

Vista User Guide

<Virtual Environment> 6.0

Contents

1. Introduction.....	4
2. Vista View	4
3. Specifying Data for Output	6
3.1. Specifying Results.....	6
3.2. Specifying Variables.....	7
3.2.1. Model Variables.....	7
3.2.2. Weather Variables	8
3.3. Specifying Parts of the Building	8
4. Using the Output Toolbar.....	9
4.1. The Common Chart Dialog	11
4.1.1. Output Menu.....	11
4.1.2. Analysis Menu	11
4.2. X-Y Chart.....	12
4.3. Multiple Room Graph Plotter.....	12
4.4. Data Table.....	14
4.5. Snapshot	15
4.6. Synopsis (min/mean/max).....	15
4.7. Range Tests	15
4.8. Monthly Totals	17
4.9. Set Dates.....	18
4.10. Comfort.....	19
4.10.1. Comfort Settings.....	19
4.11. Peak Time Table	20
4.12. Peak Day Table.....	21
4.13. Peak Day Graph.....	22
4.14. Heating Loads Summary.....	23
4.15. Cooling Loads Summary.....	24
4.16. Cooling Loads Detail	25
4.17. Air Flow Sizing Summary	26
4.18. System Cooling Loads Summary.....	26
4.19. System Cooling Loads Detail	27
4.20. Building and System Loads Summary	27
5. General Settings	30
5.1. Graph Line Colours	30
5.2. Units Display	30
5.3. Automatic Graph Saving	30
6. Vista-Pro[BETA].....	31
6.1. MacroFlow bulk airflow visualisation.....	31
6.2. Colour Coded Results in 3D model.....	31
6.3. DSM Results animations.....	31
6.4. Wind Rose.....	32
6.5. Look & Feel	33
7. Vista Variables	34
7.1. Weather Variables.....	34
7.2. Model Level Variables	35
7.2.1. Loads.....	35
7.2.2. Energy	36
7.2.3. Carbon	37
7.3. Apache System Variables	38
7.3.1. System.....	38
7.3.2. Energy	39
7.3.3. Carbon	39

7.4.	Room Variables.....	40
7.5.	Surface Variables.....	43
8.	ApacheHVAC Results.....	44
8.1.	Component Variables.....	44
8.2.	Node Variables.....	45
8.3.	Multiplex Results	45

1. Introduction

Vista is located under the thermal group of applications within the IES Virtual Environment. It is intended as a tool to quickly and easily analyse the results from one or more simulations carried out using the thermal modelling tools.

The package reads ApacheCalc (CIBSE Heat Loss & Heat Gain Calculation), ApacheLoads (ASHRAE Heat Balance Method Calculation), ApacheSim dynamic thermal simulation files and real climate data files.

2. Vista View

The Vista application workspace consists of distinct areas of user input. They are ordered vertically from top to bottom:

The main Vista menu:



The Vista toolbar provides shortcuts to opening new results files and plotting new graphs or tables and is different for each type of file to be analysed:

Simulation files (*.aps):



Heating Loads (*.htg):



Cooling Loads (*.clg):



The model view area acts in the same way as in the other application workspaces. That is, clicking onto a room selects it. If you double click a room, it takes you down one decomposition level. You can navigate down to openings to get air flow rates, etc. Please note that you can also use the model browser on the left hand side of the screen to control what room is selected. If you select outside the model or select "Model" on the browser, then the results for the whole model are selected. The variables available for selection are different to the individual rooms.

Any change in selection of any part of the model is automatically reflected in the dialog bar (in terms of what level of the model is selected) and in the last-created graph or chart, in terms of which part of the model is used for results analysis.

The view toolbar acts in the same way as other application workspaces allowing you to control the level of decomposition of the model and what angle it is viewed from.

The dialog bar has a number of input areas, with each one distinctly labelled. These are described in more detail later in the manual. Suffice to say that, once you have created a new graph or table, then when you change the selections in this area of the screen, then the viewed output on the latest graph or table is updated accordingly. This makes it easy to browse around a model and the associated thermal results.

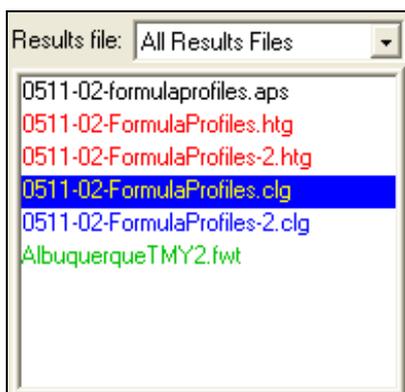
3. Specifying Data for Output

The primary aim of Vista is to allow the user to obtain a graphical or tabular form of results very quickly. Once a method of output has been selected from the output toolbar, the latest chart dialog reflects any changes selected by the user. As soon as you click onto a new results file or variable, that change should be reflected in the display straight away, although there may be some delay when large data quantities are being processed.

