Quick Start Guide

IESVE Model Review

-

IES Virtual Environment

November 2020

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1. Introduction

This quick start guide assists a reviewer in evaluating compliance with an IESVE model.

Software Engine Validation

The <Virtual Environment> has been assessed against a number of global standards, including ASHRAE Standard 140. IESVE is fully validated under ASHRAE Standard 140 and have published the results for all current versions. For more information about software validations and approval, as well as copies of ASHRAE Standard 140 results, please visit http://www.iesve.com/software/software-validation. Additionally, IESVE is approved by the US Department of Energy for Federal Incentives – IRS Code 179D.

Step 1: Installation & Activation of IESVE Software

You will receive an email with instructions on how to download the current version of the <Virtual Environment> software. This will contain a link that gives access to the software and full instructions on how to download and install.

To request keys simply run the software and click through help >> request licence keys and enter your details, leave activation code field blank and choose action: request free trial and click send request.

Once the request is sent, the IES Keys team will process the request and send out a confirmation email. Follow the directions within the email to activate the software. For additional support, email the IES Keys team at keys@iesve.com. For any single-location network license access, please see the following URL for installation details http://www.iesve.com/software/download/requesting_licence_keys.pdf.

Multiple versions of IESVE can be supported simultaneously and all older versions of IESVE software are available for download at the URL: http://www.iesve.com/software/download/ve-for-engineers/archive. When opening older software versions, the DLL files will need to be registered before that older version can be opened. To do this, run the **IESFIX.exe** from the installations 'apps' folder.

Step 2: Weather File Directory

To perform analysis in IESVE, it is also necessary to install the appropriate weather files and design day files (*.epw and *.ddy) should be copied to the following location:

C:\Program Files (x86)\IES\Shared Content\Weather

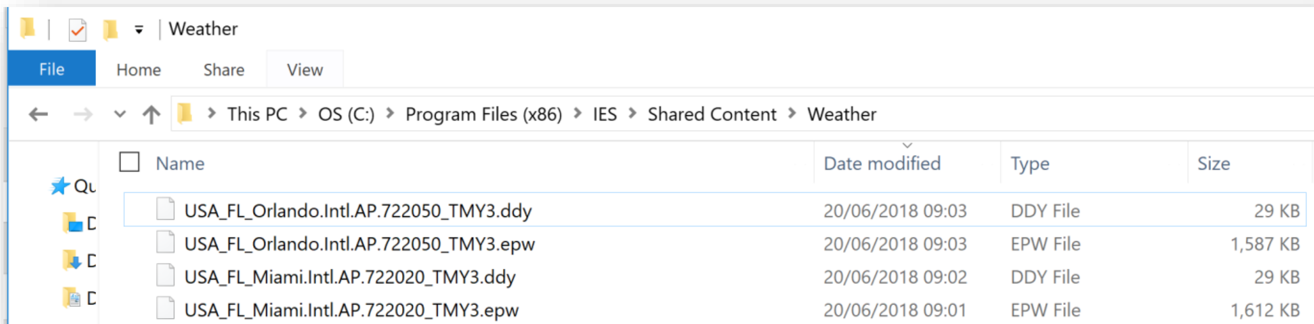

Figure 1: Weather File Directory

Opening an IESVE Model

Once IESVE Software has been opened, a number of licensed Applications should be shown (see section 01 below). To open an IESVE model, first save the model file(s) to your local directory.

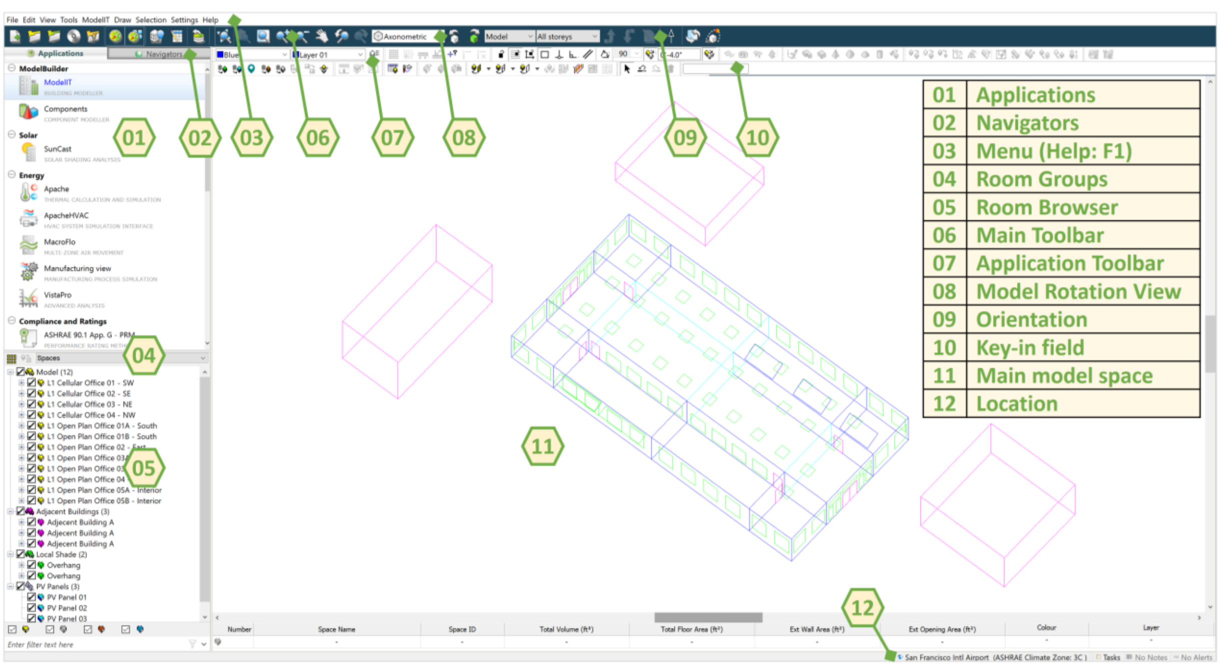

Figure 2: IESVE Software Landscape

IES <Virtual Environment> model files are most commonly shared in an archive, or cabinet file (*.cab). Before opening the archived model, it is important to note which version of IESVE is installed and in which version the archived model was created. To determine which version of IESVE is installed, simply select **Help** -> **About VE** within the software menus at the top of the screen to generate the following:

Figure 3: IESVE Version

To determine the version in which the archived model was created. Most archived model files will be named to include the software version, either at the beginning or end of the file name. For example, a file named "[VE2016]_Example Project.cab" was created in IESVE 2016. Models created in older software versions may be opened newer software versions, but newer models cannot be opened in older versions. Opening an older model in a newer version of the software requires upgrading the model and is not recommended when reviewing a model. Multiple software versions may be installed on a single computer at the same time.

Once the version of the software and the version of the archived model are aligned, open the archived model by going to **File** -> **Archive** -> **Extract** as shown below:

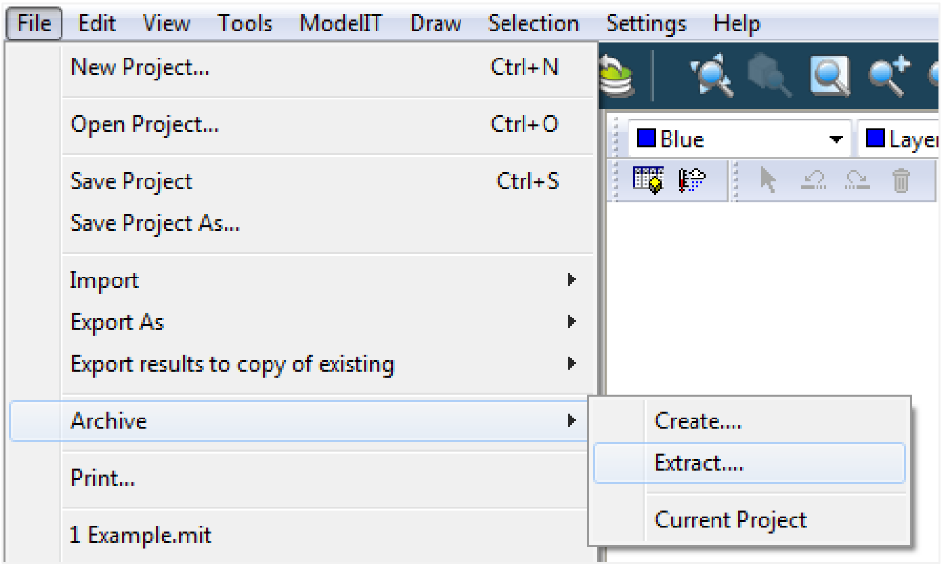

Figure 4: IESVE Model Extract

Select the model archive file (*.cab) and choose a location for extracting the model files:

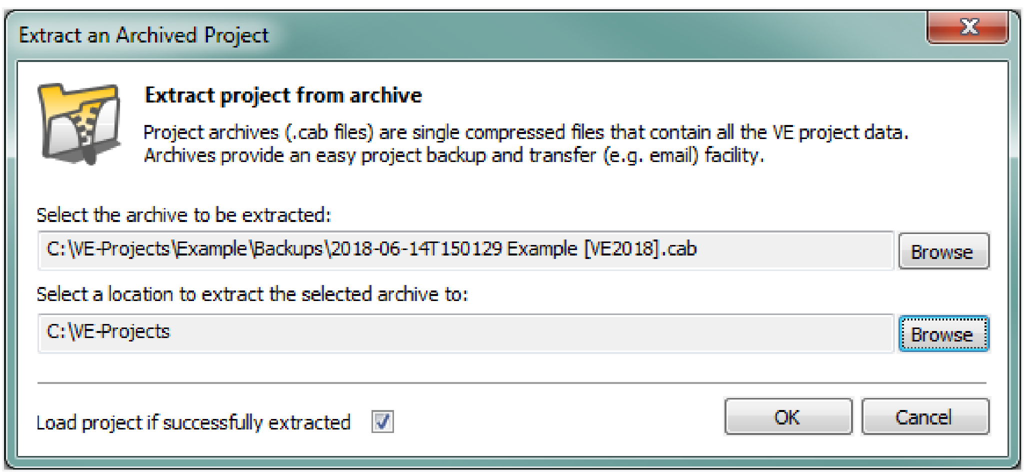

Figure 5: IESVE Archive Project

An IESVE models will consist of a model folder containing multiple files and subfolders. The model folder should be saved on the local drive and should not be a subfolder of another model, as this can cause model corruption. Take care in selecting the location for model files, especially if simulations are to be performed.

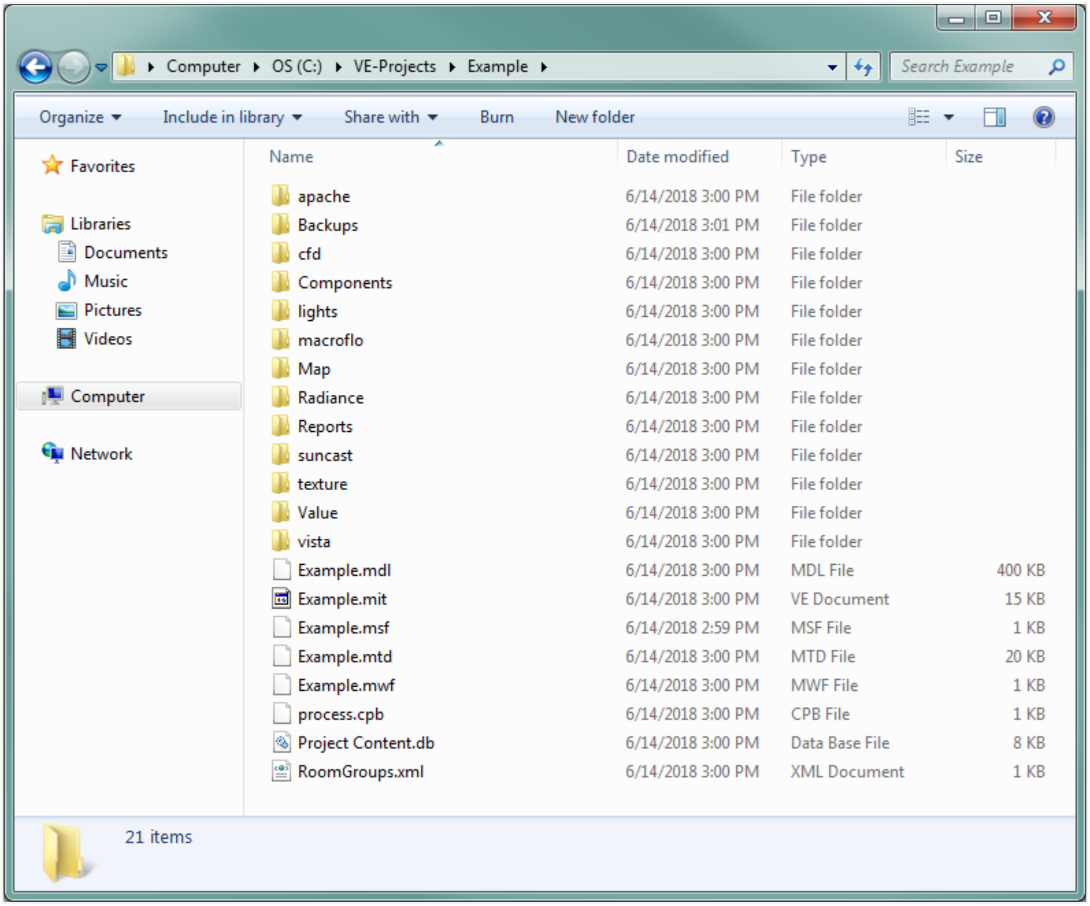

Figure 6: IESVE Project Directory

Extracting a model archive creates a model folder and all necessary subfolders and files. Any subsequent edits made to the model will be contained with the model folder and will not change the model archive in any way. As such, the same model archive can be extracted any time and produce the same resulting model.

The 8,760 simulation results files are saved in the **vista** folder. There should be one proposed file, often beginning with the letter ‘p’, and one baseline/standard result file, often beginning with the letter ‘b’. The IESVE energy model can be zipped or extracted to a .cab file with or without the results file.

2. Model Review – Inputs & Outputs

Florida 2020 Reports – 90.1 2016 AppG

The generated Florida 2020 - 90.1 2016 AppG report from IESVE is shown below and should be located in the "PROJECTNAME**\Content\Compliance Reports**" directory for each building.

