



# HOURLY ANALYSIS PROGRAM v5.00 and v5.01 NEW FEATURES GUIDE

Carrier Software Systems  
Carrier Corporation  
Syracuse, New York

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Air-Side Features

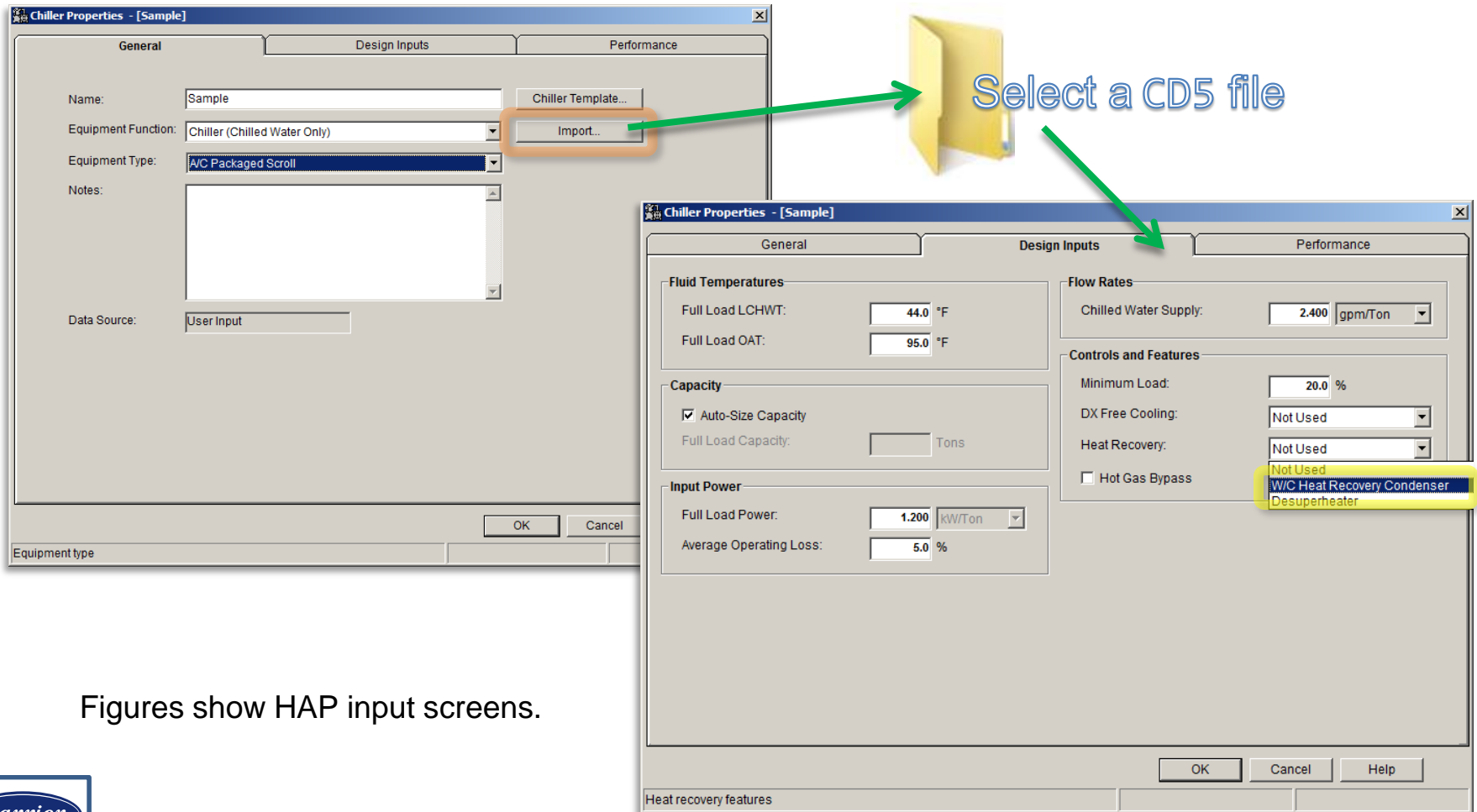
Wizard Features

Other Changes

# CHILLER FEATURES

# Updated Chiller Import

**Details:** Carrier's Electronic Catalog (ECAT) can export performance data for air-cooled chillers with heat recovery features. HAP can now import and utilize this data in energy simulations.

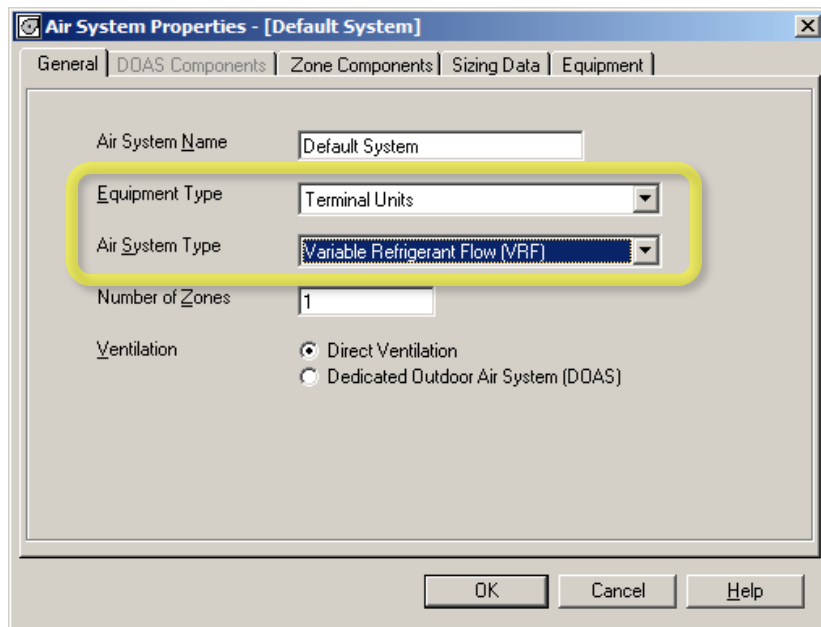


Figures show HAP input screens.

# AIR-SIDE FEATURES

# Variable Speed Rotary VRF

**Details:** Added simulation performance curves for variable speed rotary compressor VRF condensing units. With this addition, HAP now offers three types of performance models for VRF: variable speed rotary, variable speed scroll, and digital scroll.



