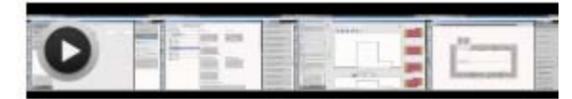


# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



Click to watch YouTube Playlist

Key SketchUp Plug-in Tools

- Choose Template
- Building Envelope
- Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

## Introduction

### Notes

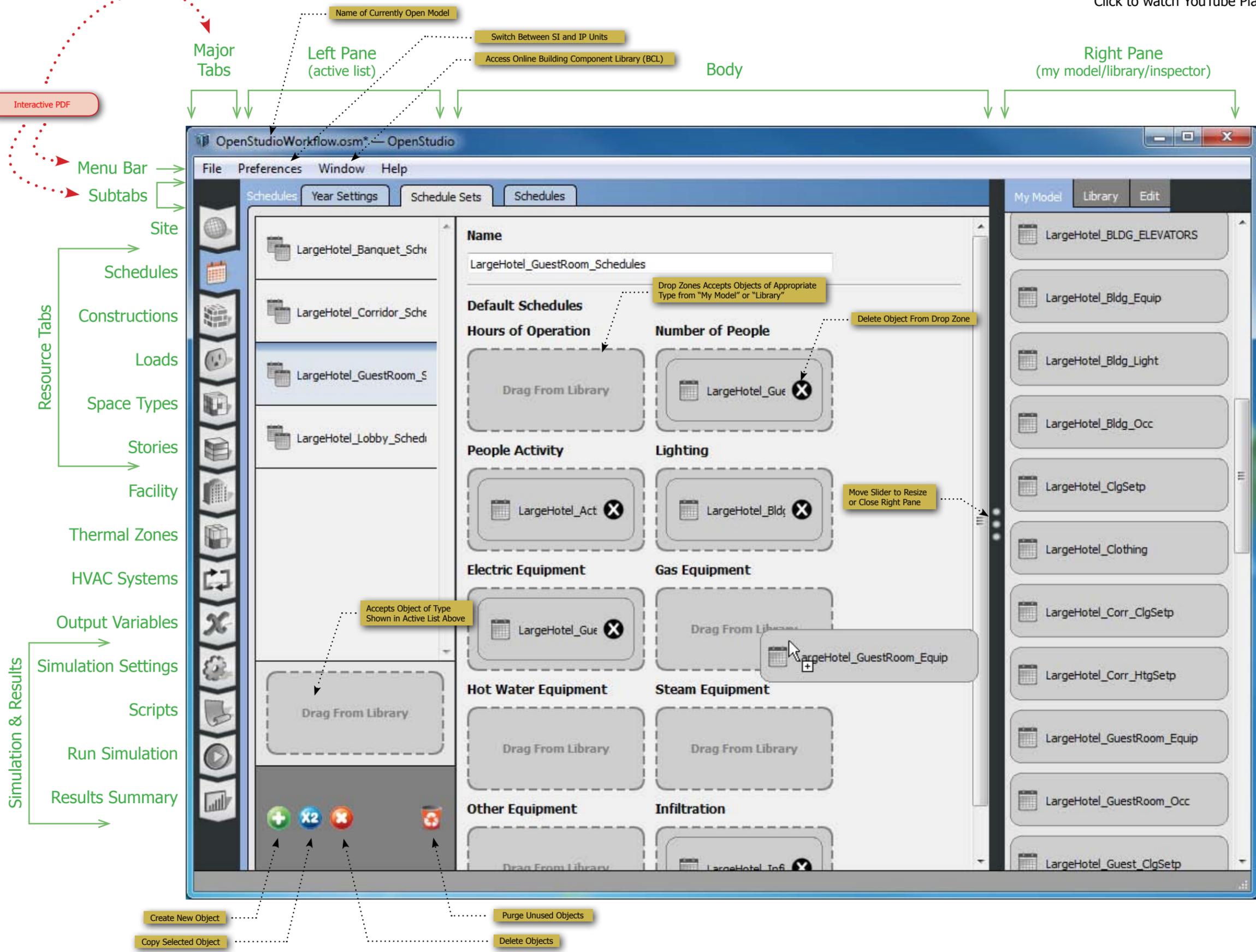
The basic workflow for OpenStudio starts in the SketchUp Plug-in creating the building envelope and assigning space attributes.

Next, the model is loaded in the OpenStudio application, shown on this page. You can step through the tabs from top to bottom. For a basic workflow the resource tabs and many others are not necessary. A minimum workflow is shown in the box below.

This PDF is an interactive guide. Click on the SketchUp Plug-in icons above or the major tab icons at the right to jump to the appropriate pages. Subtabs, menu items, and pink labels can also be clicked to jump to another view.

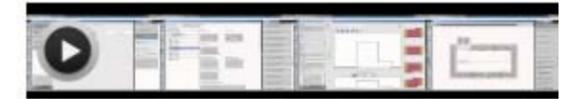
### Minimal Workflow Through OpenStudio Application

- Site
- Thermal Zones
- HVAC Systems
- Run Simulation
- Results Summary



Interactive PDF

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



Click to watch YouTube Playlist

## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

## SketchUp - Choose Template

### Notes

Each of these building type-specific templates are loaded with construction, schedule, and internal load data for Various vintages and for all U.S. climate zones.

If you plan to apply attributes only in the OpenStudio application, you can use the minimal template, which is the default when you first install OpenStudio. You can also use the ["Get BCL Space Type"](#) user script to generate and download spaces types into your current model.



The screenshot shows the SketchUp Pro interface with the OpenStudio plug-in toolbar. A dialog box titled "New OpenStudio Model From Template" is open, displaying a list of templates in the "templates" folder. The templates include:

- Stand-aloneRetail.osm
- StripMall.osm
- SuperMarket.osm
- Warehouse.osm
- MasterTemplate
- FullServiceRestaurant.osm
- Hospital.osm
- LargeHotel.osm
- LargeOffice.osm
- MediumOffice.osm
- MidriseApartment.osm
- MinimalTemplate.osm
- OutPatient.osm
- PrimarySchool.osm
- QuickServiceRestaurant.osm
- SecondarySchool.osm
- SmallHotel.osm
- SmallOffice.osm

Annotations with arrows point to the following actions:

- New OpenStudio Model From Template
- Open OpenStudio Model
- Save OpenStudio Model
- Save OpenStudio Model As
- Click to See BCL Space Types User Script

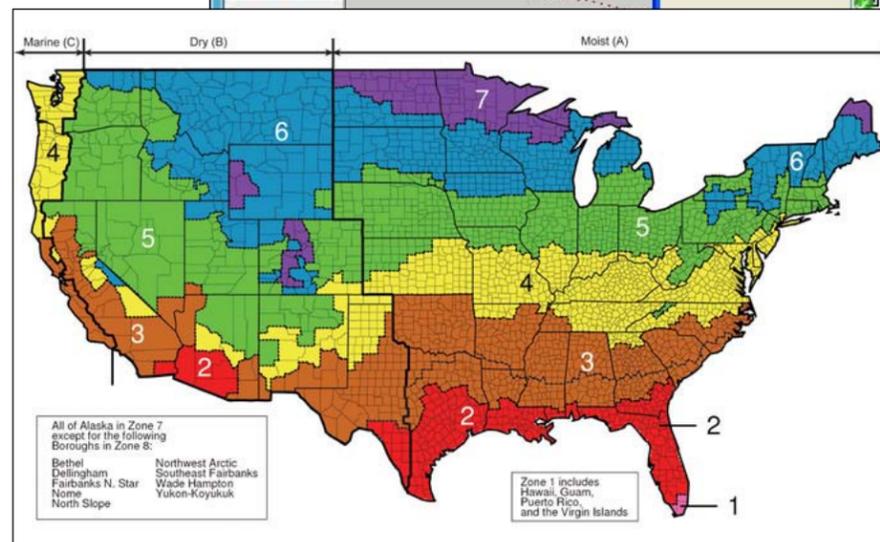
## Vintages and Climate Zones

### Vintages:

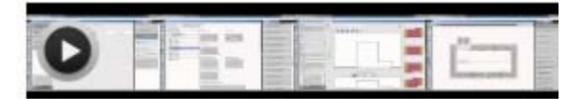
- CBECs Before 1980
- CBECs 1980-2004
- ASHRAE 901.1-2004
- ASHRAE 189.1-2009

### Climate Zones:

1-8 (see map)



# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

## SketchUp - Building Envelope

### Notes

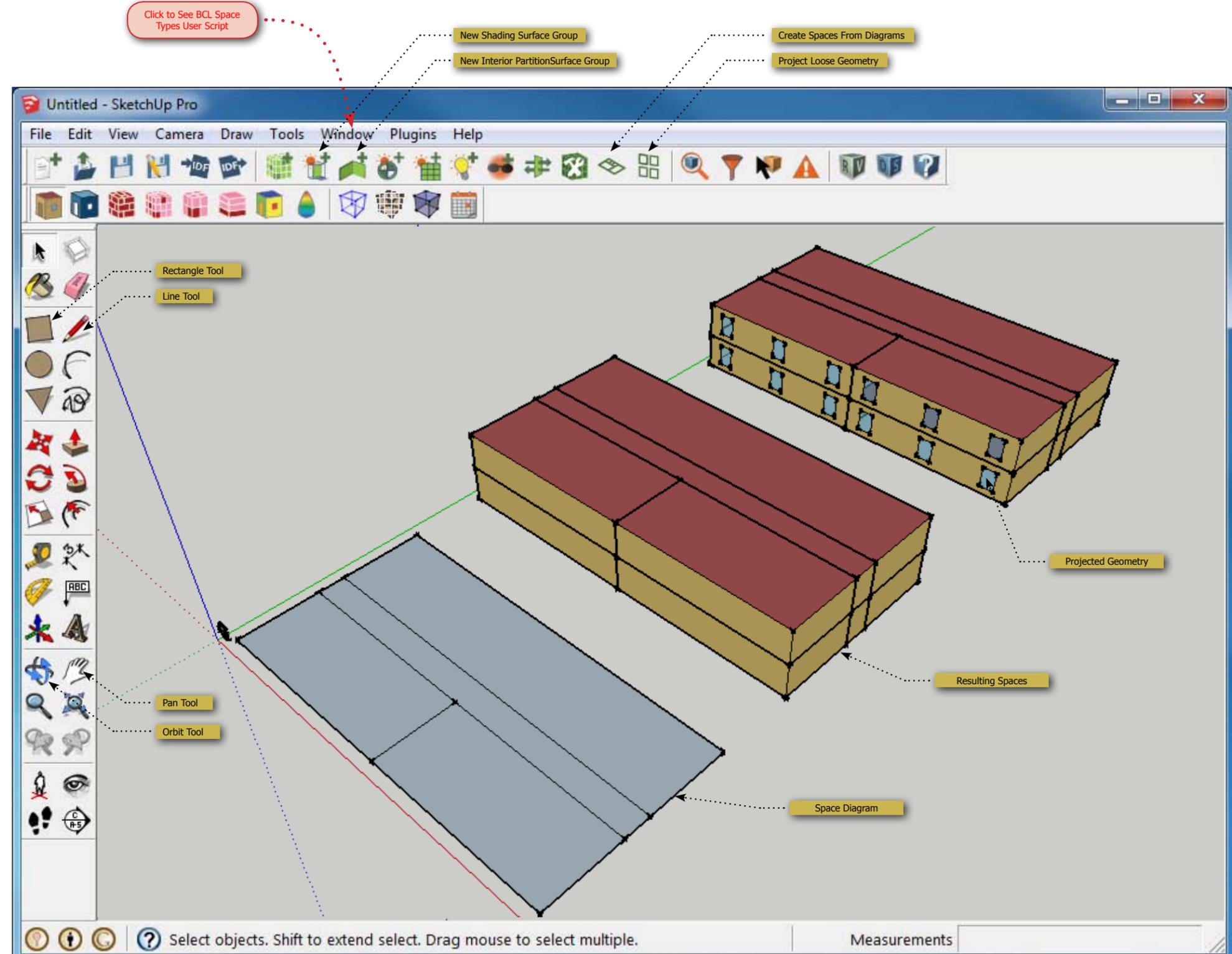
After using native SketchUp tools to draw a space outline, you use the Spaces From Diagram tool to project the diagram into a multistory building. Although the geometry is automatically generated from the diagram, you can edit it using standing SketchUp Tools.

