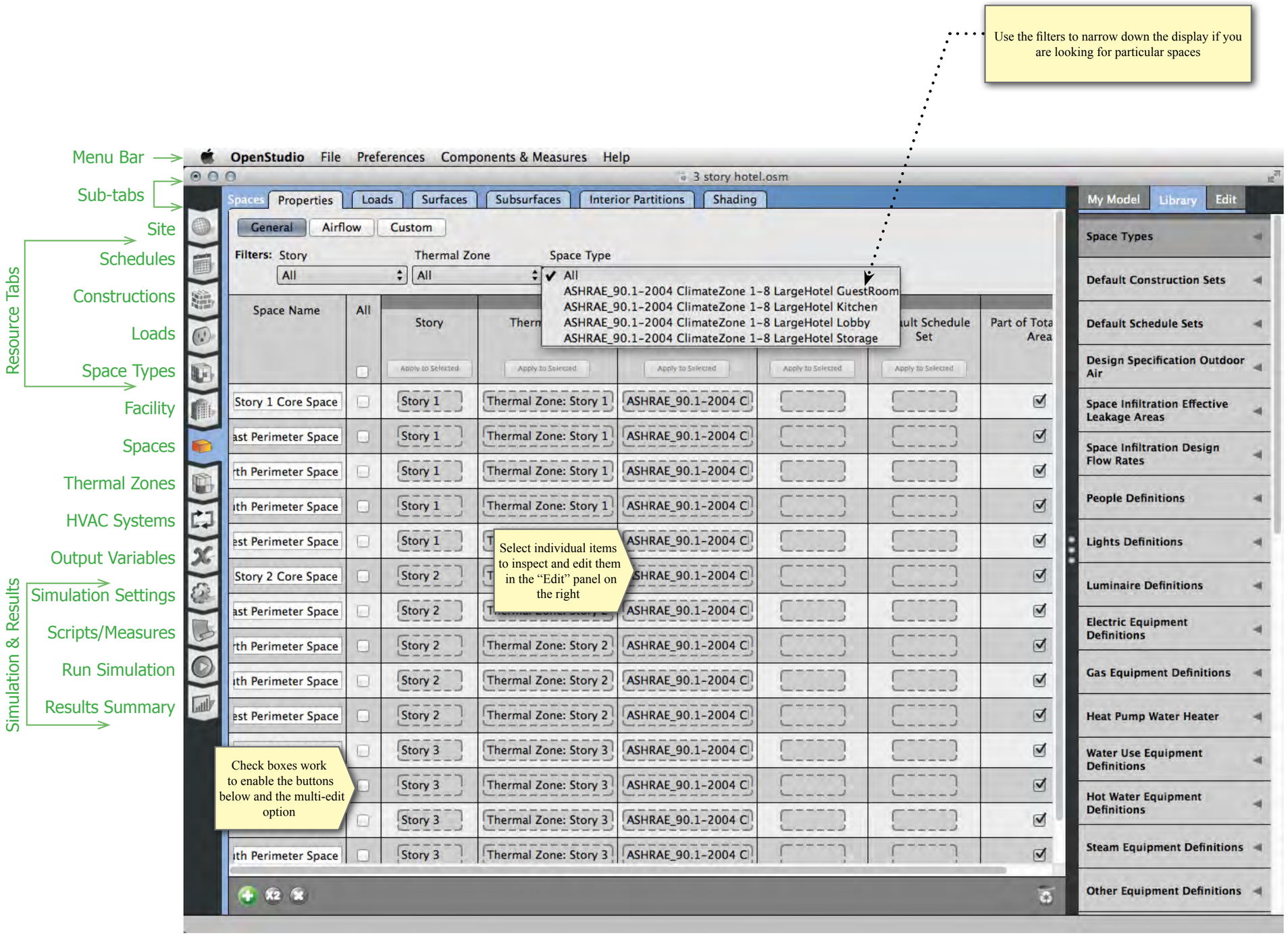
Space — Properties

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 show 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.



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

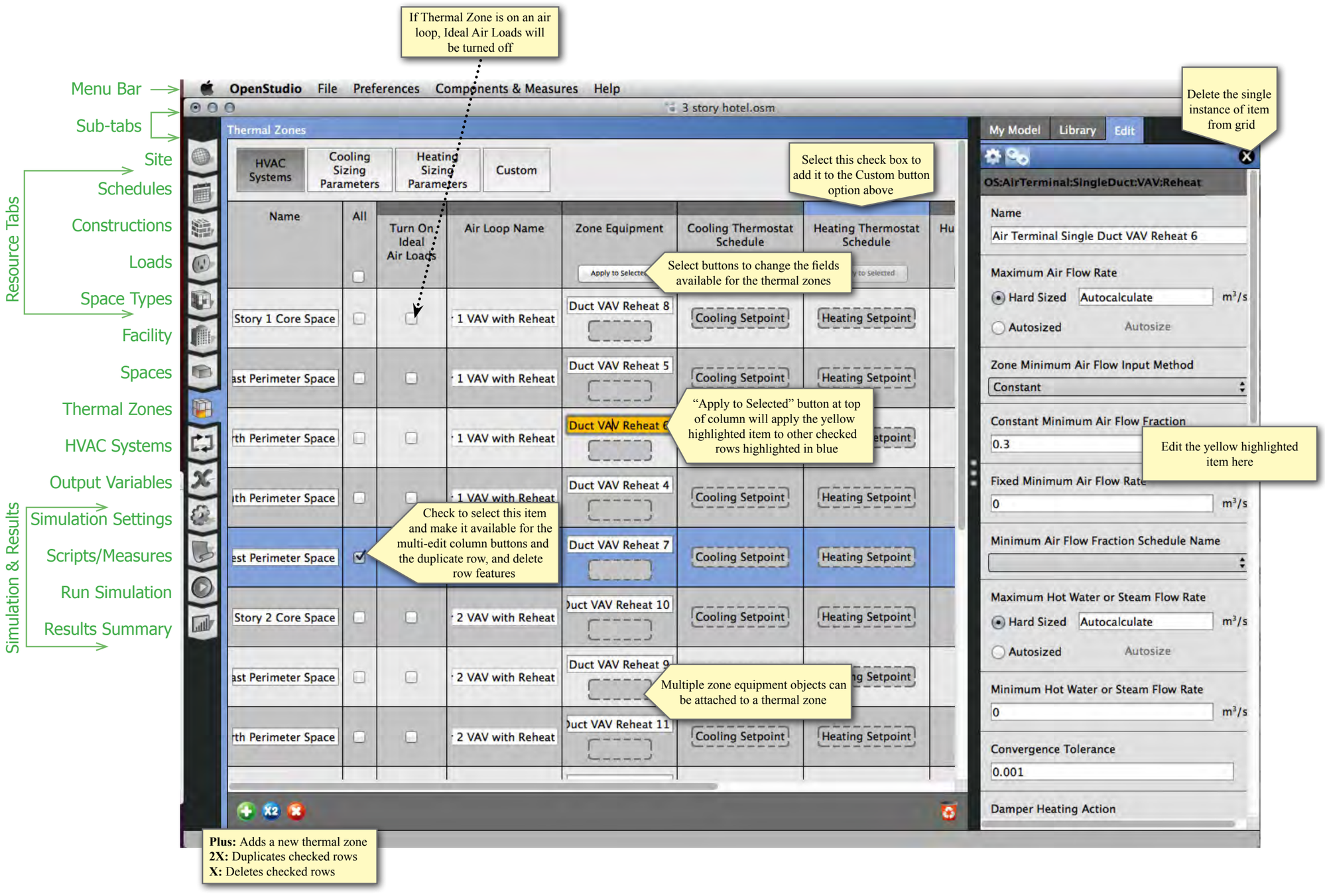
The steps for using multi-edit for adding a copy of an item to other thermal zones are below:

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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HVAC Systems — Air Loop

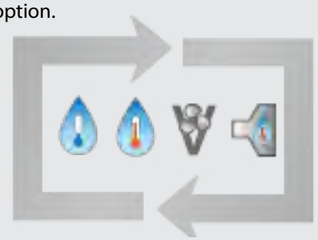
Notes

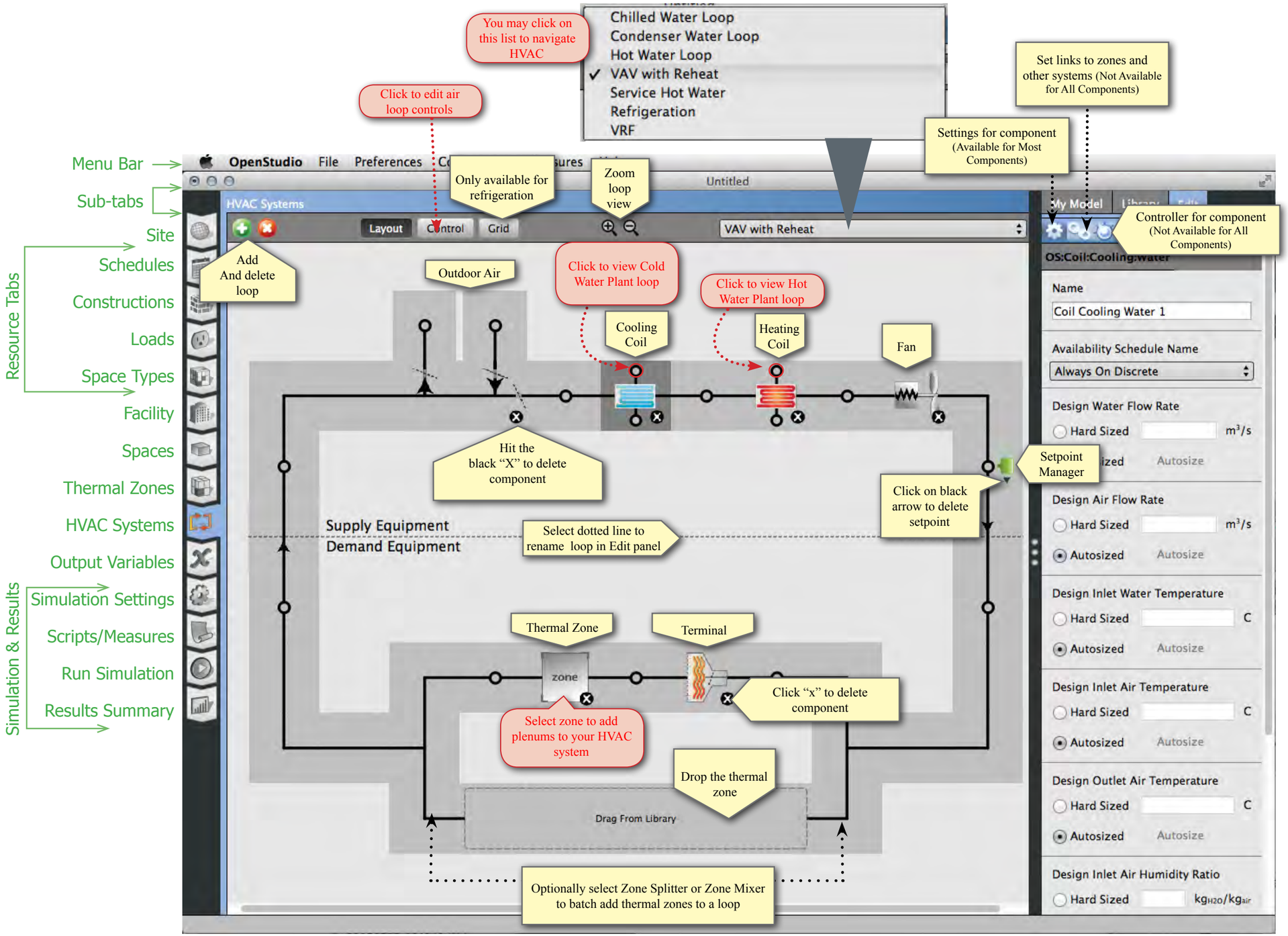
The HVAC Systems tab is used to create, inspect, and edit air and plant loops. The green "+" at the top left is used to add template or empty loops, and the "x" next to it will delete them. The pull-down at the top right of the body is to select which loop or system to display.