**Air System Properties - [Default System]**

General | DOAS Components | Zone Components | Sizing Data | Equipment

Air System Name: Default System

Equipment Type: Terminal Units

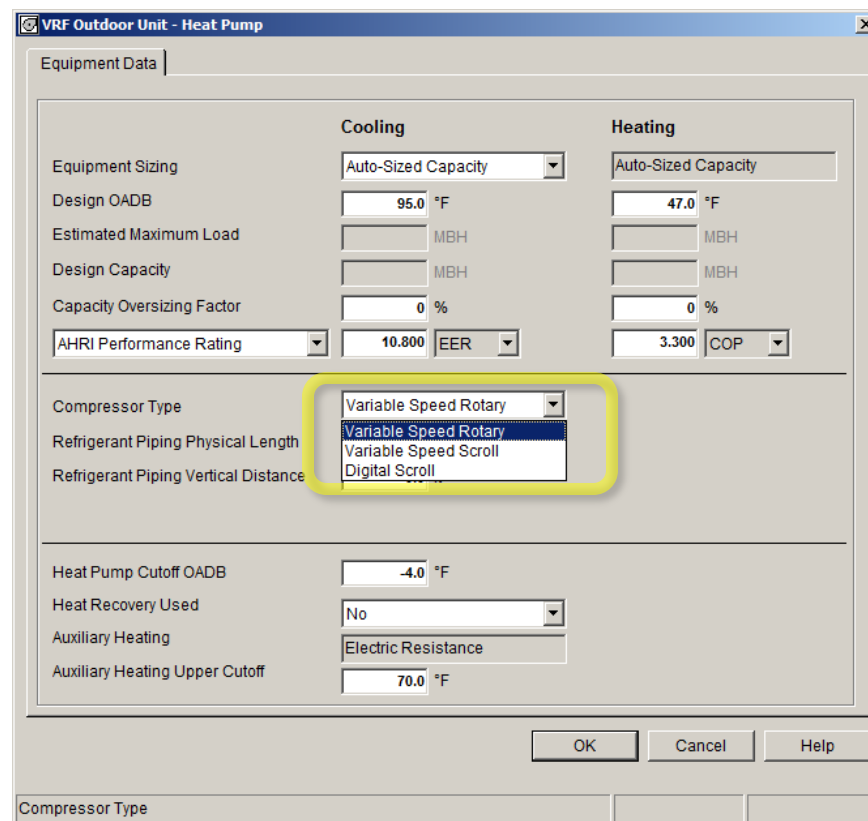
Air System Type: Variable Refrigerant Flow (VRF)

Number of Zones: 1

Ventilation:
 

- ☒ Direct Ventilation
- ☐ Dedicated Outdoor Air System (DOAS)

OK Cancel Help



**VRF Outdoor Unit - Heat Pump**

Equipment Data

	Cooling	Heating
Equipment Sizing	Auto-Sized Capacity	Auto-Sized Capacity
Design OADB	95.0 °F	47.0 °F
Estimated Maximum Load	MBH	MBH
Design Capacity	MBH	MBH
Capacity Oversizing Factor	0 %	0 %
AHRI Performance Rating	10.800 EER	3.300 COP

Compressor Type: Variable Speed Rotary

Refrigerant Piping Physical Length:

Refrigerant Piping Vertical Distance:

Heat Pump Cutoff OADB: -4.0 °F

Heat Recovery Used: No

Auxiliary Heating: Electric Resistance

Auxiliary Heating Upper Cutoff: 70.0 °F

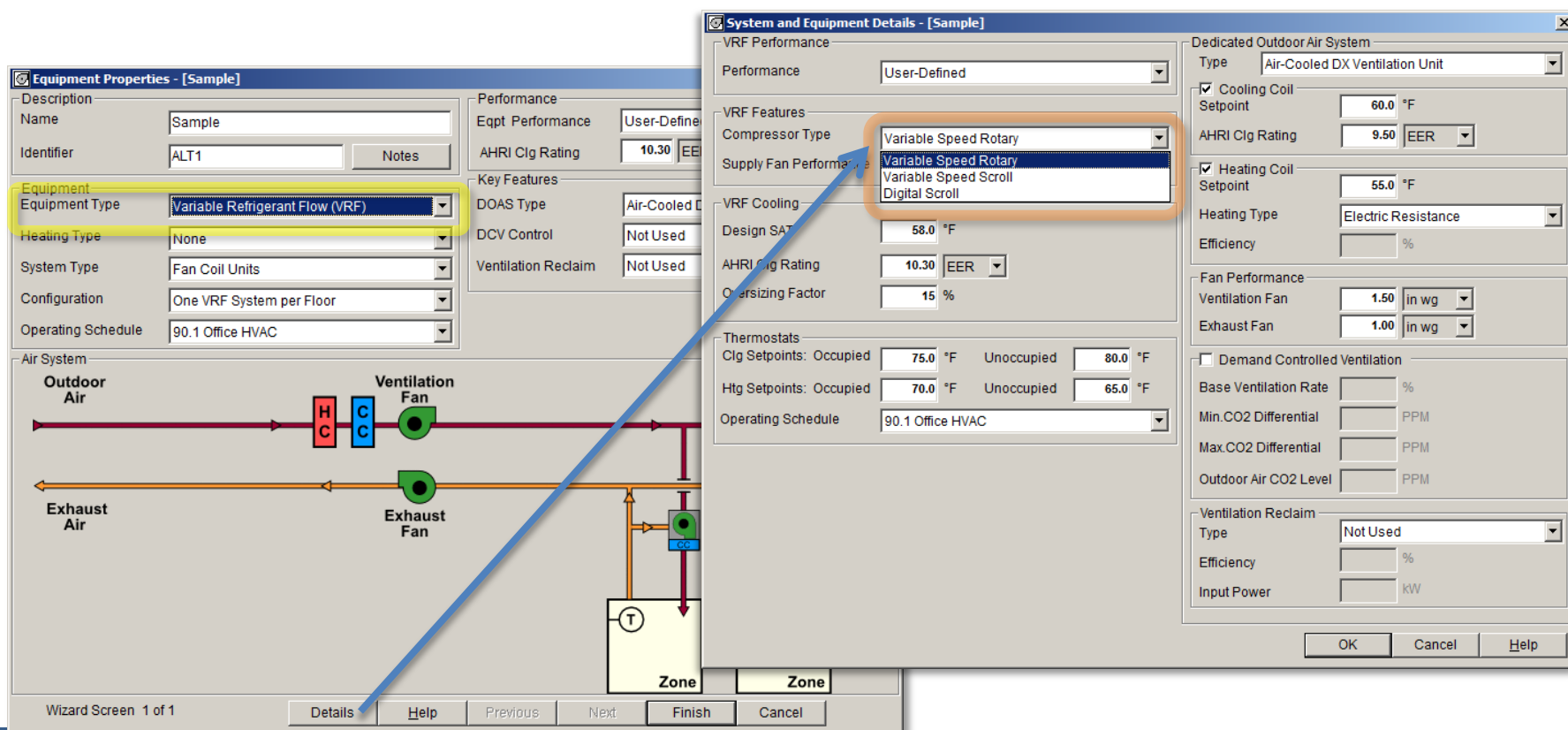
OK Cancel Help

Compressor Type

Figures show the HAP detailed input screens.

# Variable Speed Rotary VRF

**Details:** Inputs specify capacity, EER, COP, compressor type, and controls. During energy simulation HAP applies these inputs to the performance curves to create a scaled performance model for the VRF condensing unit. The model then calculates how efficiency changes each hour with changing operating conditions.



**Equipment Properties - [Sample]**

Description  
Name: Sample  
Identifier: ALT1

Equipment  
Equipment Type: Variable Refrigerant Flow (VRF)  
Heating Type: None  
System Type: Fan Coil Units  
Configuration: One VRF System per Floor  
Operating Schedule: 90.1 Office HVAC

Air System  
Outdoor Air  
Ventilation Fan  
Exhaust Air  
Exhaust Fan  
Zone

**System and Equipment Details - [Sample]**

VRF Performance  
Performance: User-Defined

VRF Features  
Compressor Type: Variable Speed Rotary  
Supply Fan Performance: Variable Speed Rotary

VRF Cooling  
Design SAT: 58.0 °F  
AHRI Cig Rating: 10.30 EER  
Oversizing Factor: 15 %

Thermostats  
Cig Setpoints: Occupied 75.0 °F Unoccupied 80.0 °F  
Htg Setpoints: Occupied 70.0 °F Unoccupied 65.0 °F  
Operating Schedule: 90.1 Office HVAC

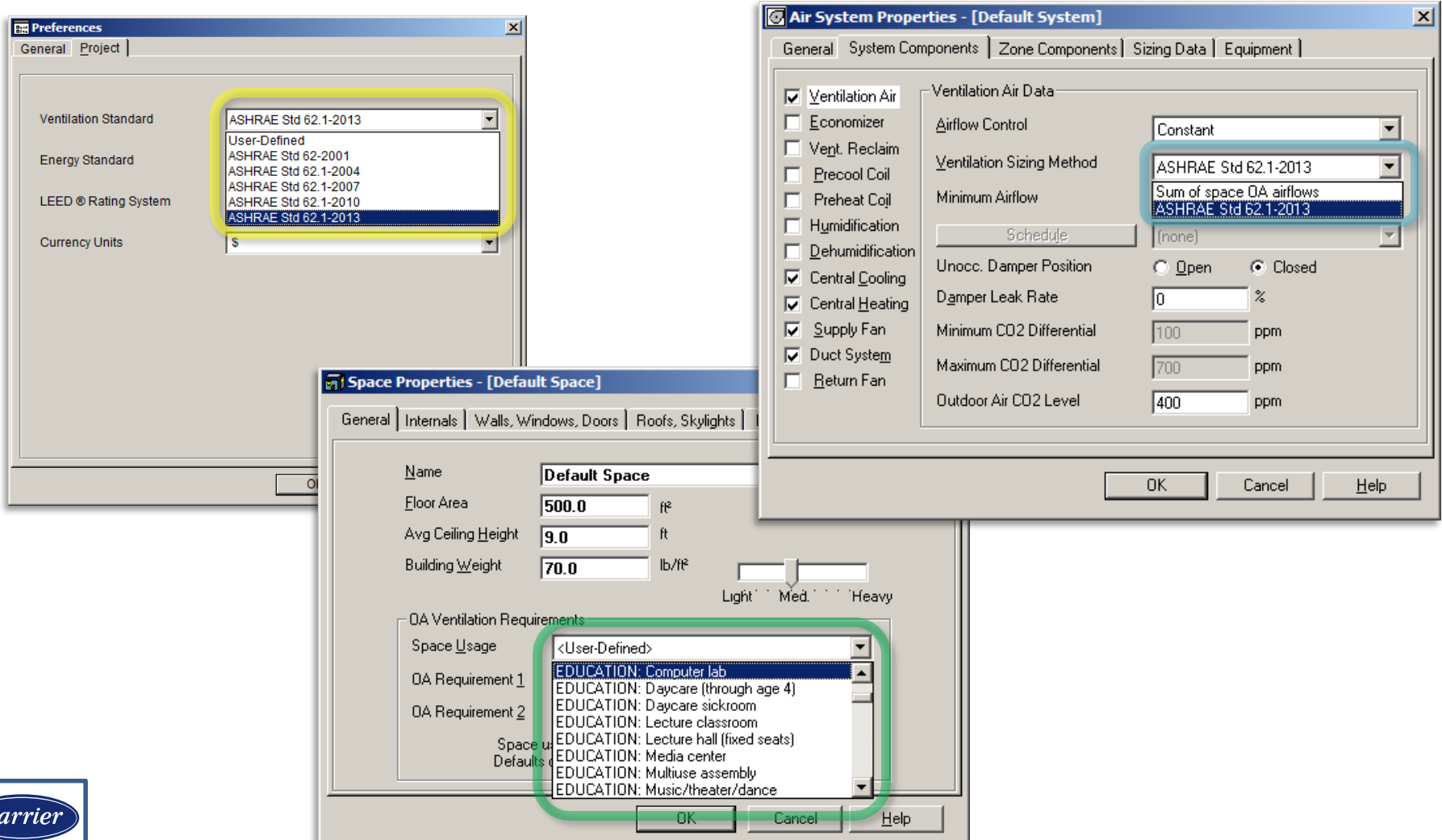
Dedicated Outdoor Air System  
Type: Air-Cooled DX Ventilation Unit  
Cooling Coil Setpoint: 60.0 °F  
AHRI Cig Rating: 9.50 EER  
Heating Coil Setpoint: 55.0 °F  
Heating Type: Electric Resistance  
Efficiency: %  
Fan Performance  
Ventilation Fan: 1.50 in wg  
Exhaust Fan: 1.00 in wg  
Demand Controlled Ventilation  
Base Ventilation Rate: %  
Min.CO2 Differential: PPM  
Max.CO2 Differential: PPM  
Outdoor Air CO2 Level: PPM  
Ventilation Reclaim  
Type: Not Used  
Efficiency: %  
Input Power: kW

Wizard Screen 1 of 1  
Details Help Previous Next Finish Cancel

Figures show the HAP wizard screens.