Compliance Forms | Florida Compliance Report

IES INTEGRATED ENVIRONMENTAL SOLUTIONS

Florida Compliance Report

Project Name: A1 Bldg (New Cons., Office Occupancy) FL Code		
Project Address: 123 Main Street, , Miami, Florida		Date: 13-Nov-2020
Designer of Record: Designer	Email:	Telephone:
Contact Person: Owner	Email:	Telephone:
City: Miami		Principal Heating Source
Weather Data: USA_FL_Miami.Intl.AP.722020_TMY3.epw		☑ Fossil Fuel ☑ Electricity ☐ Solar/site recovered ☐ Other

Space Summary

Building Use	Conditioned Area (ft²)	Unconditioned Area (ft²)	Total (ft²)	BPF (Table 4.2.1.1)
SPACE: Office - Open plan	22500.0	0	22500.0	0.62
Total/Total Area Weighted BPF	22500.0	0	22500.0	0.62

Advisory Messages

	Proposed Building Design	Budget Building	Difference Proposed/Budget
Number of hours heating loads not met (system/plant)	0.0	0.0	0.0
Number of hours cooling loads not met (system/plant)	0.0	0.0	0.0
Number of warnings	-	-	-
Number of errors	-	-	-
Number of defaults overridden			

Compliance Forms | Florida Compliance Report

INTEGRATED ENVIRONMENTAL SOLUTIONS

Florida Compliance Report

Project Name: A1 Bldg (New Cons., Office Occupancy) FL Code		
Contact Person: Designer	Email:	Telephone:

Energy and Cost Summary by Fuel Type*

		Proposed Building		Baseline Building	
Regulated Energy	Energy Type	Energy (kBtu/yr)	Energy Cost (£/yr)	Energy (kBtu/yr)	Energy Cost (£/yr)
Lighting	Electricity	19,270.6		19,077.9	
Space heating	Gas	359.1		0	
Space heating	Electricity	0		138.9	
Space cooling	Electricity	24,462.9		85,633.7	
Fans	Electricity	5,733.3		14,194.4	
Heat rejection	Electricity	1,561.5		5,466.0	
Total Regulated Electric Energy		51,028.3	16,118.3	124,510.9	39,189.7
Total Regulated Gas Energy		359.1	45.6	0	0
Total Regulated Energy		51,387.4	16,163.9	124,510.9	39,189.7
Unregulated Energy					
Office equipment	Electricity	28,905.9		27,488.0	
Total Unregulated Electric Energy		28,905.9	9,385.3	27,488.0	9,096.4
Total Unregulated Gas Energy		0	0	0	0
Total Unregulated Energy		28,905.9	9,385.3	27,488.0	9,096.4
Total Energy		80,293.3	25,549.2	151,998.9	48,286.1

Performance Cost Index Target

Variable	Description	Value	Source
BBUEC	Baseline Building Unregulated Energy Cost (£)	9,096.4	Energy and Cost Summary by Fuel Type Table
BBREC	Baseline Building Regulated Energy Cost (£)	39,189.7	Energy and Cost Summary by Fuel Type Table
BBP	Baseline Building Performance (Energy Cost) (£)	48,286.1	Energy and Cost Summary by Fuel Type Table
BPF	Total Area Weighted Building Performance Factor	0.62	Space Summary Table
PCI_t	Performance Cost Index Target	0.69	[BBUEC + (BBREC × BPF)]/BBP

Compliance Forms | Florida Compliance Report

INTEGRATED ENVIRONMENTAL SOLUTIONS

Energy Summary by End Use*

	Proposed Building		Budget Building		Performance Cost Index (PCI)
	Energy Use (kBtu/yr)	Energy Cost (£/yr)	Energy Use (kBtu/yr)	Energy Cost (£/yr)	Proposed Cost / Baseline Cost
Electricity	79,934.2	25,503.6	151,998.9	48,286.1	0.53
Gas	359.1	45.6	0	0	0
Total ex Onsite Generation	80,293.3	25,549.2	151,998.9	48,226.12	0.53
Total inc Onsite Generation	80,293.3	25,549.2	151,998.9	48,226.12	0.53
'Total inc Onsite Generation' PCI less than or equal to PCI_t? (Yes/No)					Yes

* These results use assumptions for showing compliance during a typical year; actual energy costs may be substantially different.

Figure 7: Florida 2020 - 90.1 2016 AppG report

To populate a new Florida 2020 - 90.1 2016 AppG report, a dialog is launched from IESVE Navigators, see below.

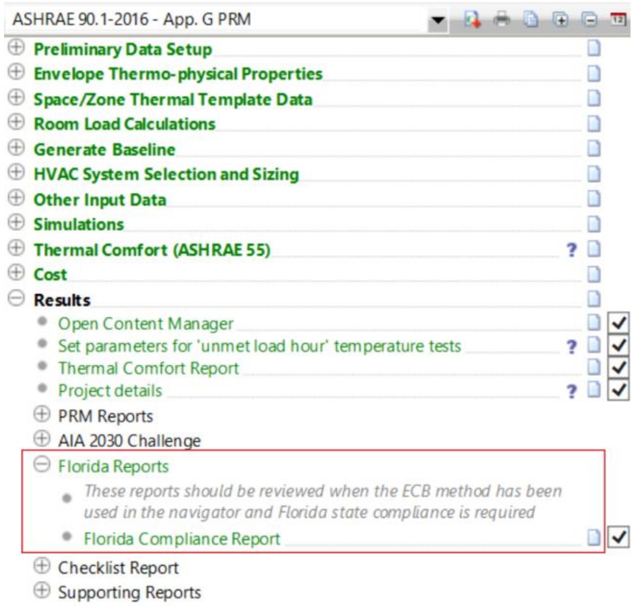

Figure 8: Florida 2020 - 90.1 2016 AppG report in the Navigator

Custom Hourly Analysis (VistaPro Application)

IESVE software has a dedicated Application (**VistaPro**) for analysis of annual, monthly, daily, hourly and sub-hourly results. Functionality of VistaPro includes graphical outputs (XY plots, bar charts, range tests of binned data, min/max peak graphs etc.) and data tables (annual hourly tables, monthly totals, etc.). The data for analysis is commonly hourly annual energy simulation results, but can also be design heating & cooling loads, metered data or weather data. The VistaPro landscape image below details how various energy end-uses can be output (graphically or tabulated) and copied (red arrows) to external sources such as MS-Excel.

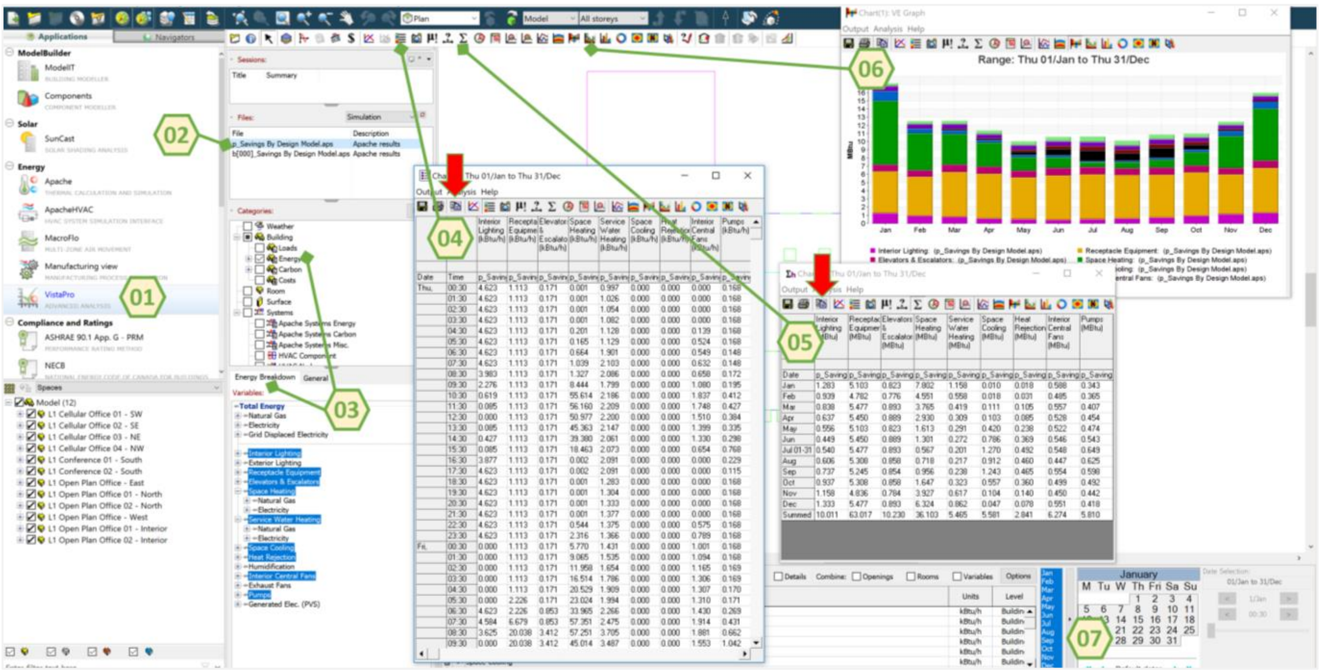

Figure 9: Customized Analysis with the VistaPro Application

1. VistaPro Application
2. Results file selection. Note a 'p_' often represents a Proposed design and a 'b_' often represents a baseline/standard design.
3. Category of analysis. Note the 'Energy' category selected and 'Energy Breakdown' tab for various energy end-uses and meters
4. 8,760 hourly data tables; requires some energy end-uses to be selected.
5. Monthly and annual data tables; requires some energy end-uses to be selected.
6. Stacked bar-charts of energy end-uses.
7. Calendar selection.

Note that while other energy end-uses are shown E.g. exterior lighting and energy generated end-uses are shown in the design, they are excluded from the Savings By Design script & report. The Savings By Design script/report only reads Space Heating Gas, Space Heating Electricity, Space Cooling, Fans Interior, Heat Rejection, Pumps, DHW Gas, DHW Electricity, Interior Lighting, Receptacle, Data Center, Cooking Gas, Cooking Electricity, Elevators, Refrigeration and Process.

General Navigator Inputs – Integrated Communication/Narrative

It is common for an end-user to use a Navigator in IESVE software, to streamline the workflow of a project, from top to bottom. Commonly used IESVE Navigators include IECC and ASHRAE 90.1 workflows, and are available for selection in **Item 01** below. If a notepad icon is colored in (**item 04**), that means that there are explanatory notes within the model, beside that associated action or input, which is normally attempting to communicate the approach taken, or provide details about those specific model inputs, that are assigned to the model. These notes can be valuable to any reviewer, as separate narrative documentation might not be necessary. Various examples (**item 02** – **item 07**) are shown below.

Note that usage of an ASHRAE-based Navigator does not mean that the baseline model is an ASHRAE baseline.

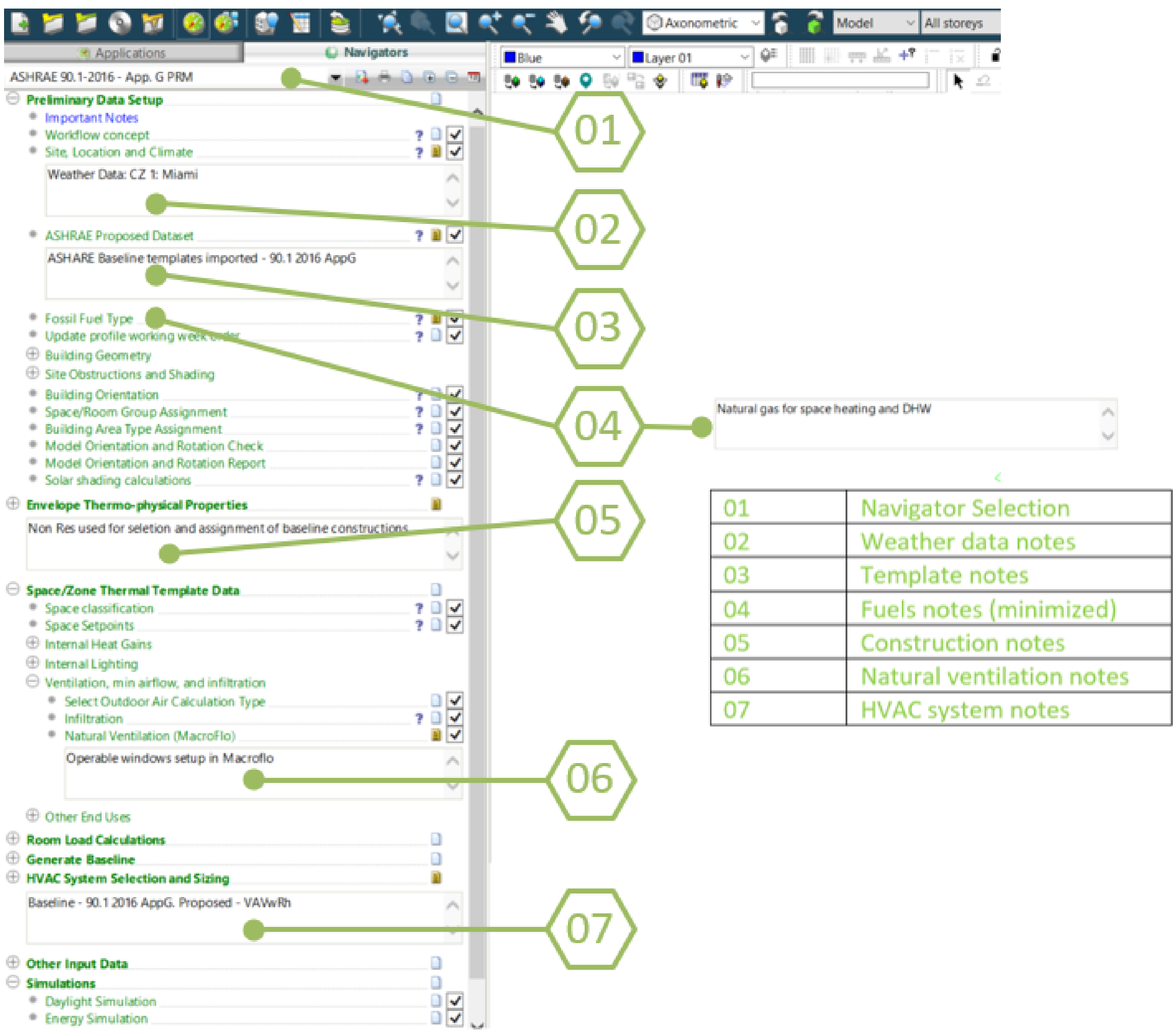

Figure 10: IES Navigator with Notes for Reviewer

Geometry

To view model geometry in a 3D viewer, see **item 01** below. Note that all IESVE geometry is spatially aware of its surroundings, local shading and internal adjacencies. In order to confirm model orientation, select **item 02**.

