HOURLY ANALYSIS PROGRAM 5.10

NEW FEATURES GUIDE

Carrier Software Systems
Carrier Corporation
Syracuse, New York

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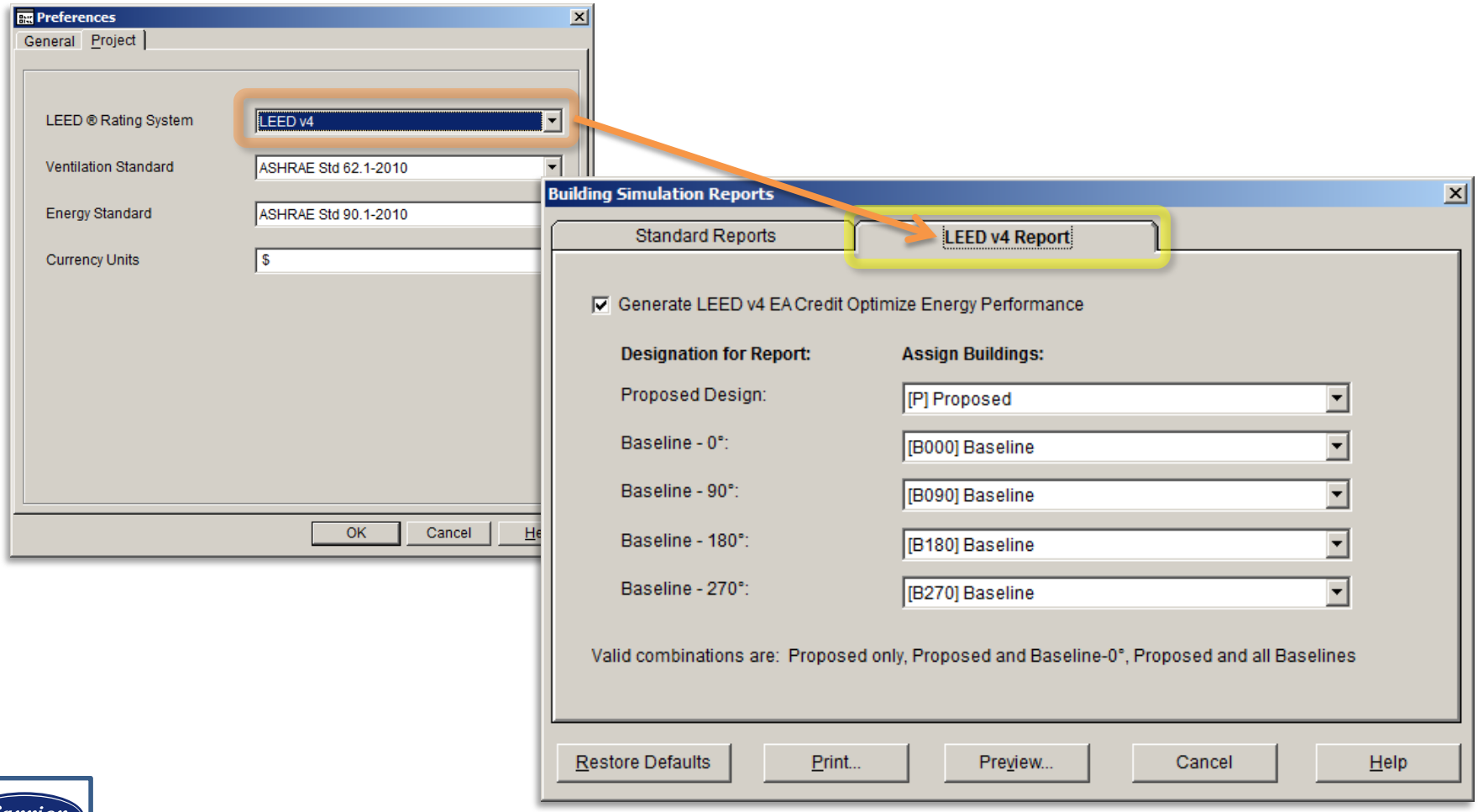
***Details**: LEED® v4 options have been added to HAP projects.*



LEED® v4 Compliance

HAP 5.10

The HAP LEED® v4 report mimics the format & inputs of the LEED® Minimum Energy Performance Calculator – to speed up data entry.

LEED v4 EA Credit Optimize Energy Performance Summary Report

08/15/2017 08:05AM

PERFORMANCE OUTPUTS

Energy Sources

Energy Type	Energy Consumption Units	Demand Units	Utility Rate Name	Utility Rate Structure
Electric	kWh	kW	Illinois - EIA 2014	
Natural Gas	MCF	MBH	Illinois - EIA 2014	

Performance Rating Method Compliance

Baseline Energy Summary by End Use

End Use	Unregulated ?	Baseline Design Energy Type	Units of Annual Energy & Peak Demand	Baseline (0° rotation)	Baseline (90° rotation)	Baseline (180° rotation)	Baseline (270° rotation)	Baseline Design Total (Average of 4 Rotations)
Interior Lighting		Electric	Consumption [kWh]	235,828.1	235,828.1	235,828.1	235,828.1	235,828.1
			Demand [kW]	72.9	72.9	72.9	72.9	72.9
Space Heating		Electric	Consumption [kWh]	424,264.1	438,838.1	433,666.3	438,838.0	433,901.6
			Demand [kW]	506.6	532.5	532.5	532.5	526.0
Space Heating		Natural Gas	Consumption [MCF]	297.7	0.0	0.0	0.0	74.5
			Demand [MBH]	415.6	16.8	16.8	16.8	116.5
Space Cooling		Electric	Consumption [kWh]	233,259.8	226,537.2	222,249.6	226,537.3	227,146.0
			Demand [kW]	1,303.8	1,335.0	1,329.5	1,306.0	1,325.8
Pumps		Electric	Consumption [kWh]	0.0	0.0	0.0	0.0	0.0
			Demand [kW]	0.0	0.0	0.0	0.0	0.0
Heat Rejection		Electric	Consumption [kWh]	0.0	0.0	0.0	0.0	0.0
			Demand [kW]	0.0	0.0	0.0	0.0	0.0
Fans - Interior		Electric	Consumption [kWh]	106,777.1	108,716.1	106,808.1	108,716.1	107,754.4
			Demand [kW]	72.9	72.9	72.9	72.9	72.9
Receptacle Equipment	X	Electric	Consumption [kWh]	195,935.6	195,935.6	195,935.6	195,935.6	195,935.6
			Demand [kW]	60.8	60.8	60.8	60.8	60.8
1	X	Electric	Consumption [kWh]	5,826.4	0.0	0.0	0.0	1,456.6
			Demand [kW]	1.8	0.0	0.0	0.0	0.5
2		Electric	Consumption [kWh]	0.0	0.0	0.0	0.0	0.0
			Demand [kW]	0.0	0.0	0.0	0.0	0.0
third		Electric	Consumption [kWh]	0.0	0.0	0.0	0.0	0.0
			Demand [kW]	0.0	0.0	0.0	0.0	0.0
Total energy consumption by energy type		Electric	kWh	1,201,891.0	1,205,855.1	1,194,487.7	1,205,855.2	1,202,022.3
		Natural Gas	MCF	297.7	0.0	0.0	0.0	74.5