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.



Click tabs to navigate back to OpenStudio application documentation pages



# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



Click to watch YouTube Playlist

Key SketchUp Plug-in Tools

- Choose Template
- Building Envelope
- Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

Click tabs to navigate back to OpenStudio application documentation pages

## 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 run your simulation click the OpenStudio button to Launch your model in OpenStudio and [then go to the Run tab.](#)

Daylighting Tools

- Daylighting Control Point
- Illuminance Map
- Glare Sensor

Surface Matching

Set Attributes for Selected Spaces

Render Mode Aware Inspector

Launch OpenStudio Application

Render By Story

Render By Thermal Zone

Render By Space Type

Render By Boundary Condition

Scale Tool (to size Illuminance Map)

Surface Boundary Condition

Click to See BCL Space Types User Script

**Set Attributes for Selected Spaces**

Space Type: ASHRAE\_189.1-2009\_ClimateZone 4-8\_LargeHotel\_Lobby

Building Story: <no change>

Construction Set: <no change>

Thermal Zone: <no change>

Set Parent Thermal Zone's - Ideal Air Loads Status: <no change>

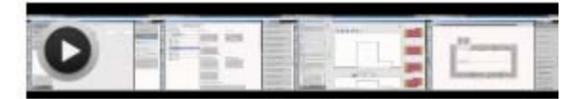
Set Parent Thermal Zone's - Thermostat: <no change>

OK Cancel

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

Measurements

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



Click to watch YouTube Playlist

Key SketchUp Plug-in Tools

- Choose Template
- Building Envelope
- Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

Click tabs to navigate back to OpenStudio application documentation pages

## SketchUp - User Scripts (BCL Space Type)

### Notes

"Get BCL Space Type" 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.

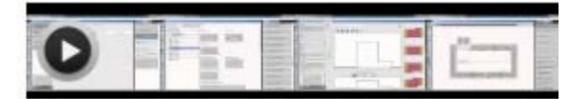
The first time you request a specific combination of inputs it will take some time to download the component. The components are saved to your local database; they don't have to be downloaded next time you make the same request.

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](#).

The user scripts menu contains many other additional example scripts.

The screenshot shows the SketchUp Pro interface with the 'OpenStudio User Scripts' menu open. The 'Building Component Library' option is selected, leading to a sub-menu with 'Get BCL Space Type', 'Get BCL Weather File', and 'Setup BCL Key'. A 'User input' dialog box is open, showing a dropdown menu for 'Primary Space Type' with 'FullServiceRestaurant' selected. A red callout box points to the 'Get BCL Space Type' option with the text 'Click for Instructions on Getting a BCL Auth Key'. Another dialog box, 'Enter your BCL Auth Key', is shown with a text input field and 'OK' and 'Cancel' buttons. The interface includes a menu bar (File, Edit, View, Camera, Draw, Tools, Window, Plugins, Help), a toolbar, and a left sidebar with various tool icons.

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



Click to watch YouTube Playlist

## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left  
for SketchUp  
Plug-in Pages

## File Menu

### 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.

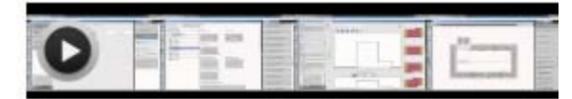
When you save an OSM model in the OpenStudio Application or the SketchUp Plug-in a folder is saved next to the OSM file. This folder contains external resources such as the weather file, scripts, and simulation results.

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.

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.

The screenshot shows the OpenStudio application window titled 'OpenStudioWorkflow.osm\* — OpenStudio'. The 'File' menu is open, showing options: New, Open, Load Library (highlighted with a mouse cursor), Save, Save As, Export IDF, Import IDF, Scan for Tools, and Exit. The background interface includes a menu bar (File, Preferences, Window, Help), subtabs (File & Design Days, Utility Rates), and resource tabs (My Model, Library, Edit). The 'Location' panel displays: Name: Denver Centennial Golden Nr, Latitude: 39.74, Longitude: -105.18, Elevation: 1829, Time Zone: -7, and Number of Design Days: 18. A vertical toolbar on the left contains icons for Site, Schedules, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables, Simulation Settings, Scripts, Run Simulation, and Results Summary. Green arrows on the left side of the image point from text labels to these menu items and toolbar icons.

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



Click to watch YouTube Playlist

## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left  
for SketchUp  
Plug-in Pages

## Preferences Menu

### Notes

The Units menu lets you switch between SI and IP units. This affects both input fields and output data on the results tab. It does not currently affect standard Energy-Plus output files.

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

Menu Bar

Subtabs

Resource Tabs

Simulation & Results

Site

Schedules

Constructions

Loads

Space Types

Stories

Facility

Thermal Zones

HVAC Systems

Output Variables

Simulation Settings

Scripts

Run Simulation

Results Summary

OpenStudioWorkflow.osm\* — OpenStudio

File Preferences Window Help

Metric (SI)

English (I-P)

**Weather Files**

EPW File Path

files/USA\_CO\_Golden-NREL.724666\_TMY3.epw

Browse

Download weather files at [www.energyplus.gov](http://www.energyplus.gov)

**Design Days**

DDY File Path

Browse

**Location**

Name: Denver Centennial Golden Nr

Latitude: 39.74

Longitude: -105.18

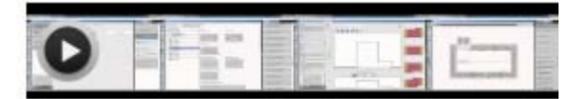
Elevation: 1829

Time Zone: -7

Number of Design Days: 18

My Model Library Edit

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

## (BCL) Window Menu

### 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 "Window" 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.

The Online BCL window currently exposes construction and material objects. You can choose a category and you can also search for a text string. 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.

The screenshot shows the OpenStudio Online BCL window with the following annotations:

- Search Input Box:** A callout pointing to the search field containing '7A'.
- Click for Instructions on Getting a BCL Auth Key:** A red callout pointing to the 'Enter your BCL Auth Key' dialog box.
- Page Through Results:** A callout pointing to the navigation buttons (1, 2, 3) in the 'Constructions' list.
- Close Window when Done:** A callout pointing to the window's close button.
- Attributes for Selected Object:** A callout pointing to the 'Attributes' table on the right.
- Download Checked Components:** A callout pointing to the 'Download' button at the bottom.
- Progress Bar Will Appear Here:** A callout pointing to the progress bar area at the bottom.
- Choose Category and Type of Construction or Material:** A callout pointing to the 'Exterior Wall' item in the 'Wall' category.

**Resource Tabs (left sidebar):**

- Menu Bar
- Subtabs
- Site
- Schedules
- Constructions
- Loads
- Space Types
- Stories
- Facility
- Thermal Zones
- HVAC Systems
- Output Variables
- Simulation Settings
- Scripts
- Run Simulation
- Results Summary

**Attributes Table:**

Attributes	
Standard	Large Office TSD
Climate Zone	ASHRAE 2004:7A
Climate Zone	ASHRAE 2004:7B
Construction	Exterior Wall
Construction Type	Steel-Framed
Effective R-value	2.599 ft <sup>2</sup> F h/Btu
Insulation Minimum R-value	R-13.0 + R-7.5 ci f
Film Coefficients	false
OpenStudio Type	OS:Construction

**Files:**

- Large Office TSD\_7A\_Exterior Wall\_Steel-Framed\_v7
- Large Office TSD\_7A\_Exterior Wall\_Steel-Framed\_v0
- Large Office TSD\_7A\_Exterior Wall\_Steel-Framed\_v0

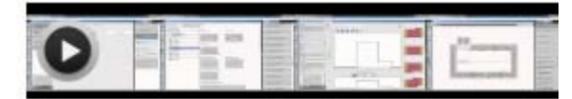
**Sources:**

- Author: nlong
- Comment: File generation based on iterative targeting
- Date & time: 2012-06-06T17:31:23Z

**Tags:**

- Construction Assembly.Wall.Exterior Wall

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages



<http://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 <http://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 Account."
4. Click the "View" link to see your key
5. Select and copy the Key.
6. 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.

Step 1 - Register

Step 2 - Login

Step 3 - Click My Account

Click to go to BCL Website Registration Page

**Building Component Library**

Welcome, **David Goldwasser** | [My Account](#) | [Logout](#)

[View](#) | [API Access](#) | [Edit](#) | [My Library](#)

**David\_Goldwasser**

**Preferences**

Units: SI

**API**

API key: **8L788-BL348273486-p0d1w0V1-1N3ip-0B0L72MM8**

**History**

Member for: 1 year 25 weeks

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.

Content Last Updated: 9/21/2012

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Step 6 - Paste Key into OpenStudio

Link to BCL Constructions and Materials in the OpenStudio Application

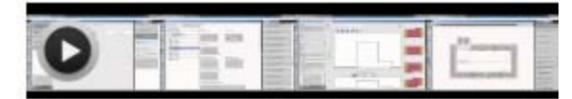
Link to BCL Space Types Generator in SketchUp Plug-in

**Enter your BCL Auth Key**

BCL Auth Key:

OK Cancel

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left  
for SketchUp  
Plug-in Pages

## Help Menu

### Notes

The help menu can take you to the OpenStudio website or open a window that provides details about your installation of OpenStudio.

The screenshot shows the OpenStudio application window titled "OpenStudioWorkflow.osm\* - OpenStudio". The menu bar includes "File", "Preferences", "Window", and "Help". The "Help" menu is open, showing "OpenStudio Help" and "About". The main workspace is divided into subtabs: "Site", "Weather File & Design Days", "My Model", "Library", and "Edit". The "Site" subtab is active, displaying fields for "Weather File" (EPW File Path: files/USA\_CO\_Golden-NREL.724666\_TMY3.epw) and "Design Days" (DDY File Path). The "Location" section shows: Name: Denver Centennial Golden Nr, Latitude: 39.74, Longitude: -105.18, Elevation: 1829, Time Zone: -7, and Number of Design Days: 18.

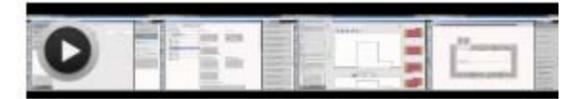
Annotations on the left side of the interface include:

- Menu Bar**: Points to the top menu bar.
- Subtabs**: Points to the subtab bar.
- Resource Tabs**: A vertical list of icons with labels: Site, Schedules, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables, Simulation Settings, Scripts, Run Simulation, and Results Summary.
- Simulation & Results**: A vertical list of icons with labels: Simulation Settings, Scripts, Run Simulation, and Results Summary.

An "About OpenStudio" dialog box is open in the foreground, displaying the following information:

- OpenStudio**
- Version: 0.9.0
- Build Number: Unknown
- Copyright © 2012 National Renewable Energy Laboratory
- OpenStudio is a cross-platform tool to support whole building energy modeling using [EnergyPlus](#).
- OK button

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left  
for SketchUp  
Plug-in Pages

## 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 and for loading design day files.

The weather file is stored in the OSM file as a path. When you reopen a model you will still see that path displayed. Design days are a little different. They are loaded into your model. The path they were loaded from is not saved, so when you reopen your model you will not see a path in the DDY file path box.