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.





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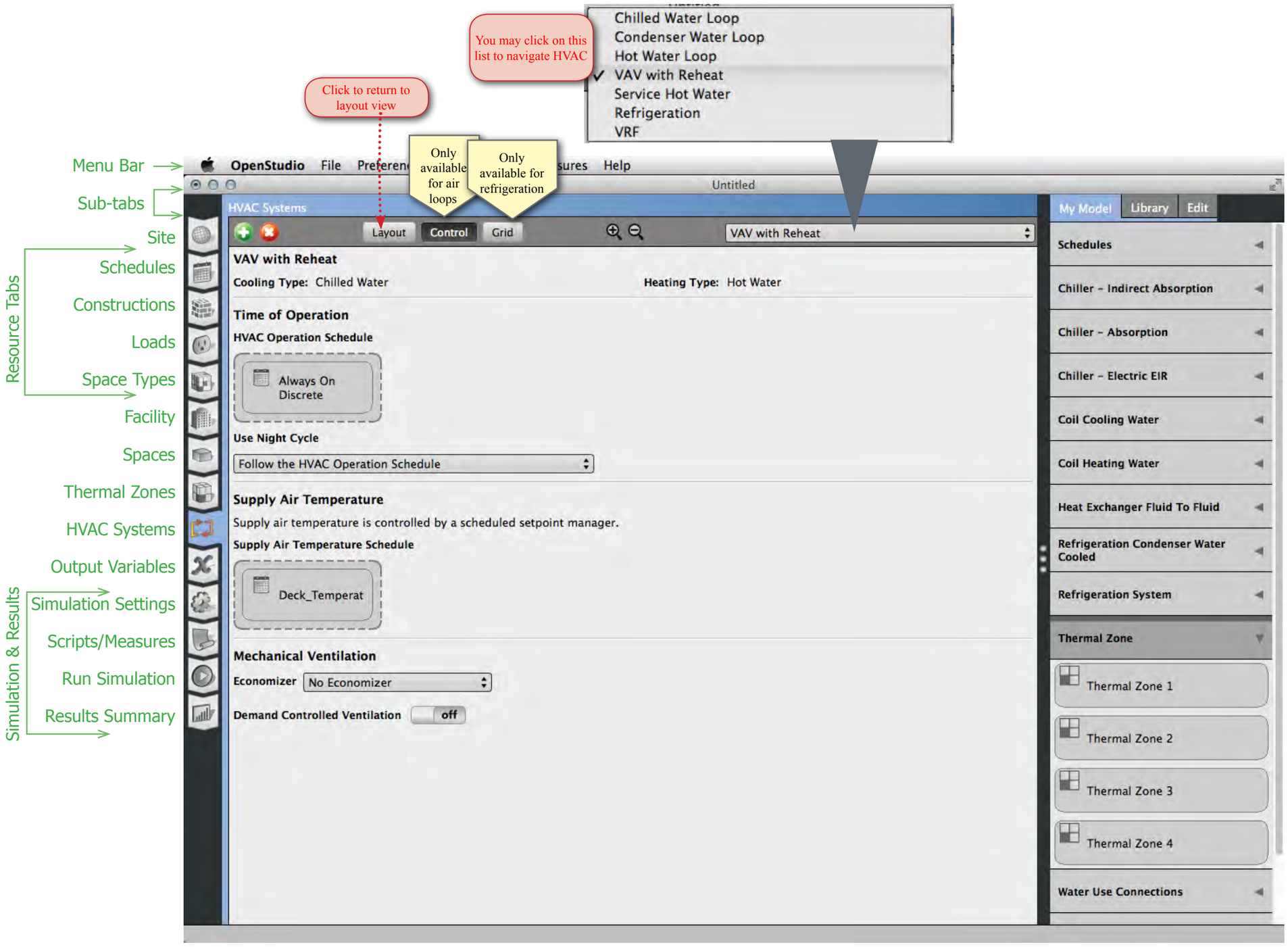
HVAC Systems — Controls View

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.



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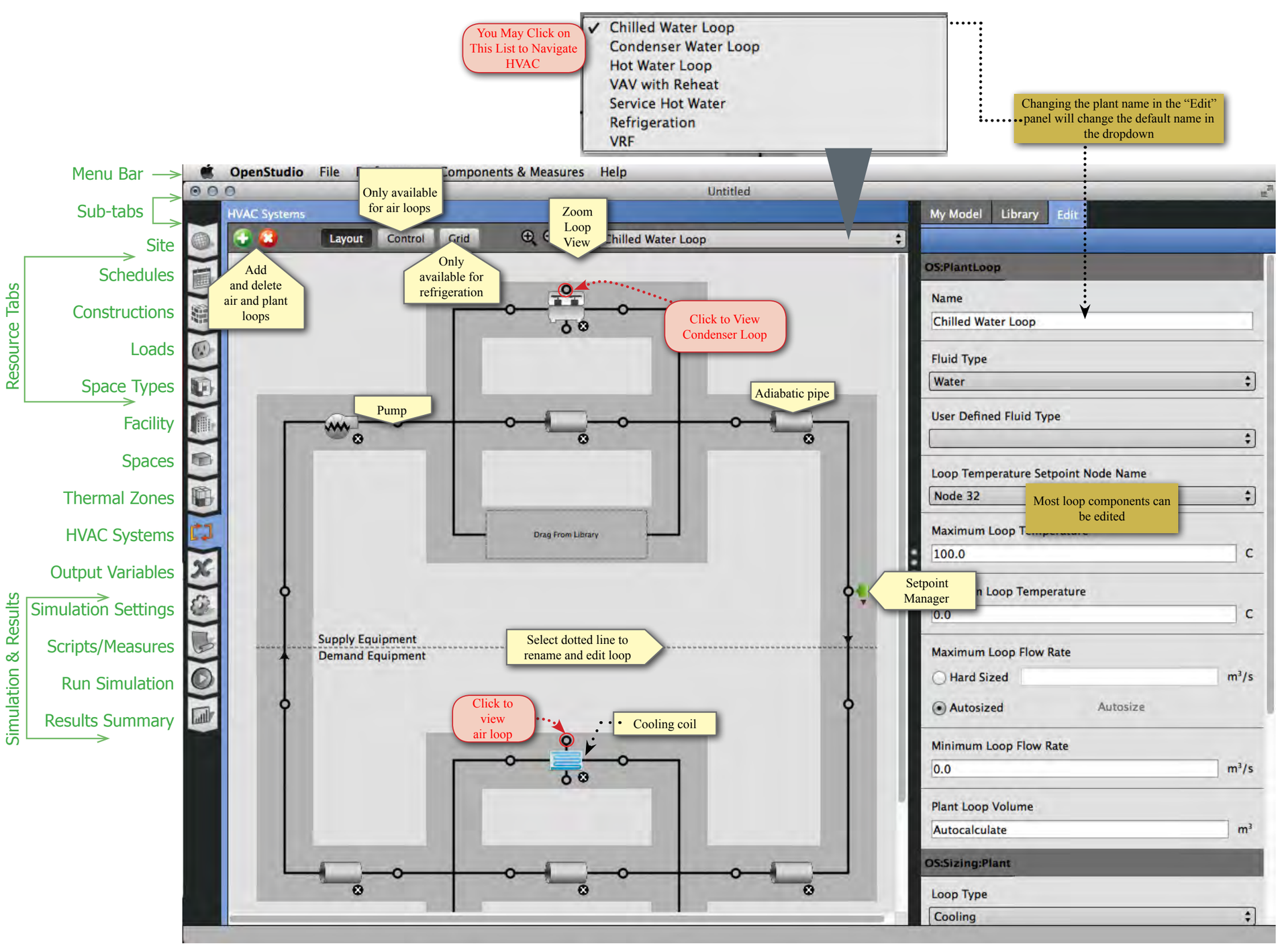
HVAC Systems — Cold Water Loop

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.



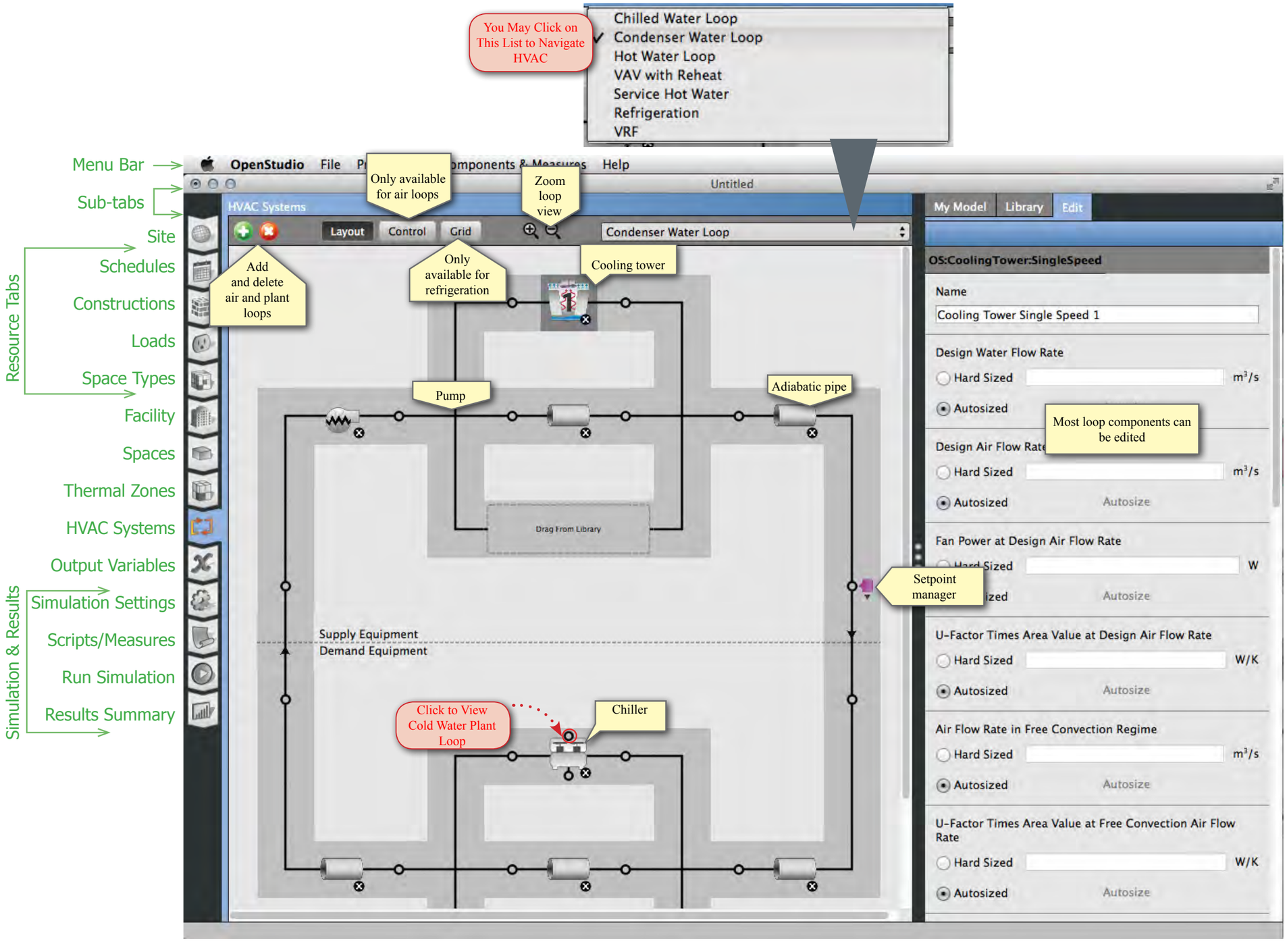
HVAC Systems — Condenser Loop

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.