(1) This form determines compliance using cost calculations from Section 1.9. Process Energy Costs should be modeled to accurately reflect the proposed building. Process Energy must be the same in the baseline and proposed cases, unless an exceptional calculation is used. Process energy costs must be at least 25% of the total baseline energy costs. Any exceptions must be supported by a narrative and/or other supporting documentation.
(2) In this project Process Energy is 15.6% of total baseline energy cost.

Baseline Building Annual Energy Cost by Energy Type

Energy Type		Baseline (0° rotation) ($)	Baseline (90° rotation) ($)	Baseline (180° rotation) ($)	Baseline (270° rotation) ($)	Baseline Design Total ($)
Electric	kWh	120,189	128,586	119,449	120,586	120,202
Natural Gas	MCF	26,454	4	4	4	6,617
Baseline Annual Energy Cost		146,644	128,590	119,453	120,590	126,819

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Report includes the project's EA credit points score, supporting multiple ratings systems.

3. EA CREDIT POINTS REFERENCE TABLE

ASHRAE Std 90.1-2010 Appendix G Percentage Improvement

Minimum Energy Cost Savings Percentage for Each Point Threshold

Project Cost Savings: 13.0%

Cost Savings			Points		
New Construction	Major Renovations	Core and Shell	Healthcare	Schools	All Others
6%	4%	3%	3	1	1
8%	6%	5%	4	2	2
10%	8%	7%	5	3	3
12%	10%	9%	6	4	4
14%	12%	11%	7	5	5
16%	14%	13%	8	6	6
18%	16%	15%	9	7	7
20%	18%	17%	10	8	8
22%	20%	19%	11	9	9
24%	22%	21%	12	10	10
26%	24%	23%	13	11	11
29%	27%	26%	14	12	12
32%	30%	29%	15	13	13
35%	33%	32%	16	14	14
38%	36%	35%	17	15	15
42%	40%	39%	18	16	16
46%	44%	43%	19	-	17
50%	48%	47%	20	-	18

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LEED® 2009 Updates

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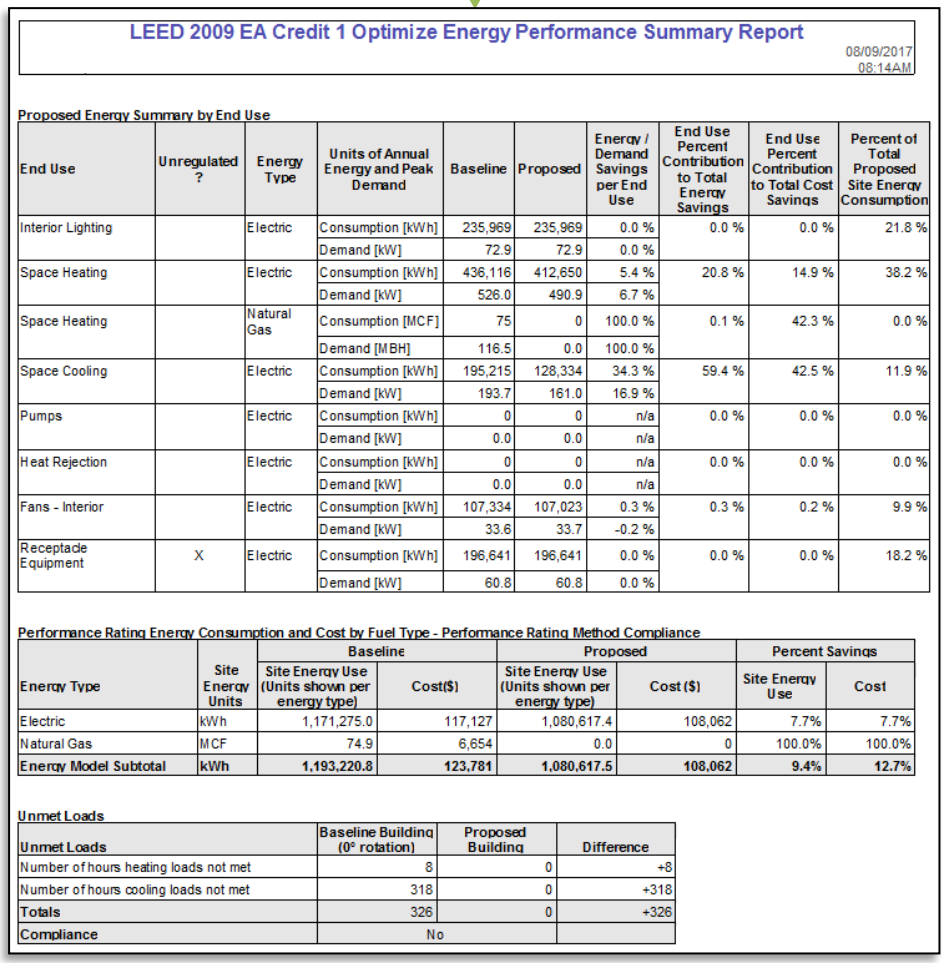
The HAP LEED® 2009 report has also been updated to match the latest LEED® spreadsheet.