The major advantage of the 3D model is that the architecture (geometry) of the building can provide energy savings against the baseline model. This can come from an optimized orientation, intelligent fenestration placement, external shading devices (e.g. overhangs) and well-daylit spaces with integrated daylight controls.

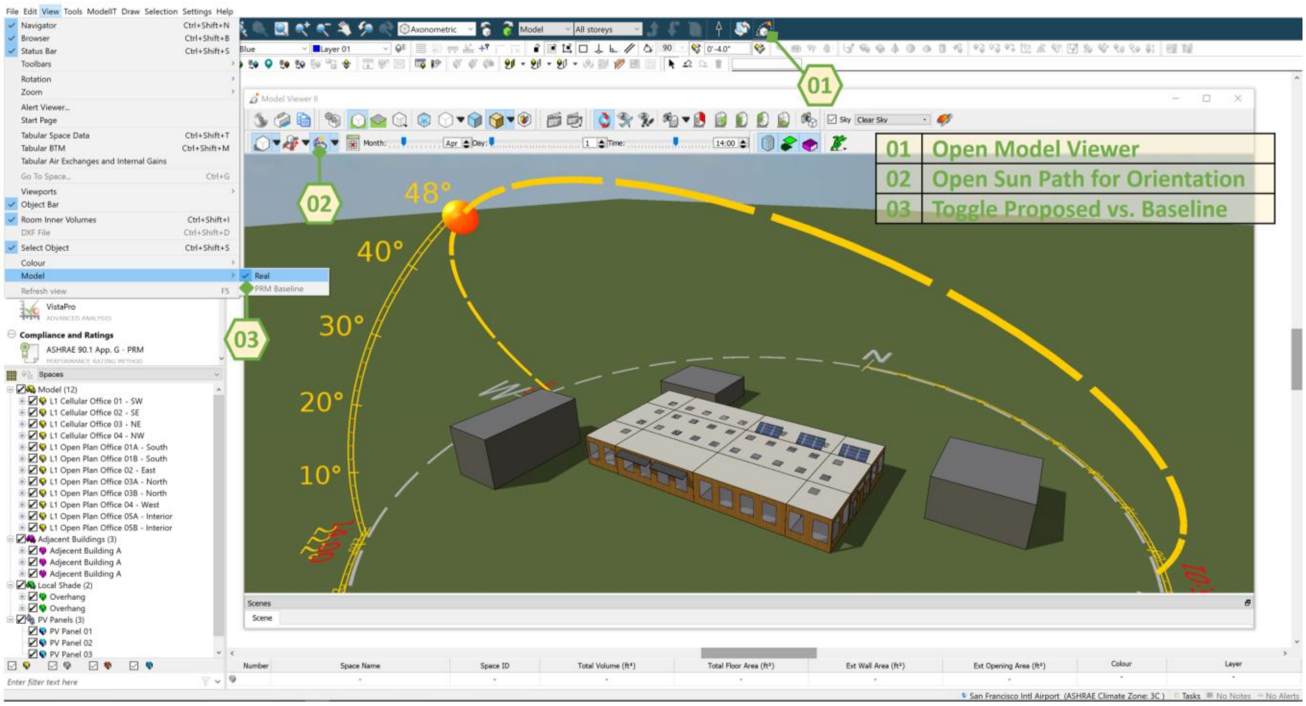

Figure 11: Proposed/Baseline Model Viewer

There are two model approaches for comparing a proposed and standard (baseline) model.

1. Host the two models in one model file. This is the most common approach, so if a Title 24 baseline model needs to be viewed, go to the **View** menu and select **PRM Baseline**. Note that the "PRM Baseline" geometry can represent any Baseline model (e.g. Title 24, ECB, etc.) and will have been modified by the user to represent the appropriate baseline code.
2. Separate proposed and standard (baseline) models in two model files. This is less common, but can be common when underfloor systems are being compared.

Weather

Before validating the weather data used for a model, ensure California weather files are accessible within IESVE software by following the process described in the Step 2: Weather File Directory section of this document.

The weather data referenced by a model can be viewed & edited from ApacheLocate (ApLocate). ApLocate can be accessed by double clicking on the globe icon in the bottom right corner of IESVE software and the weather file used for simulations can be seen on the Simulation Weather Data tab within ApLocate:

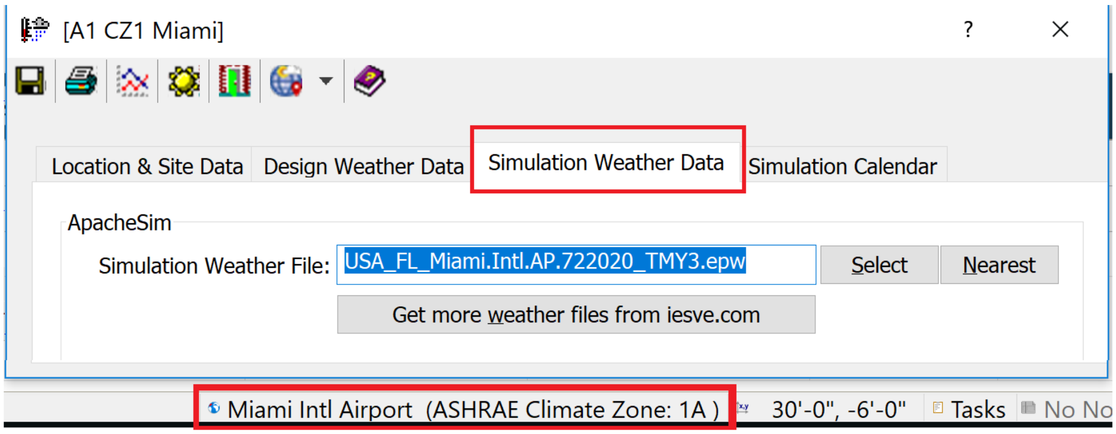

Figure 12: ApLocate and Simulation Weather File

Envelope

Follow actions 01-05 below to review construction assignments and assemblies for proposed and standard (baseline) models.

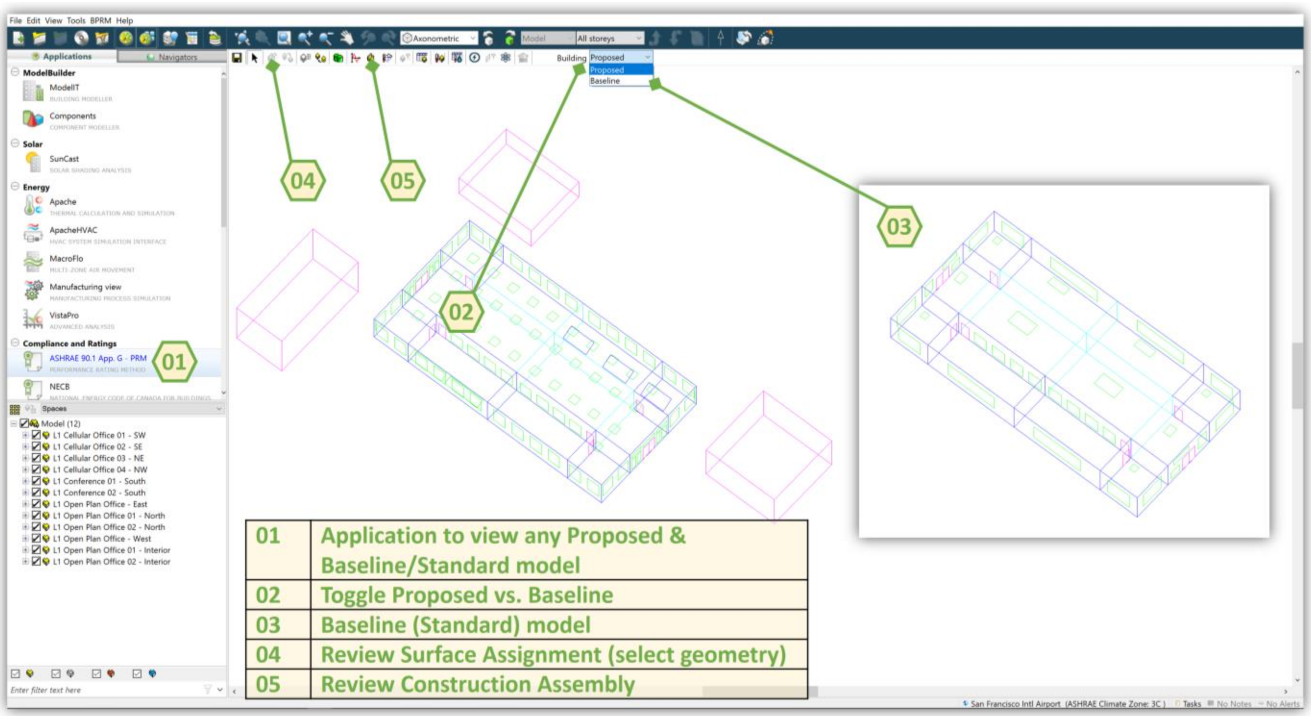

Figure 13: Building Envelope Assignment Review

To review any construction assembly, the appropriate construction can be selected and **Edit construction** to review.

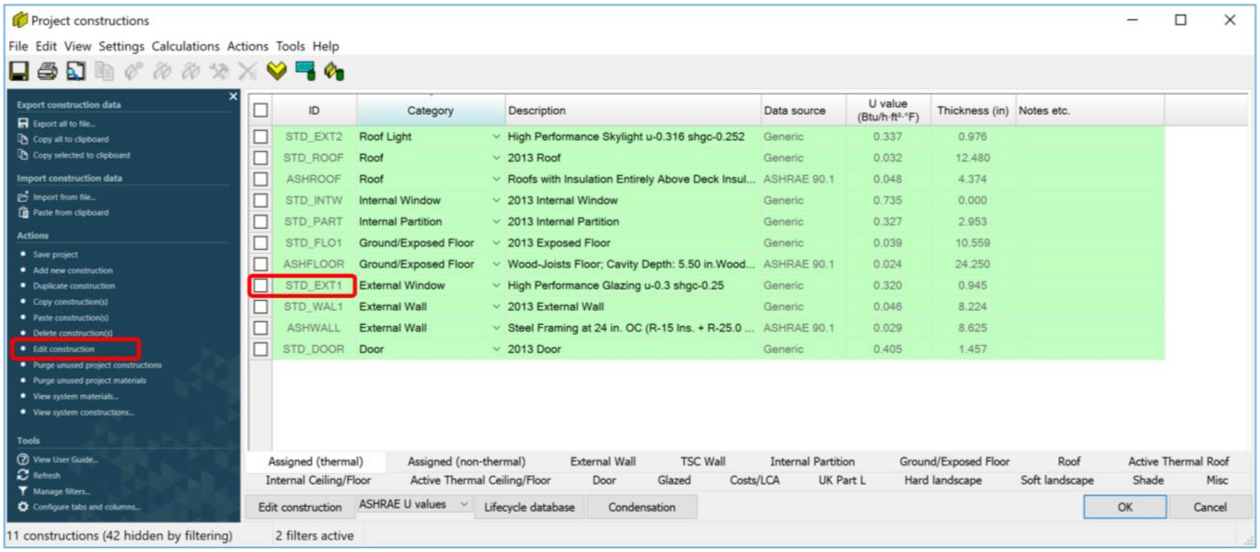

Figure 14: Model Constructions Review

An example glazed assembly is shown below, which includes information about u-value (with/without frame), Solar Heat Gain Coefficient (SHGC) and Visible Light Transmittance (VLT). Dynamic shades can be viewed in the **Shading Device** tab below.

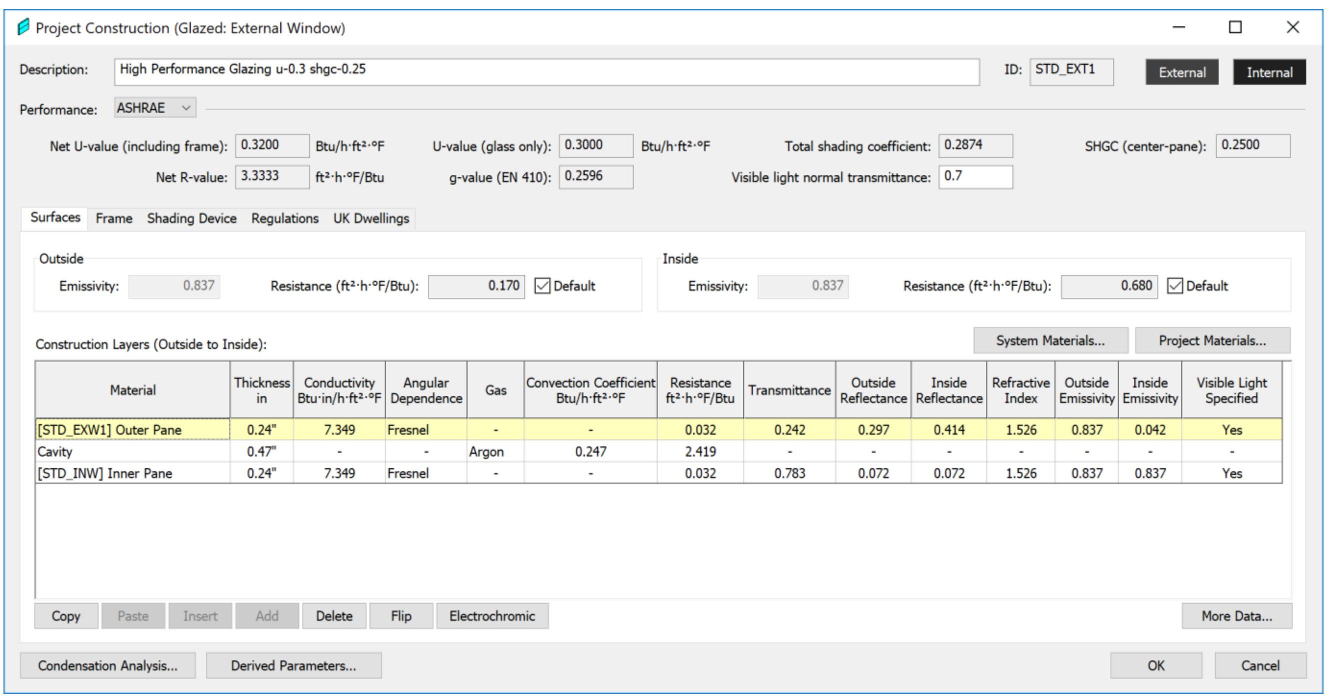

Figure 15: Glazed Assembly Characteristics

An example opaque construction assembly is shown below.