HVAC Systems — Hot Water Loop

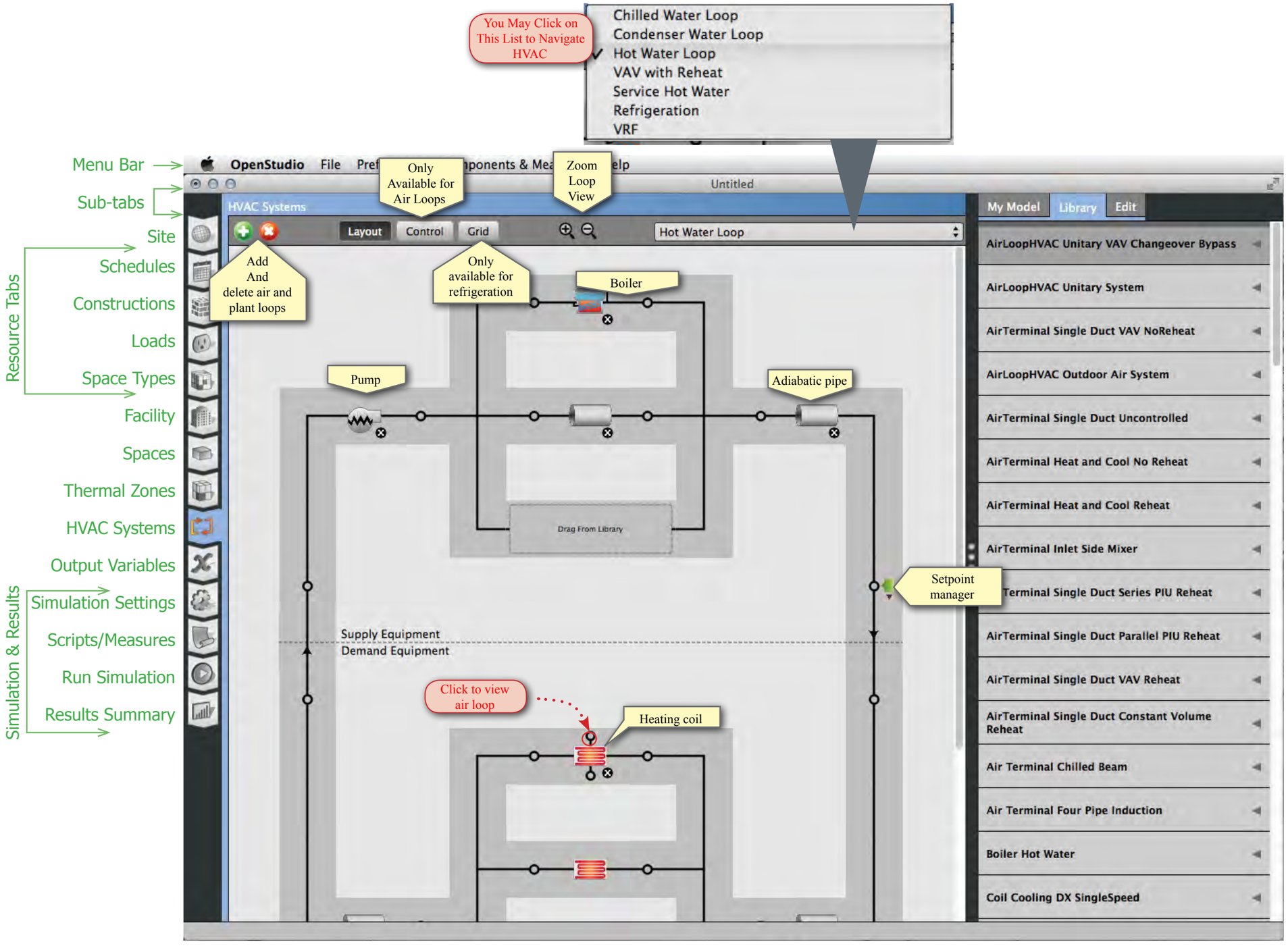
Notes

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.



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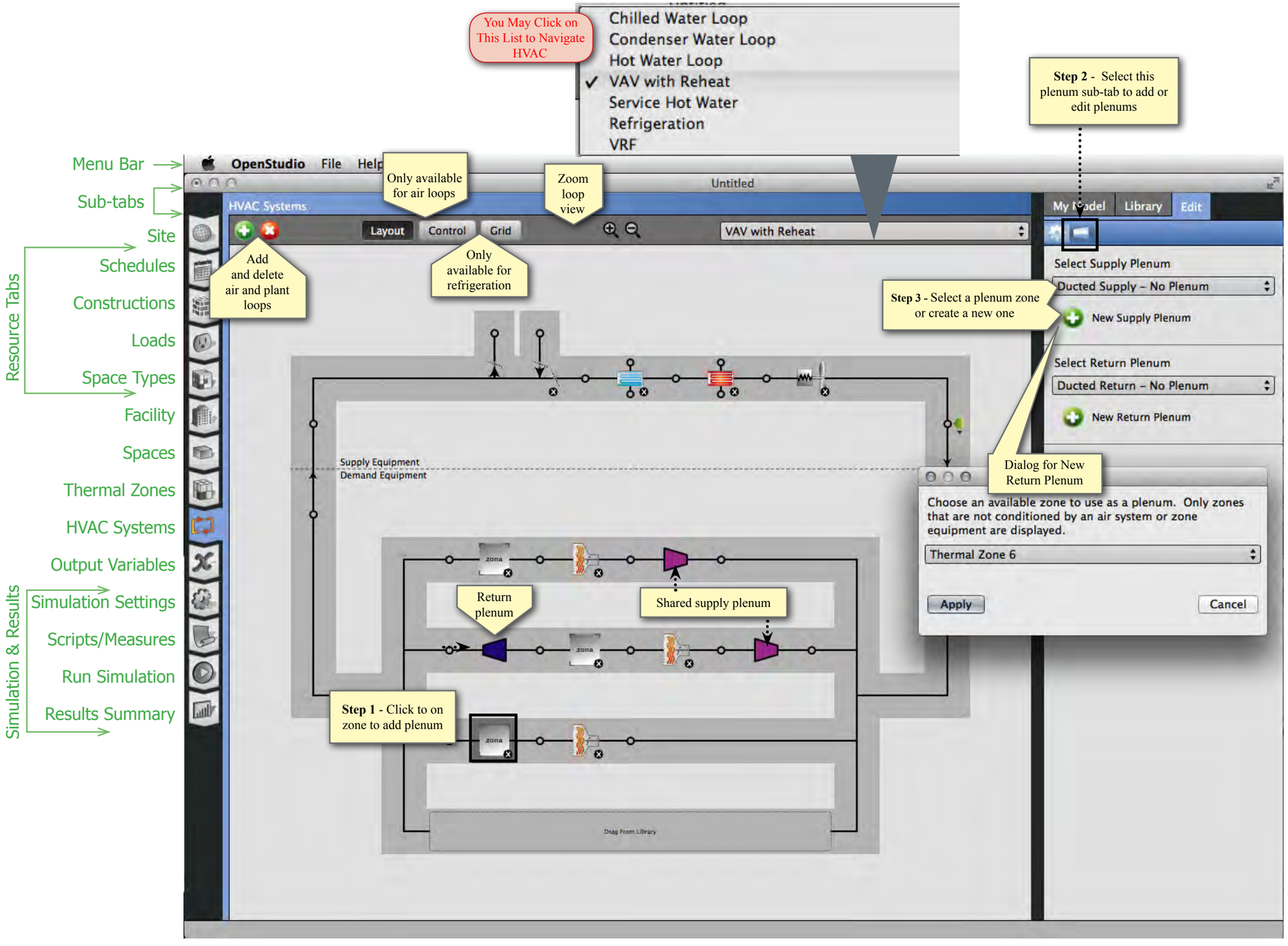
HVAC Systems — Plenums

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.



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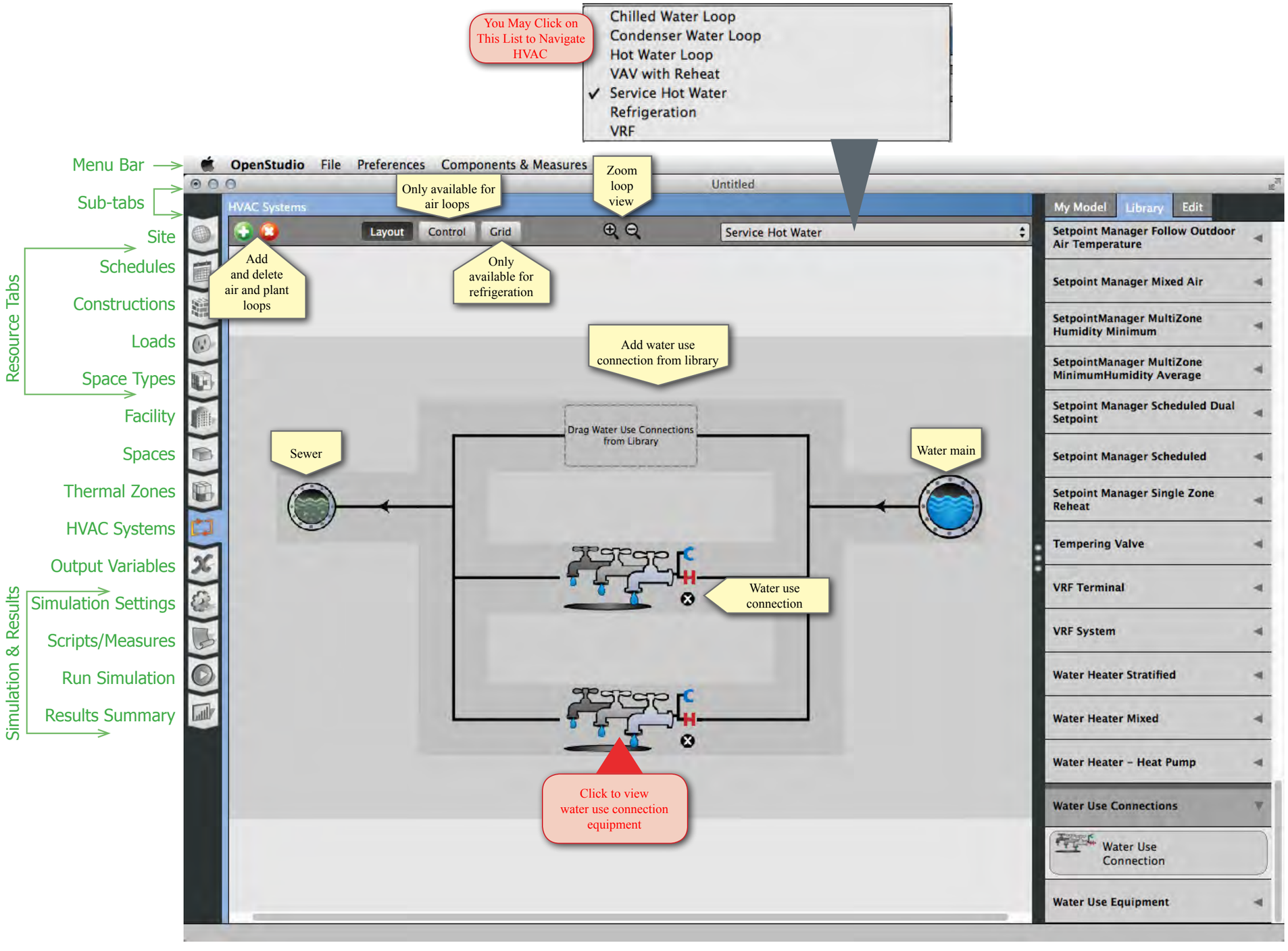
HVAC Systems —Water Mains Editor

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.