LEED 2009 EA Credit 1 Optimize Energy Performance Summary Report

08/09/2017 08:14AM

Proposed Energy Summary by End Use

End Use	Unregulated ?	Energy Type	Units of Annual Energy and Peak Demand	Baseline	Proposed	Energy / Demand Savings per End Use	End Use Percent Contribution to Total Energy Savings	End Use Percent Contribution to Total Cost Savings	Percent of Total Proposed Site Energy Consumption
Interior Lighting		Electric	Consumption [kWh]	235,969	235,969	0.0 %	0.0 %	0.0 %	21.8 %
			Demand [kW]	72.9	72.9	0.0 %			
Space Heating		Electric	Consumption [kWh]	436,116	412,650	5.4 %	20.8 %	14.9 %	38.2 %
			Demand [kW]	526.0	490.9	6.7 %			
Space Heating		Natural Gas	Consumption [MCF]	75	0	100.0 %	0.1 %	42.3 %	0.0 %
			Demand [MBH]	116.5	0.0	100.0 %			
Space Cooling		Electric	Consumption [kWh]	195,215	128,334	34.3 %	59.4 %	42.5 %	11.9 %
			Demand [kW]	193.7	161.0	16.9 %			
Pumps		Electric	Consumption [kWh]	0	0	n/a	0.0 %	0.0 %	0.0 %
			Demand [kW]	0.0	0.0	n/a			
Heat Rejection		Electric	Consumption [kWh]	0	0	n/a	0.0 %	0.0 %	0.0 %
			Demand [kW]	0.0	0.0	n/a			
Fans - Interior		Electric	Consumption [kWh]	107,334	107,023	0.3 %	0.3 %	0.2 %	9.9 %
			Demand [kW]	33.6	33.7	-0.2 %			
Receptacle Equipment	X	Electric	Consumption [kWh]	196,641	196,641	0.0 %	0.0 %	0.0 %	18.2 %
			Demand [kW]	60.8	60.8	0.0 %			

Performance Rating Energy Consumption and Cost by Fuel Type - Performance Rating Method Compliance

Energy Type	Site Energy Units	Baseline		Proposed		Percent Savings	
		Site Energy Use (Units shown per energy type)	Cost($)	Site Energy Use (Units shown per energy type)	Cost ($)	Site Energy Use	Cost
Electric	kWh	1,171,275.0	117,127	1,080,617.4	108,062	7.7%	7.7%
Natural Gas	MCF	74.9	6,654	0.0	0	100.0%	100.0%
Energy Model Subtotal	**kWh**	**1,193,220.8**	**123,781**	**1,080,617.5**	**108,062**	**9.4%**	**12.7%**

Unmet Loads

Unmet Loads	Baseline Building (0° rotation)	Proposed Building	Difference
Number of hours heating loads not met	8	0	+8
Number of hours cooling loads not met	318	0	+318
Totals	326	0	+326
Compliance	No		

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ASHRAE® STANDARDS UPDATES

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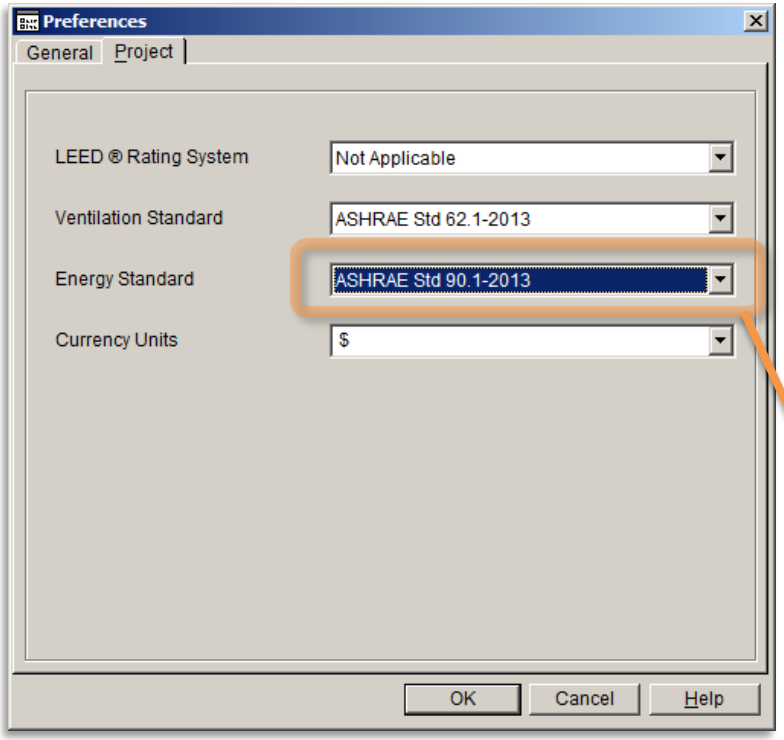
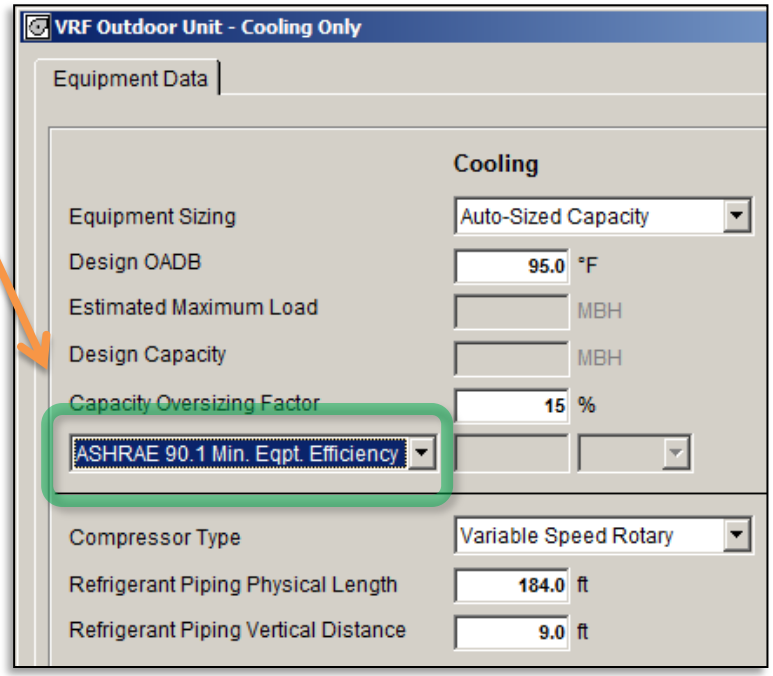
Support for ASHRAE® Standard 90.1-2013