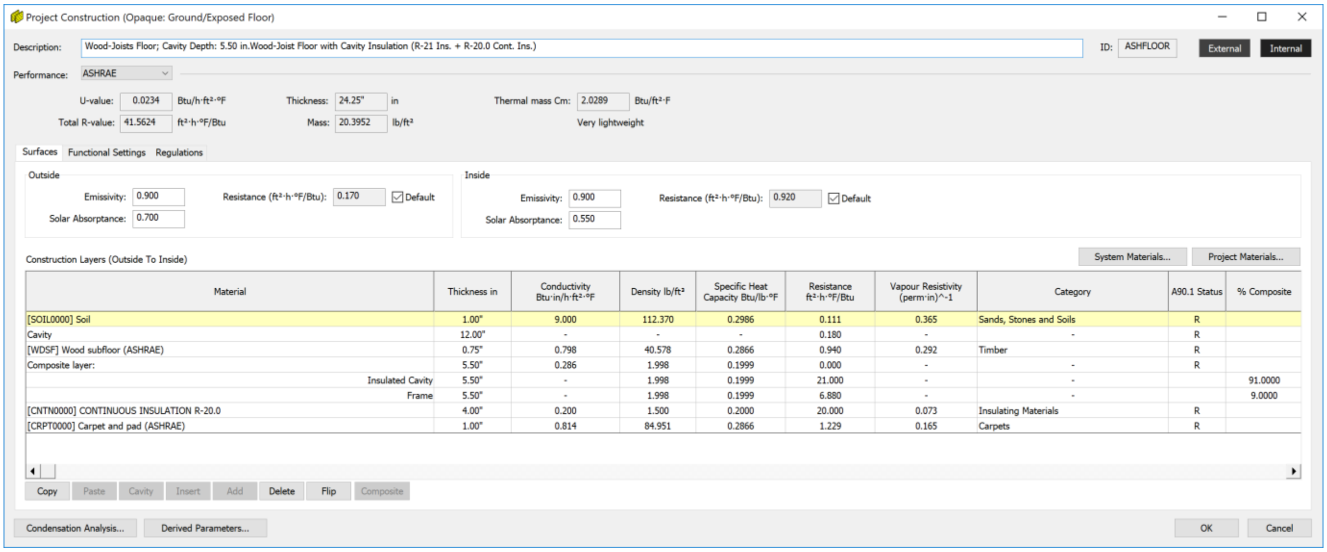

Figure 16: Opaque Construction Assembly Characteristics

An alternative review of constructions assignment can be made in the Apache Application or the ASHRAE 90.1 Application, using the **Input Data Visualization** tool, as shown below. In this example, **Constructions** is the category and variable selected to be visualized.

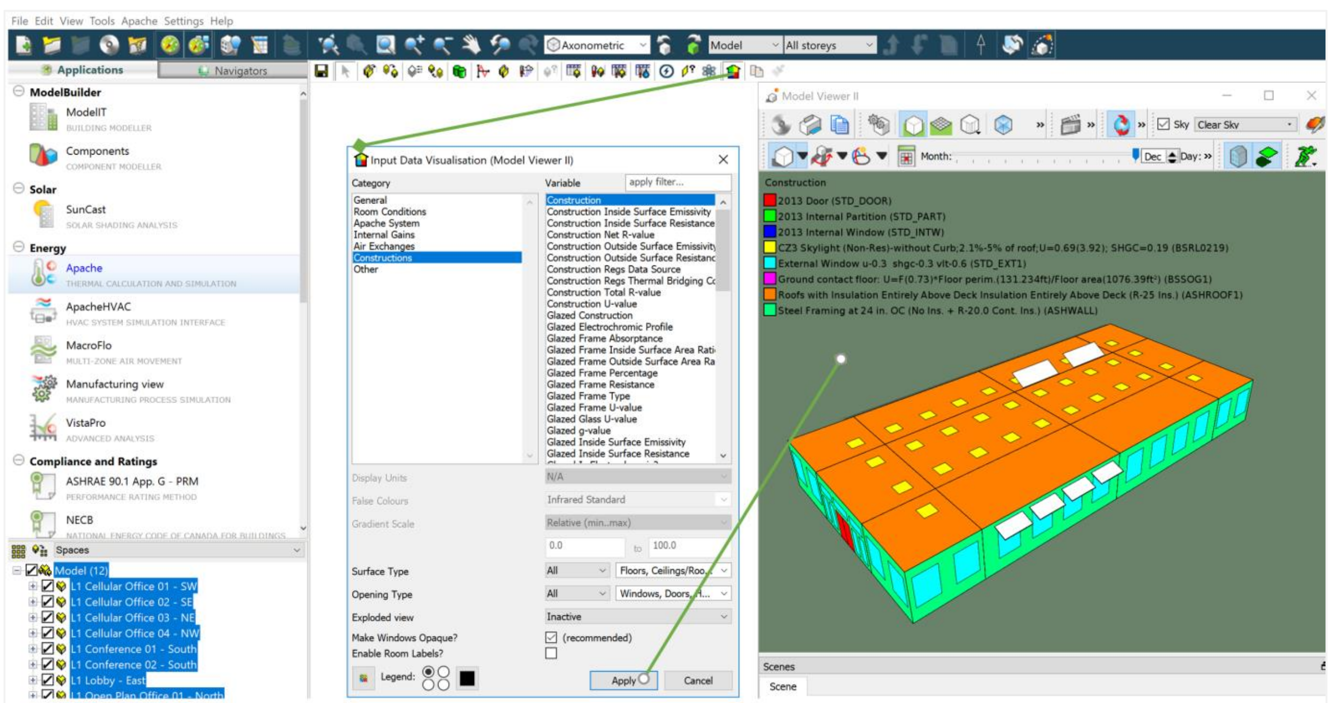

Figure 17: Input Data Visualization

Many other variables can be visualized in this way, including internal gains (e.g. Lighting power density) and room conditions (e.g. heating setpoints).

Internal Gains

To review any occupancy gains, receptacle equipment (Plug Loads), lighting gains, refrigeration, cooking, data center gains, other process gains; schedules and diversity factors of internal gains for proposed and standard (baseline) models, open the **Tabular Space Data** dialog.

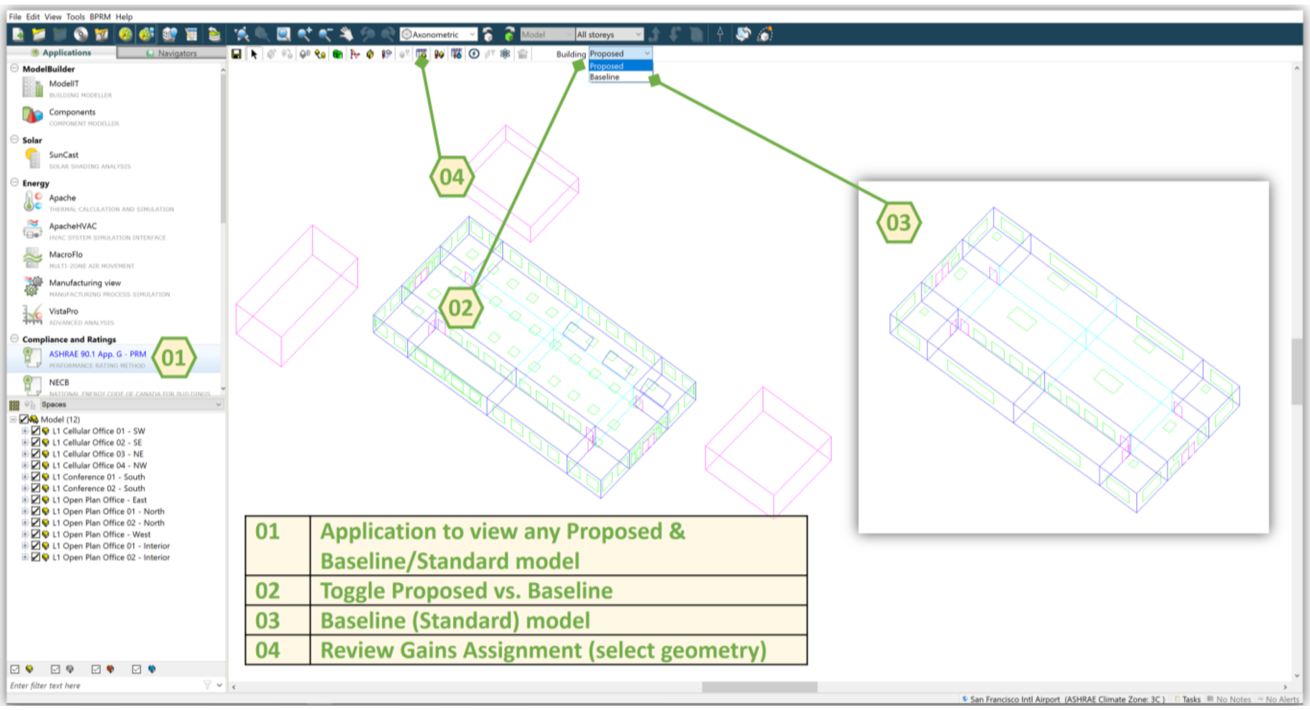

Figure 18: Proposed/Baseline toggle for Internal Gains Review

Action item 04 above will launch the **Tabular Space Data** dialog, as shown below.

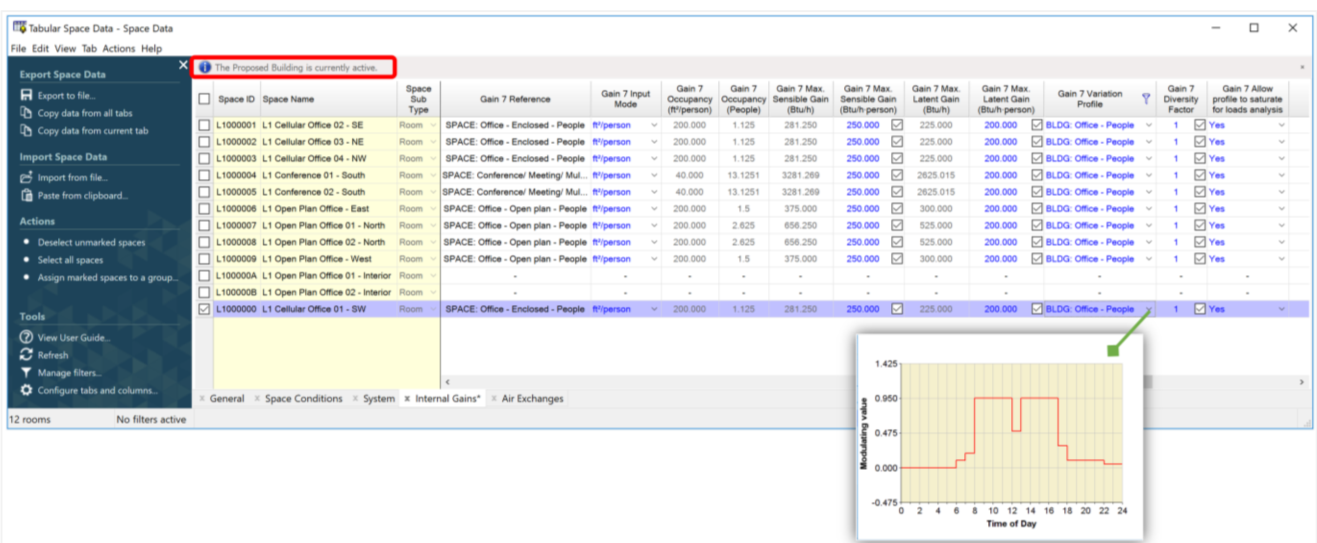

Figure 19: Tabular Data of Space Internal Gains Inputs

Internal lighting gains (W/ft^2) may be automatically split into separate daylight zones, depending upon model geometry (sidelit areas, skylit areas, etc.) and may be controlled by dynamic daylight sensors, linked to the RadianceIES daylight simulation engine.

Miscellaneous Gains (e.g. elevators)

To review miscellaneous energy consumption (elevators, exterior lights, etc.) select the **Miscellaneous Energy Consumption** feature.

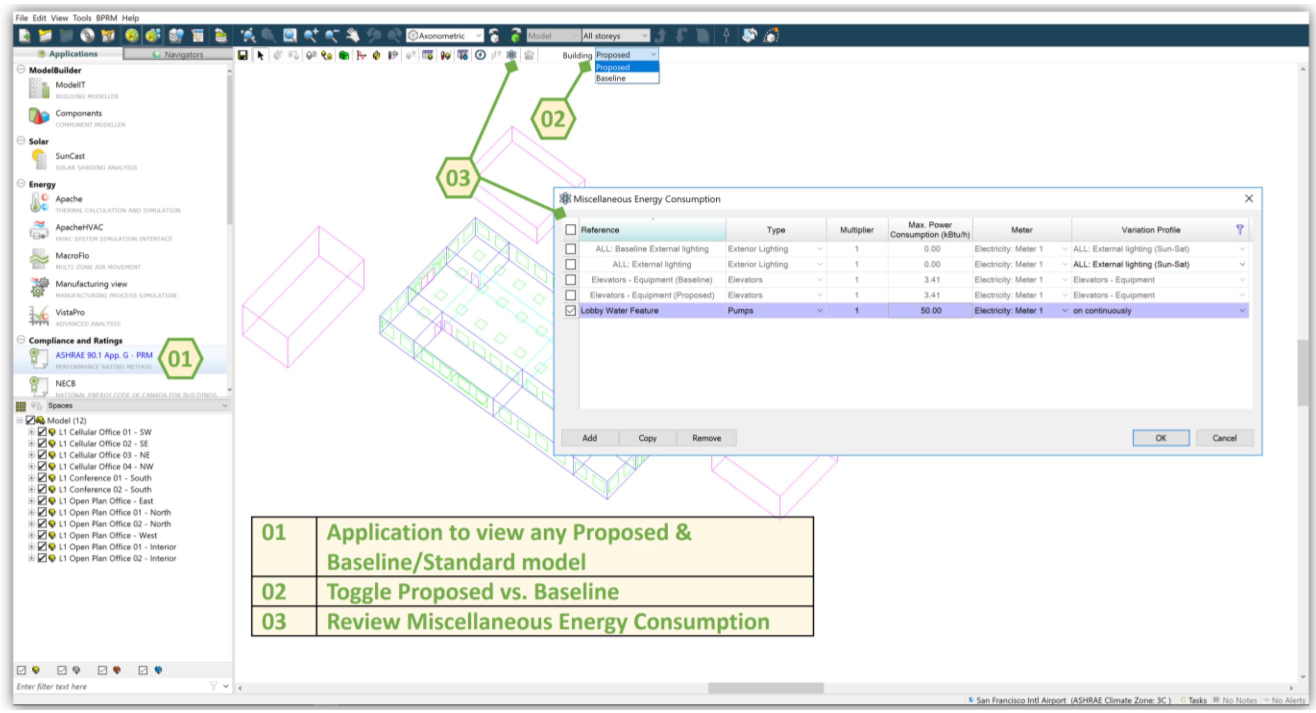

Figure 20: Miscellaneous Energy Consumption Review

Miscellaneous energy consumption types may have alternatively been setup through the **Building Template Manager** / Internal Gains from the **Tools** menu.