3.1. Specifying Results

When Vista is manually selected by the user, the system automatically loads the results files stored in the Vista sub-folder of your project. If you wish to add new files to look at, you can select File > Open from the Vista menu, or you can click the Open File button in the Output toolbar. Any new files are added to the simulation results files list at the bottom of the screen.

When Vista is called automatically at the end of a simulation run, you don't need to specify the results file. The newly created file is opened automatically for you. Results are sorted into the 4 main types; heating load results either from ApacheCalc or ApacheLoads are shown in red text and have the suffix *.htg, cooling load results either from ApacheCalc or ApacheLoads are shown in blue text and have the suffix *.clg. ApacheSim dynamic thermal simulation results are shown as black text and have the suffix *.aps, weather files (*.fwt or *.epw) are shown with green text. The drop down box above the results can be used to sort the different results.



When you want to specify a file to be used, just click onto it. All highlighted files will be used for results display. You can deselect a file by just clicking onto it again.

Results files are closed by selecting File > Close from the Vista menu. All

currently highlighted files are closed, and removed from the file list.

3.2. Specifying Variables

All available variables are displayed in the dialog bar at the bottom of the screen. There are two different types of variables: those for the model simulation and those for the weather. The currently selected variables are highlighted in the Single lists. The Multi-select lists are just ways of short-cutting selecting various common combinations of single variables. If you select None in the Multi-select box, it will clear all highlighted variables. To deselect a single variable, click on it a second time.

3.2.1. Model Variables

These variables are obtained from the steady state calculations and Apache simulation results files. When you navigate to different levels of the building, you will notice the listed variables change.

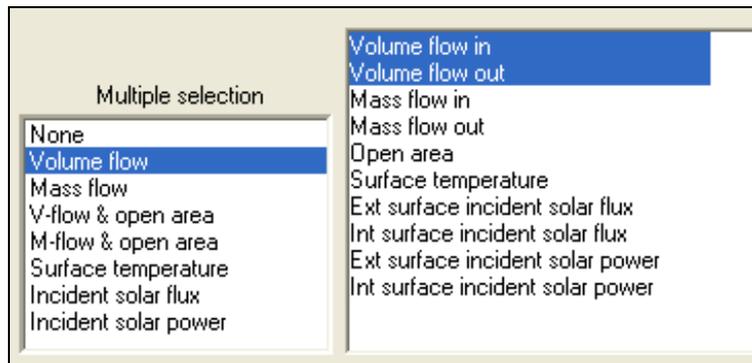
When you are at the model level (i.e. more than one room is displayed), and at least one room is selected, then the variables which are relevant to rooms are displayed.

<input type="checkbox"/> Combine rooms	<input type="checkbox"/> Combine variables	Air temperature	Heating plant sensible load	Natural vent gain	Humidification plant load	Infiltration lat gain
<input type="checkbox"/> Multiple selection		Operative temperature	Cooling plant sensible load	Infiltration gain	Dehumidification plant load	MacroFlo ext vent lat gain
None		Mean radiant temperature	Internal gain	MacroFlo ext vent gain	Cooling + dehum plant load	MacroFlo int vent lat gain
Air temp & heating/cooling		Dew-point temperature	Lighting gain	MacroFlo int vent gain	Internal latent gain	Convective room units load
System inputs (sensible)		People dissatisfied	Equipment gain	System air supply	Equipment latent gain	Convective lighting gain
Air & radiant temperatures		Predicted mean vote	People gain	Aux mech vent	People latent gain	Convective equipment gain
Humidity & hum/dehum		Comfort index	Solar gain	Natural vent	Number of people	Convective people gain
Sensible heat balance		Relative humidity	External conduction gain	Infiltration	Air system input latent	Environmental temperature
Latent heat balance		Moisture content	Internal conduction gain	MacroFlo external vent	Vent/infiltr. latent gain	Steady state heating plant load
System inputs (latent)		Room CO2 concentration	Air system input sensible	MacroFlo internal vent	Aux mech vent lat gain	Conduction gain
Latent loads		Space conditioning sensible	Aux mech vent gain	Space conditioning latent	Natural vent lat gain	

When you can see more than one room, but no room is selected, or you click Model on the Model Browser, then you can access the model level variables (total energy loads, etc).

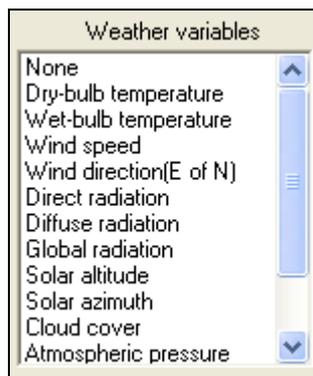
Loads	Energy	Carbon	Room heating plant sens. load	Chillers load
Multiple selection			Room hum. plant load	
None			System air heating load	
Heating plant			Aux mech vent heating load	
Cooling plant			Boilers load	
Room unit loads			Room cooling plant sens. load	
Aux mech vent loads			Room dehum. plant load	
HVAC coil loads			System air sens. clg. load	
Central plant loads			System air lat. clg. load	
HVAC heat recovery			Aux mech vent sens. clg. load	
			Aux mech vent lat. clg. load	

Air flow rates etc. can be accessed by navigating down to the surface level and selecting an opening. This assumes that you have incorporated air flow into the simulation using MacroFlo.