OpenStudio 1.9.0 Basic Workflow Guide (September 2015)

HVAC Systems — Water Use Connection

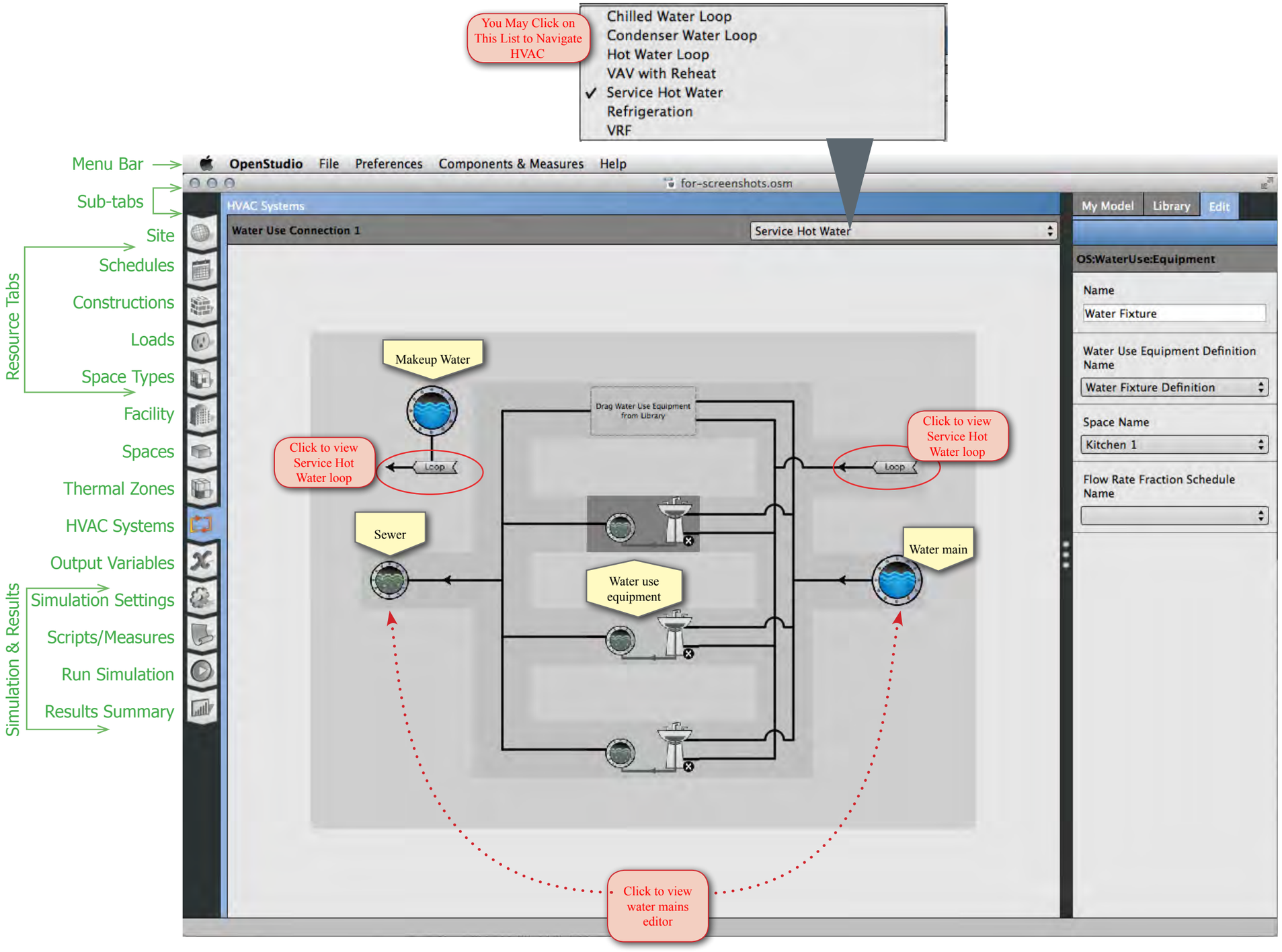
Notes

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.



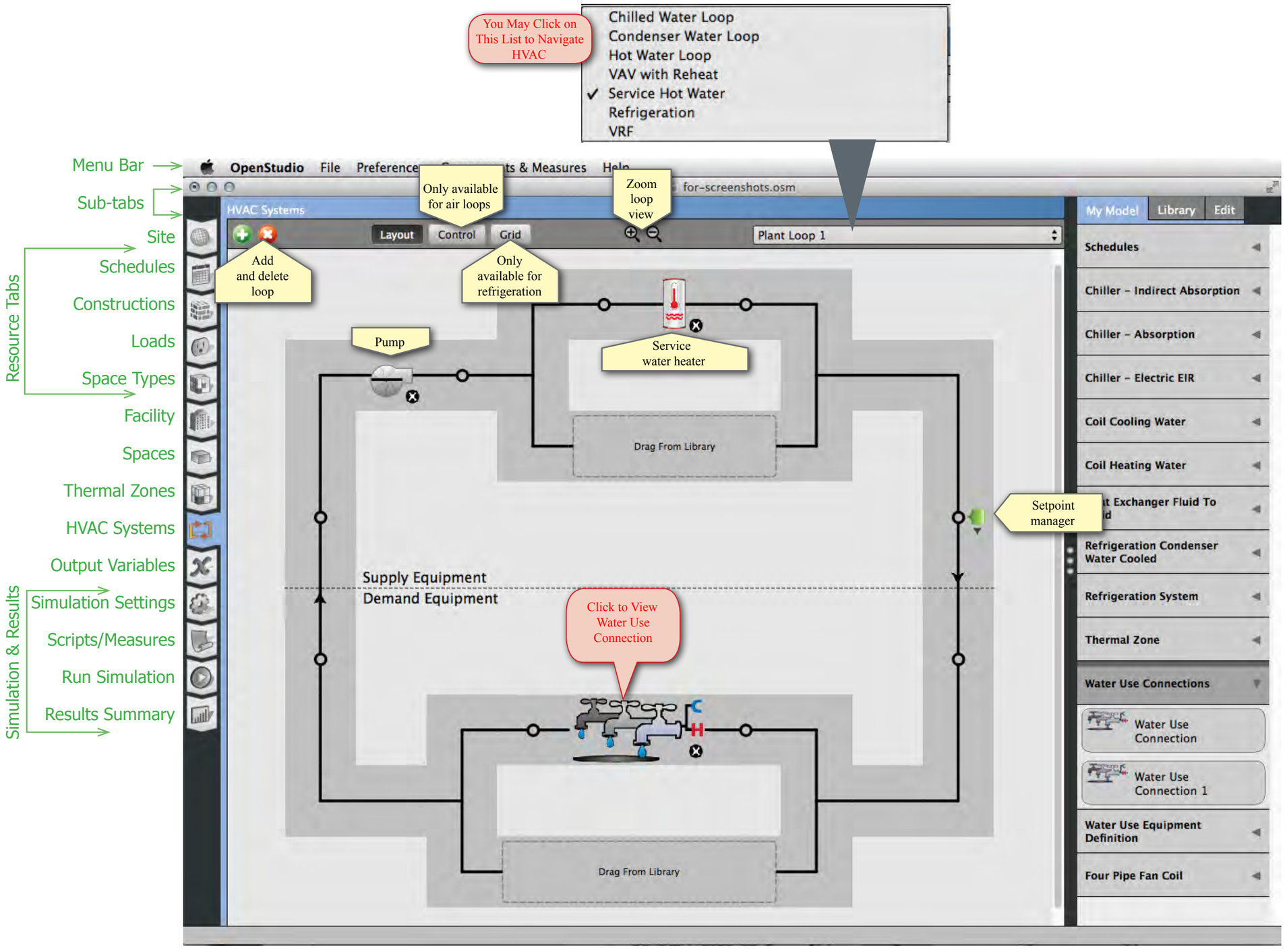
HVAC — Service Water Heater Loop

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 set-point 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 equip-ment 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.



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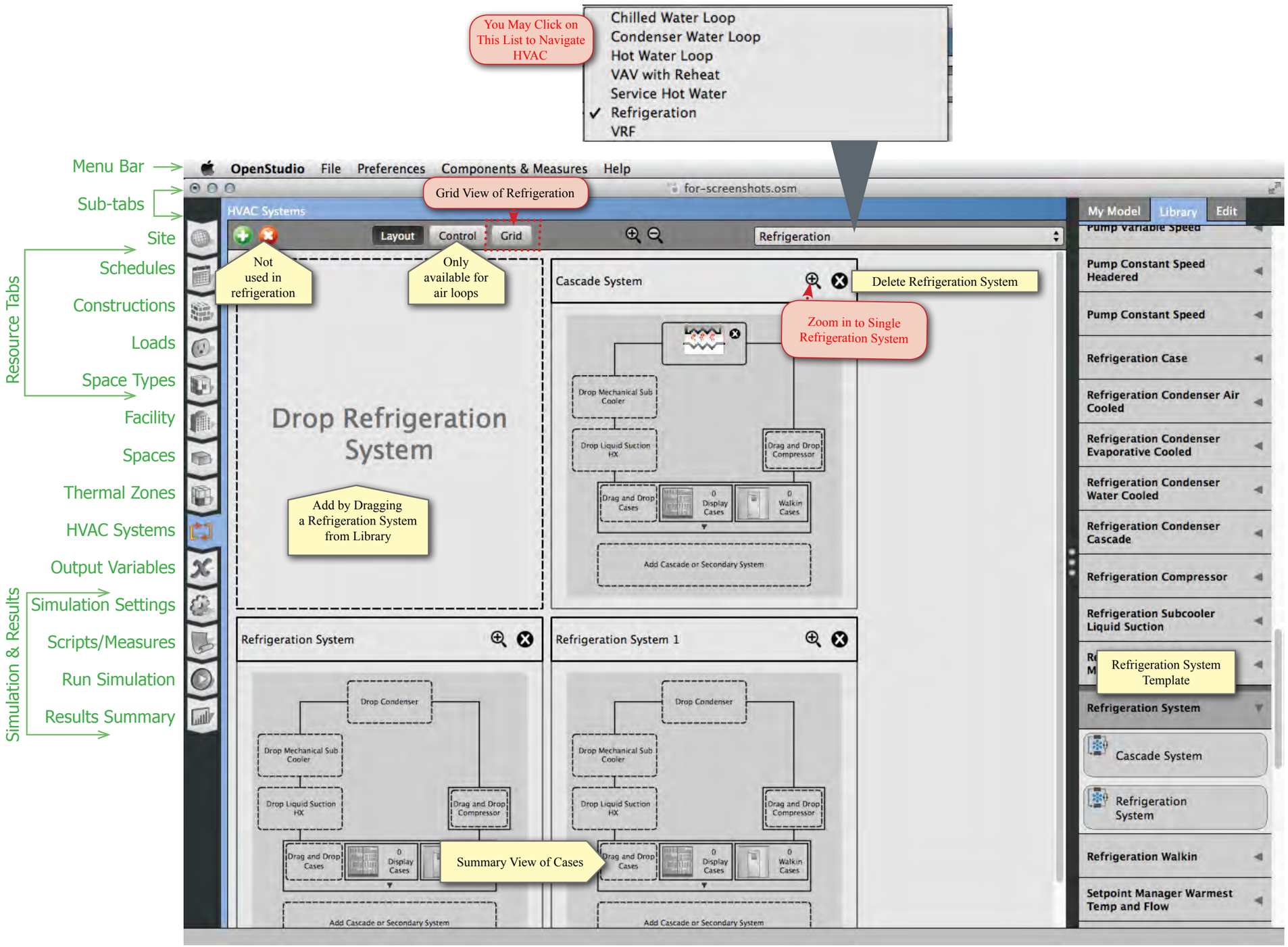
HVAC — Add Refrigeration System