The Utility Rates subtab is not yet functional. For this release you can use the "ImportImfSection.rb" script in the Scripts tab to load these.

Menu Bar →

Subtabs →

Resource Tabs

- Site
- Schedules
- Constructions
- Loads
- Space Types
- Stories
- Facility

Simulation & Results

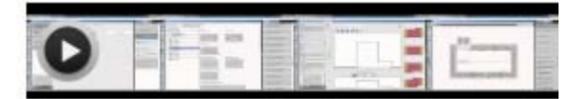
- Output Variables
- Simulation Settings
- Scripts
- Run Simulation
- Results Summary

Utility Rates Tab Is Not Active

EPW Path Saved in OSM File

Design Day Files Imported, the Path Is Not Saved in Your OSM File

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left  
for SketchUp  
Plug-in Pages

## Schedules - Year Settings

### Notes

The Year Settings subtab lets you set the day of the week the simulation should start. Define using Calendar Year or First Day Of Year buttons and pull-downs.

The tab can also be used to configure and turn Daylight Savings Time on and off.

The screenshot shows the OpenStudio software interface with the 'Year Settings' subtab selected. The interface is annotated with green arrows and labels:

- Menu Bar:** Points to the top menu (File, Preferences, Window, Help).
- Subtabs:** Points to the subtab bar (Schedules, Year Settings, Schedule Sets, Schedules).
- Resource Tabs:** A vertical sidebar on the left with icons for Site, Schedules, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables, Simulation Settings, Scripts, Run Simulation, and Results Summary.
- Simulation & Results:** A bracket on the left side of the Resource Tabs sidebar grouping Simulation Settings, Scripts, Run Simulation, and Results Summary.

The main content area of the 'Year Settings' subtab contains the following settings:

- Select Year by:**
  - Calendar Year: 2000
  - First Day of Year: UseWeatherFile
- Daylight Savings Time:** on
- Starts:**
  - Define by Day of The Week And Month: Second, Sunday, March
  - Define by Date: 3/8/2009
- Ends:**
  - Define by Day of The Week And Month: First, Sunday, November
  - Define by Date: 11/1/2009

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

## 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 subtab 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.

- Menu Bar
- Subtabs
- Site
- Schedules
- Constructions
- Loads
- Space Types
- Stories
- Facility
- Thermal Zones
- HVAC Systems
- Output Variables
- Simulation Settings
- Scripts
- Run Simulation
- Results Summary

Resource Tabs

Simulation & Results

OpenStudioWorkflow.osm\* — OpenStudio

File Preferences Window Help

Schedules Year Settings Schedule Sets Schedules

My Model Library Edit

Name: LargeHotel\_GuestRoom\_Schedules

Default Schedules

Hours of Operation: Drag From Library

Number of People: LargeHotel\_Gue (X)

People Activity: LargeHotel\_Act (X)

Lighting: LargeHotel\_Bldg (X)

Electric Equipment: LargeHotel\_Gue (X)

Gas Equipment: Drag From Library

Hot Water Equipment: Drag From Library

Steam Equipment: Drag From Library

Other Equipment: Drag From Library

Infiltration: LargeHotel\_Inf (X)

LargeHotel\_Banquet\_Sch

LargeHotel\_Corridor\_Sch

LargeHotel\_GuestRoom\_S

LargeHotel\_Lobby\_Sch

LargeHotel\_GuestRoom\_Equip

LargeHotel\_BLDG\_ELEVATORS

LargeHotel\_Bldg\_Equip

LargeHotel\_Bldg\_Light

LargeHotel\_Bldg\_Occ

LargeHotel\_ClgSetp

LargeHotel\_Clothing

LargeHotel\_Corr\_ClgSetp

LargeHotel\_Corr\_HtgSetp

LargeHotel\_GuestRoom\_Equip

LargeHotel\_GuestRoom\_Occ

LargeHotel\_Guest\_ClgSetp

Text Field to Rename Active Object in Left Pane

My Model and Library Tabs Will Populate with Object Types Appropriate for Drop Zones in Left Pane and Body

Click to Delete Object from Drop Zone

The Edit Tab is Only Used in Specific Tabs, This Tab is Not One of Them

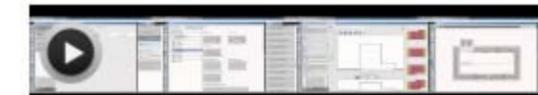
Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



Click to watch YouTube Playlist

## 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.

- Menu Bar
- Subtabs
- Site
- Schedules
- Constructions
- Loads
- Space Types
- Stories
- Facility
- Thermal Zones
- HVAC Systems
- Output Variables
- Simulation Settings
- Scripts
- Run Simulation
- Results Summary

The screenshot shows the OpenStudio Schedules interface. The main window displays a rule editor for 'LargeHotel\_Bldg\_Light Rule 3'. The interface includes a menu bar (File, Preferences, Window, Help), subtabs (Schedules, Year Settings, Schedule Sets, Schedules), and a resource bar on the left with icons for Site, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables, Simulation Settings, Scripts, Run Simulation, and Results Summary.

The central panel shows the rule configuration:
 

- LargeHotel\_Bldg\_Light Rule 3**
- Date Range: 01/01 to 12/31
- Apply to: S, M, T, W, T, F, S (M, T, W, T, F are selected)
- Design Day Profiles: Summer, Winter
- Run Period Profiles: Priority 1, Priority 2, Priority 3, Default

The main graph shows a light intensity profile over a 24-hour period. Annotations include:
 

- 'Days of Week and Date Range for Rule' pointing to the date range and day selection.
- 'Delete Rule' pointing to the red X icon.
- 'Visualize Rules on Annual Calendar' pointing to the calendar on the right.
- 'Add Rule' pointing to the plus icon in the Run Period Profiles.
- 'Change Range of Vertical' pointing to the vertical axis.
- 'Double Click Vertical To Merge Profile' pointing to a vertical segment.
- 'Double Click Horizontal To Split Profile' pointing to a horizontal segment.
- 'Click to edit LargeHotel\_Bldg\_Light Rule 3' pointing to the rule name.
- 'Throughout the Application, Hovering Over an Object Will Display the Full Name' pointing to the 'Set Limits' label.

The right side features a calendar for January, February, March, and April, with days color-coded by rule. The bottom of the graph shows zoom controls: 'Hourly', '15 Minutes', and '1 Minute'. A lower profile view is visible at the bottom, with annotations:
 

- 'Zoom to smaller timestep' pointing to the 15-minute and 1-minute buttons.
- 'When Zoomed in Use This to Navigate' pointing to the navigation arrows.

Zoom to smaller timestep

When Zoomed in Use This to Navigate

- Choose Template
- Building Envelope
- Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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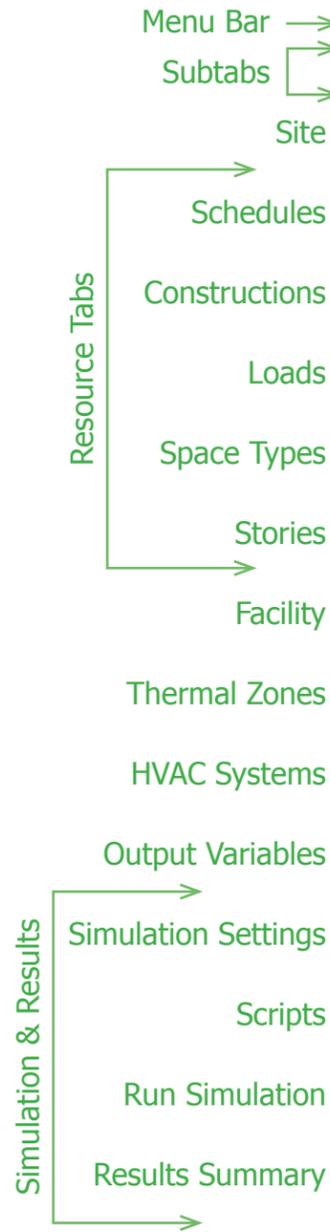
## Constructions - Construction Sets

### 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.

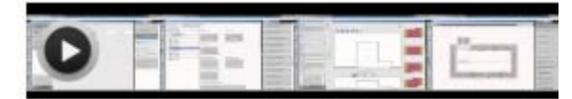
Construction sets do not have to be complete sets. For example, you can have a construction set assigned to a story that has only an exterior wall. For the rest of the surface types, constructions will be inherited from the building object.



The screenshot shows the OpenStudio application window with the 'Construction Sets' subtab active. The interface is divided into several sections:

- Left Panel:** Lists construction sets including 'ASHRAE\_189.1-2009\_Clin 5 (l\_ht) alt-res\_ConstSet' and 'Default Construction Set 1'. A yellow callout box states: 'Model Objects Downloaded from the BCL Have a Visual Indicator'. A red callout box points to a 'BCL' label on a wall construction object, stating: 'Link to BCL Constructions and Materials in the OpenStudio Application'.
- Main Panel:** Displays 'Exterior Surface Constructions' (Walls, Floors, Roofs), 'Interior Surface Constructions' (Walls, Floors, Ceilings), 'Ground Contact Surface Constructions' (Walls, Floors, Ceilings), and 'Exterior Sub Surface Constructions' (Fixed Windows, Operable Windows, Doors). Each category contains specific construction objects with 'BCL' labels and 'X' icons.
- Right Panel:** A library of construction sets, including 'ASHRAE\_189.1-2009\_ExtRoof\_IEA 2-5', 'ASHRAE\_189.1-2009\_ExtWall\_Steel-Framed', 'ASHRAE\_189.1-2009\_ExtWindow\_4-5', 'ASHRAE 90.1-2007 5B Exterior Wall Steel-Framed', 'ASHRAE AEDG SHC 5B Exterior Wall Steel-Framed', 'ASHRAE AEDG SHC 7A Exterior Wall Mass', 'ASHRAE AEDG-SmOffice Small Office 5B Exterior Wall Steel-Framed', 'ASHRAE AEDG-SmOffice Small Office 5B Exterior Wall Wood-Framed and Other', 'ASHRAE Std189 5B Exterior Wall Mass', and 'ASHRAE Std189 5B Exterior Wall Steel-Framed'.

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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Key SketchUp Plug-in Tools

- Choose Template
- Building Envelope
- Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

## Constructions - Constructions

### Notes

The Constructions subtab lists construction objects that are in your model. You can drag additional constructions here from the library. Constructions download 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.

**Menu Bar** → File Preferences Window Help

**Subtabs** → Constructions Construction Sets Constructions Materials

**Resource Tabs** → Site Schedules Constructions Loads Space Types Stories Facility Thermal Zones HVAC Systems Output Variables Simulation Settings Scripts Run Simulation Results Summary

**Constructions List:**

- 1-4
- CBECS\_Before-1980\_Extl 5-8
- CBECS\_Before-1980\_Extl Irgoff\_hosp 1-8
- Special Mass Wall
- Steel-Framed\_R-13 + R-7.5 ci\_Ext-wall
- Internal Source Constructions
- C-factor Underground Wall Constructions
- F-factor Ground Floor Constructions
- Drag From Library

**Special Mass Wall Details:**

- Concrete Block - 8 in. - 85 lb/ft3 - Unreinforced - Cells Insulated (BCL)
- 000\_F04 Wall air space resistance
- Wood-Framed - 4 in. Studs - 16 in. OC - R-13 Cavity Insulation (BCL)
- 000\_G01a 19mm gypsum board
- Drag From Library
- 000\_G01a 19mm gypsum board

**Materials Library:**

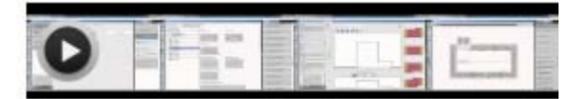
- 000\_F08 Metal surface
- 000\_F16 Acoustic tile
- 000\_G01a 19mm gypsum board
- 000\_G05 25mm wood
- 000\_I01 25mm insulation board
- 000\_I02 50mm insulation board
- 000\_M01 100mm brick
- 000\_M05 200mm concrete block
- 000\_M11 100mm lightweight concrete
- 000\_M15 200mm heavyweight

Drop Material Layers onto Construction From My Model or Library

- Choose Template 
- Building Envelope 
- Surface & Space Attributes 

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## Constructions - Materials

### Notes

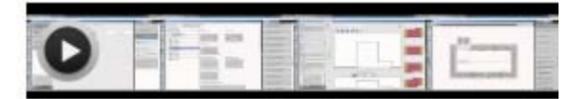
Constructions are made of one or more layers of materials. The Materials subtab lets you inspect and edit those materials.