# ASHRAE Std. 62.1-2013

**Details:** ASHRAE Standard 62.1-2013 ventilation defaults has been added, as well as Ventilation Rate Procedure sizing calculations.



The image displays three software dialog boxes illustrating the configuration of ASHRAE Std. 62.1-2013 ventilation defaults.

**Preferences Dialog:** The "Ventilation Standard" dropdown menu is highlighted with a yellow box, showing the selection of "ASHRAE Std 62.1-2013".

**Air System Properties - [Default System] Dialog:** The "Ventilation Air Data" section is highlighted with a blue box, showing the selection of "ASHRAE Std 62.1-2013" for the "Ventilation Sizing Method".

**Space Properties - [Default Space] Dialog:** The "OA Ventilation Requirements" section is highlighted with a green box, showing the selection of "EDUCATION: Computer lab" for "Space Usage".



# Ventilation Sizing Summary Report

**Details:** New layout for terminal systems clarifies sizing of zone ventilation airflow and DOAS airflow:

New table summarizes system ventilation requirements

Zones now listed separately, with individual per-zone totals. This better reflects actual sizing calculation procedures.

Project Name: VSS

Prepared by: carrier corporation

Ventilation Sizing Summary

1. Summary

Ventilation Sizing Method ..... ASHRAE Std 62.1-2007

Design Condition ..... Heating operation

Zone Name	Zone Outdoor Airflow (CFM) (Voz)	Uncorrected Outdoor Air Intake (CFM) (Vou)	Ventilation Efficiency (Ev)	Outdoor Air Intake (CFM) (Vot)
BLD1-F001-Z01		606	0.929	652
BLD1-F001-Z02	191		1.000	191
BLD1-F001-Z03		1014	0.852	1190
BLD1-F001-Z04	112		1.000	112
System Total				2144

Note: For terminal systems, Standard 62.1 considers each terminal unit to be a "ventilation system". Standard 62.1 calculations are performed separately for each terminal unit zone. Outdoor air intake flow rates for all terminal zones are summed to determine the total system outdoor air flow rate.

2. Space Ventilation Analysis

2.1 Zone: BLD1-F001-Z01

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vpz)	Space Floor Area (ft²) (Az)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
BLD1-F001-Z01										
BLD1-F001-Z01	1	342	225.0	0.06	1.1	5.00	0.80	24	19	1.020
BLD1-F001-Z02	2	1190	1800.0	0.06	9.0	5.00	0.80	191	153	0.929
BLD1-F001-Z03	1	279	225.0	0.06	1.1	5.00	0.80	24	19	1.004
BLD1-F001-Z04	1	1114	1050.0	0.06	5.3	5.00	0.80	112	89	0.990
BLD1-F001-Z05	1	368	225.0	0.06	1.1	5.00	0.80	24	19	1.025
BLD1-F001-Z06	1	2251	1800.0	0.06	9.0	5.00	0.80	191	153	1.005
Totals (incl. Space Multipliers)		6735							606	0.929

2.2 Zone: BLD1-F001-Z02

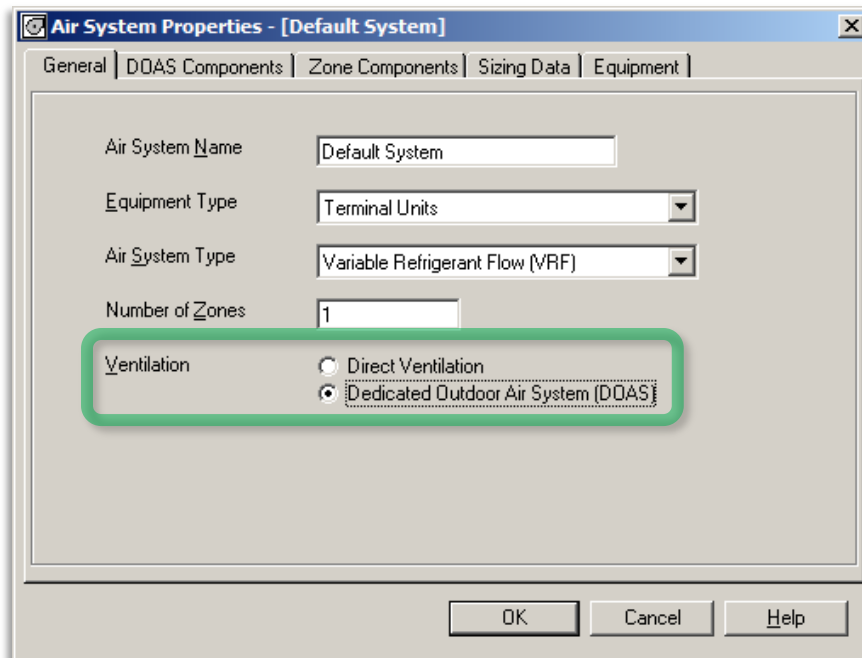
Zone Name / Space Name	Mult.	Supply Air (CFM) (Vpz)	Space Floor Area (ft²) (Az)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
BLD1-F001-Z02										
BLD1-F001-Z02	1	1190	1800.0	0.06	9.0	5.00	0.80	191	153	1.000
Totals (incl. Space Multipliers)		1190							153	1.000