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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HVAC — Edit Refrigeration System in Layout View

Notes

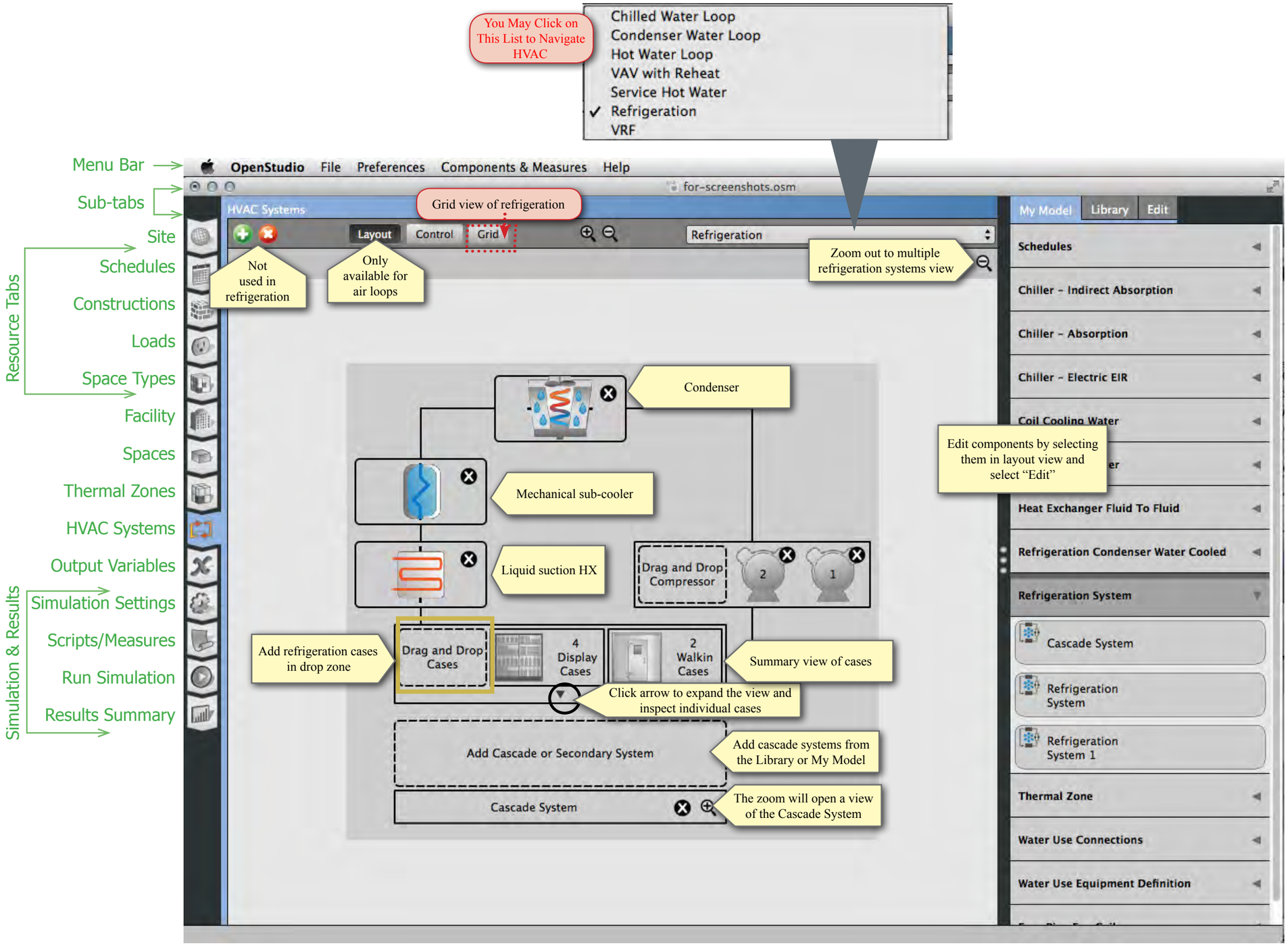
This zoomed in view provides the layout view of one refrigeration rack. You may add cases by dragging them on to the "Drag and Drop Cases" drop zone.

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.



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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.

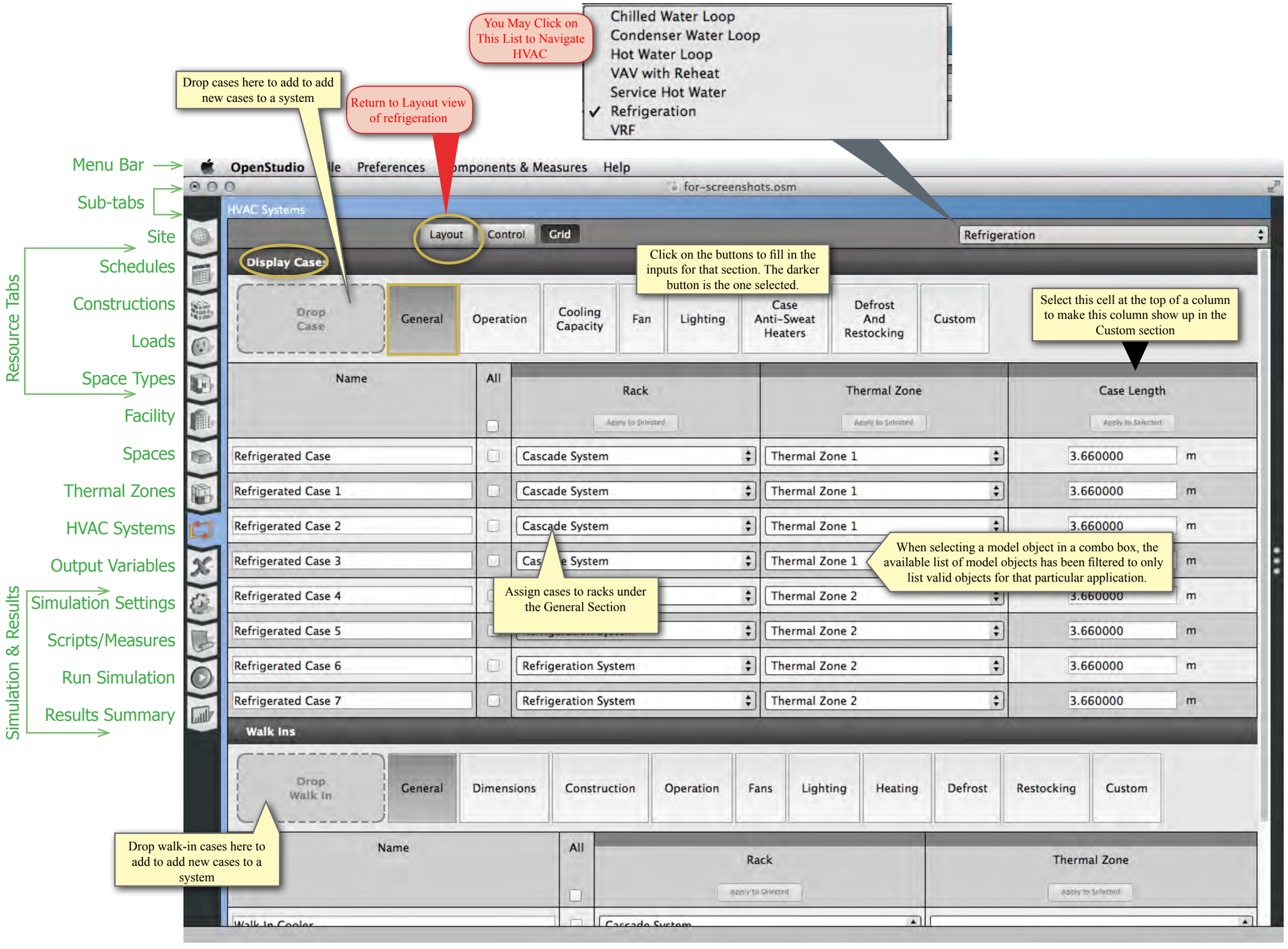
Create your own custom view of this information by checking the box on the right of the column header. Checked columns will show up under the Custom button.

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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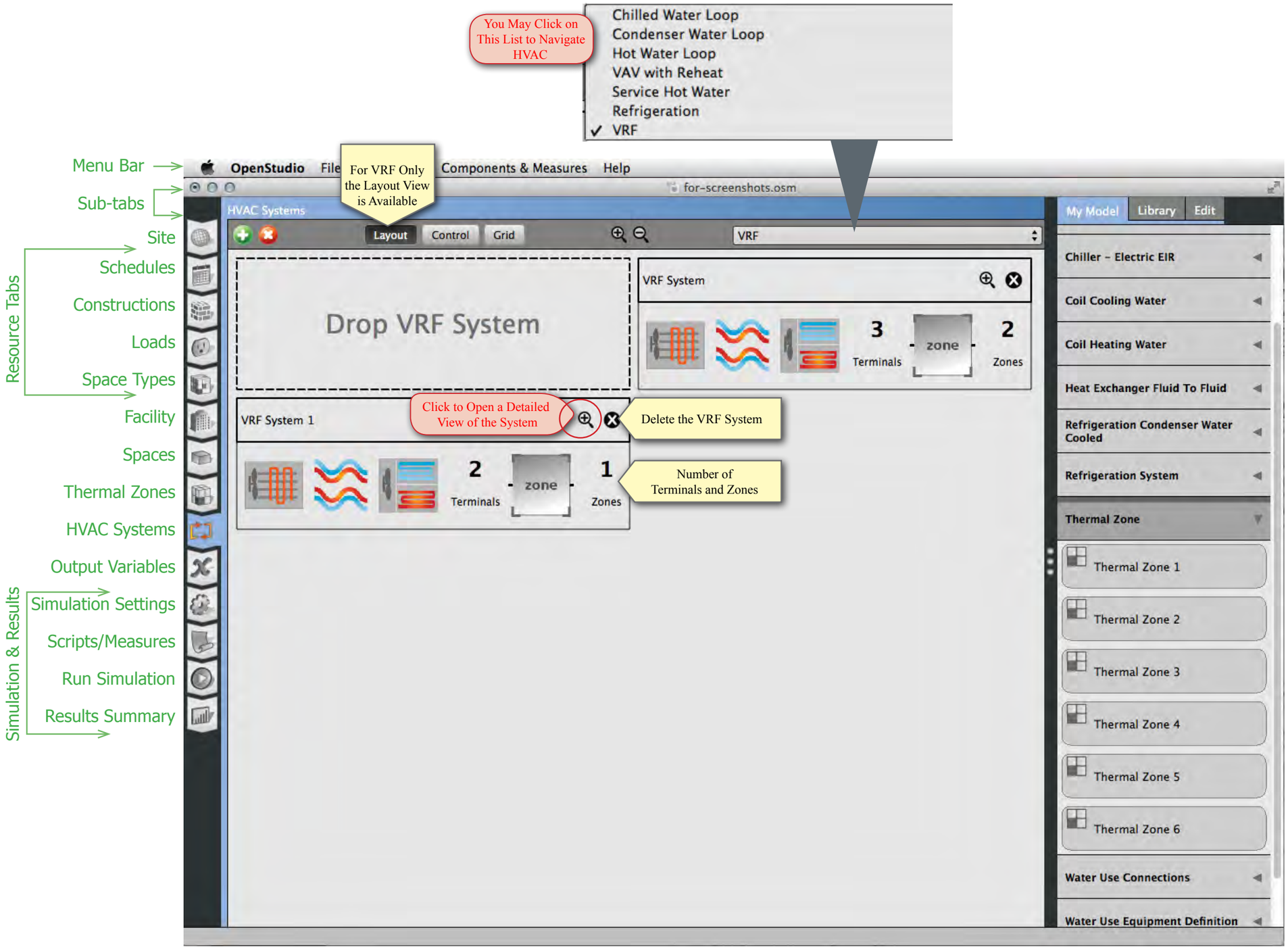
HVAC — Add Variable Refrigerant Flow (VRF) System

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.