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.

The screenshot displays the OpenStudio software interface. At the top, there is a menu bar with 'File', 'Preferences', 'Window', and 'Help'. Below the menu bar are subtabs: 'Constructions', 'Construction Sets', 'Constructions', and 'Materials'. The 'Materials' subtab is active, showing a list of materials on the left and a detailed property editor on the right. The property editor includes fields for Name, Roughness, Thickness, Conductivity, Density, Specific Heat, Thermal Absorptance, Solar Absorptance, and Visible Absorptance. A yellow callout box labeled 'Edit Material Attributes' points to the property editor. On the left side, there is a resource pane with icons for Site, Schedules, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables, Simulation Settings, Scripts, Run Simulation, and Results Summary. A 'Drag From Library' box is visible at the bottom of the material list.

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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Key SketchUp Plug-in Tools

- Choose Template
- Building Envelope
- Surface & Space Attributes

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## Loads

### Notes

The Loads tab contains internal load objects. 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

Menu Bar →

Subtabs →

Site →

Schedules →

Constructions →

Loads →

Space Types →

Stories →

Facility →

Thermal Zones →

HVAC Systems →

Output Variables →

Simulation Settings →

Scripts →

Run Simulation →

Results Summary →

Resource Tabs

OpenStudioWorkflow.osm\* — OpenStudio

File Preferences Window Help

Loads

My Model Library Edit

Ruleset Schedules

Compact Schedules

Constant Schedules

Fixed Interval Schedules

Variable Interval Schedules

People Definitions

MediumOffice\_PeopDef

Lights Definitions

Luminaire Definitions

Electric Equipment Definitions

Gas Equipment Definitions

Hot Water Equipment Definitions

People Definitions

Name: LargeHotel\_GuestRoom\_PeopDef

Number of People: 0.000000 people

People per Space Floor Area: 0.003570 people/ft<sup>2</sup>

Space Floor Area per Person: [ ] ft<sup>2</sup>/pers

Fraction Radiant: 0.300000

Sensible Heat Fraction Radiant: [ ]

Carbon Dioxide Generation: 0.284658 ft<sup>3</sup>/min

LargeHotel\_Banquet\_PeopDef

LargeHotel\_Cafe\_PeopDef

LargeHotel\_Corridor\_PeopDef

LargeHotel\_GuestRoom\_F

LargeHotel\_GuestRoom\_PeopDef

LargeHotel\_Kitchen\_PeopDef

LargeHotel\_Laundry\_PeopDef

Drag From Library

Choose Template

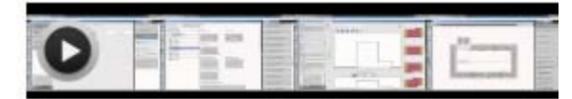
Building Envelope

Surface & Space Attributes

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# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Space Types

### 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.

If you scroll down to the bottom of the body 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<sup>2</sup>). 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<sup>2</sup> and then add another lighting load for decorative lighting using another W/ft<sup>2</sup>.

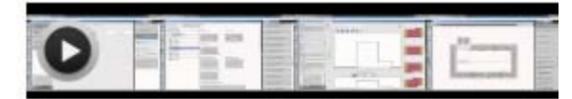
Choose Template

Building Envelope

Surface & Space Attributes

Click Icons at left for SketchUp Plug-in Pages

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Building Stories

### Notes

A Building Story is a container that can hold a collection of space objects. This can be used to change constructions or schedules based on the building story.

You can also use the story assignments to generate reports that summarize data by story.

**Menu Bar** → File Preferences Window Help

**Subtabs** → Building Stories

**Resource Tabs**

- Site
- Schedules
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- Stories
- Facility
- Thermal Zones
- HVAC Systems
- Output Variables
- Simulation Settings
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- Results Summary

**Simulation & Results**

**Main Workspace:**

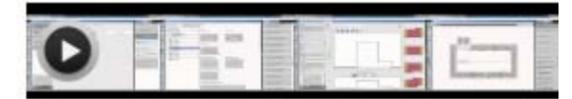
- Name:** Building Story 1
- Default Construction Set:** Drag From Library
- Default Schedule Set:** Drag From Library
- Rendering Color:** [Color Picker] Select Color

**Right Panel: My Model Library**

- CBECs\_Before-1980\_ClimateZone 3c (l\_htl)\_ConstSet
- CBECs\_Before-1980\_ClimateZone 4a (l\_htl)\_ConstSet
- CBECs\_Before-1980\_ClimateZone 4b (l\_htl)\_ConstSet
- CBECs\_Before-1980\_ClimateZone 4c (l\_htl)\_ConstSet
- CBECs\_Before-1980\_ClimateZone 5a (l\_htl)\_ConstSet
- CBECs\_Before-1980\_ClimateZone 5b (l\_htl)\_ConstSet
- CBECs\_Before-1980\_ClimateZone 6 (l\_htl)\_ConstSet
- CBECs\_Before-1980\_ClimateZone 7 (l\_htl)\_ConstSet
- CBECs\_Before-1980\_ClimateZone 8 (l\_htl)\_ConstSet
- Unique First Floor Constructions

**Default Schedule Sets**

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

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## Facility

### Notes

The Facility tab serves a number of functions. First, it allows you to see a hierarchical tree of your model. This tree can be organized by building story, thermal zone, or as shown here, space type.

If you are viewing the tree by space type, and a space does not have a space type assigned, it would appear under Unassigned Space Type. A similar pattern is followed for Thermal Zone and Story.

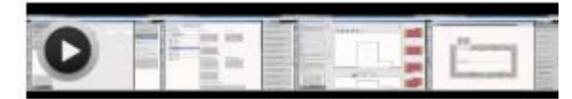
The Facility tab is also where you can select spaces and assign a building story, thermal zone, and space type. This is also where you can add loads to a space. These loads would be on top of loads inherited from the space type.

You can also drill down to inspect individual surfaces or subsurfaces.

Lastly, it lets you pick the Building object. This contains top level construction, schedule, or space type assignments, and sets the rotation for the building.

The screenshot shows the OpenStudio interface with the Facility tab active. The left sidebar contains a vertical menu of Resource Tabs: Site, Schedules, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables, Simulation Settings, Scripts, Run Simulation, and Results Summary. The main window displays a hierarchical tree on the left and a configuration panel on the right. The tree is sorted by Space Type and shows a 'Large Hotel' object containing several spaces, with 'Space 201' selected. The configuration panel for 'Space 201' includes fields for Name, Building Story (set to 'Building Story 2'), Thermal Zone (set to 'Thermal Zone 2'), Space Type (set to 'ASHRAE\_189.1-2009\_4-8\_LargeHotel\_Gue'), Default Construction Set, Default Schedule Set, Design Specification Outdoor Air (set to 'LargeHotel\_GuestRo'), and Space Infiltration Design Flow Rates. Annotations include: 'Menu Bar' pointing to the top menu; 'Subtabs' pointing to the Facility tab; 'Building Object' pointing to the 'Large Hotel' in the tree; 'Tree Organization Pull-Down' pointing to the 'Sort Building by:' dropdown; 'Click to Expand and View Surface' pointing to a plus icon in the tree; and 'Drag To Expose Right Pane' pointing to the right edge of the configuration panel.

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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

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Click Icons at left for SketchUp Plug-in Pages

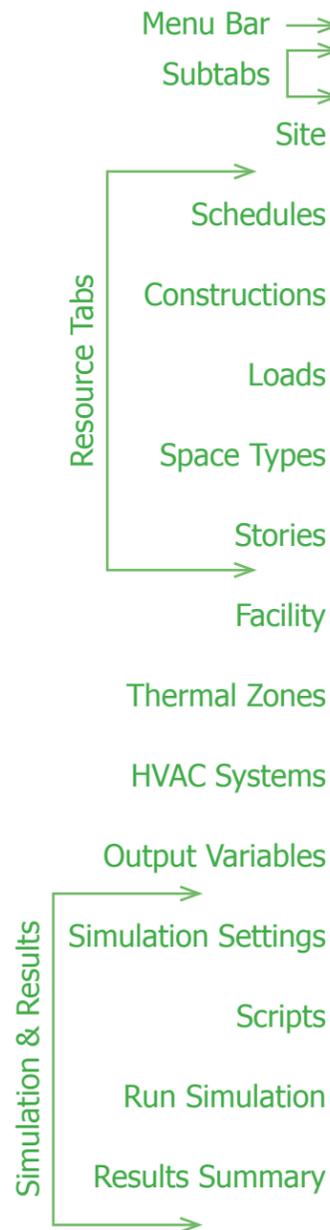
## Facility

### Notes

This screenshot of the Facility tab shows a surface selected.

Although you will generally work with the SketchUp Plug-in to define the building envelope, having a surface or subsurface selected in the Facility tab will allow you inspect and edit most attributes. Only the vertices are locked down.

Spaces and surface cannot be deleted or created. You need to use the SketchUp Plug-in to do that.



Tree Organization Pull-Down

Sort Building by: Space Type

Name: Surface 28

Surface Type: Wall

Construction: 000\_Interior Wall

Outside Boundary Condition: Surface

Outside Boundary Condition Obj: Surface 34

Sun Exposure: NoSun

Wind Exposure: NoWind

Vertices:

Number	x (ft)	y (ft)	z (ft)
1	50	-25	10
2	50	-25	0
3	50	0	0
4	50	0	10

Click to Collapse and View Space

When Outside Boundary Condition Is Surface, This Will Have A Matching Surface.

Construction Can Be Inherited from Space, Space Type, Story, or the Construction Can Be Set For a Specific Surface.

# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

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Click Icons at left for SketchUp Plug-in Pages

## Thermal Zones

### Notes

The Thermal Zones tab has three main functions.

1. It allows you to 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.

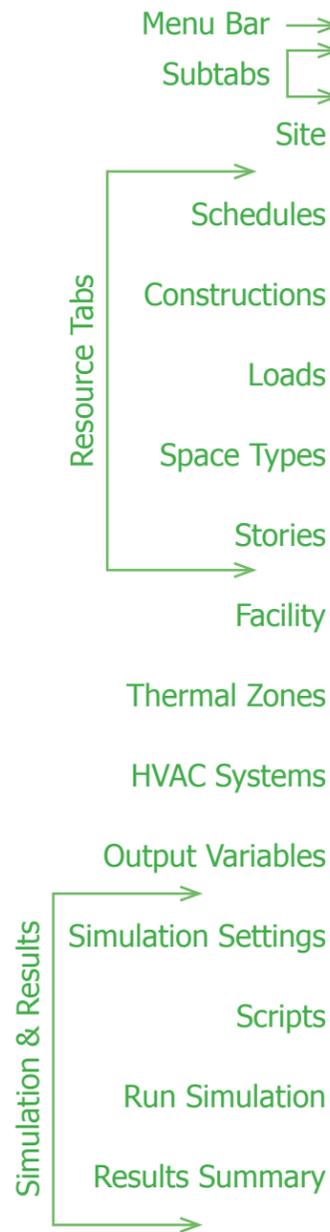
2. It allows you to attach zone equipment to your zone, for example a Packaged Terminal Air Conditioner.