2.3 Zone: BLD1-F001-Z03

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vpz)	Space Floor Area (ft²) (Az)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
BLD1-F001-Z03										
BLD1-F001-Z03	1	279	225.0	0.06	1.1	5.00	0.80	24	19	1.061
BLD1-F001-Z07	1	406	225.0	0.06	1.1	5.00	0.80	24	19	1.087
BLD1-F001-Z08	1	1279	1050.0	0.06	5.3	5.00	0.80	112	89	1.059
BLD1-F001-Z09	1	3034	8400.0	0.06	42.0	5.00	0.80	893	714	0.852
BLD1-F002-Z01	1	387	225.0	0.06	1.1	5.00	0.80	24	19	1.084
BLD1-F002-Z02	1	1552	1800.0	0.06	9.0	5.00	0.80	191	153	1.023
Totals (incl. Space Multipliers)		6937							1014	0.852

# DOAS Terminology

**Details:** Updated terminology to consistently use “Dedicated Outdoor Air System” (or DOAS) throughout the program.



**Air System Properties - [Default System]**

General | DOAS Components | Zone Components | Sizing Data | Equipment

Air System Name: Default System

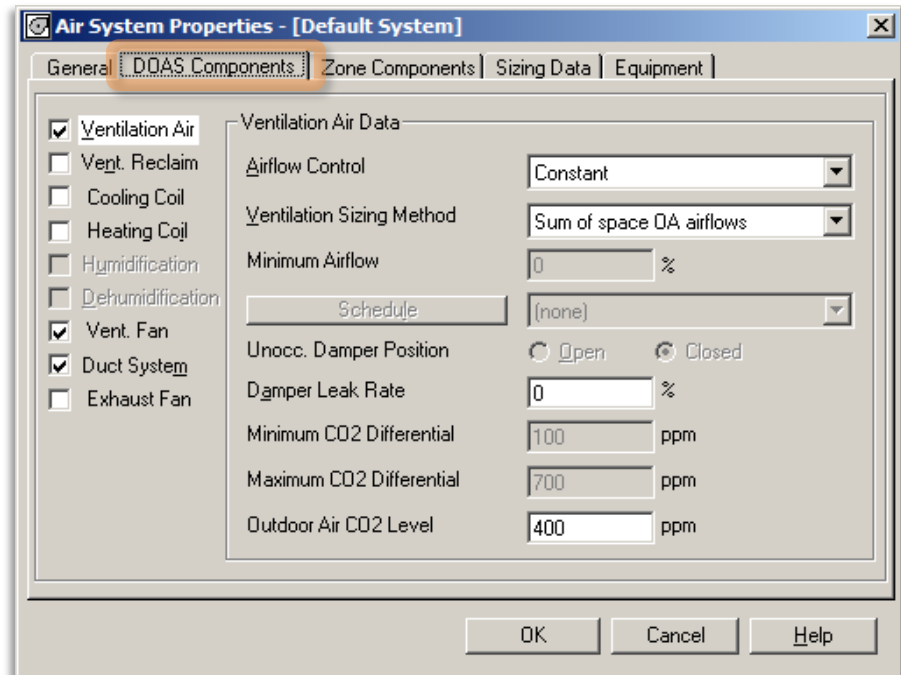
Equipment Type: Terminal Units

Air System Type: Variable Refrigerant Flow (VRF)

Number of Zones: 1

Ventilation: ☐ Direct Ventilation ☒ Dedicated Outdoor Air System (DOAS)

OK Cancel Help



**Air System Properties - [Default System]**

General | DOAS Components | Zone Components | Sizing Data | Equipment

☒ Ventilation Air

☐ Vent. Reclaim

☐ Cooling Coil

☐ Heating Coil

☐ Humidification

☐ Dehumidification

☒ Vent. Fan

☒ Duct System

☐ Exhaust Fan

**Ventilation Air Data**

Airflow Control: Constant

Ventilation Sizing Method: Sum of space OA airflows

Minimum Airflow: 0 %

Schedule: (none)