***Details**: 90.1-2013 has been added as a project energy standard option.*



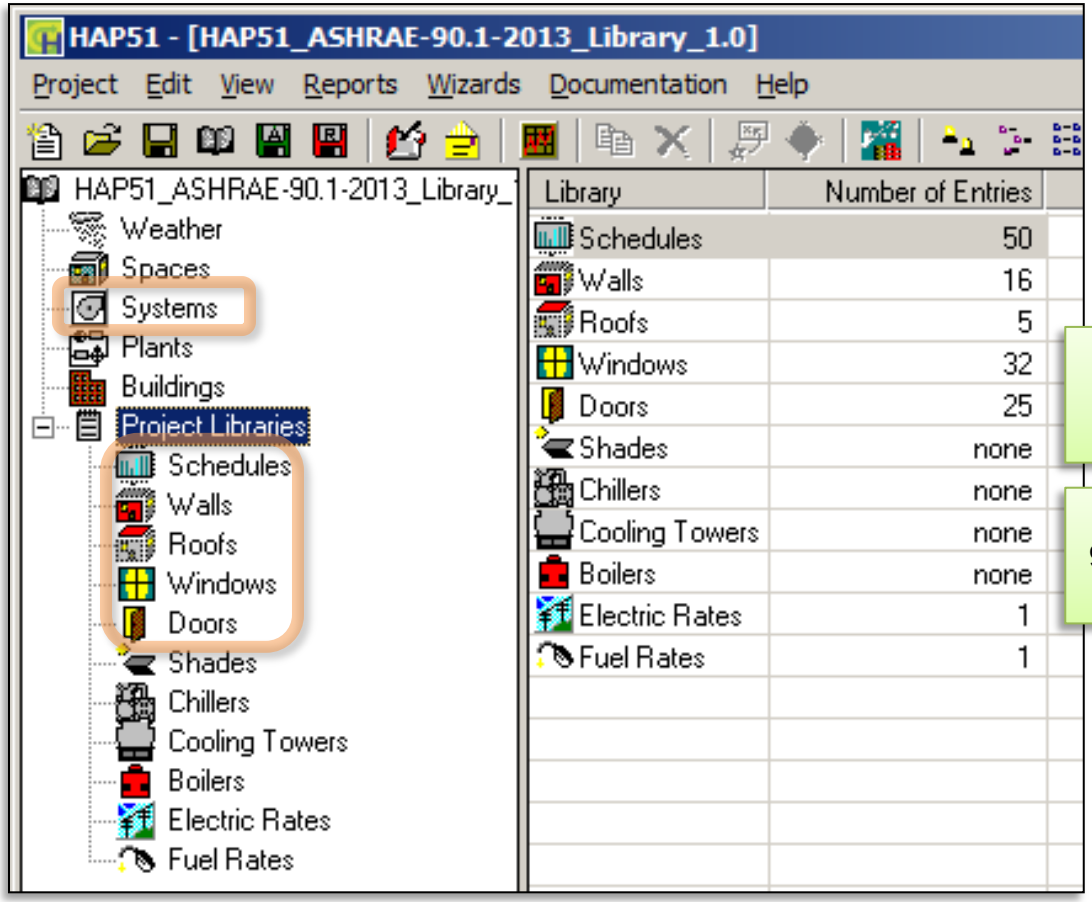
*Using the "ASHRAE Minimum Efficiency" options for equipment, HAP will derive efficiency using 90.1-2013 tables. **Now including VRF equipment**.*



Support for ASHRAE® Standard 90.1-2013

HAP 5.10

***Details**: Templates for 90.1-2013 baseline systems, construction assemblies, and schedules are included with HAP 5.10.*



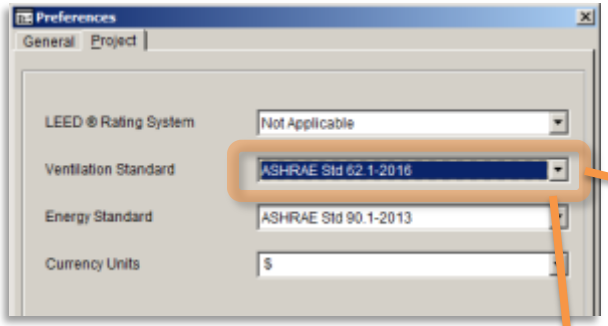
Load the project archive "HAP51_ASHRAE-90.1-2013_Library_1.0.E3A" to get started with 90.1 templates.

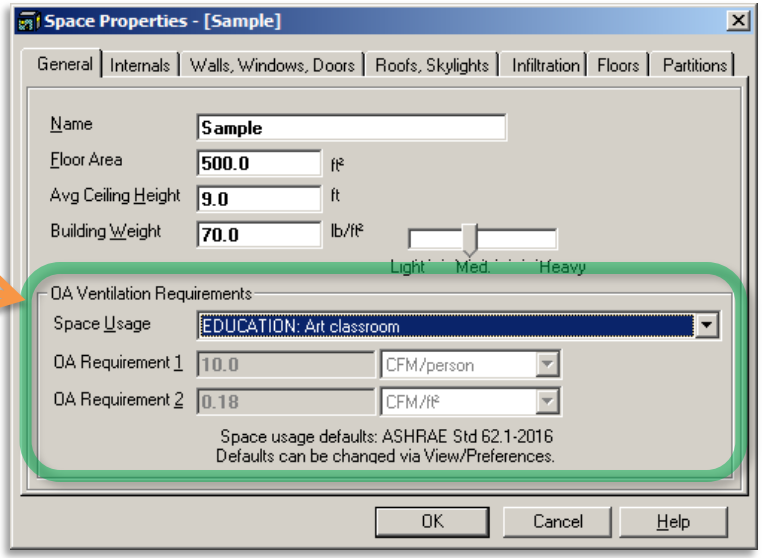
Updated templates for 90.1-2007 and 90.1-2010 are also included in separate archives.