3. It allows you to assign thermostats to your thermal zone. The thermostat slider has to be set to "on" before you can drag a schedule in from the right pane.

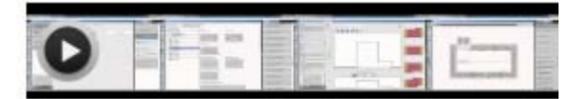
If you click on an object in the Zone Equipment drop box, you will be able to inspect it in the Edit tab of the right pane.

### 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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## Key SketchUp Plug-in Tools

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## HVAC Systems - Air Loop

### Notes

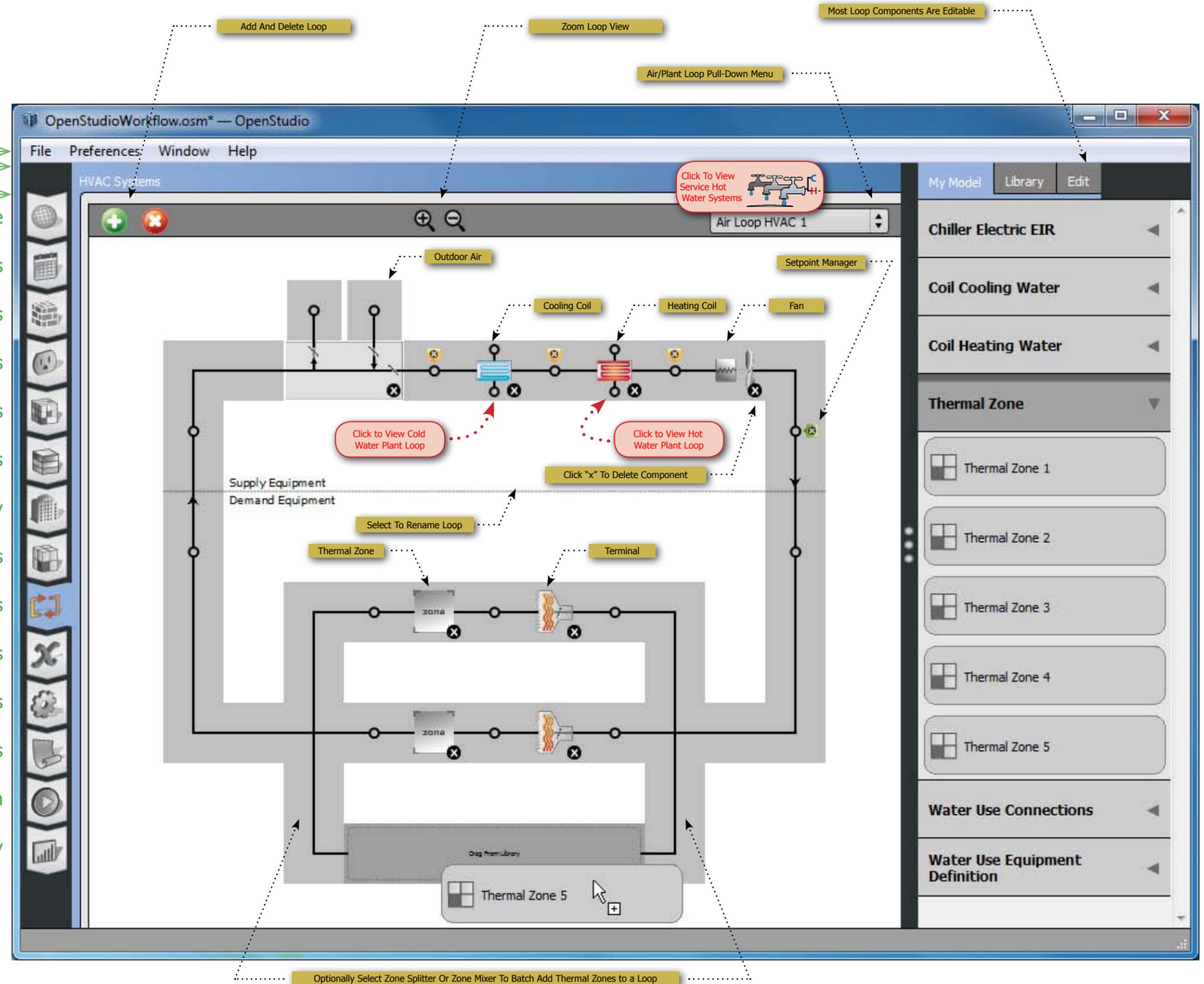
The HVAC Systems tab is used to create, inspect, and edit air and plant loops. The green "+" at the top left is used to add template or empty loops, and the "x" next to it will delete them. The pull-down at the top right of the body is to select which loop to is displayed.

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.



- Menu Bar
- Subtabs
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## Key SketchUp Plug-in Tools

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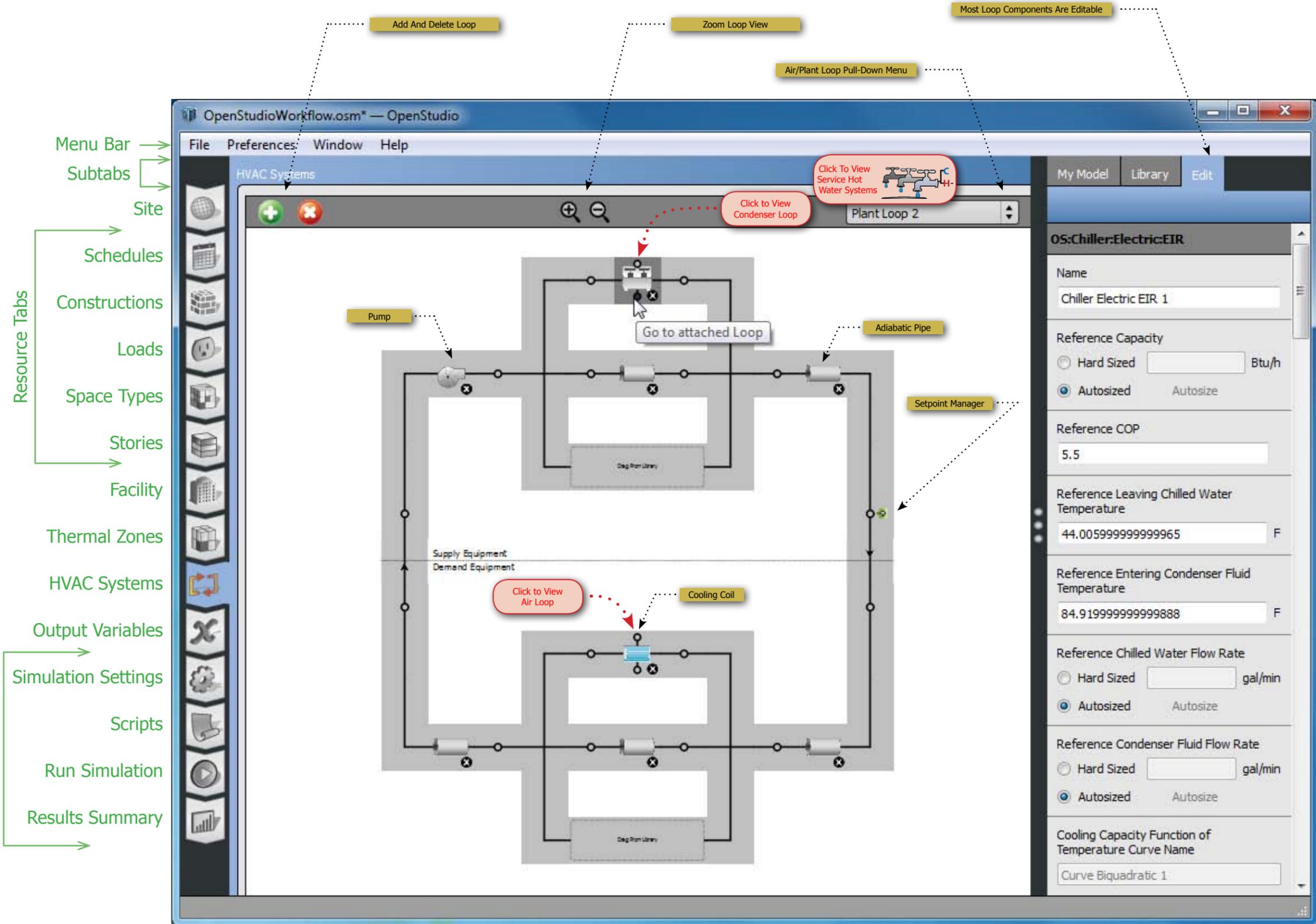
## HVAC Systems - Cold Water Loop

### Notes

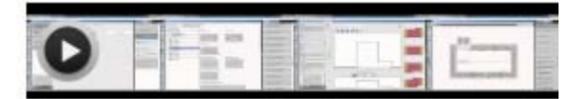
In the cold water loop the cooling coil that had been a supply side object on the air loop is now a demand object.

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.



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

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## HVAC Systems - Condenser Loop

### Notes

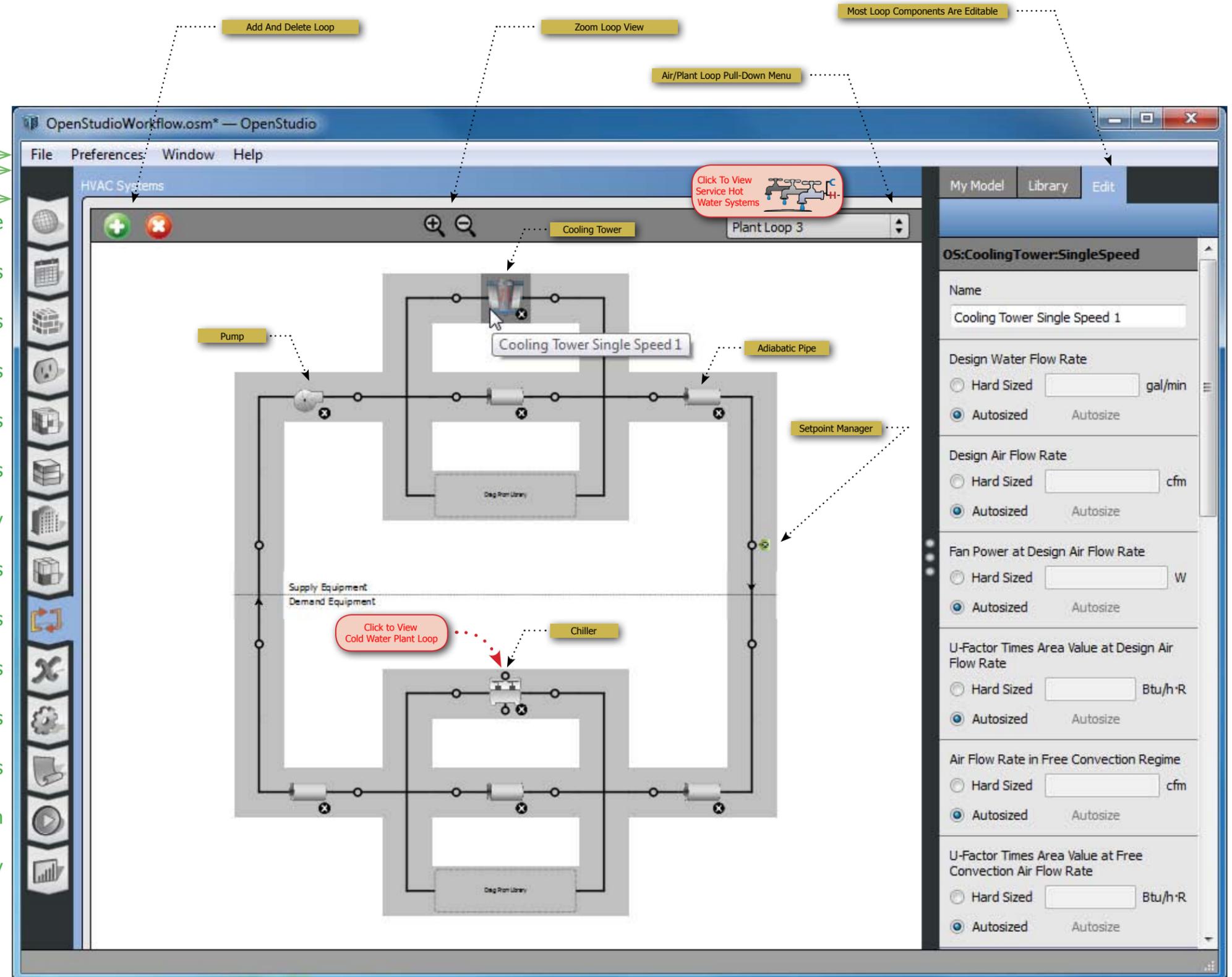
In the condenser loop the chiller that had been a supply side object on the cold water loop is now a demand object.