3.2.2. Weather Variables

These variables are obtained from the weather file which is associated with a specific simulation results file. As with the Model simulation variables, you can select common groups of variables. The 'None' selection removes all previous selections.



The weather data is not extracted from the simulation file, but is instead extracted from the weather file which is associated with a particular simulation. Individual weather files can also be viewed separately.

3.3. Specifying Parts of the Building

You can use the view toolbar to control how you view the model, in the same way as for other application workspaces such as ModelIT.

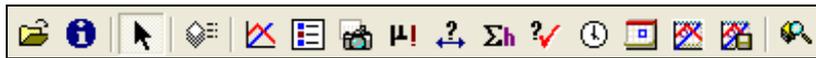


Please note that when the blue arrows (up/down) are clicked, then the variables which are accessible will change accordingly.

4. Using the Output Toolbar

The output toolbar is shown below the Vista menu.

Simulation files (*.aps):



The buttons are (from left to right):

- Open File
- Results file properties
- Cursor reset
- Layer properties
- X-Y chart
- Multiple Graph Room Plotter
- Data Table
- Snapshot
- Synopsis (min\mean\max)
- Range tests
- Monthly Totals
- Comfort Settings.
- Peak time table
- Peak day table
- Peak day graph
- Peak day graph autosave
- Model Viewer

Heating Loads (*.htg):



The buttons are (from left to right):

- Open File
- Results file properties
- Cursor reset
- Layer properties
- Building and System Loads report
- X-Y chart
- Multiple Graph Room Plotter
- Data Table

- Synopsis (min\mean\max)
- Comfort Settings.
- Heating loads summary
- Radiator selection
- Model Viewer

Cooling Loads (*.clg):



The buttons are (from left to right):

- Open File
- Results file properties
- Cursor reset
- Layer properties
- X-Y chart
- Multiple Graph Room Plotter
- Data Table
- Snapshot
- Synopsis (min\mean\max)
- Range tests
- Monthly Totals
- Comfort Settings.
- Peak time table
- Peak day table
- Peak day graph
- Peak day graph autosave
- Room cooling loads summary
- Room cooling loads detail
- Air sizing summary
- System loads summary
- System loads detail
- Model Viewer

The Open File button has been described before, and is used to add sets of results. The reset cursor button acts in the same way as for ModelIT. The other buttons will generate a new chart/table and display it straight away, incorporating the currently selected variables for the currently selected parts of the building these will be explained in greater detail in later sections of this user guide.

Charts List	Help
Chart(1): Tue 01/Apr to Thu 03/Apr	
Chart(2): Fri 04/Apr to Sun 06/Apr	

When charts or tables are created, they are listed in the Charts List menu. You can minimise a chart, and it will remain listed here. When you select it in the list it will be displayed again. If you close a chart, it is removed from the list, and completely removed from memory.

4.1. The Common Chart Dialog

The common chart dialog is used to accommodate the different displays and manipulation for the displayed output. It will appear automatically when one of the output buttons have been clicked on the Output toolbar.

The two main menu items in the common chart dialog are Output and Analysis.

4.1.1. Output Menu

This menu item allows you to:

Copy	Copies the current output to the Windows clipboard for pasting into another application.
Save	Saves the output to the relevant file format.
Print	Prints the display directly to a selected printer.
Report	Creates a HTML report when results are being viewed as a table.
Hide	Minimises the chart so that it can be reactivated again by selecting the chart in the chart list.
Close	Destroys the chart and closes the window, removing it from the chart list.