OpenStudio 1.9.0 Basic Workflow Guide (September 2015)

HVAC — Edit Variable Refrigerant Flow (VRF)

Notes

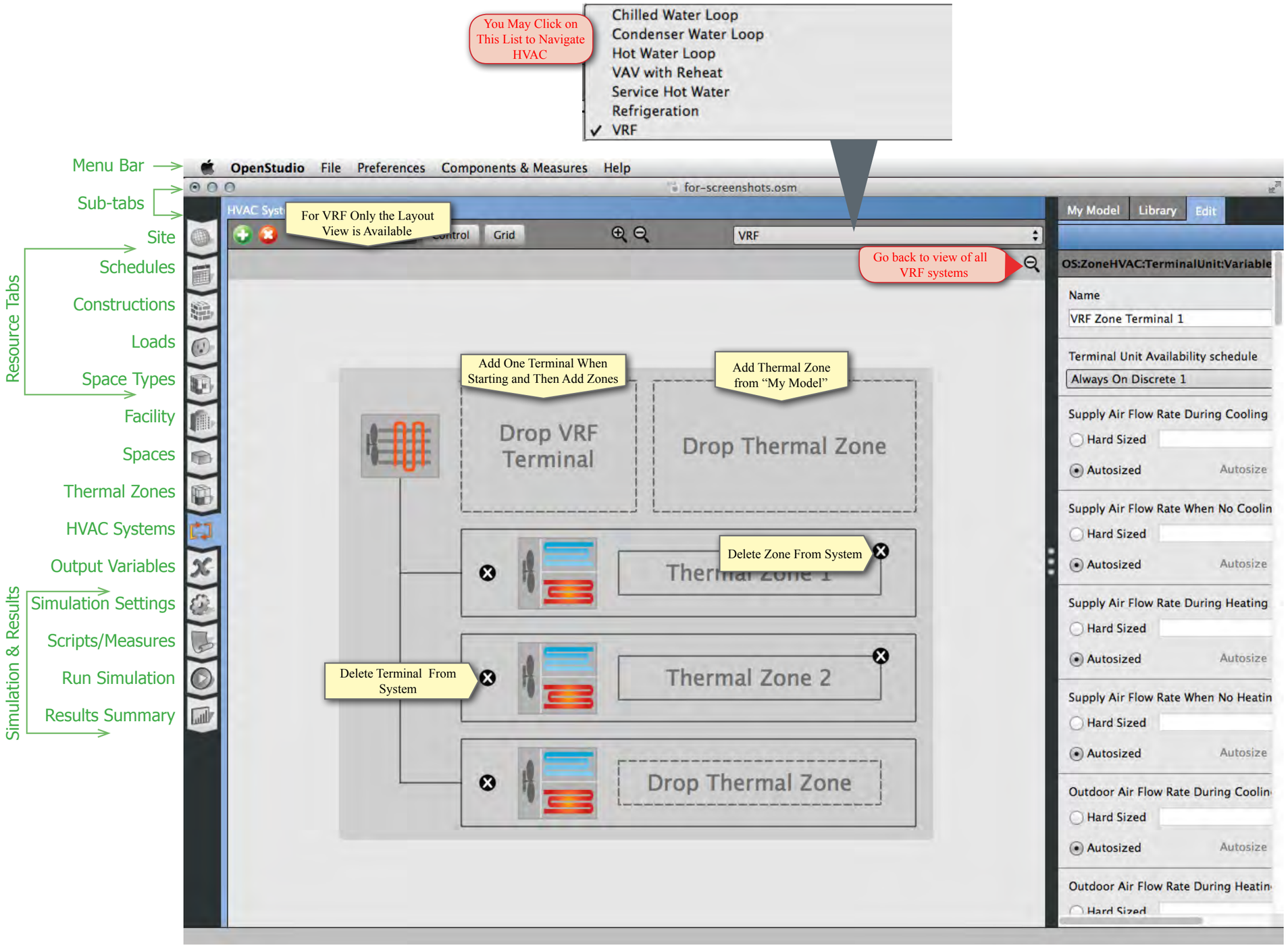
To create your VRF system, start by dropping a terminal from the "Library" onto the drop zone. Then add thermal zones from "My Model." When a thermal zone is added a new VRF terminal will automatically be created.

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.



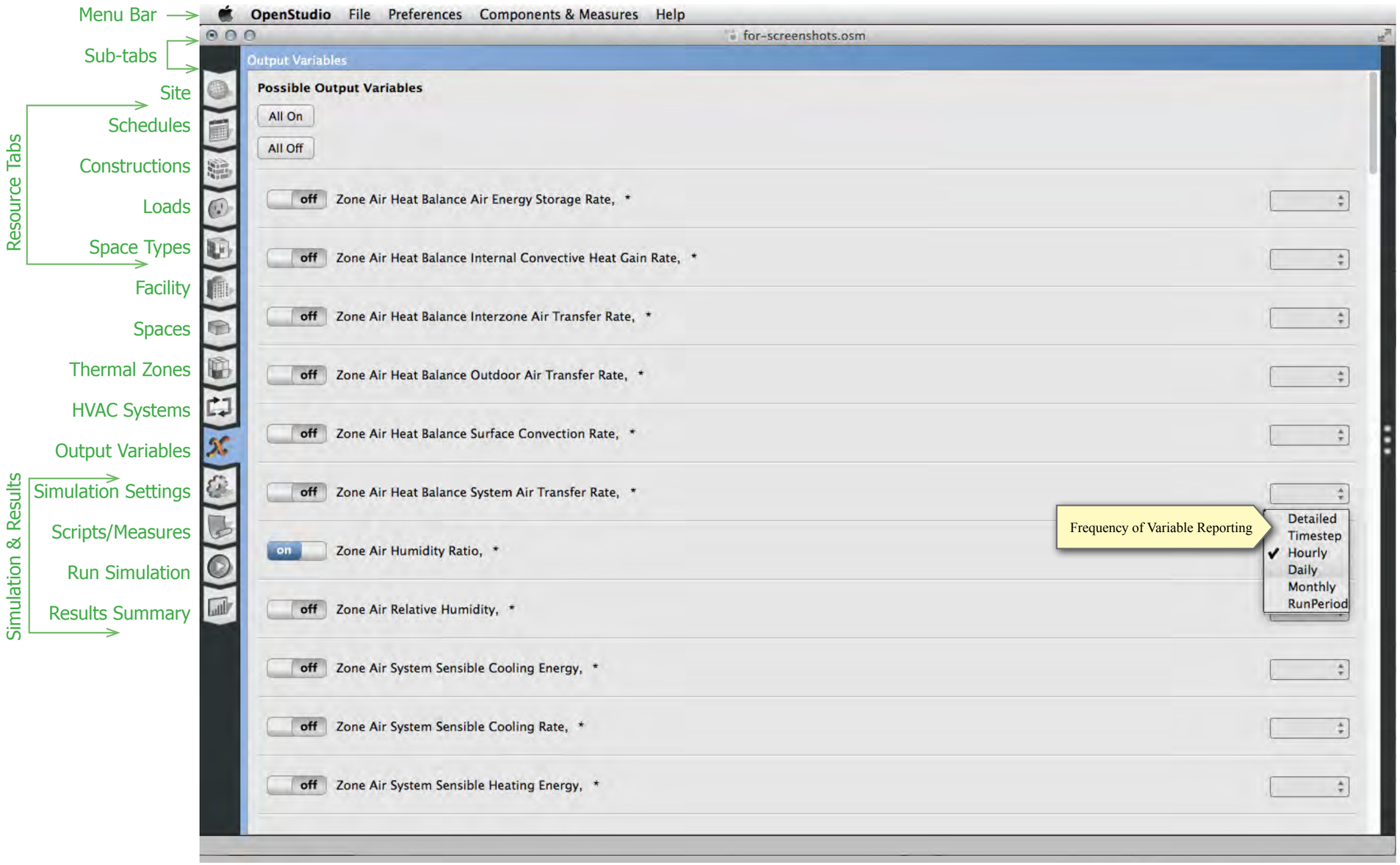
Output Variables

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*).