HVAC Systems

To review the mechanical systems for both proposed and standard building models, go to **ApacheHVAC** and open the "**Baseline**.asp" file and/or the "**Proposed**.asp" file.

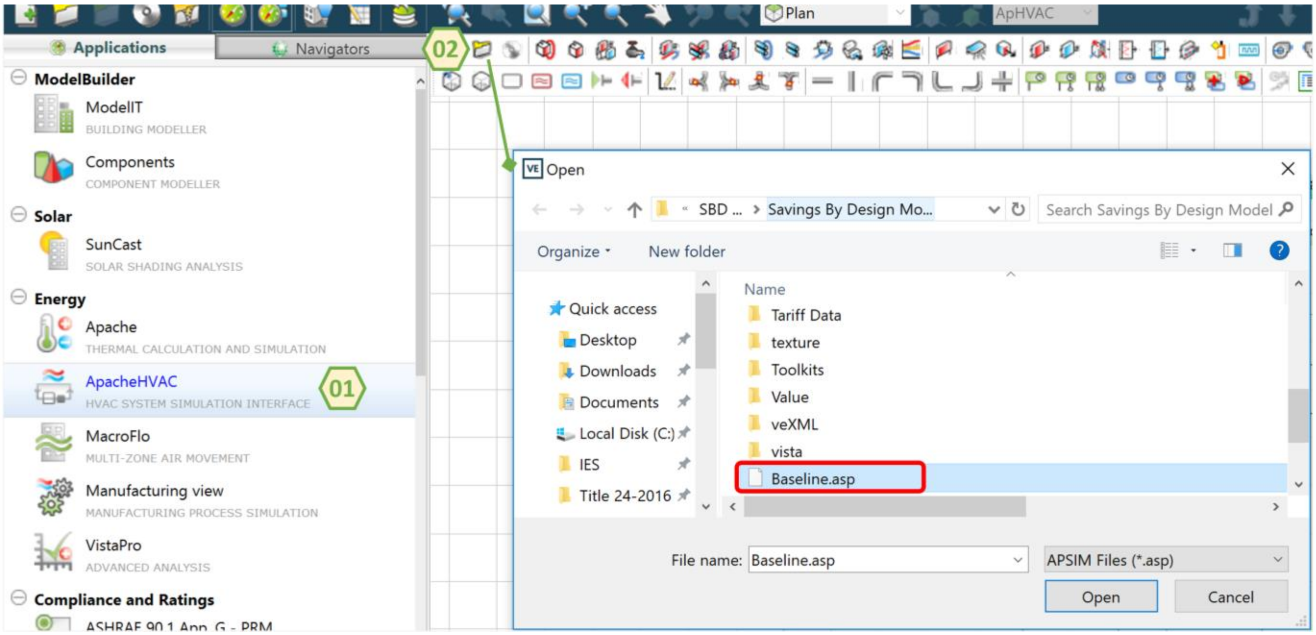

Figure 21: Opening an HVAC File in ApacheHVAC

The same can be done for the "**Proposed**.asp" file.

There are a number of autosized prototypical HVAC systems available in ApacheHVAC for the proposed case. They include, though are not limited to: Package Terminal Air-Conditioners, Package Terminal Heat Pumps, Package Single-Zone Systems, Package Single-Zone Heat Pumps, VAV with Reheat, Indirect/Direct Evaporative Cooling VAV systems, VAV with Parallel Fan-Powered boxes, VAV with Series Fan-Powered boxes, Natural Ventilation or Mixed-mode VAV systems, VAV single-fan dual-duct systems, VAV dual-fan dual-duct systems, Underfloor air with Displacement Ventilation, Advanced VAV systems, Constant-volume reheat systems, with nighttime airflow setback, demand-controlled ventilation, Dedicated Outside Air Systems with Fan-coil units, Dedicated Outside Air Systems with water-loop heat pumps, DOAS with Active chilled beams (2 pipe), DOAS with Active chilled beams (4 pipe), Radiant Heating/Cooling panels with DCV, heating & ventilation only, DOAS with Air-source VRF, DOAS with Water-source VRF and any customizable HVAC system.

Features of any customizable HVAC systems can include airside or waterside economizers, pre-heating and pre-cooling devices, ground-source heat pumps, solar HW heat recovery, solar Trombe walls, earth tubes and wind-catcher devices.

Once the HVAC system is open in ApacheHVAC, the name of the HVAC file is shown (tag 02) below and the name of the system type (tag 03) is also shown. ApacheHVAC is a component-based HVAC user-interface, whereby any component (fan, coil, etc.) can be viewed by double-clicking in order to review the performance parameters of the HVAC system components.

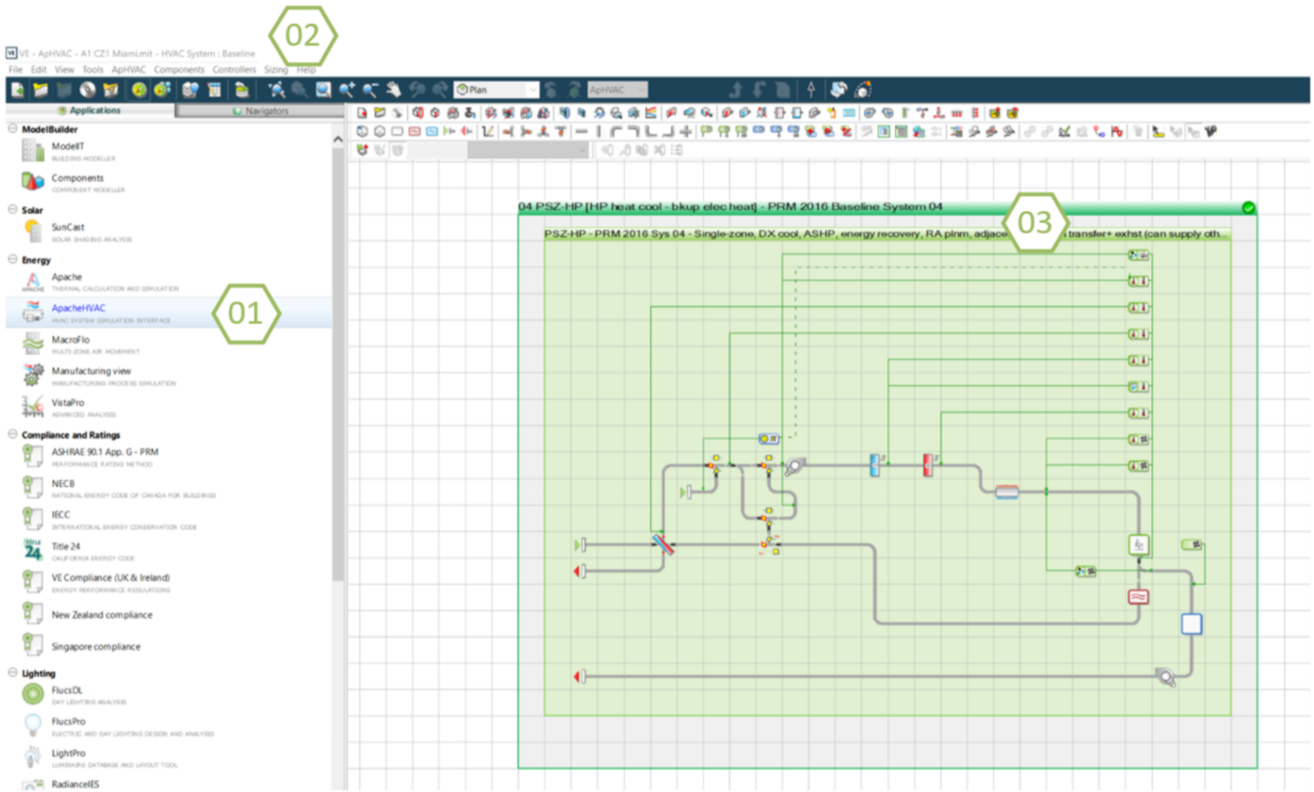

Figure 22: HVAC File Review

Space Heating (Gas & Electricity)

In **ApacheHVAC**, there are two airside views for space heating equipment:

1. Radiant heating components (e.g. radiant panels)
2. Convective heating components (e.g. hot water coils)

Radiant heating equipment on the airside view can be reviewed by double-clicking a room component:

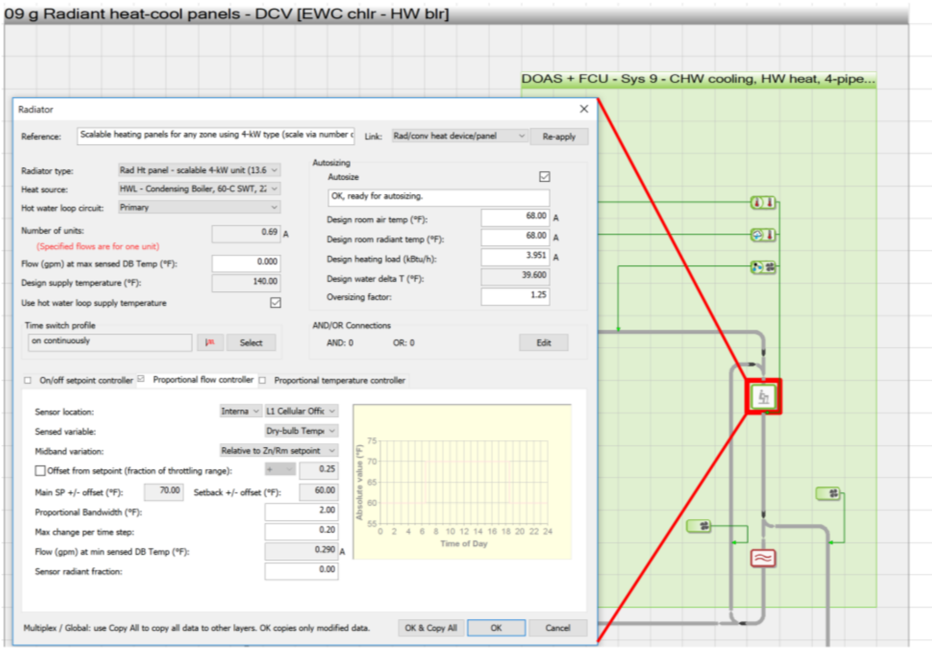

Figure 23: Radiant Heating Units Input Review

Convective heating equipment on the airside view can be reviewed by double-clicking a coil component:

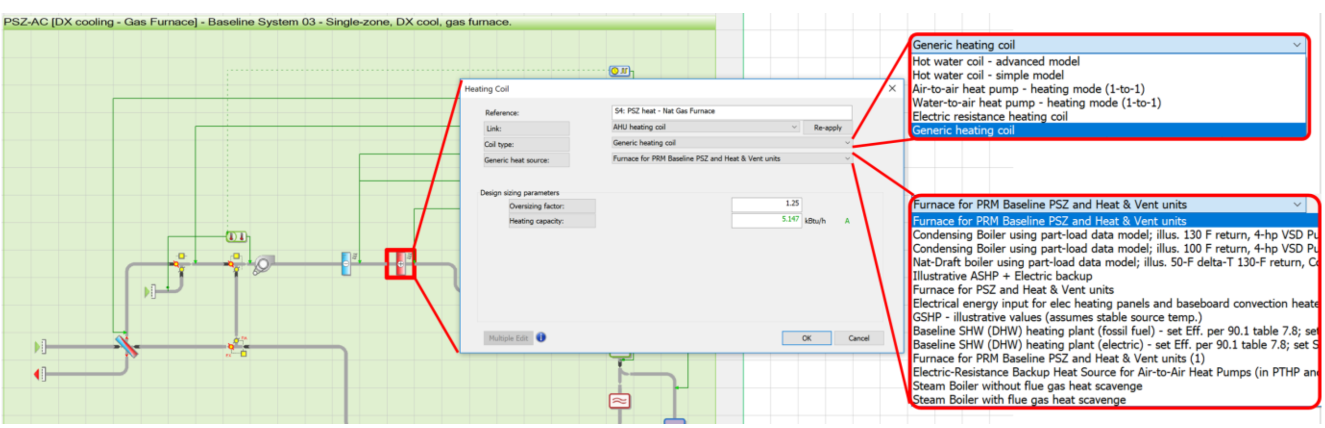

Figure 24: Heating Coil Review

Both radiative and convective airside components will reference a heat source. This can be electricity (e.g. electric resistance heating coil) or can be Space Heating source equipment plant (e.g. gas furnace, heat pumps, hydronic hot water plant – boilers, etc.). Opening an airside coil will allow the waterside-source to be reviewed. The example below shows two boilers, with a primary/secondary loop configuration and three secondary hot water loops with independent control for heating coils, radiant panels and a DHW tank.