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.

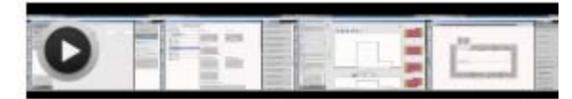
You can click on the chiller to drill to go back to the cold water loop.

- Menu Bar
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Simulation & Results



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

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## 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.

Menu Bar

Subtabs

Site

Schedules

Constructions

Loads

Space Types

Stories

Facility

Thermal Zones

HVAC Systems

Output Variables

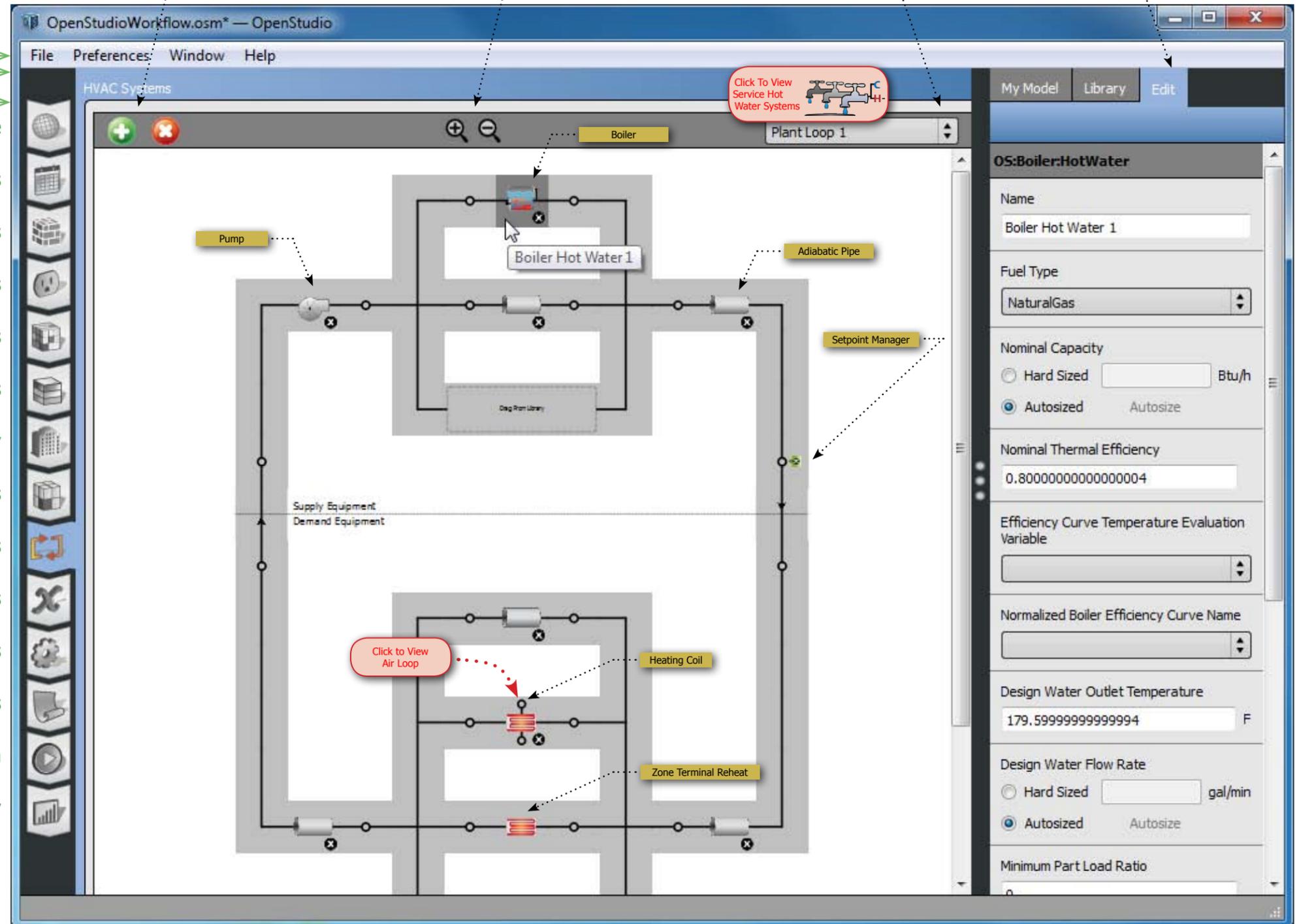
Simulation Settings

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Key SketchUp Plug-in Tools

- Choose Template
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Click Icons at left for SketchUp Plug-in Pages

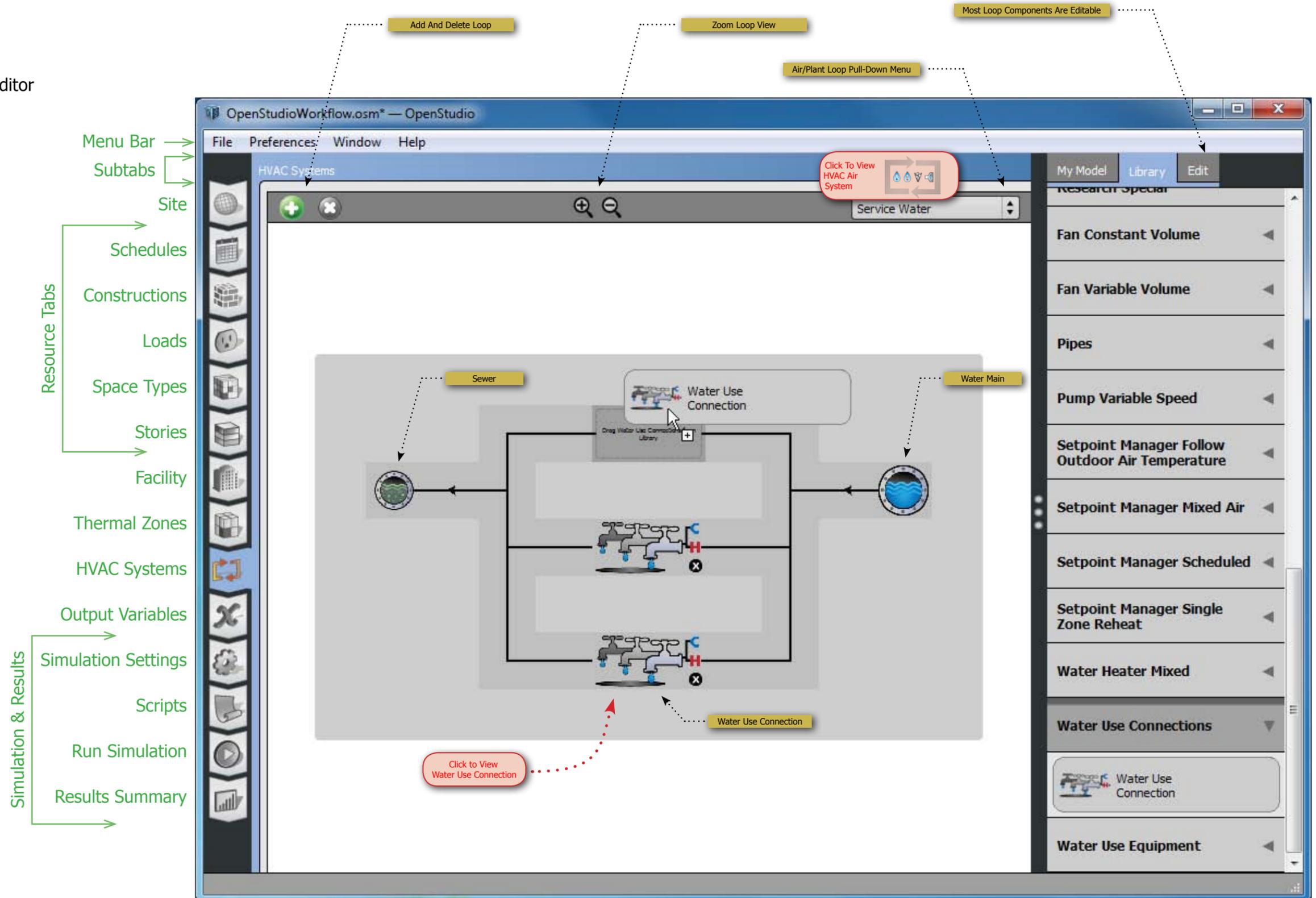
## HVAC Systems - Water Mains Editor

### Notes

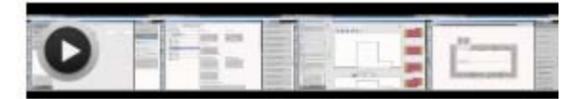
New to OpenStudio 0.9.0 are tools to model service hot water. The first view into the HVAC tab will be the water mains editor, which shows as "Service Water" on loops pulldown list.