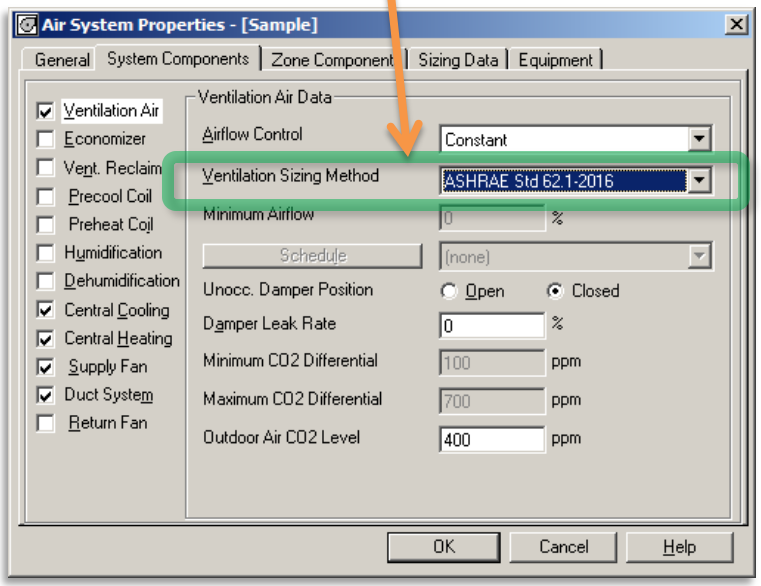
Support for ASHRAE® Standard 62.1-2016

HAP 5.10

***Details**: ASHRAE® Standard 62.1-2016 was added as a project ventilation standard option. When selected, ventilation requirements can be selected from -2016 space usage types in space inputs. System inputs offer an option to calculate system ventilation requirements using the 62.1-2016 Ventilation Rate Procedure.*







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MODELING CAPABILITIES

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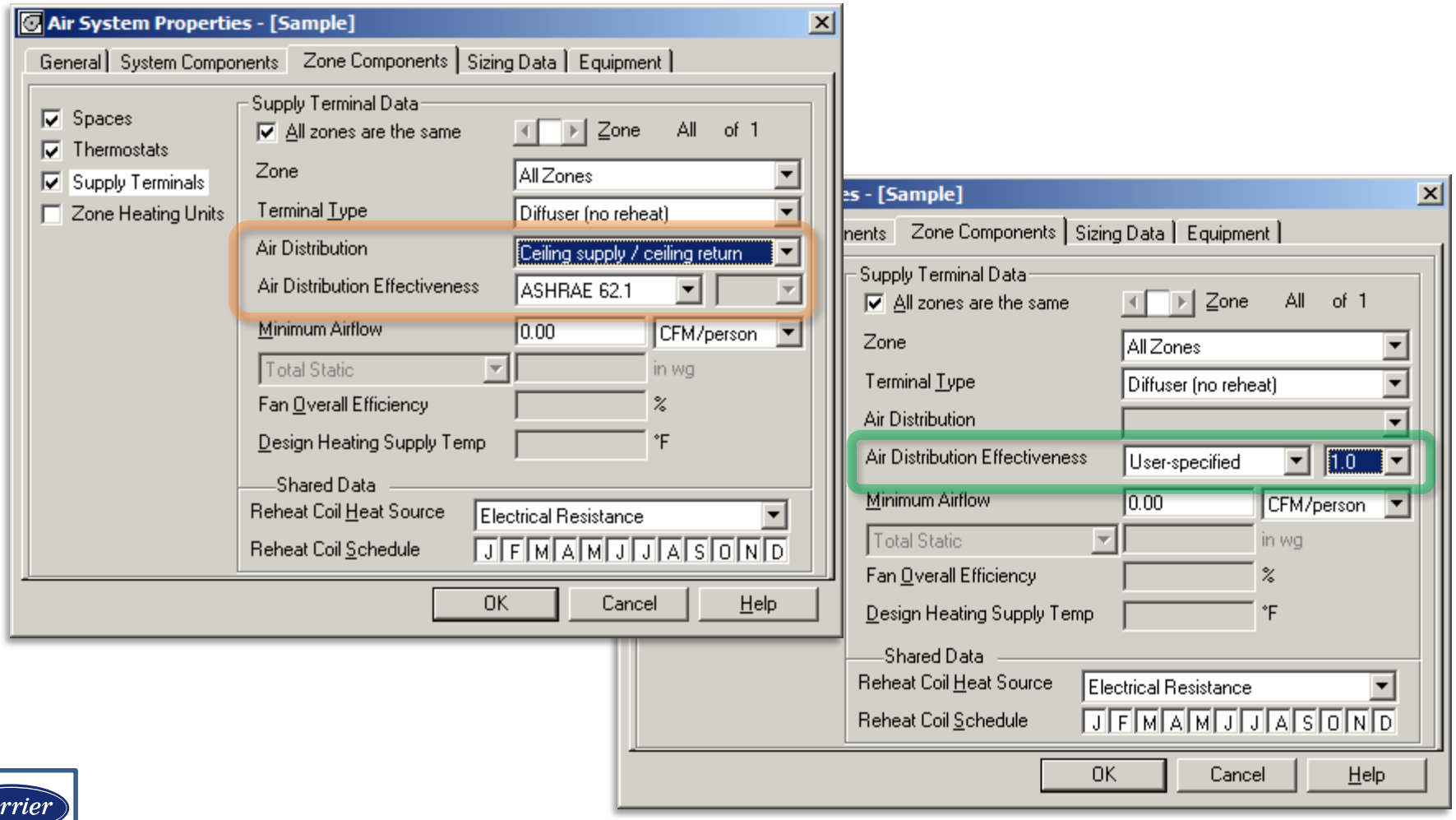
Zone Air Distribution Effectiveness