4.1.2. Analysis Menu

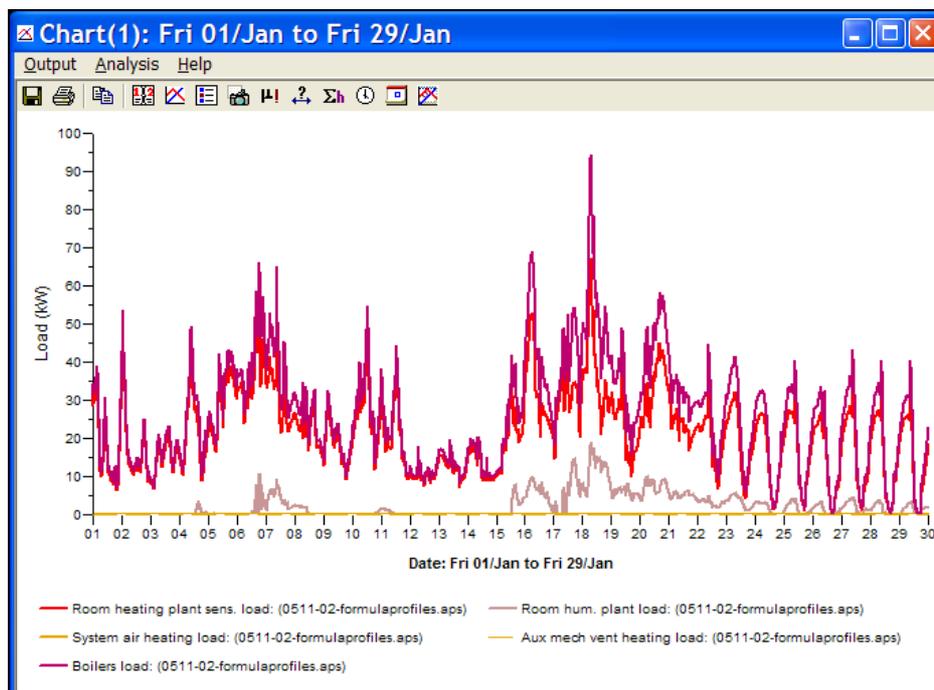
This menu item allows you to change analysis/display options and has the same differet options dependant on the results being viewed:

Set Dates	Changes the days (or time) over which you want to look at results
X-Y Line Graph	Changes the mode to an X-Y plot
Data Table	Changes the display to the source data, displayed in tabular format
Snapshot	Shows data at a specific time and date
Synopsis	Summarises the data, in terms of minimum value, maximum value and mean value over the currently selected period
Ranges	Allows you to test the data over the currently selected dates (above/below/between set values).
Monthly Totals	Allows you to summarise data totals over calendar months. Primarily intended for use with variables which are given in watts or kW
Peak time table	Identifies the peak time for the selected variable and shows any coincident variable data chosen in tabular form
Peak day table	Identifies the peak day for the selected variable and shows any coincident variable data chosen in tabular form

Peak day graph	Identifies the peak day for the selected variable and shows any coincident variable data chosen in graphical form
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4.2. X-Y Chart

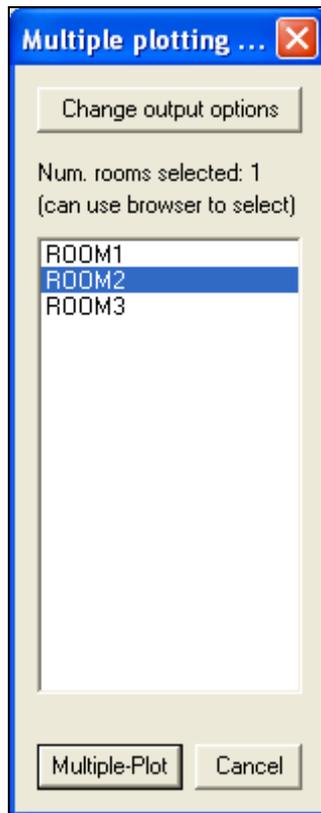
The X-Y chart mode for the common chart dialog allows you to look at a straightforward plot of the currently selected data. If you left-mouse click the graph, you can set the dates for the analysis period. Right-mouse clicking allows you to copy/save/print the graph.



If you have a large number of data selected, it is recommended that you enlarge the window (which will resize automatically) to improve the area within which the graph can be plotted.

4.3. Multiple Room Graph Plotter

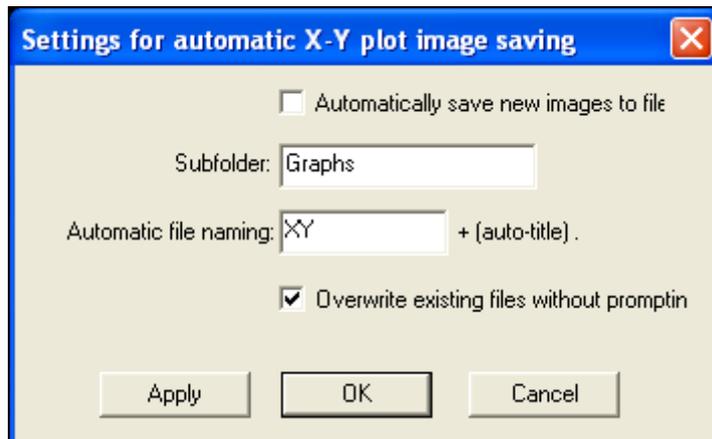
This option enables the user to automatically plot several rooms and output each graph to disk. Until the X-Y chart button is selected then this option is inactive. Once the button becomes active, we can then click the button which will execute the dialogue below:



The user can select any number of rooms from the list of rooms provided (or from the room browser) and then click the button labeled Multiple-Plot. Once clicked, a graph for each room would be saved in an enhanced meta file (*.emf) format which can easily be inserted to any reporting documentation.