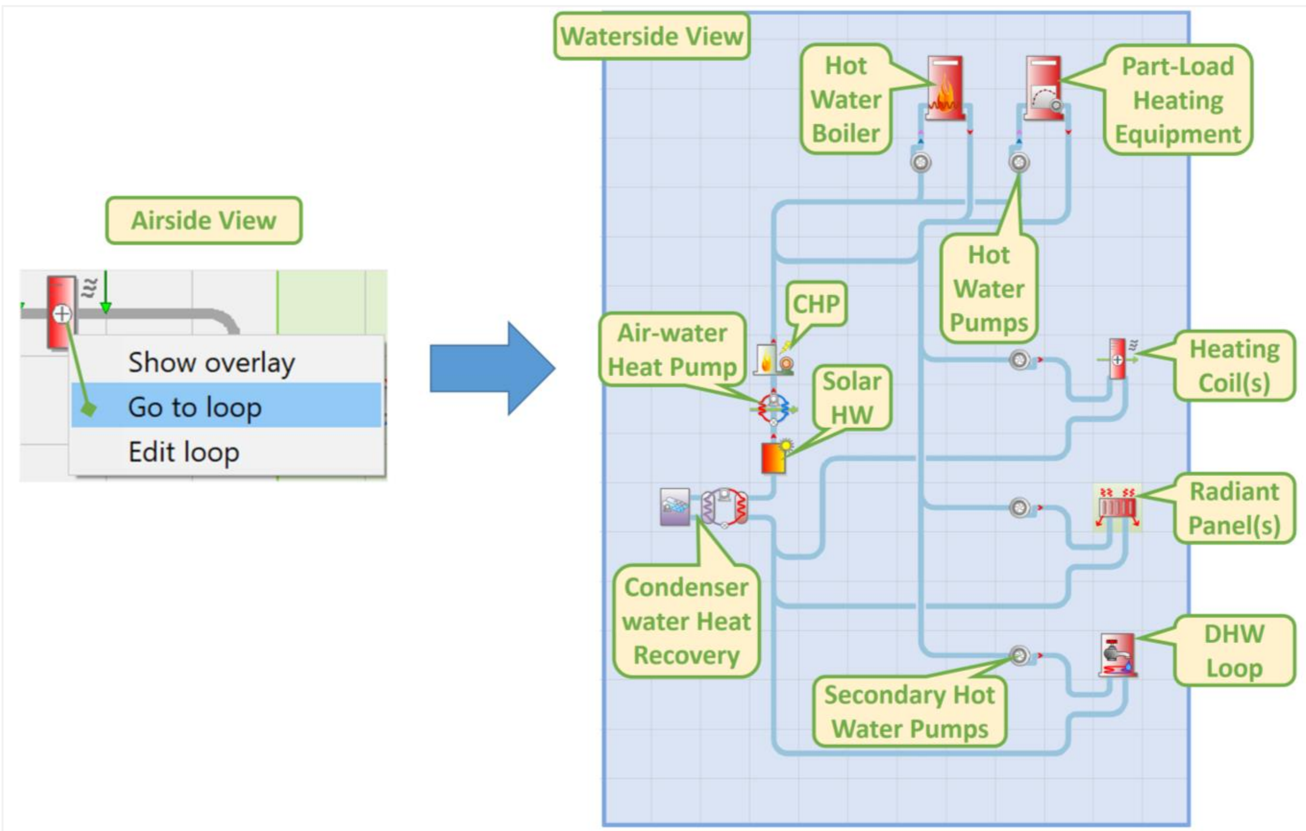

Figure 25: Hot Water Loop Review

Heating equipment performance sets and efficiencies are editable for review:

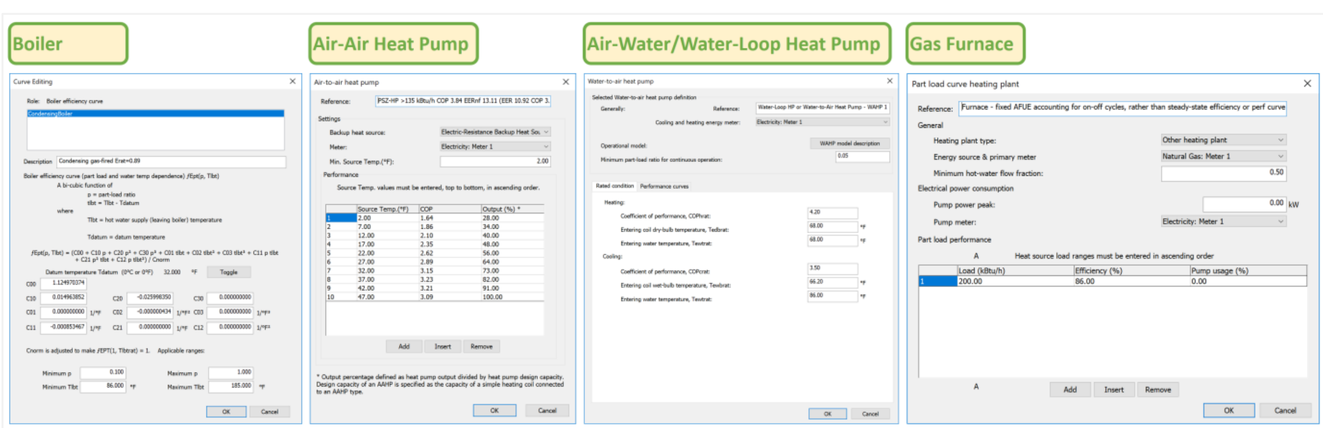

Figure 26: Heating Equipment Efficiencies and Performance Curve Data

Space Cooling

In **ApacheHVAC**, there are two airside views for space cooling equipment:

1. Radiant cooling components (e.g. radiant panels)
2. Convective cooling components (e.g. chilled water coils)

Radiant cooling equipment on the airside view can be reviewed by double-clicking a room component:

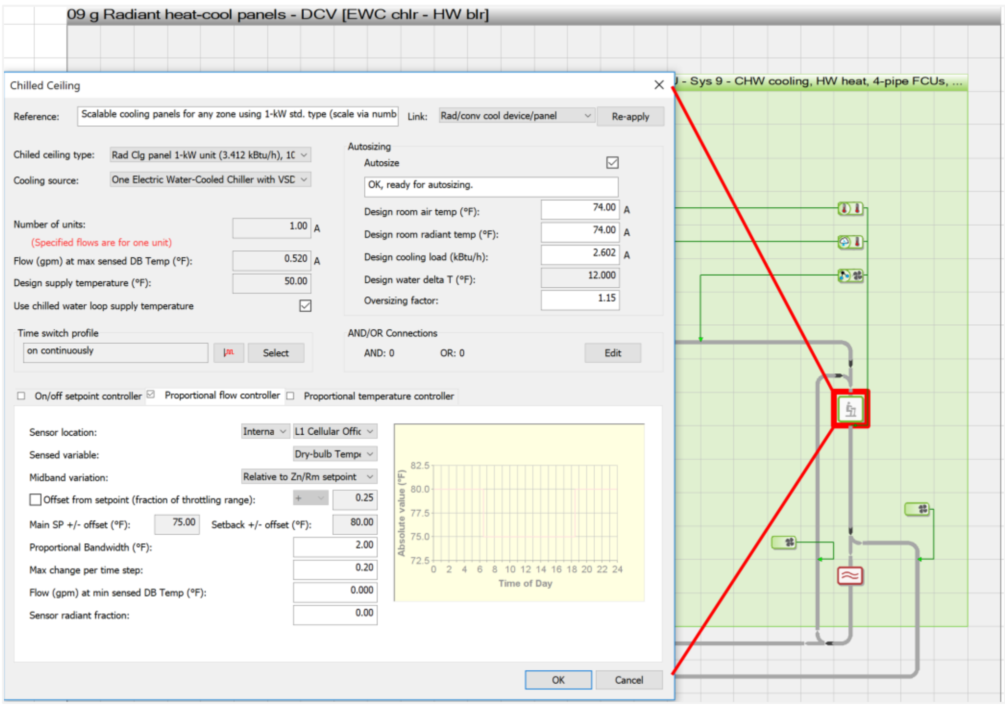

Figure 27: Radiant Cooling Units Input Review

Convective cooling equipment on the airside view can be reviewed by double-clicking a coil component:

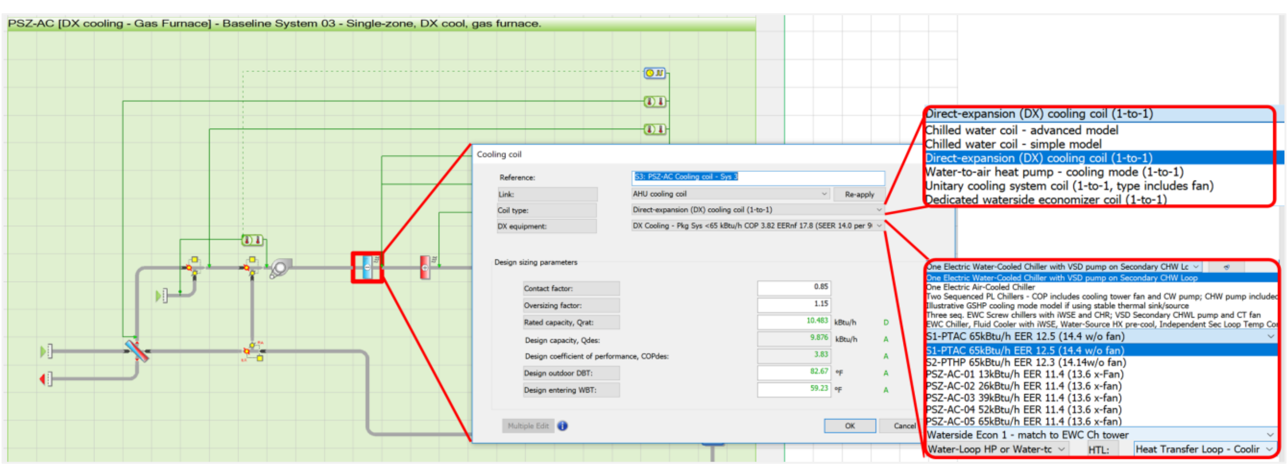

Figure 28: Cooling Coil Review

Both radiative and convective airside components will reference a cooling source. This can be electricity (e.g. electric evaporative-cooling spray chamber) or can be Space Cooling source equipment plant (e.g. DX cooling, heat pumps, dedicated waterside economizer, hydronic chilled water plant – chillers, etc.). Opening an airside coil will allow the waterside-source to be reviewed. The example below shows two

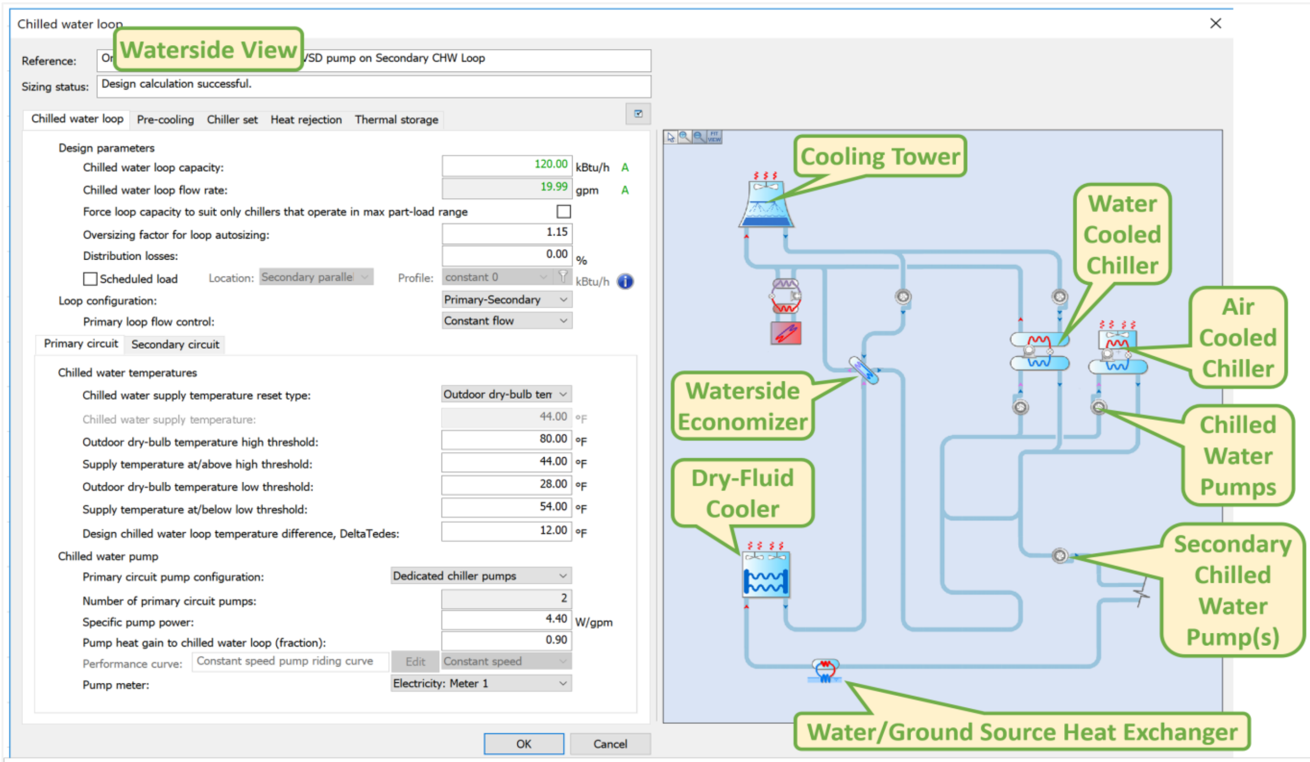

Figure 29: Chilled Water Loop Review

Water Cooled Chiller equipment performance sets and efficiencies are editable for review:

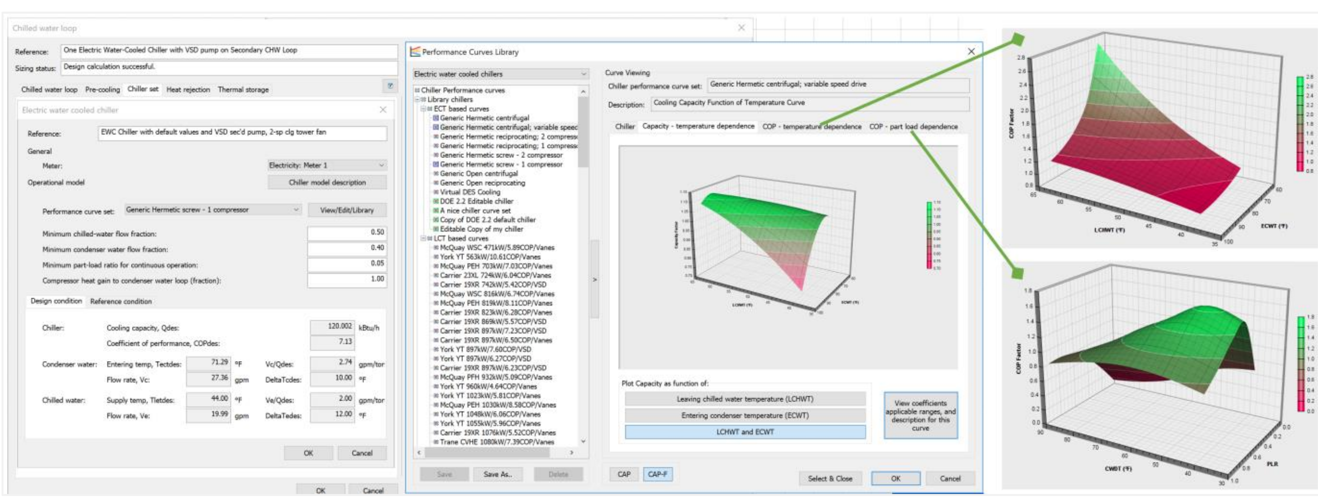

Figure 30: Water Cooled Chiller Review - Efficiency and Performance Curve Data

Air Cooled Chiller equipment performance sets and efficiencies are editable for review:

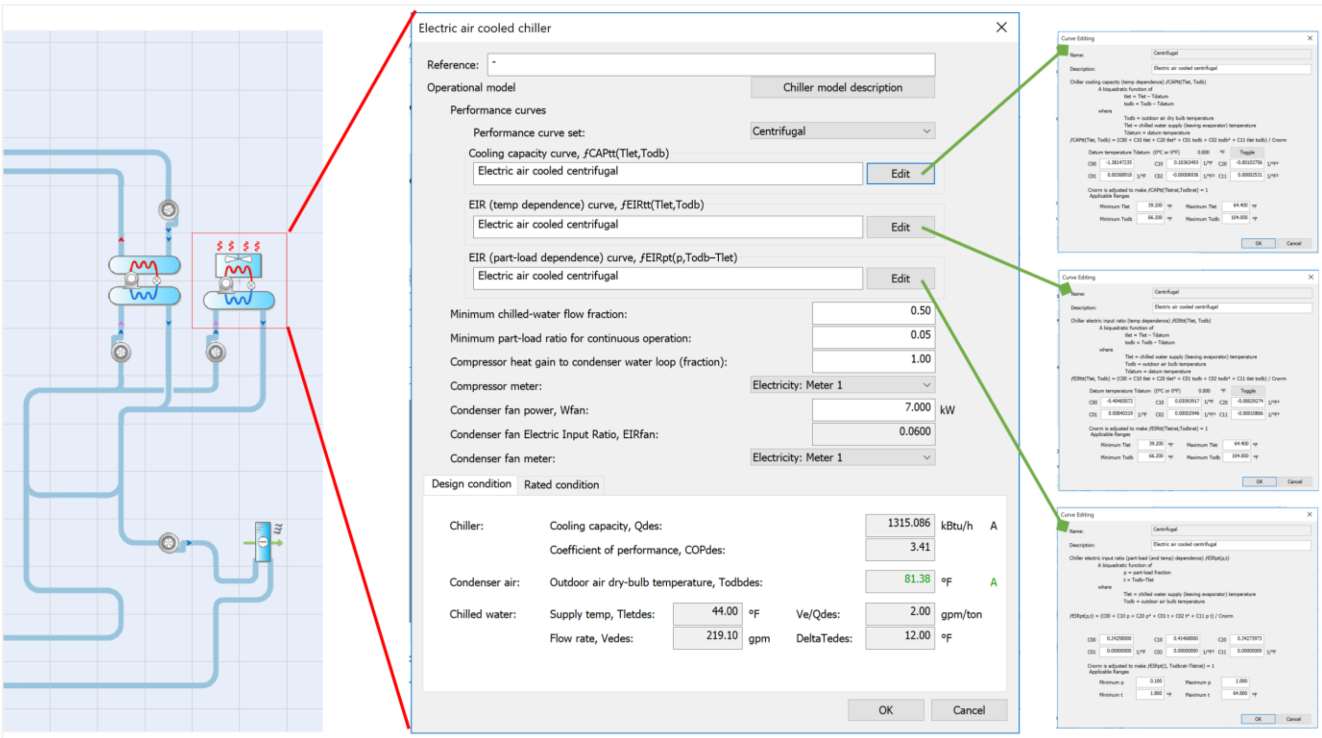

Figure 31: Air Cooled Chiller Review - Efficiency and Performance Curve Data

DX Cooling & **Unitary Cooling** equipment performance sets and efficiencies are editable for review:

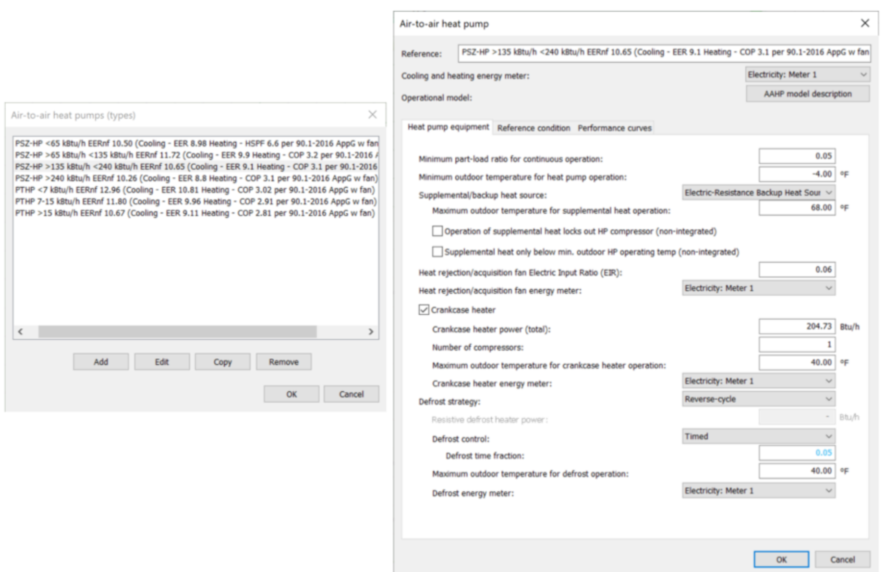

Figure 32: DX & Unitary Cooling Equipment Review - Efficiency and Performance Curve Data

Fans Interior

In **ApacheHVAC**, the Fan inputs are editable for review by opening the fan components.

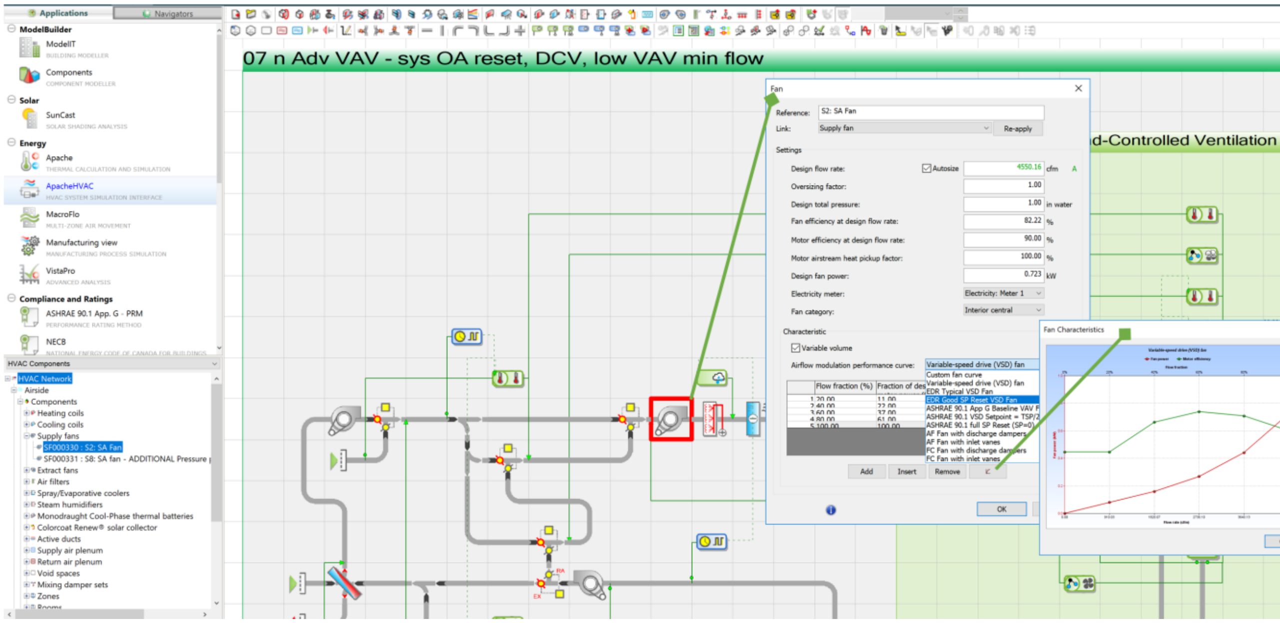

Figure 33: Fan Input

In **VistaPro**, total or individual Fan outputs can be reviewed by selecting the appropriate simulation result file and fan(s) components.

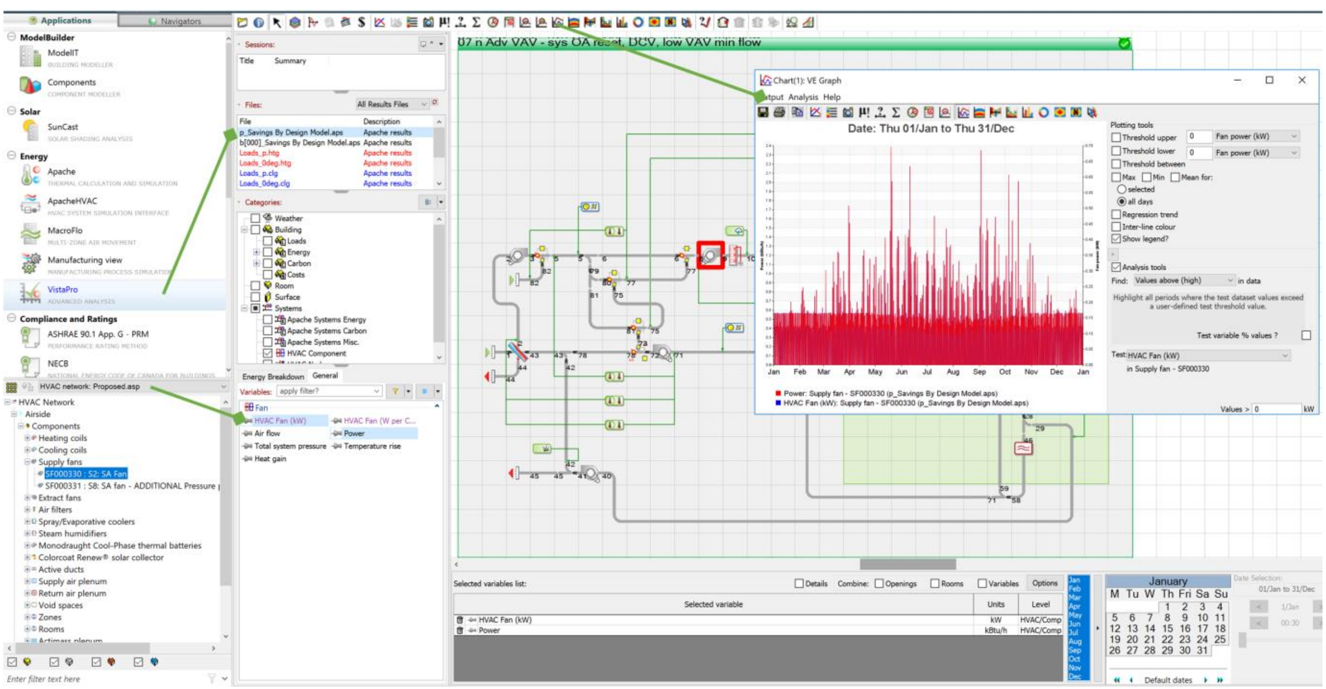

Figure 34: Fan Output

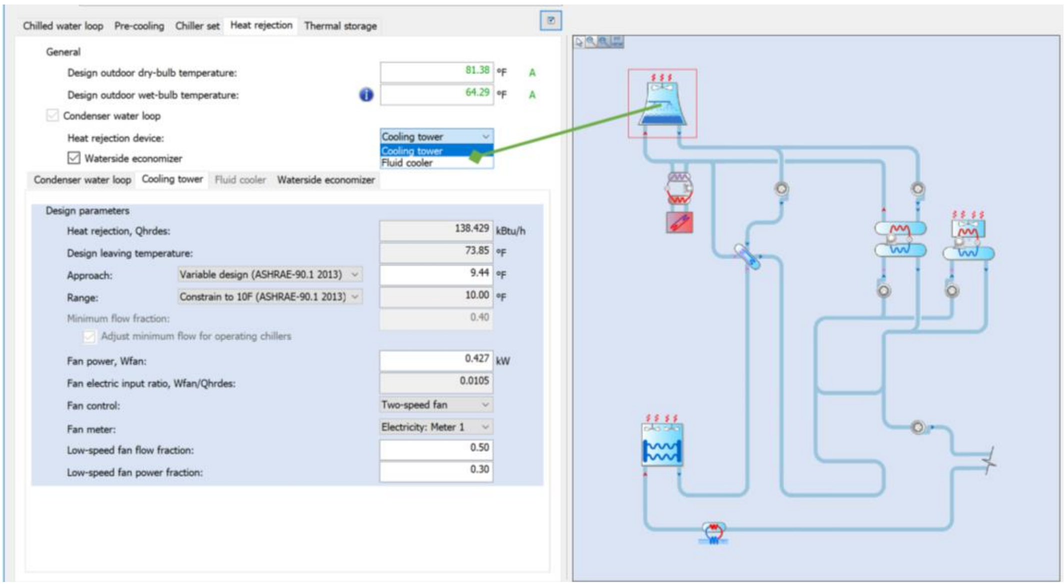

Figure 35: Cooling Tower Inputs

There is also a possibility of some Heat Rejection coming from a pre-cooling device, as below.