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 0.9.0 Basic Workflow Guide (September 2012)



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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

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## HVAC Systems - Water Use Connection

### Notes

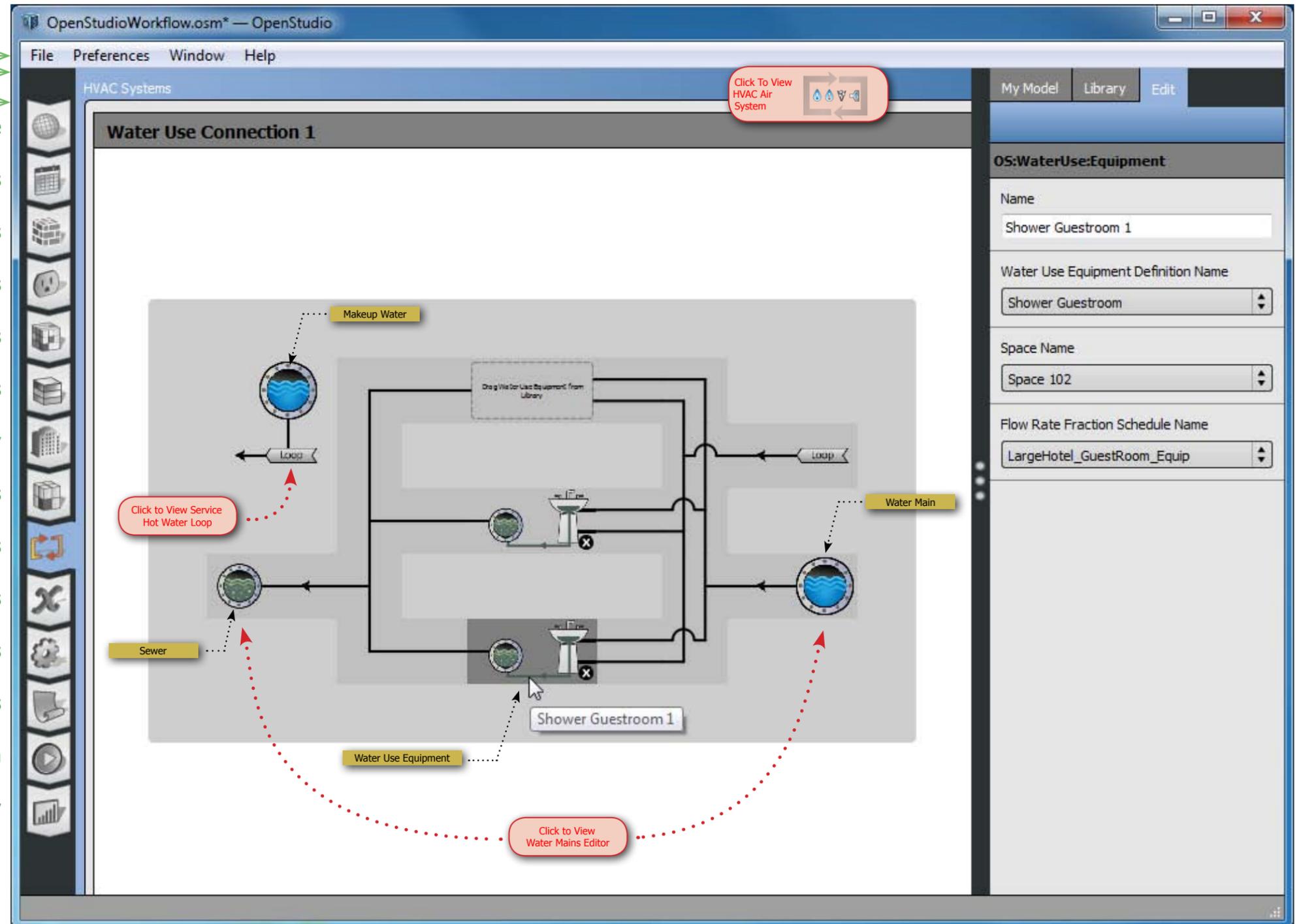
Dragging a water use equipment object into the water use connection will create an instance of that definition. Much like lights, people and other loads, there is a fractional schedule to define usage patterns.

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.

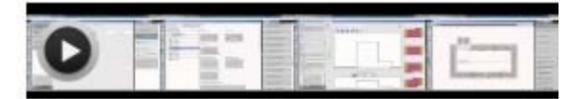
The equipment can be anything that uses water, hot or cold. The definition contains a peak flow rate and a target temperature schedule. Hot and cold water will mix to reach the target temperature at the fixture.

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.

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## Key SketchUp Plug-in Tools

Choose Template

Building Envelope

Surface & Space Attributes

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## HVAC - Service Water Heater Loop

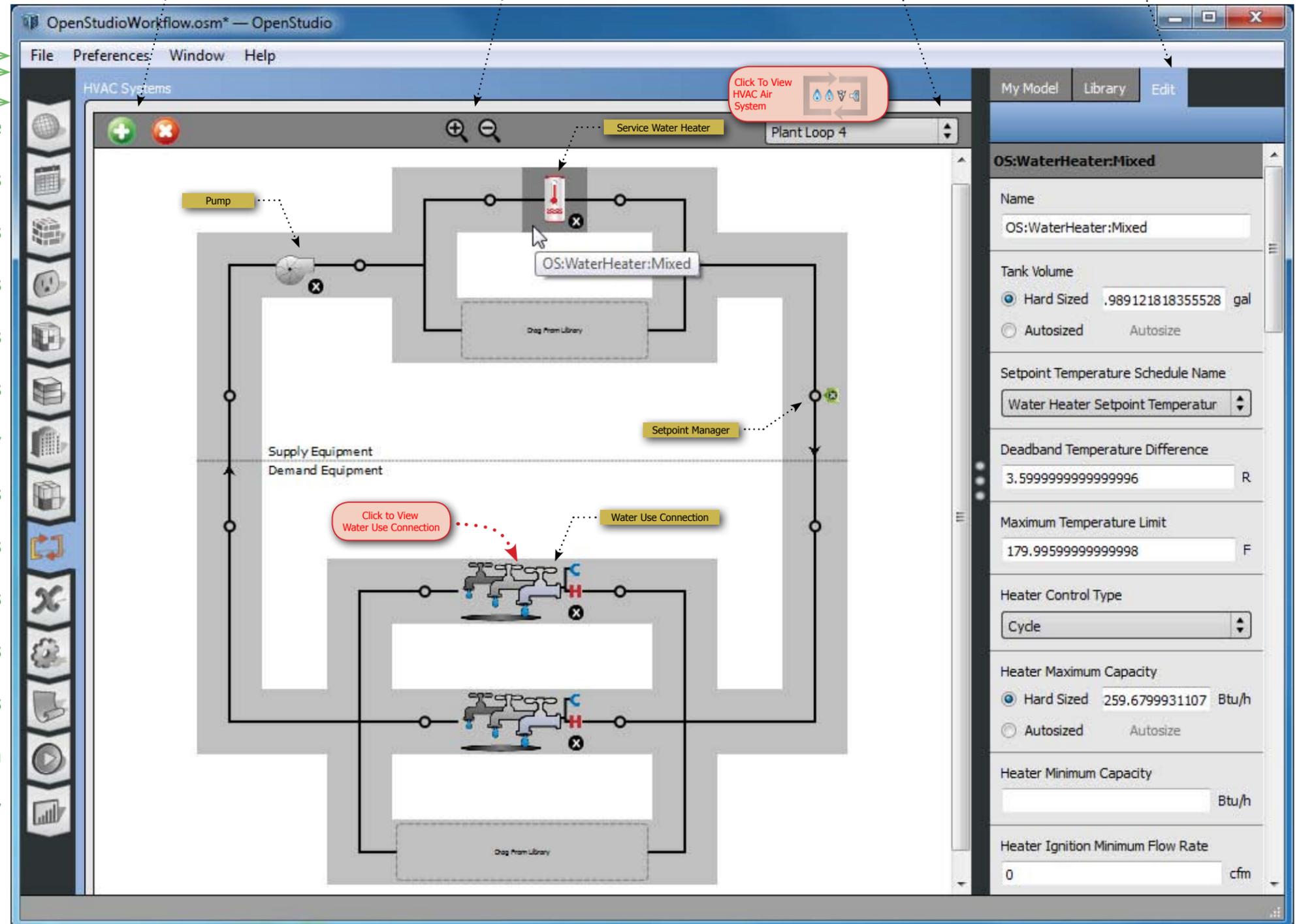
### Notes

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.

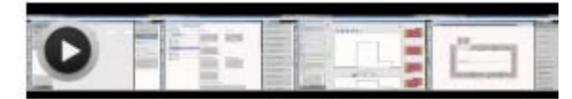
Both the hot water heater and the setpoint manager require a temperature schedule. Generally these should use the same schedule, which should have a temperature high enough to meet the setpoints at the water use equipment objects.

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.

- Menu Bar
- Subtabs
- Site
- Schedules
- Constructions
- Loads
- Space Types
- Stories
- Facility
- Thermal Zones
- HVAC Systems
- Output Variables
- Simulation Settings
- Scripts
- Run Simulation
- Results Summary



# OpenStudio 0.9.0 Basic Workflow Guide (September 2012)



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## 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 injecting raw IDF text in the Scripts tab.

The screenshot shows the 'Output Variables' dialog box in OpenStudio. The window title is 'OpenStudioWorkflow.osm — OpenStudio'. The menu bar includes 'File', 'Preferences', 'Window', and 'Help'. The dialog has a 'Subtabs' area on the left with icons for Site, Schedules, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables (selected), Simulation Settings, Scripts, Run Simulation, and Results Summary. The main area lists variables with toggle switches and dropdown menus for reporting frequency:

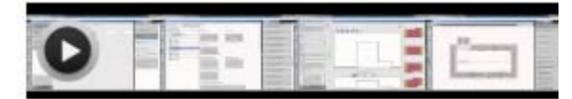
Variable Name	Status	Frequency
Zone/Sys Moisture Load Rate Predicted	off	[Dropdown]
Zone/Sys Moisture Load Rate Predicted to dehumidifying setpoint	off	[Dropdown]
Zone/Sys Moisture Load Rate Predicted to humidifying setpoint	off	[Dropdown]
Zone/Sys Sensible Cooling Energy	off	[Dropdown]
Zone/Sys Sensible Cooling Rate	on	Hourly
Zone/Sys Sensible Heating Energy	off	[Dropdown]
Zone/Sys Sensible Heating Rate	on	Hourly
Zone/Sys Sensible Load Predicted	off	[Dropdown]
Zone/Sys Sensible Load to Cooling Setpoint Predicted	off	[Dropdown]

Annotations on the left side of the dialog:

- Menu Bar: Points to the top menu bar.
- Subtabs: Points to the subtab icons.
- Resource Tabs: A bracket groups Site, Schedules, Constructions, Loads, Space Types, Stories, and Facility.
- Simulation & Results: A bracket groups Simulation Settings, Scripts, Run Simulation, and Results Summary.

A callout box labeled 'Frequency of Variable Reporting' points to the 'Hourly' dropdown menu for the 'Zone/Sys Sensible Cooling Rate' variable.

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## Simulation Settings

### Notes

The Simulation Settings tab has not yet been implemented. This tab will allow you to control simulation settings such as start and end dates, time step, and other simulation options.

If you need to control these now, you can use the Scripts tab.

Menu Bar →

Subtabs →

Resource Tabs

- Site
- Schedules
- Constructions
- Loads
- Space Types
- Stories
- Facility
- Thermal Zones
- HVAC Systems

Simulation & Results

- Output Variables
- Simulation Settings
- Scripts
- Run Simulation
- Results Summary

OpenStudioWorkflow.osm\* — OpenStudio

File Preferences Window Help

Simulation Settings

**Coming Soon**  
Basic and Advanced Simulation Settings

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## Scripts

### Notes

The Scripts tab is a very powerful tool that allows you to extend the functionality of OpenStudio. To use this tab you need to have Ruby installed on your machine. Ruby is not automatically installed as part of OpenStudio. The OpenStudio website has instructions for installing ruby on Windows and Linux. Mac has Ruby installed by default.

An important thing to understand about the Scripts tab is when scripts can be run in the simulation workflow. The normally workflow for running a simulation is to convert the OSM (OpenStudio Model) to an IDF (Input Data File), then that IDF is handed to EnergyPlus to run a simulation.

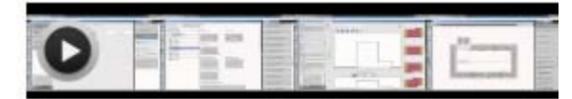
Model scripts are run on the OSM model before it is converted to an IDF. IDF scripts are run on the IDF file before it is handed to EnergyPlus, and Post EnergyPlus scripts are run after the EnergyPlus simulation.

Some scripts such as the example shown here take arguments. These arguments and the scripts are saved alongside your OSM file.