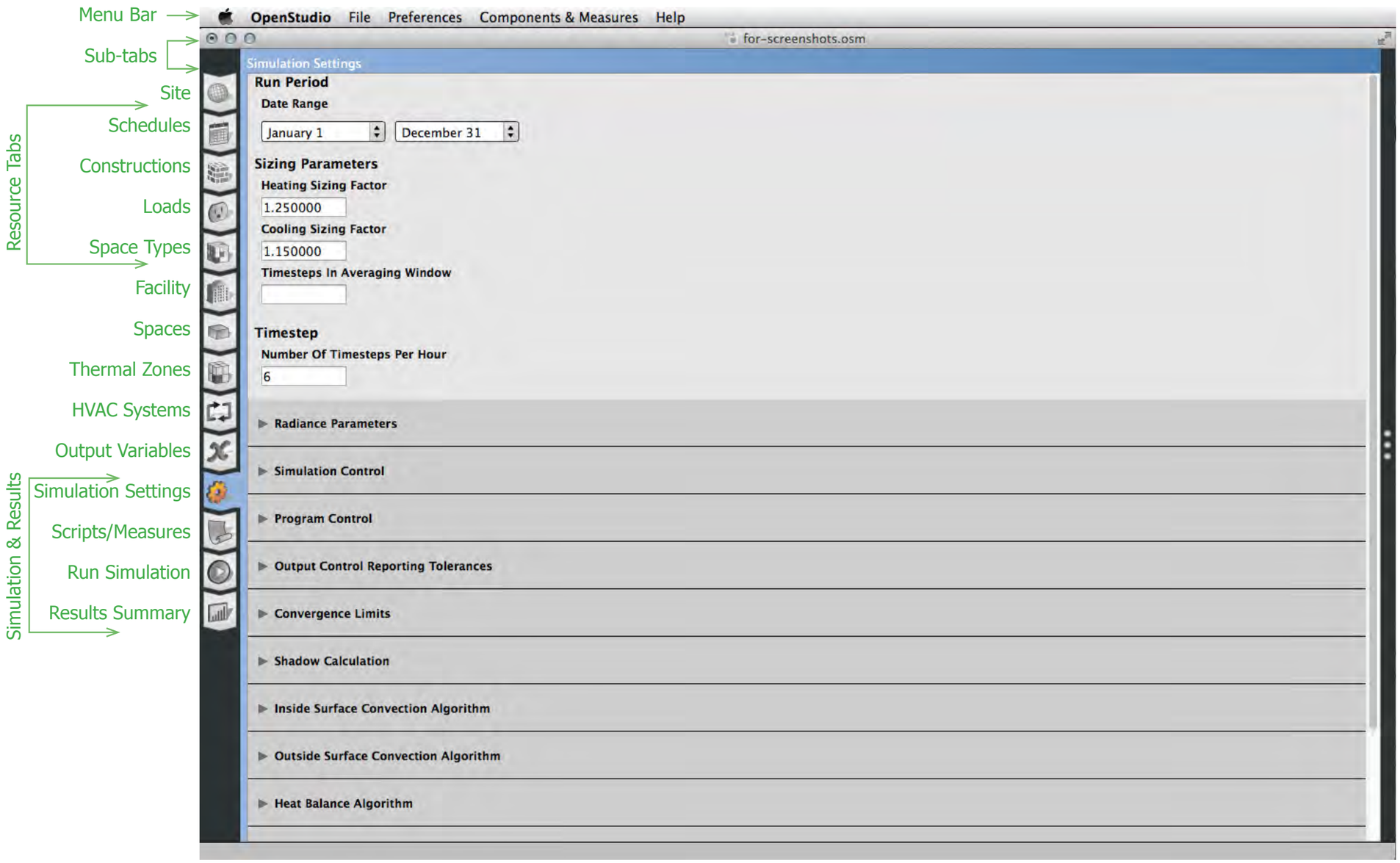


Simulation Settings

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

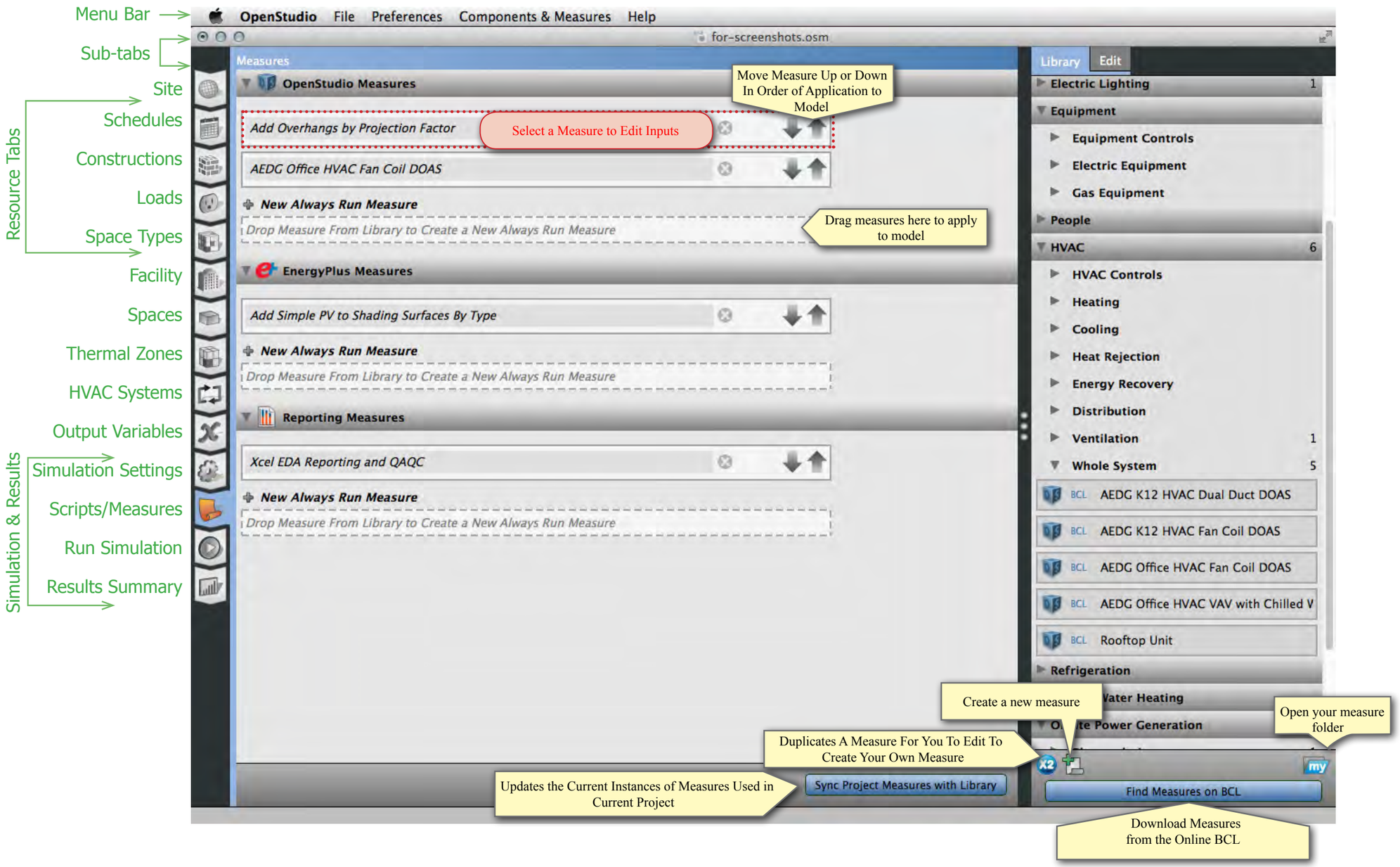
Notes

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.

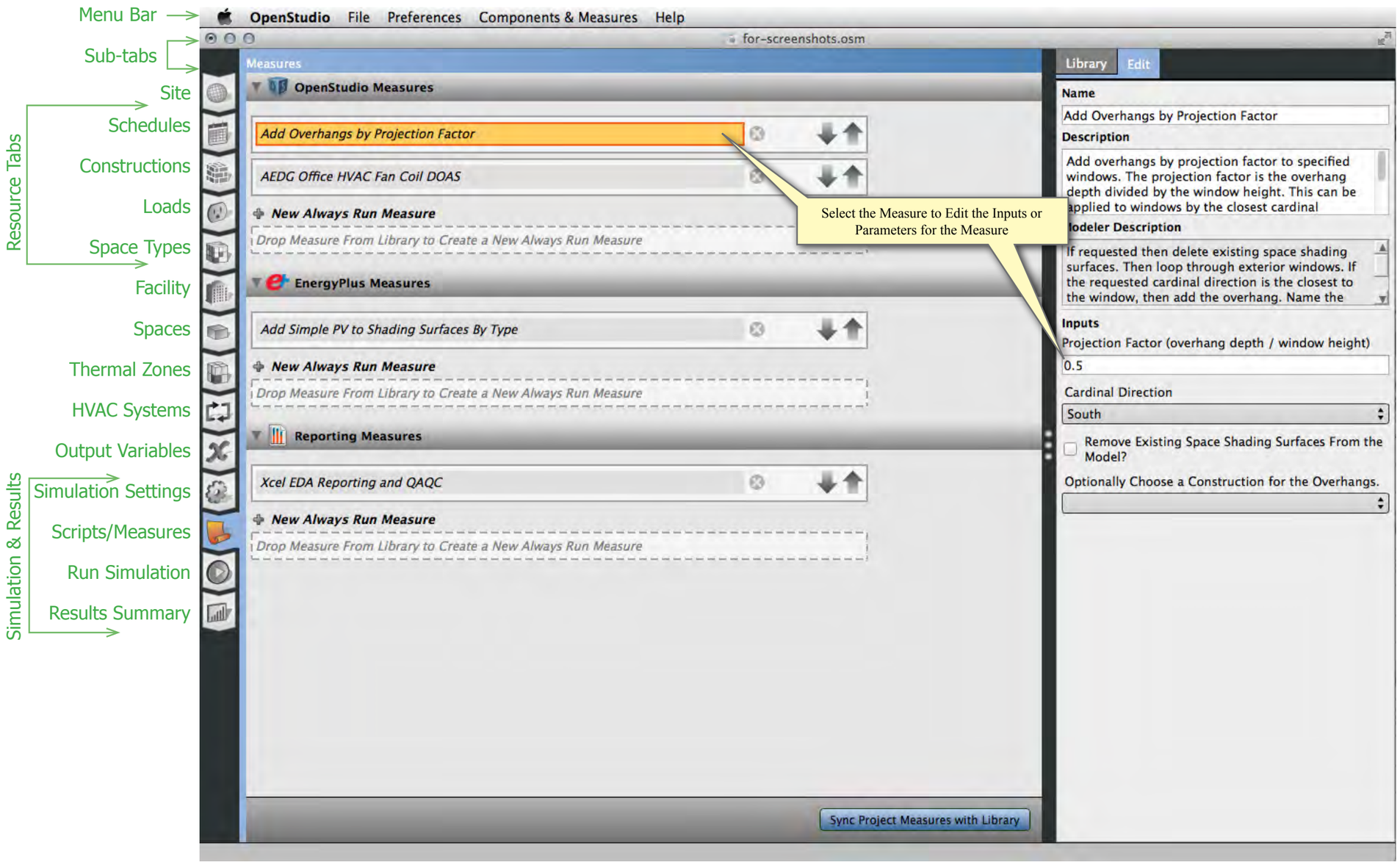


Measures — Edit Inputs

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

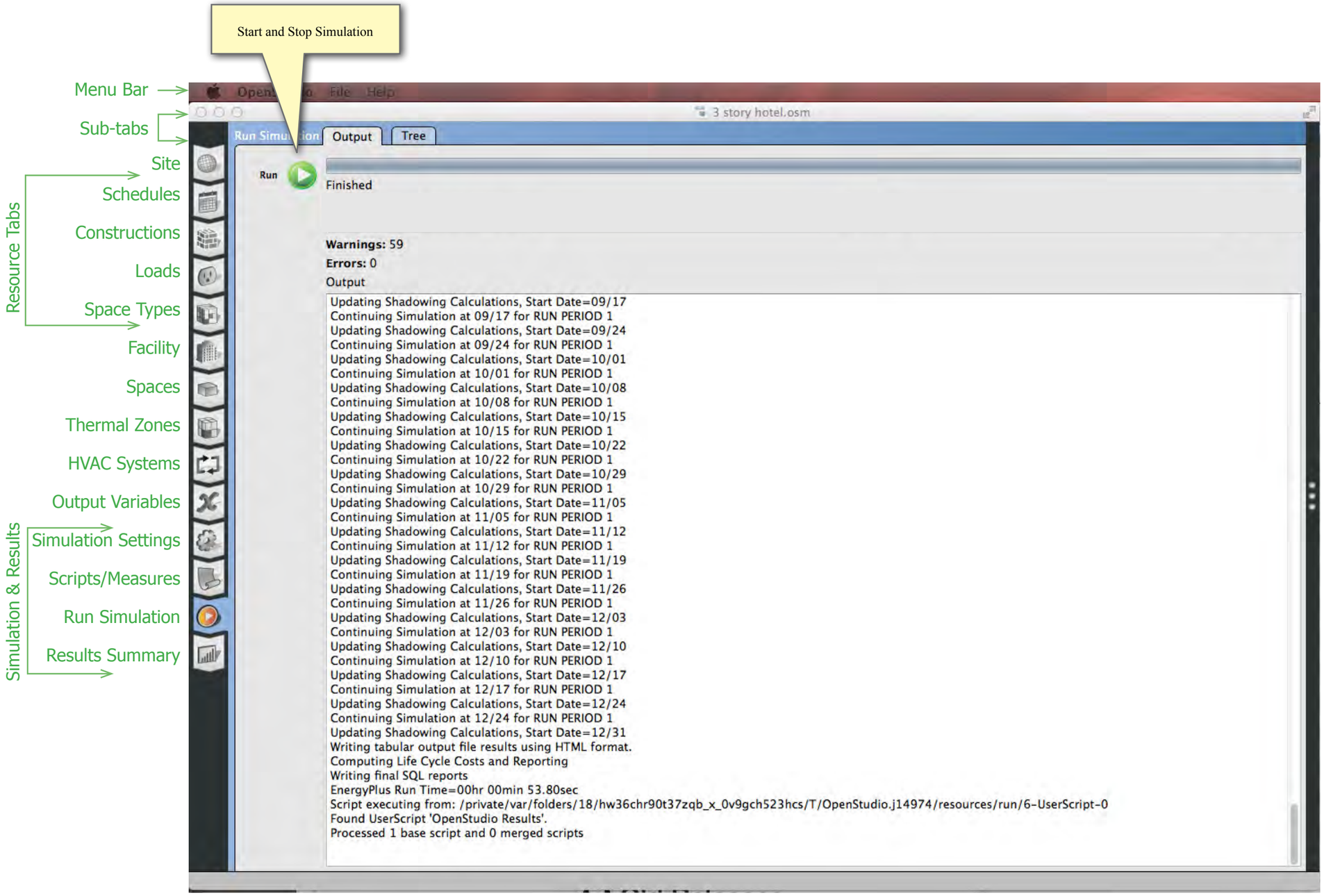
Notes

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.