Note Enhanced Meta File is a common vector based graphics format which can be easily imported into most word processors, such as: MS Word, Open Office etc.

By default, each file will be saved into a sub-folder of the <project>\Vista\ folder called graphs and each file name will be pre-ceded with XY. Should you wish to change these values then click the button labeled Change Output Options which will execute the settings for automatic X–Y plot image and saving window allowing you to customise these values:



Note this window can also be executed from the menu item Settings > Automatic Graph Saving

4.4. Data Table

This tabular mode allows you to inspect all of the constituent data for the current selections of file, model item and variable. You can use the Output menu to Copy, Save, Print, etc. You can copy the data to the clipboard and paste it into a spreadsheet package, which should automatically drop the data into row/column formats for further analysis. The Analysis > Set Dates menu can also be used to change the analysis period.

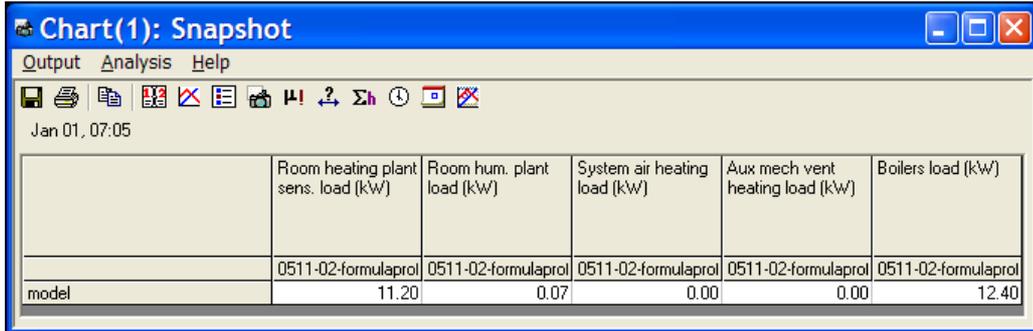
Date	Time	Room heating plant sens. load (kW)	Room hum. plant load (kW)	System air heating load (kW)	Aux mech vent heating load (kW)	Boilers load (kW)
Fri, 01/Jan	00:05	31.12	0.00	0.00	0.00	34.24
	00:15	28.59	0.00	0.00	0.00	31.45
	00:25	29.26	0.00	0.00	0.00	32.19
	00:35	29.46	0.00	0.00	0.00	32.40
	00:45	29.89	0.00	0.00	0.00	32.88
	00:55	29.98	0.00	0.00	0.00	32.98
	01:05	30.04	0.00	0.00	0.00	33.04
	01:15	30.04	0.00	0.00	0.00	33.05
	01:25	30.08	0.00	0.00	0.00	33.08
	01:35	30.12	0.00	0.00	0.00	33.13
	01:45	30.17	0.00	0.00	0.00	33.19
	01:55	30.23	0.00	0.00	0.00	33.25
	02:05	30.19	0.00	0.00	0.00	33.21
	02:15	30.08	0.00	0.00	0.00	33.08
	02:25	30.37	0.00	0.00	0.00	33.41
	02:35	31.25	0.00	0.00	0.00	34.38
	02:45	32.75	0.00	0.00	0.00	36.02
	02:55	34.63	0.00	0.00	0.00	38.09
	03:05	35.34	0.00	0.00	0.00	38.87

If you have quite a few columns in the table, it is recommended that you

enlarge the table manually to improve the appearance of what can be viewed.

4.5. Snapshot

This tabular mode shows the value of any selected variable for the date/time specified:

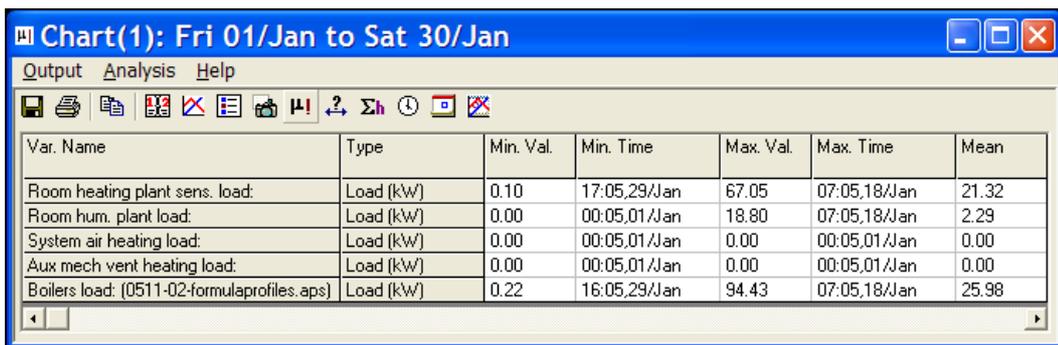


	Room heating plant sens. load (kW)	Room hum. plant load (kW)	System air heating load (kW)	Aux mech vent heating load (kW)	Boilers load (kW)
model	0511-02-formulaprol 11.20	0511-02-formulaprol 0.07	0511-02-formulaprol 0.00	0511-02-formulaprol 0.00	0511-02-formulaprol 12.40

The output can be copied, saved, etc. in the normal way, using the Output menu.