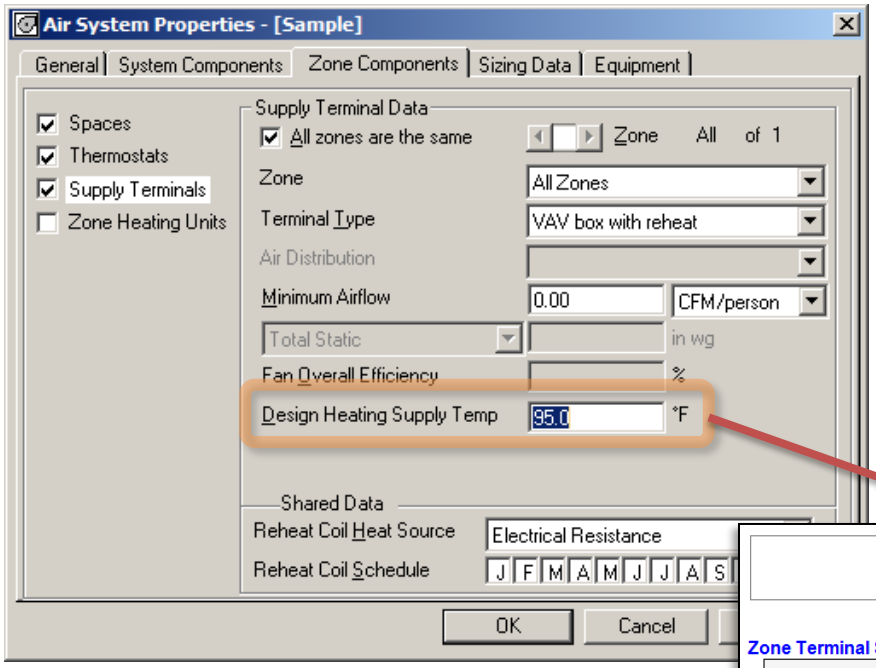
Details**:* Zone Air Distribution Effectiveness (Ez***) can be calculated automatically for a 62.1 ventilation analysis. Alternatively, ***Ez*** can be directly specified.



Design Supply Temp. for Reheat Terminals

HAP 5.10

***Details**: Improved reheat coil capacity sizing calculations are now temperature based. Capacity is derived from coil flow, inlet temperature and the specified reheat coil design heating supply temperature.*



Applies to terminals for:

- *VAV reheat,*
- *Single zone constant volume,*
- *Constant volume terminal reheat,*
- *Dual or triple duct constant volume,*
- *Series fan powered mixing boxes, and*
- *Parallel fan powered mixing boxes*

Zone Sizing Summary

08/09/2017
08:39AM

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
BLD1-F001-Z01	2025	2025	1.00	99.9	10.00	0.0	0.00	0
BLD1-F001-Z02	1275	1275	1.00	62.9	6.29	0.0	0.00	0
BLD1-F001-Z03	2025	2025	1.00	99.9	10.00	0.0	0.00	0
BLD1-F001-Z04	1275	1275	1.00	62.9	6.29	0.0	0.00	0
BLD1-F001-Z05	8400	8400	1.00	414.4	41.46	0.0	0.00	0

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PRODUCTIVITY ENHANCEMENTS

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New VRF Outdoor Unit Sizing Data

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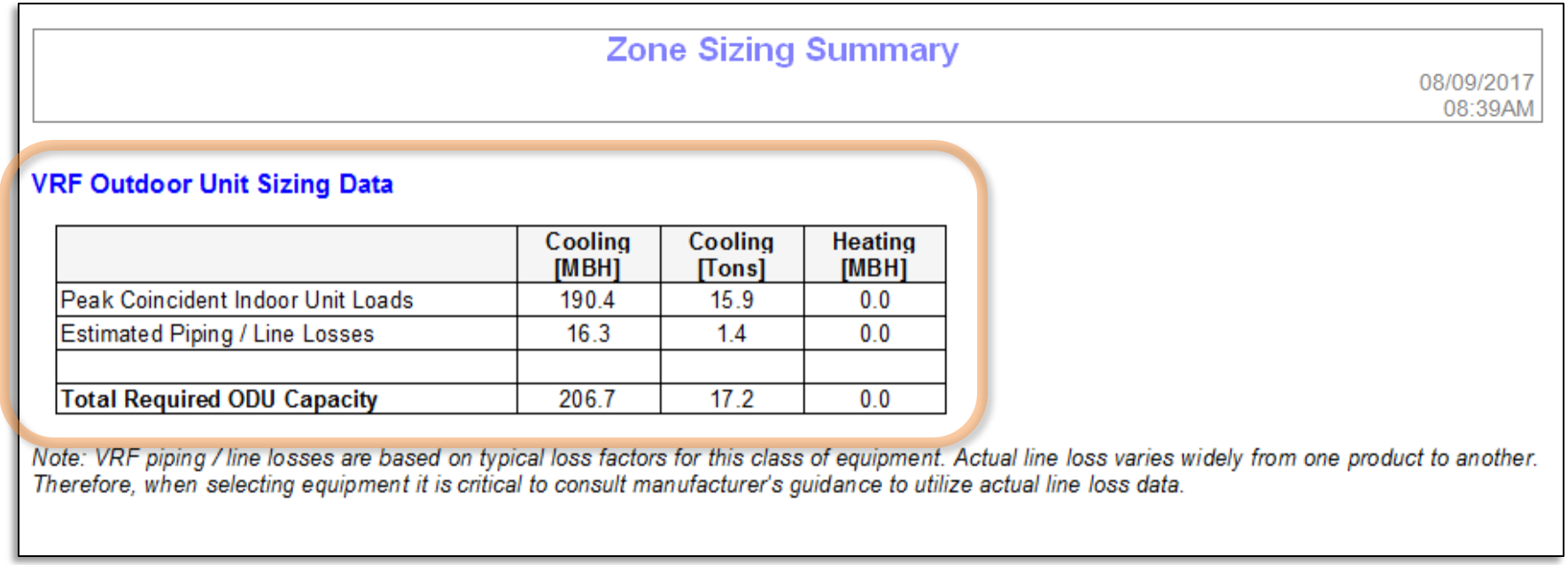
***Details**: The Zone Sizing Summary report for Variable Refrigerant Flow (VRF) systems now includes a sizing table for the VRF outdoor unit (ODU). This lists the peak coincident load for all indoor units, an estimate of pipe losses, and the total capacity requirement for the ODU.*