The screenshot shows the OpenStudio interface with the Scripts tab active. The window title is "OpenStudioWorkflow.osm\* - OpenStudio". The menu bar includes File, Preferences, Window, and Help. The Scripts tab is divided into several sections:

- Resource Tabs:** A vertical sidebar on the left contains icons for Site, Schedules, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables, Simulation Settings, Scripts, Run Simulation, and Results Summary. Green arrows point from these labels to their respective icons.
- Model Scripts:** A list of script files is shown, including "SetWindowToWallRa" (with a close icon).
- Model Script Resources:** A list of resource files, including "SortOsmFile.rb".
- IDF Scripts and IDF Script Resources:** Lists for scripts and resources associated with the current IDF file.
- Post EnergyPlus Scripts:** A list of scripts to be run after the simulation.
- Main Panel:** Displays details for the selected script "SetWindowToWallRatioByFacade.rb". It includes:
  - Location:** C:/Users/dgoldwas/AppData/Local/Temp/1/qt\_temp.Xd9984/resources/scripts/model\_scripts/SetWindc
  - User Script Arguments:** A section with a "Formal User Script" button set to "Yes" and a "Refresh User Script Arguments" button.
  - Facade:** A dropdown menu set to "North".
  - Sill Height (m):** A text input field containing "2.5".
  - Window to Wall Ratio (fraction):** A text input field containing "0.1".
  - Buttons:** "Open Script in Text Editor" and "Click Here To Load Arguments" (with a tooltip).
- Drag From Library:** A dashed box at the bottom with a tooltip "Drag Scripts Here To Include in Model".

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## 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.

New to OpenStudio 0.9.0 is a check box to use Radiance for daylighting calculations. [Using Radiance within OpenStudio requires installation of a number of other tools.](#) Look on OpenStudio for videos (coming soon) demonstrating a workflow for using Radiance.

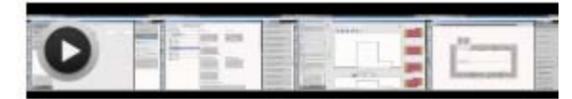
The output windows shows standard output that you can look at to follow the simulation's progress.

If you want to run multiple jobs at once, there is a button to launch the standalone RunManager application.

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

The screenshot shows the OpenStudio application window titled "OpenStudioWorkflow.osm\* - OpenStudio". The interface includes a menu bar (File, Preferences, Window, Help) and subtabs (Run Simulation, Output, Tree). A vertical toolbar on the left contains icons for Site, Schedules, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables, Simulation Settings, Scripts, Run Simulation, and Results Summary. The main workspace is divided into a "Run" section with a green play button and a progress bar at 100%, and an "Output" section displaying simulation logs. Annotations include: "Start Simulation" pointing to the play button; "Launch RunManager To Batch Run Simulations" pointing to a button in the top right; "Click to view Configuration Instructions for Radiance Integration with OpenStudio" pointing to a checkbox; and "Open RunManager for Multiple Runs" pointing to a button in the top right. A "Simulation & Results" label on the left side groups the bottom toolbar items.

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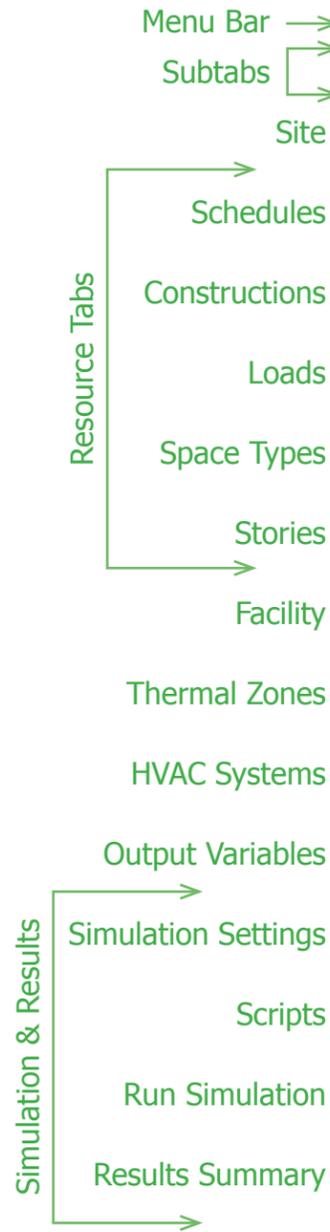
## Run Simulation - Tree

### Notes

The top right table in the screenshot shows the jobs that ran as part of the simulation run. First was "ModelToIdf". This converted the OSM model to an IDF model.

If you have any Ruby scripts setup in the Scripts tab, 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.



The screenshot shows the OpenStudio interface with the following components:

- Menu Bar:** File, Preferences, Window, Help
- Subtabs:** Run Simulation, Output, Tree
- Resource Tabs (Left Panel):** Site, Schedules, Constructions, Loads, Space Types, Stories, Facility, Thermal Zones, HVAC Systems, Output Variables, Simulation Settings, Scripts, Run Simulation, Results Summary
- Workflow Description Table:**

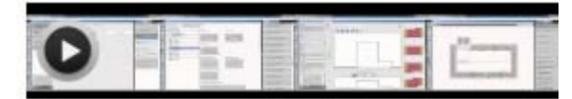
Job Description	Warnings	Errors	Last Run	Status
ModelToIdf (../in.osm)	0	0	2012-Sep-27 01:35:41	Idle
Output Files				
in.idf (2012-Sep-27 07:35:48)				
ExpandObjects	0	0	2012-Sep-27 01:35:51	Idle
Output Files				
stdout (2012-Sep-27 01:35:52)				
EnergyPlusPreProcess	0	0	2012-Sep-27 01:35:52	Idle
Output Files				
out.idf (2012-Sep-27 07:35:54)				
<b>EnergyPlus</b>	43	0	2012-Sep-27 01:35:...	Idle
Output Files				
Energy+.ini (2012-Sep-27 01:35:55)				
eplusout.audit (2012-Sep-27 01:37:18)				
eplusout.bnd (2012-Sep-27 01:37:18)				
eplusout.eio (2012-Sep-27 01:37:17)				
- Standard Output / Details:**

```

Missing Energy+.ini
EnergyPlus Starting
EnergyPlus-64-MP 7.1.0.012, 9/27/2012 1:35 AM
Processing Data Dictionary
Processing Input File
Initializing Response Factors
Calculating CTFs for "CBECS_BEFORE-1980_EXTWALL_STEELFRAME_CLIMATEZONE 3C", Construction #1
Calculating CTFs for "CBECS_1980-2004_EXTWALL_STEELFRAME_CLIMATEZONE 4A", Construction #2
Calculating CTFs for "CBECS_BEFORE-1980_EXTWALL_METAL_CLIMATEZONE 5B", Construction #3
Calculating CTFs for "CBECS_1980-2004_EXTWALL_WOODFRAME_CLIMATEZONE 6A", Construction #4
Calculating CTFs for "CBECS_1980-2004_EXTWALL_METAL_CLIMATEZONE 6B", Construction #5
Calculating CTFs for "CBECS_1980-2004_EXTROOF_ATTICFLOOR_CLIMATEZONE 2A", Construction #6
Calculating CTFs for "CBECS_1980-2004_EXTWALL_MASS_CLIMATEZONE 4A", Construction #7
Calculating CTFs for "CBECS_BEFORE-1980_EXTWALL_STEELFRAME_CLIMATEZONE 1-3B", Construction #8
Calculating CTFs for "CBECS_1980-2004_EXTWALL_METAL_CLIMATEZONE 4A", Construction #9
Calculating CTFs for "CBECS_1980-2004_EXTWALL_WOODFRAME_CLIMATEZONE 7", Construction #10
Calculating CTFs for "CBECS_BEFORE-1980_EXTROOF_I_EAD_CLIMATEZONE 7", Construction #11
Calculating CTFs for "CBECS_BEFORE-1980_EXTWALL_METAL_CLIMATEZONE 4B", Construction #12
Calculating CTFs for "ASHRAE_189.1-2009_EXTWALL_STEELFRAME_CLIMATEZONE 1-3", Construction #13
                    
```
- Jobs Summary (Bottom Right):**
  - Jobs In Queue: 4
  - Local Jobs Running: 0
  - Remote Jobs Running: 0
  - Completed Jobs: 4
  - Failed Jobs: 0

Right Click Here To Open Directory With Output Files

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## Results Summary

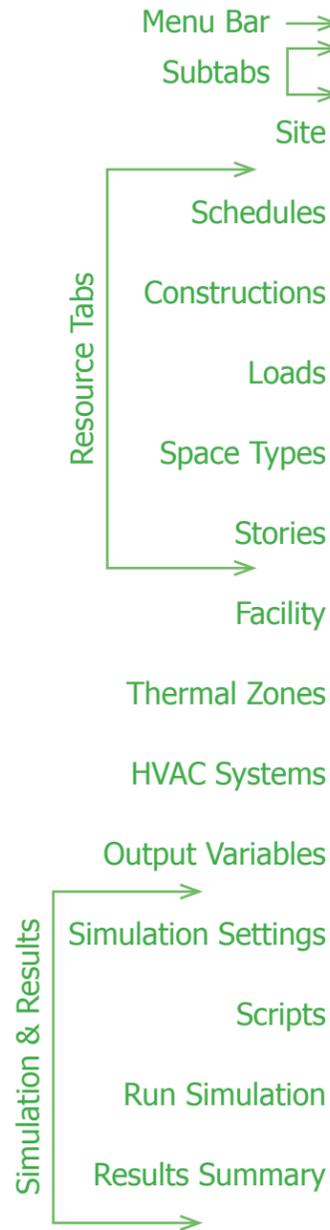
### Notes

The Results Summary tab is populated with data after you run a simulation. It displays monthly and annual end use summary data for electricity and natural gas.

It also shows in table form district heating and cooling, which you would use if you ran your model with ideal air loads.

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.

When you reopen a previously run simulation, it will populate this tab with previous results.



Launch ResultsViewer to View Time Series Variables

**Electricity Consumption (kWh)**

**Natural Gas Consumption (MBtu)**

**Electricity Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Heating	125.6	408.7	162.9	8,795	7,451	0	0	0	0	8,959	82.51	401.4	1206
Cooling	268.8	213.9	453.9	554.1	881.7	1549	1999	2172	1543	763.9	482.3	99.9	1.098e+04
Interior Lighting	2555	2308	2551	2485	2531	2485	2574	2531	2485	2555	2462	2574	3.01e+04
Exterior Lighting	—	—	—	—	—	—	—	—	—	—	—	—	—
Interior Equipment	3187	2880	3189	3087	3185	3087	3191	3185	3087	3187	3085	3191	3.754e+04
Exterior Equipment	—	—	—	—	—	—	—	—	—	—	—	—	—
Fans	203.7	217	222.4	204.4	223.3	244	266.3	273.5	249.1	223.8	212.3	223.4	2763
Pumps	301.6	262.2	272.6	345.1	345.2	352.2	378.9	381.8	336.7	343.5	378.9	385.2	4084
Heat Rejection	3.134	0.07906	35.98	72.4	133.8	213.6	251.4	267.7	193.6	79.25	20.46	18.22	1290
Humidification	—	—	—	—	—	—	—	—	—	—	—	—	—
Heat Recovery	—	—	—	—	—	—	—	—	—	—	—	—	—
Water Systems	—	—	—	—	—	—	—	—	—	—	—	—	—
Refrigeration	—	—	—	—	—	—	—	—	—	—	—	—	—
Generators	—	—	—	—	—	—	—	—	—	—	—	—	—
<b>Total</b>	<b>6644</b>	<b>6290</b>	<b>6887</b>	<b>6757</b>	<b>7308</b>	<b>7931</b>	<b>8660</b>	<b>8811</b>	<b>7894</b>	<b>7161</b>	<b>6723</b>	<b>6893</b>	<b>8.796e+04</b>

**Natural Gas Consumption (MBtu x000.000)**