4.6. Synopsis (min/mean/max)

This tabular mode does a quick analysis of the selected data in terms of minimum, mean and maximum values, over the currently selected time period. The times at which the limits are reached are displayed as well.



Var. Name	Type	Min. Val.	Min. Time	Max. Val.	Max. Time	Mean
Room heating plant sens. load:	Load (kW)	0.10	17:05,29/Jan	67.05	07:05,18/Jan	21.32
Room hum. plant load:	Load (kW)	0.00	00:05,01/Jan	18.80	07:05,18/Jan	2.29
System air heating load:	Load (kW)	0.00	00:05,01/Jan	0.00	00:05,01/Jan	0.00
Aux mech vent heating load:	Load (kW)	0.00	00:05,01/Jan	0.00	00:05,01/Jan	0.00
Boilers load: (0511-02-formulaprofiles.aps)	Load (kW)	0.22	16:05,29/Jan	94.43	07:05,18/Jan	25.98

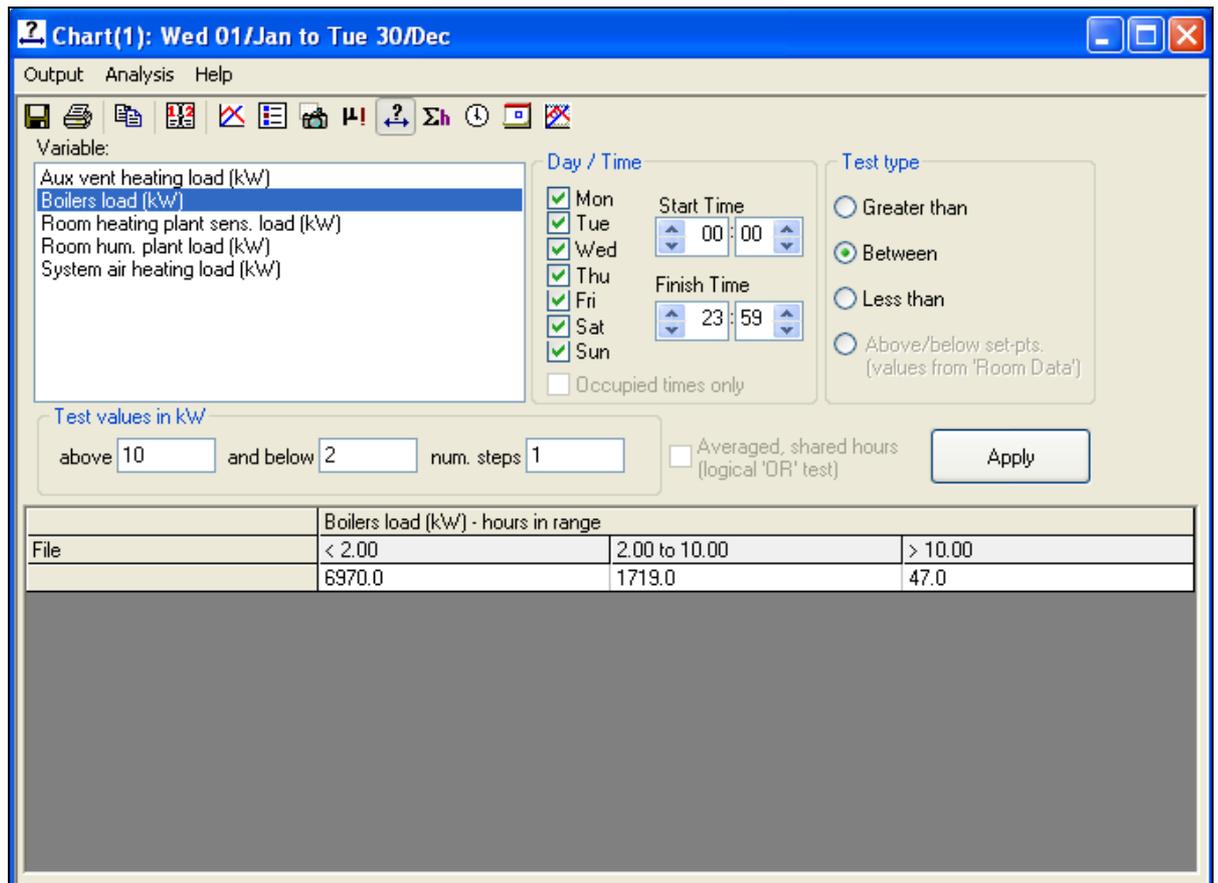
The output can be copied, saved, etc. in the normal way, using the Output menu.