Unocc. Damper Position: ☐ Open ☒ Closed

Damper Leak Rate: 0 %

Minimum CO2 Differential: 100 ppm

Maximum CO2 Differential: 700 ppm

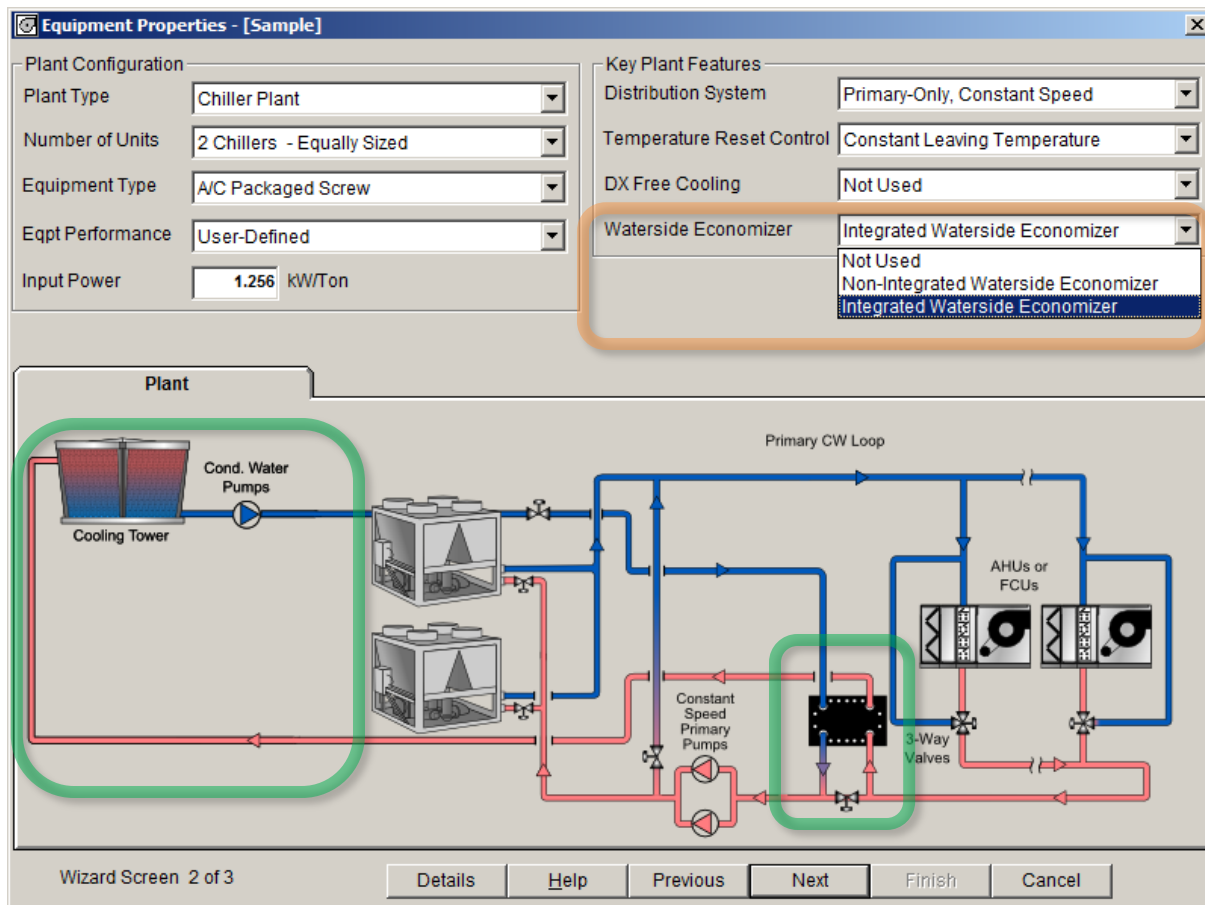
Outdoor Air CO2 Level: 400 ppm

OK Cancel Help

# WIZARD FEATURES

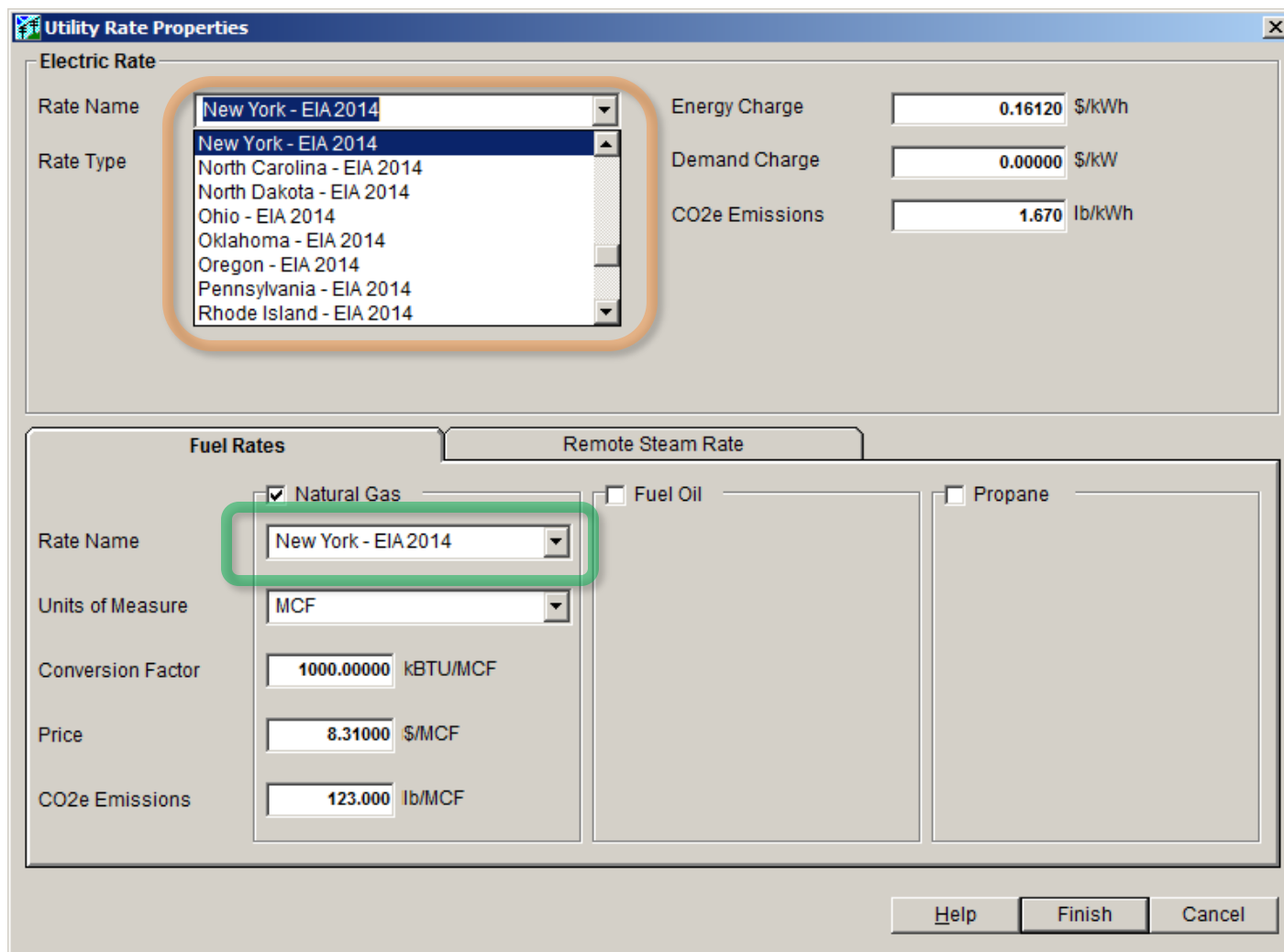
# Waterside Economizer for Air-Cooled Chiller Plants

**Details:** This feature models a cooling tower used for direct cooling duty alongside air-cooled chillers, when ambient conditions allow. Integrated and non-integrated configurations are supported. This complements existing features for water-cooled chiller plants.



# US Energy Information Administration (EIA) Rates

**Details:** The Utility Rate Wizard has been updated with 2014 EIA rates for gas and electricity. (2014 data was the latest available at time of release).