Zone Sizing Summary

08/09/2017
08:39AM

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	190.4	15.9	0.0
Estimated Piping / Line Losses	16.3	1.4	0.0
Total Required ODU Capacity	206.7	17.2	0.0

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

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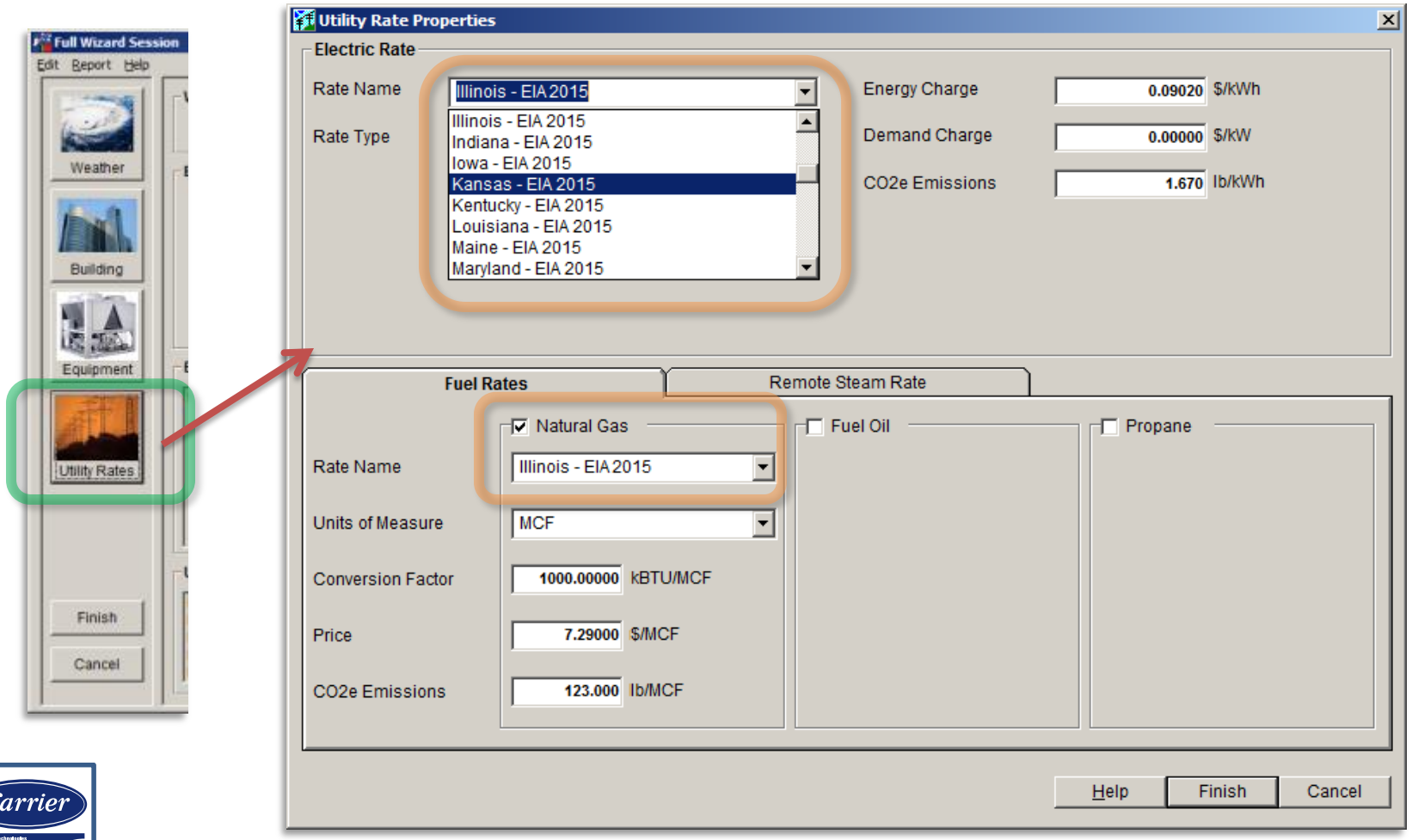
Updated EIA Electric and Gas Prices for the US