4.7. Range Tests

The range test mode is particularly useful if you want to test for certain

conditions being met in the room of a building. It allows you to test how frequently certain limits are exceeded. The following areas of this dialog are of particular importance:

Variable	Allows you to pick the single variable to be tested.
Test Type	Allows you to select how the test is to be carried out (above certain values, below certain values, or between set limits). 'Above/below set points' tests against the room heating and cooling set points as defined in Room Conditions of the thermal template.
Values	Specifies the limits to be used. The number of steps specifies the number of equal graduations to be used between the specified limits.
Day/Time	Specifies which week days are to be tested within the currently selected period and also which times of day are to be included. 'Occupied times only' restricts the test to only times when there are people in the room as defined by Occupancy gains in thermal template.



Chart(1): Wed 01/Jan to Tue 30/Dec

Output Analysis Help

Variable:

- Aux vent heating load (kW)
- Boilers load (kW)**
- Room heating plant sens. load (kW)
- Room hum. plant load (kW)
- System air heating load (kW)

Day / Time

Mon
 Tue
 Wed
 Thu
 Fri
 Sat
 Sun

Start Time: 00:00
 Finish Time: 23:59

Occupied times only

Test type

Greater than
 Between
 Less than
 Above/below set-pts. (values from 'Room Data')

Test values in kW

above and below num. steps

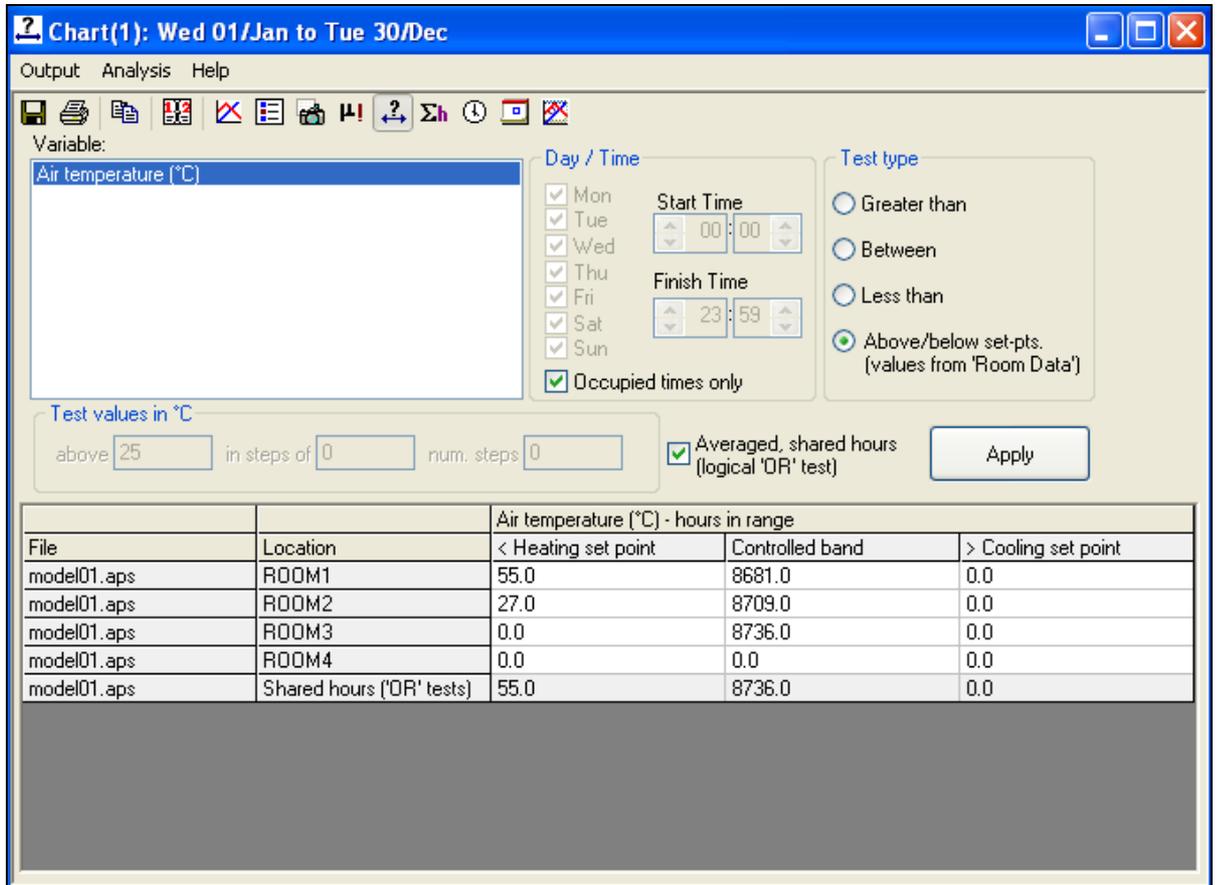
Averaged, shared hours (logical 'OR' test)

Apply

	Boilers load (kW) - hours in range		
File	< 2.00	2.00 to 10.00	> 10.00
	6970.0	1719.0	47.0

Average, Shared hours (logical 'OR' test)

When the average, shared hours checkbox is ticked an additional row is added to the bottom of the table displaying the sum of hours when at least one room in the selection meets the range condition for each column.