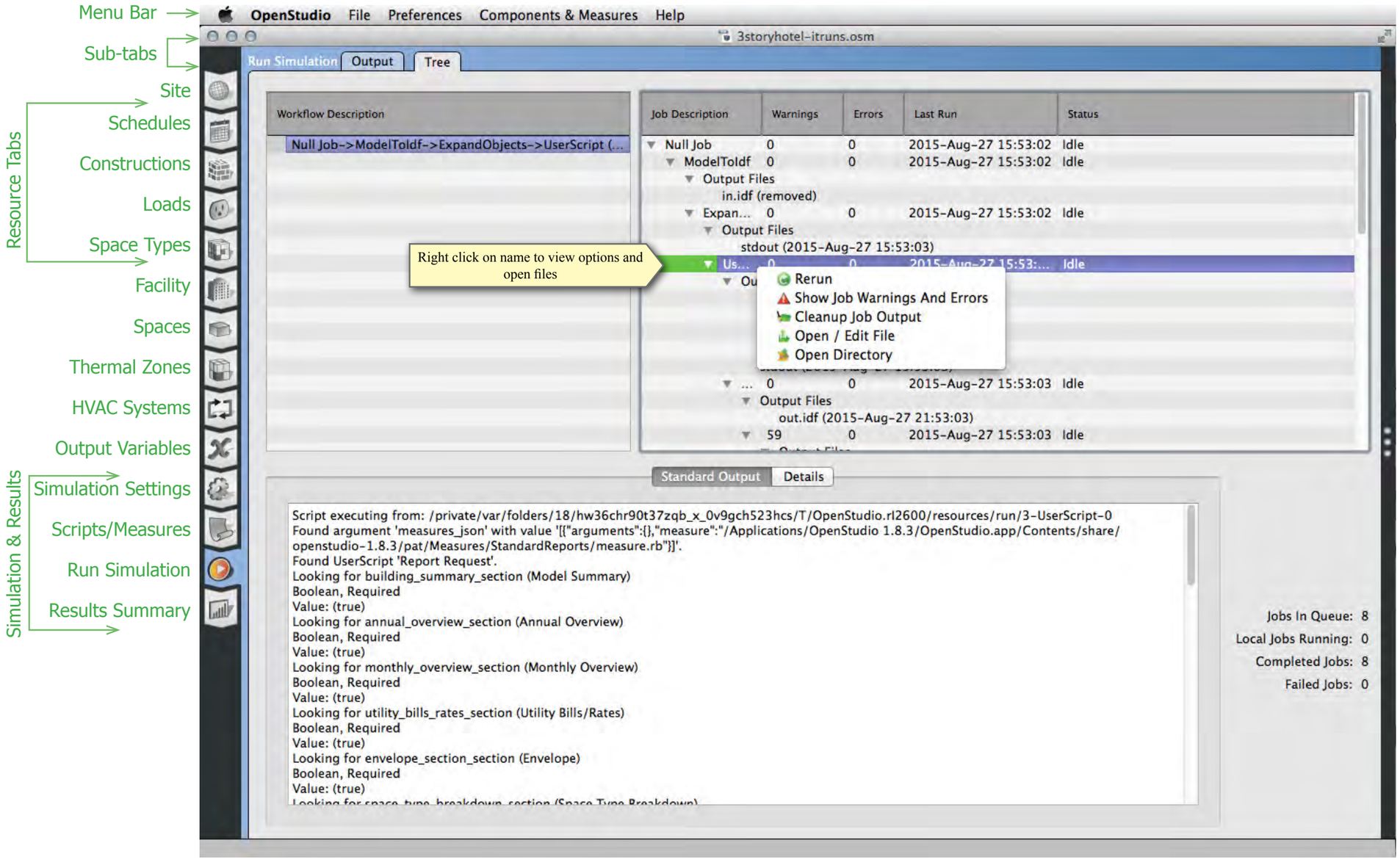
Run Simulation — Tree

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

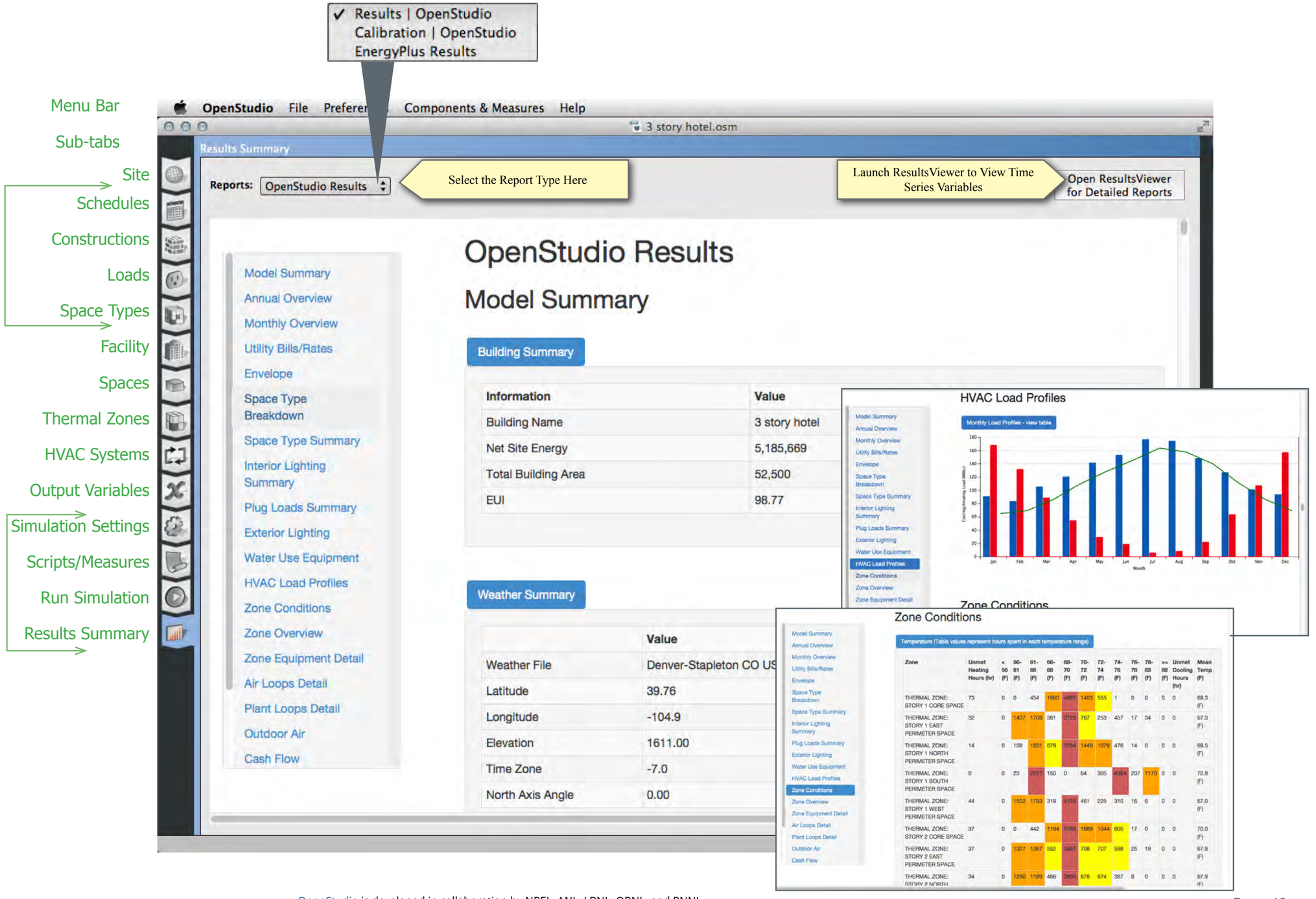
The Results Summary tab is populated with data after you run a simulation. The standard reports available are:

- 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.



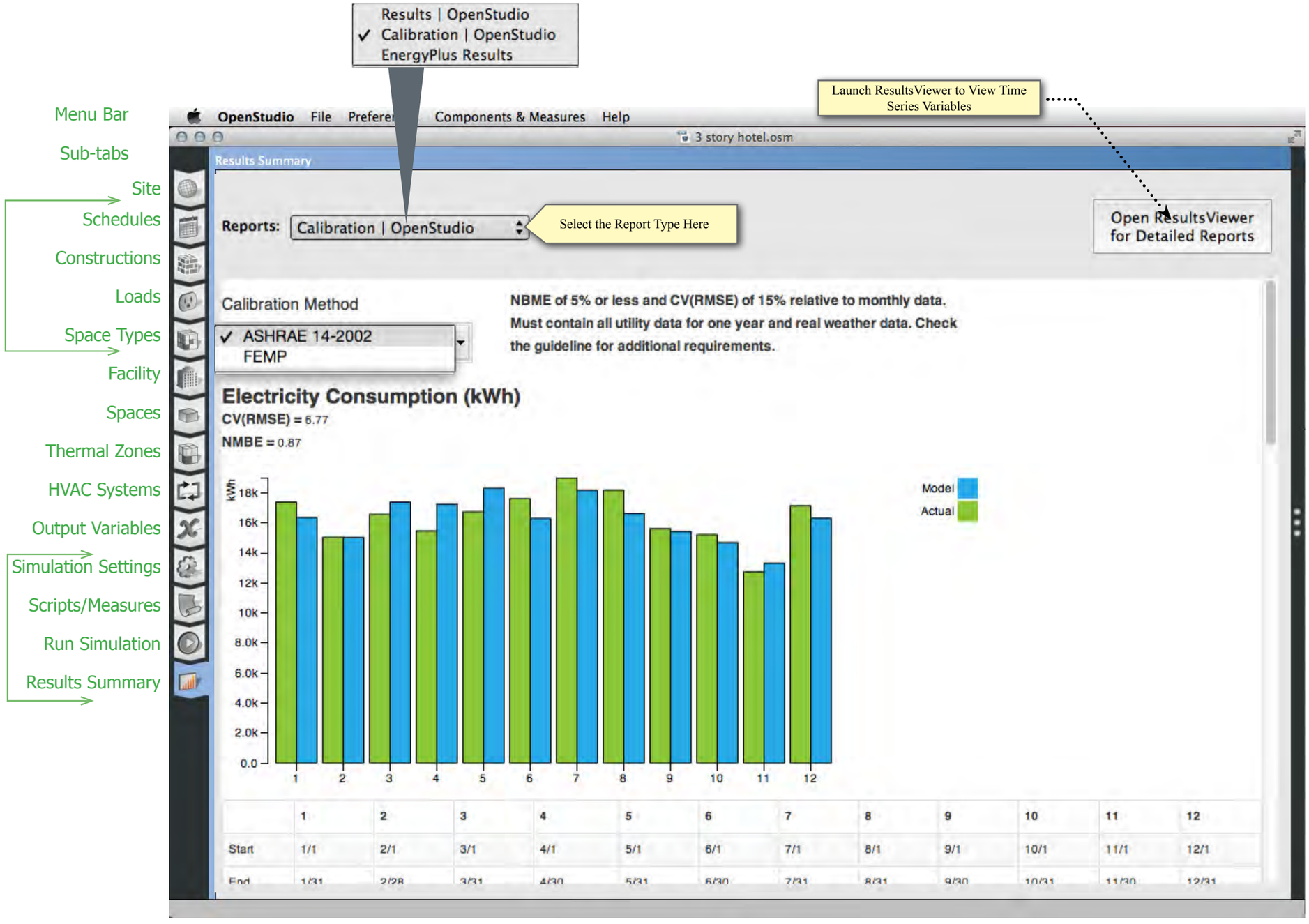
Results Summary: Calibration

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.



Results Summary: EnergyPlus Results

Notes

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