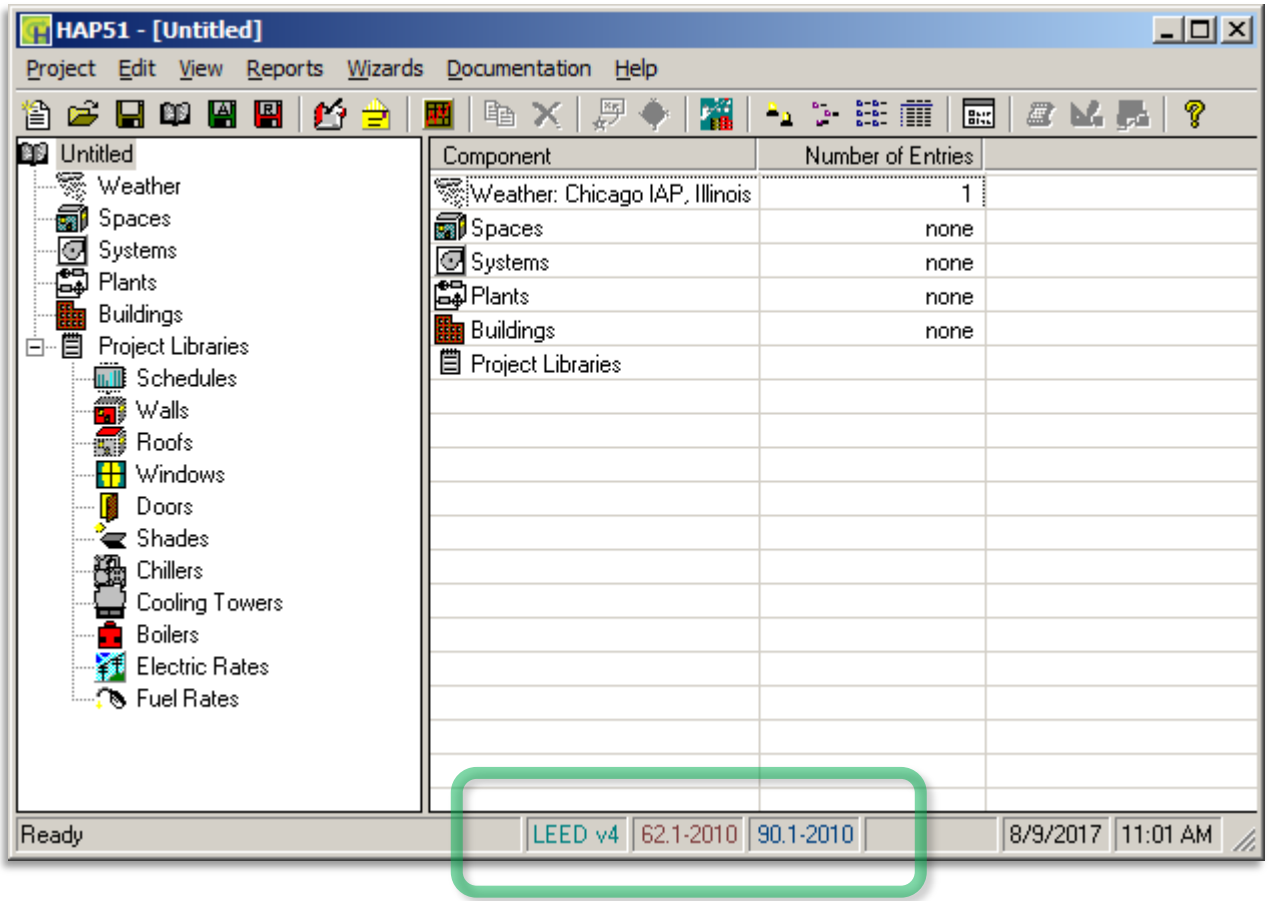
HAP 5.10

***Details**: Energy Information Administration (EIA) prices for electricity and natural gas includes the latest data (2015 calendar year). Statewide average commercial sector prices are provided for each US state.*



Summary of Project Settings

***Details**: The HAP main window the status bar now displays the current project settings for LEED® rating method, energy standard, and ventilation standard.*



Other Enhancements

HAP 5.10

a. **Air System Design Reports** – Added a CFM/ton check figure to the central cooling coil section of the Air System Sizing Summary report.

b. **Air System Design Reports** – Added a System Psychrometrics graph for design heating condition. When the graph is selected for the "peak" time, HAP will generate psychrometric process graphs both for the design cooling and design heating conditions.

c. **Air System Simulation Reports** – Modified the Zone Temperature Report for the special case where a system has zero occupied period operating hours for the year (i.e., all hours are in the unoccupied period). In this case the report shows maximum and minimum occupied temperatures as "na".

d. **LEED® Reports** - The *Baseline Performance – Performance Rating Method Compliance* table now displays process energy cost as a percentage of total baseline energy cost with 1 decimal place rather than as a whole number (e.g. 24.6% rather than 25%). This helps in clarifying compliance with the 25% minimum rule. This change was made both in the LEED® v4 Optimize Energy Performance Summary report and the *LEED 2009 EA Credit 1 Summary* report.

e. **Spaces** - Increased the maximum limit for electric equipment heat gain from 99 W/sqft (1065 W/sqm) to 1000 W/sqft (10763 W/sqm).

f. **Plants** - Increased the maximum size for service hot water storage tanks from 1500 gal (5678 L) to 99999 gal (378537 L).

g. **Chillers** - Reduced minimum chiller EWCT limit from 45 F (7.2 C) to 35 F (1.7 C).

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Bugs / Corrections

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a. **Air System Design Reports** – The System Psychrometrics report incorrectly displayed preheat coil airflow. (This was only a display error. HAP correctly calculated coil airflow and coil load.)

b. **Air System Design Calculations** – A “Subscript out of range” error occurred when performing design calculations for a system using ASHRAE® Std. 62.1 ventilation sizing. This could occur when the volume of a space was unusually large.

c. **Air System Input Report** – The estimated maximum load shown for a VRF outdoor unit (ODU) was incorrect. (This was only a display problem. HAP correctly calculated the estimated maximum load and the ODU cooling and heating capacities.)

d. **Air System Inputs** – When defining a Split DX Fan Coil terminal system, the Terminal Cooling equipment input screen incorrectly labeled the equipment performance input as “Compressor kW” rather than “Compressor + Outdoor Fan kW”.

e. **Plant Simulation** – In a Dedicated Heat Recovery Chiller (DHRC) heat recovery plant with multiple cooling-only chillers, in certain off-design situations the plant operated with an extra cooling-only chiller running.

f. **Weather Data** – When importing a simulation weather file, an error occurred if the file used the TMY2, TMY3, ASHRAE® IWEC or IWEC2 formats. The error did not occur when importing a file with the EnergyPlus EPW format.

g. **Space Inputs** – If a space without exterior walls had been modified via the global change feature to apply a CFM/sqft (L/s/sqm) infiltration value, it could later show a "validation error" message, but no input items were highlighted as invalid.

h. **Equipment Wizard** – If a VRF system was defined without a DOAS the options for Demand Controlled Ventilation and Ventilation Reclaim were shown but were invalid for a terminal system using direct ventilation.

i. **Project Management** – In some cases data files containing deleted items were not removed from a project. This resulted in greater disk space usage than necessary.

QUESTIONS?

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If you have any questions please contact Carrier Software Systems at

software.systems@carrier.utc.com

Thank you!

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