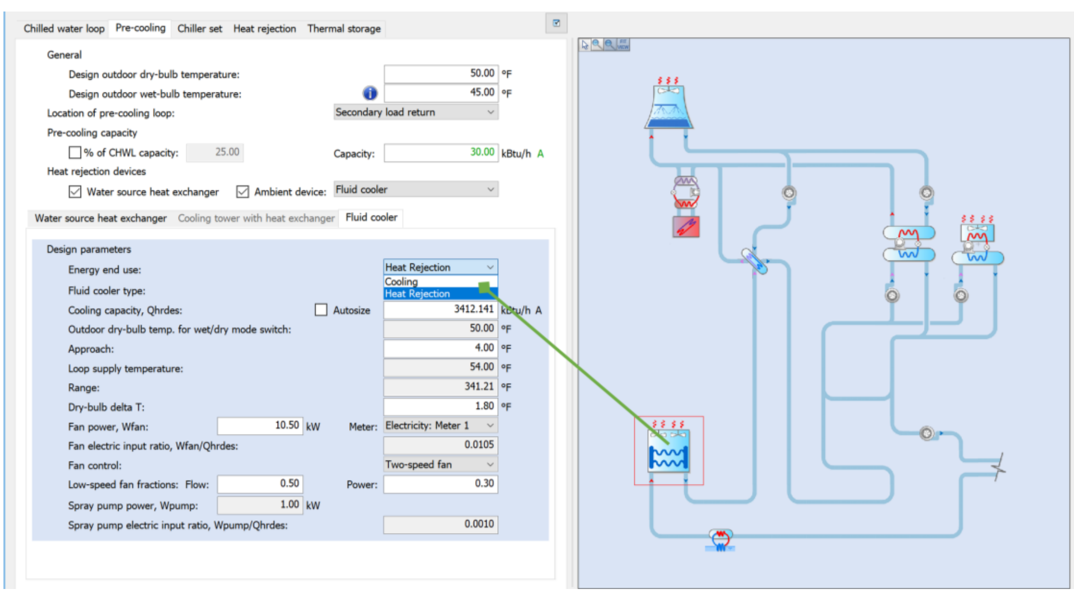

Figure 36: Fluid Cooler Input (as Heat Recovery)

Pumps

In **ApacheHVAC**, the Pumps inputs are editable for review by opening the Pumps components in the Waterside view. The pumps may exist on both heating and cooling systems.

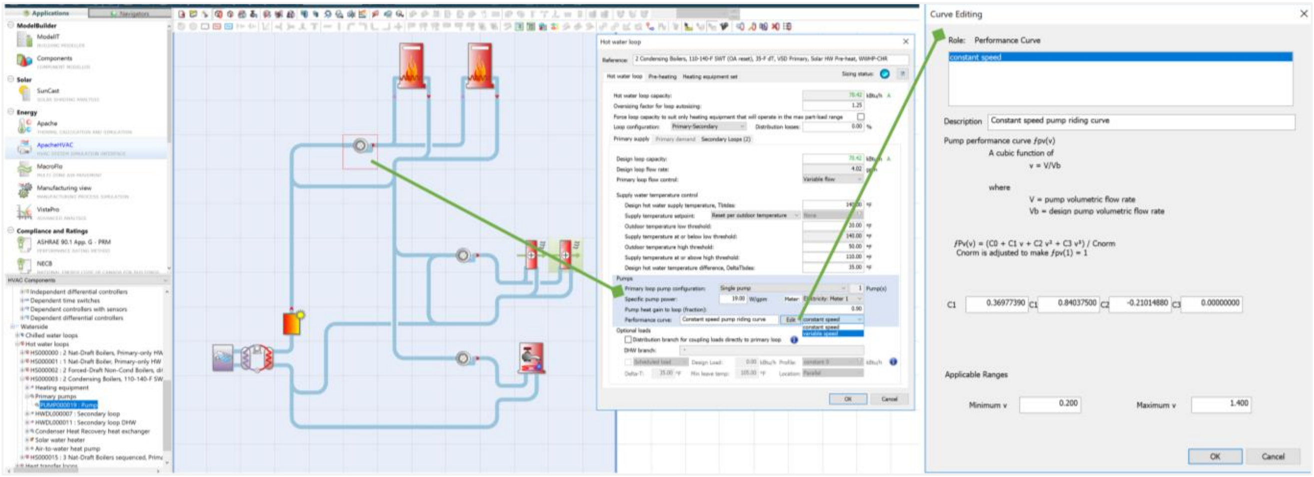

Figure 37: Pumps Input

In **VistaPro**, total or individual Pumps outputs can be reviewed by selecting the appropriate simulation result file and pump(s) components.

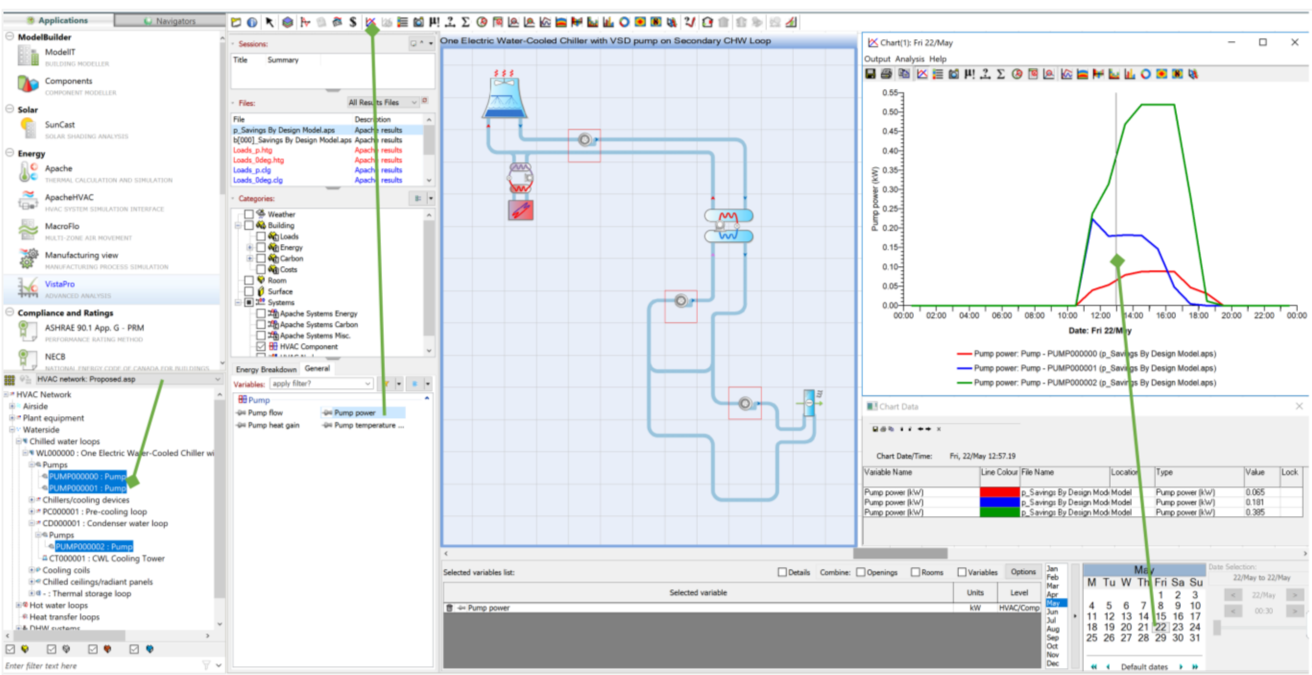

Figure 38: Pumps Output

DHW (Gas & Electricity)

In **ApacheHVAC**, the DHW inputs are editable for review by opening the DHW Loop from the toolbar below. The DHW (Gas & Electricity) on models previous to IESVE-2018 will likely be set in the **Building Template Manager** (Tools menu).

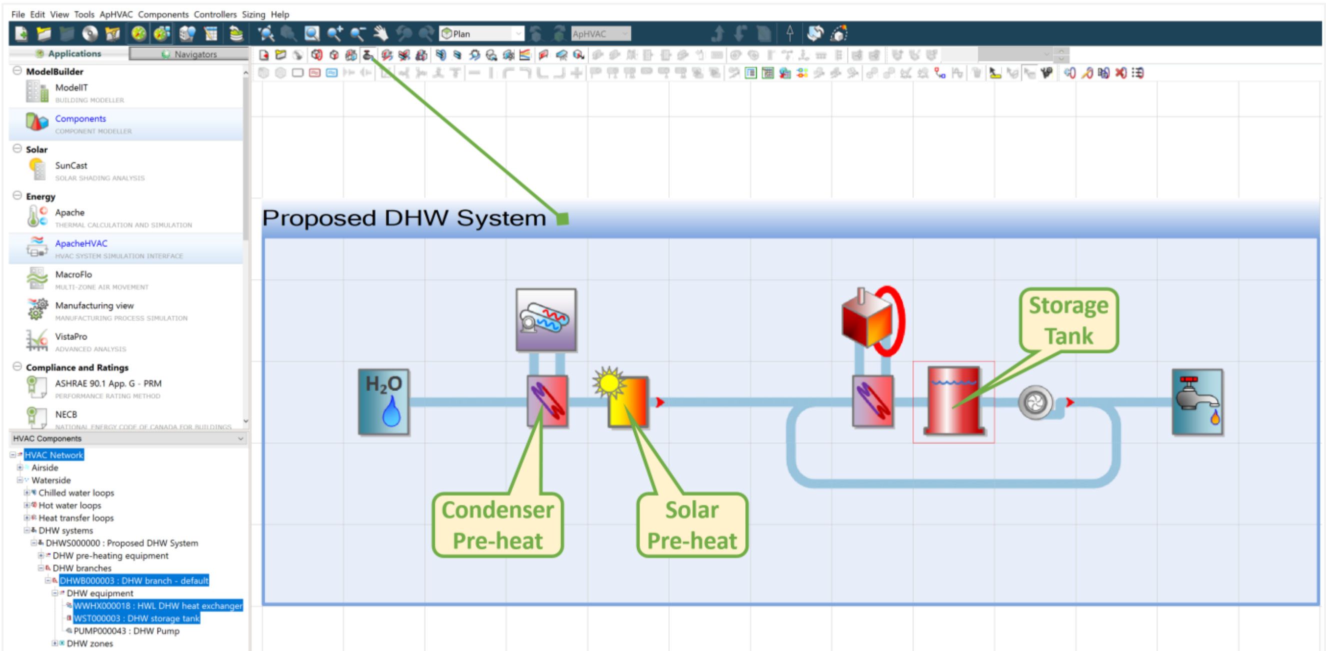

Figure 39: DHW in ApacheHVAC

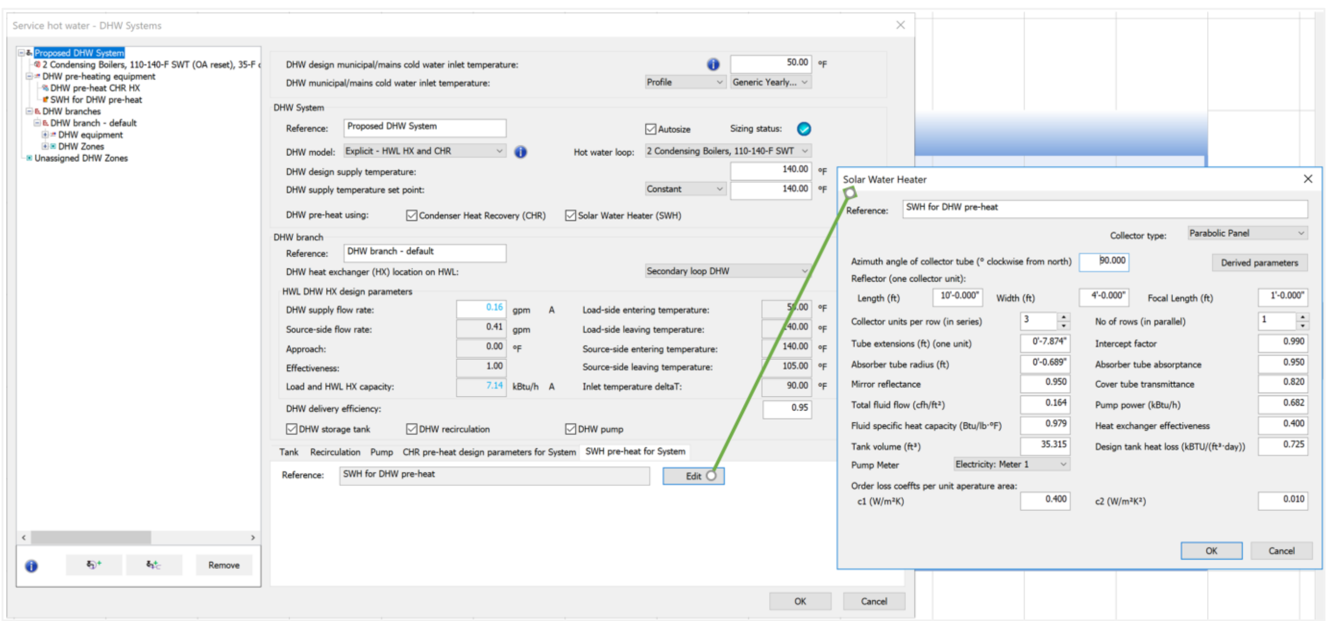

Figure 40: DHW Inputs including Solar Hot Water Pre-heat

3. Resources

Links and references to several resources have been provided in this guide. A summary of those references is provided here:

- IES software engine validation resources
http://www.iesve.com/software/software-validation
- IES <Virtual Environment> software download
http://iesve.com/software/download
- IES <Virtual Environment> software license request
http://www.iesve.com/software/download/requesting_licence_keys.pdf
- IES Content Store (for supplemental scripts)
http://www.iesve.com/content-store/
- IESVE youTube videos
https://www.youtube.com/user/IESVE

IES offers many additional resources that may be useful when evaluating project specifics within a model. User guides describe the details of the various applications within the VE, explaining how features work and describing how calculations are performed. The IES Knowledge Base contains answers to our Frequently Asked Questions as well as guidance documents (like this one!) on a wide range of VE and modeling related topics. Finally, our global technical support team is available to answer any software related questions.

User Guides

User guides for the applications within the <Virtual Environment> can be found in a searchable, online format at https://help.iesve.com/ve2018/.

To download PDF copies of older User Guides (prior to the release of VE 2018), visit http://www.iesve.com/support/userguides.

Technical Support

The IES Support Team is happy to assist with any question regarding the <Virtual Environment>. They can be contacted via email at support@iesve.com or via phone at 617-502-2085 (choose option 1 for software support). When sending email queries about a specific project, please attach a model archive (the *.cab file) so the team can assist you more effectively.

Knowledge Base

The full breadth of IES resources and product supporting content is searchable within the Knowledge Base at http://www.iesve.com/support/knowledgebase.

An online community of VE users share experiences and answer software questions on the IES Forums and the IES VE LinkedIn Group.

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