**Utility Rate Properties**

**Electric Rate**

Rate Name: **New York - EIA 2014**

Rate Type: **New York - EIA 2014**

Energy Charge: **0.16120** \$/kWh

Demand Charge: **0.00000** \$/kW

CO2e Emissions: **1.670** lb/kWh

**Fuel Rates**

☒ Natural Gas ☐ Fuel Oil ☐ Propane

Rate Name: **New York - EIA 2014**

Units of Measure: **MCF**

Conversion Factor: **1000.00000** kBTU/MCF

Price: **8.31000** \$/MCF

CO2e Emissions: **123.000** lb/MCF





**Remote Steam Rate**

**Help Finish Cancel**

# Interoperability Among Wizards

**Full Wizard Session**

Edit Report Help

 Weather  
 Building  
 Equipment  
 Utility Rates

**Weather**  
Chicago IAP, Illinois

**Building**  
 Building Type: Office  
 Building Subcategory: Low-rise (1-2 stories)  
 Building Shape: Rectangular  
 Zoning Method: One Zone per Floor  
 Building Identifier: BLD1  
 Floor Area per Floor: 15000 ft<sup>2</sup>  
 Total Floor Area: 15000 ft<sup>2</sup>

**Equipment Alternatives**  
No equipment alternatives have been defined.

**Utility Rates**  
 Electric: Electric Rate, \$0/kW, \$0.1/kWh  
 Natural Gas: Gas Rate, \$0/THM  
 Fuel Oil: Not Defined

Finish

Cancel

1. Weather location automatically selects EIA utility rates (where available)

2. Building type automatically selects equipment operating schedule

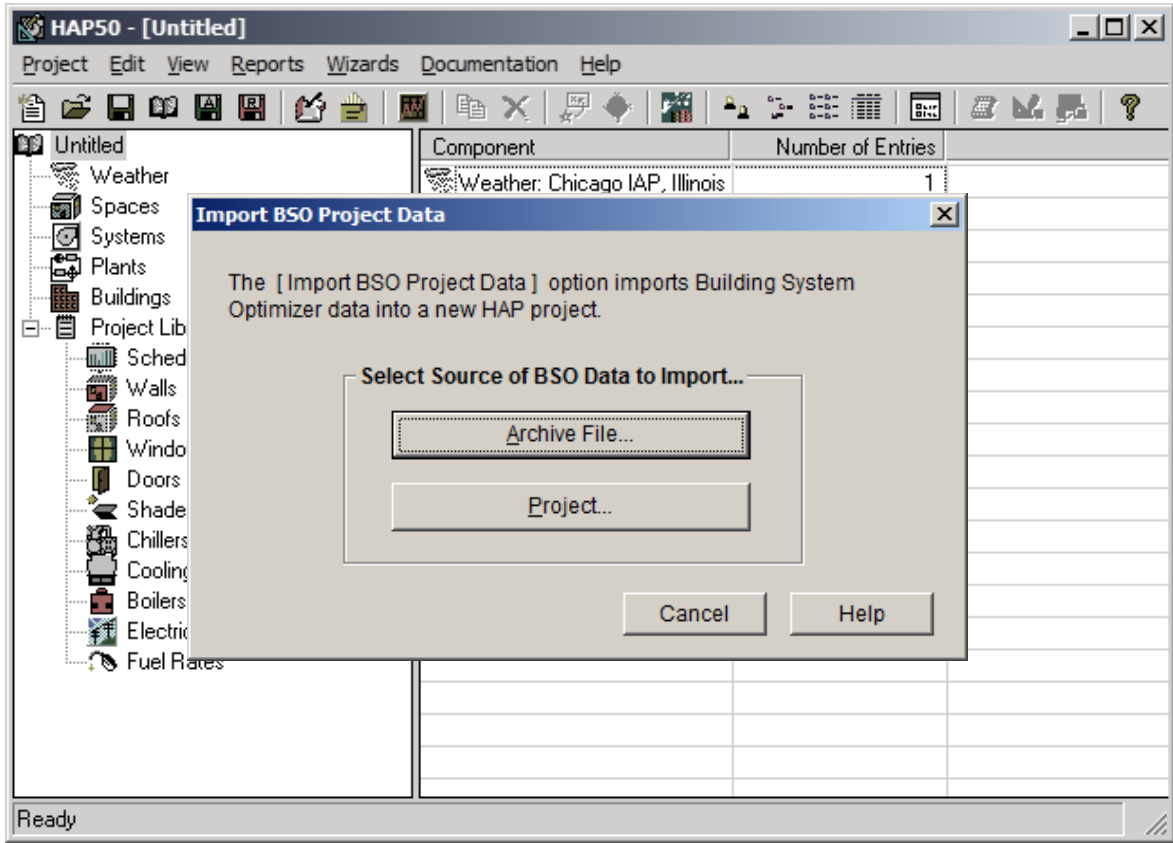
*Automatic selections can be overridden*

# OTHER FEATURES

# Import from Carrier Building System Optimizer

**Details:** Projects created in Building System Optimizer (BSO) can now be loaded into HAP. Once imported, full HAP capabilities can be used.

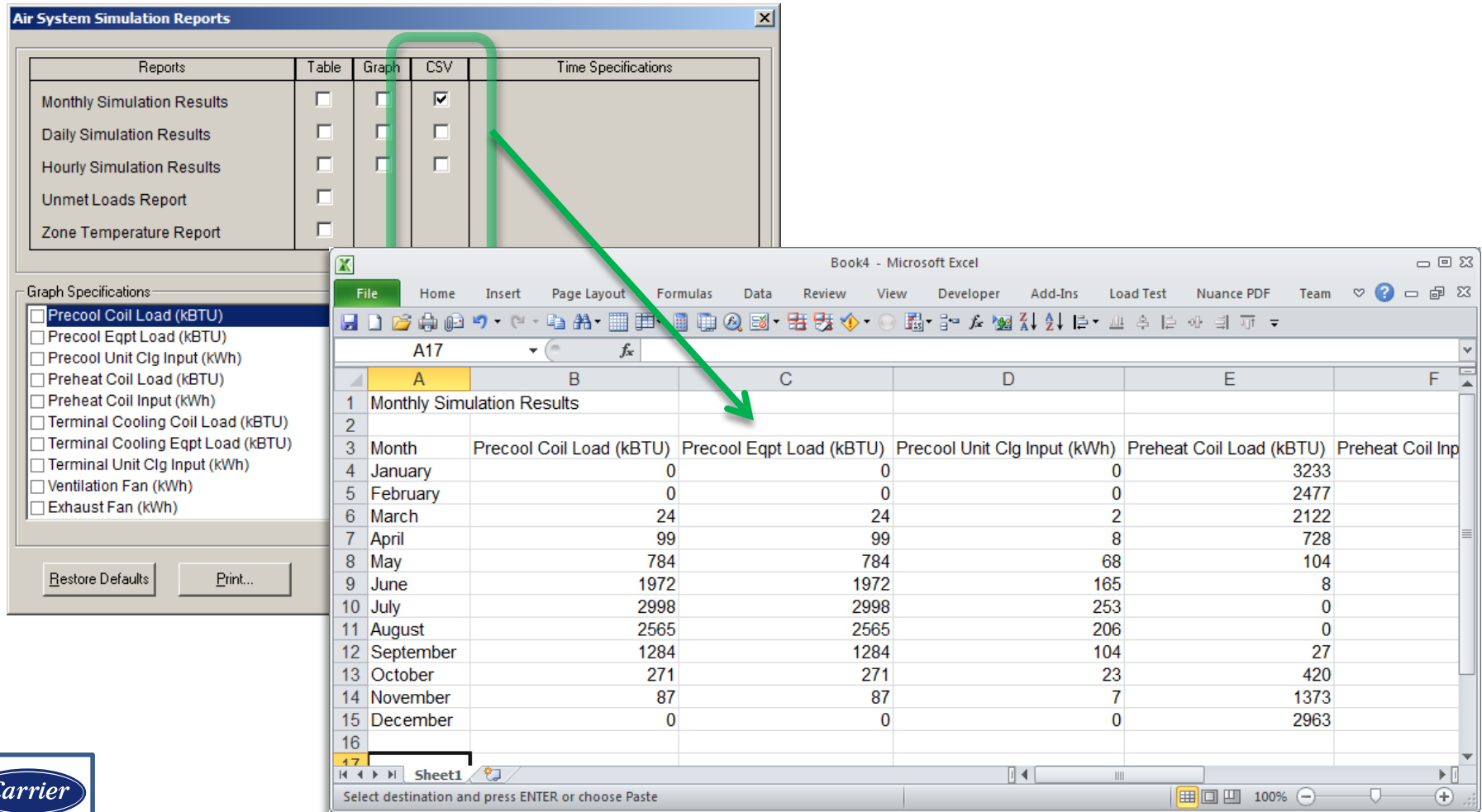
*This facilitates scenarios where schematic design was done in BSO but further detailed design or analysis is required.*





# Export to Comma Separated Values (CSV) Files

**Details:** CSV is a common file format compatible with spreadsheets such as Microsoft Excel and other software. Energy simulation results for air systems, plants, and buildings can now be output in this format.



The screenshot shows the 'Air System Simulation Reports' window. In the 'Reports' tab, the 'CSV' checkbox is selected for 'Monthly Simulation Results'. A green arrow points from this checkbox to the corresponding data in the Excel spreadsheet.

The Excel spreadsheet, titled 'Book4 - Microsoft Excel', displays the following data:

	A	B	C	D	E	F
1	Monthly Simulation Results					
2						
3	Month	Precool Coil Load (kBTU)	Precool Eqpt Load (kBTU)	Precool Unit Clg Input (kWh)	Preheat Coil Load (kBTU)	Preheat Coil Inp
4	January	0	0	0	3233	
5	February	0	0	0	2477	
6	March	24	24	2	2122	
7	April	99	99	8	728	
8	May	784	784	68	104	
9	June	1972	1972	165	8	
10	July	2998	2998	253	0	
11	August	2565	2565	206	0	
12	September	1284	1284	104	27	
13	October	271	271	23	420	
14	November	87	87	7	1373	
15	December	0	0	0	2963	
16						

# Bugs / Corrections (v5.01)

*The following problems were corrected:*

1. **Plant Simulations** – Air-cooled chillers imported from ECAT could show excess energy consumption when in water-cooled heat recovery mode during low-load conditions.
2. **Publish to ECAT** – When publishing sizing results to ECAT an error occurred when the peak month for a cooling coil happened to be the winter / heating design condition.
3. **Spaces Search & Replace** – Fixed problem preventing all choices from being listed for space usage type for projects using ASHRAE 62.1-2013.
4. **General** – Eliminated occasional runtime error on computers with missing “MS Sans Serif” font.
5. **General** – Fixed problem which prevented disabling the “What’s New” screen.

# Bugs / Corrections (v5.00)

*The following problems were corrected:*

1. **Air System Inputs** – When the “90.1 Appendix G Fan kW” option was selected for supply fan performance, the button to display the A-Factor Calculations input screen appeared in the wrong position on the screen, obscuring other inputs.
2. **System Design Reports** – For an induction beam or active chilled beam system in which a zone contains multiple spaces, and in which the zone primary airflow is set by induction supply requirements rather than outdoor air ventilation requirement, the Ventilation Sizing Summary report showed incorrect Voz values for spaces in that zone. This was a cosmetic error. Calculation of ventilation airflow requirements for the system was correct.
3. **Building Simulation I** – It was possible to create a complex electric rate with zero energy charge steps. If that electric rate was used in a building simulation an error message appeared.
4. **Building Simulation II** – The unmet load hours shown on the LEED EAc1 report incorrectly included unmet loads for service hot water (SHW), but should only contain data for space conditioning. This only occurred for projects modeling a standalone SHW system.
5. **Building Wizard** – When a wall, roof, or window assembly created in the detailed user interface was selected in the Building Wizard, the overall U-value was shown as zero. In addition, an error occurred when generating the Building Wizard input report. These were cosmetic errors; inputs were successfully transformed into spaces, assemblies and schedules for the detailed HAP interface and were reliable for use in load calculations and energy simulations.
6. **Utility Rate Wizard** – When price data for remote steam was entered, it was incorrectly assigned to the remote hot water meter in the building.
7. **Reports** – Under specific conditions an “Error 521: Unable to open clipboard” error occurred when generating certain reports.
8. **gbXML Import** – For a very specific set of conditions the gbXML Import feature linked the wrong window or door assembly to spaces. This only occurred when window names exceeded 30 characters, and the first 30 characters of each name matched other names.
9. **Example Problem Results PDF** – Example problem results listed in the *Example Problems Results* PDF document did not match results produced by the HAP v4.9 example problem. This PDF document is used by customers performing validation of the program.

# QUESTIONS?

***If you have any questions about Carrier Hourly Analysis Program v5.01  
please contact Carrier Software Systems at***

***[software.systems@carrier.utc.com](mailto:software.systems@carrier.utc.com)***

***Thank you!***