Air temperature (°C) - hours in range				
File	Location	< Heating set point	Controlled band	> Cooling set point
model01.apr	ROOM1	55.0	8681.0	0.0
model01.apr	ROOM2	27.0	8709.0	0.0
model01.apr	ROOM3	0.0	8736.0	0.0
model01.apr	ROOM4	0.0	0.0	0.0
model01.apr	Shared hours ('OR' tests)	55.0	8736.0	0.0

Whenever you change the Variable selection, the table at the bottom of the dialog will be updated automatically. However, for other parts of the dialog, you will need to click the apply button to update the range test table.

Note: Above/below set points, Occupied Hours only and Averaged, Shared hours only available for room variables.

If you select more than 2 or 3 steps for the tests, then you may want to enlarge the window to ensure that all the text is visible.

4.8. Monthly Totals

This mode for the common chart dialog will total all data values over a calendar month, based on the simulation time step (default 1 hour). It is primarily intended to total energy and load values as kWh values, allowing power demand and usage to be analysed for the building elements.

Chart(1): Fri 01/Jan to Thu 30/Dec

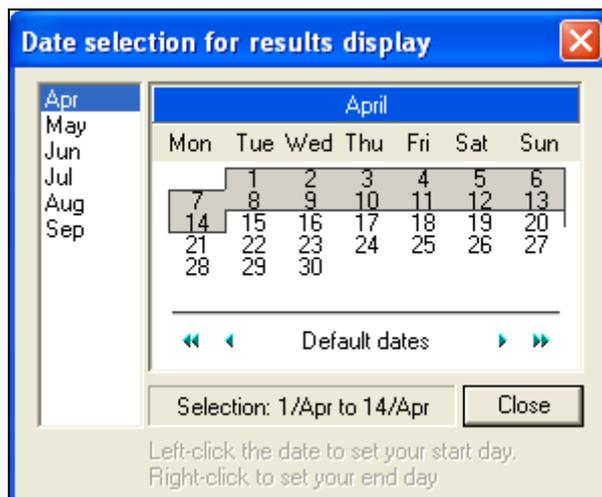
Output Analysis Help

	Room heating plant sens. load (MWh)	Room hum. plant load (MWh)	System air heating load (MWh)	Aux mech vent heating load (MWh)	Boilers load (MWh)
	0511-02-formulaprofile	0511-02-formulaprofile	0511-02-formulaprofile	0511-02-formulaprofile	0511-02-formulaprofile
Date					
Jan 01-31	15.701	1.683	0.000	0.000	19.122
Feb 01-28	11.924	0.790	0.000	0.000	13.985
Mar 01-31	9.632	1.581	0.000	0.000	12.334
Apr 01-30	8.334	1.108	0.000	0.000	10.387
May 01-31	1.860	0.026	0.000	0.000	2.075
Jun 01-30	0.683	0.004	0.000	0.000	0.756
Jul 01-31	0.108	0.031	0.000	0.000	0.152
Aug 01-31	0.254	0.015	0.000	0.000	0.296
Sep 01-30	0.869	0.073	0.000	0.000	1.036
Oct 01-31	2.993	0.007	0.000	0.000	3.300
Nov 01-30	8.051	0.470	0.000	0.000	9.373
Dec 01-30	13.057	0.346	0.000	0.000	14.743
Summed total	73.466	6.132	0.000	0.000	87.558

If several variables are selected, you may need to enlarge the window to allow you to see all of the text.

4.9. Set Dates

The Set Dates dialog is used to set the start and finish dates for viewing in the common chart dialog.



In the main month area of the dialog, if you left-mouse click a day, then that day will be set as the start day to view. You can right-mouse click a day to set that day as the end-day. Move between months using the list at the left of the dialog. All currently selected days are displayed with a grey background.

Click Default Dates to select the entire simulation period.

Click the blue single arrow (backwards or forwards) to move the whole selected period by the same duration as the span between the start and end days. That is, if you select 7 days of a month, and you click the Next Selection single arrow button, then the selection will be moved forwards one week. If you select a whole calendar month, and click the same button, then it will move the whole selection one month forward.

Click the blue double arrow (backwards or forwards) to skip to the corresponding month, in order to make a selection.

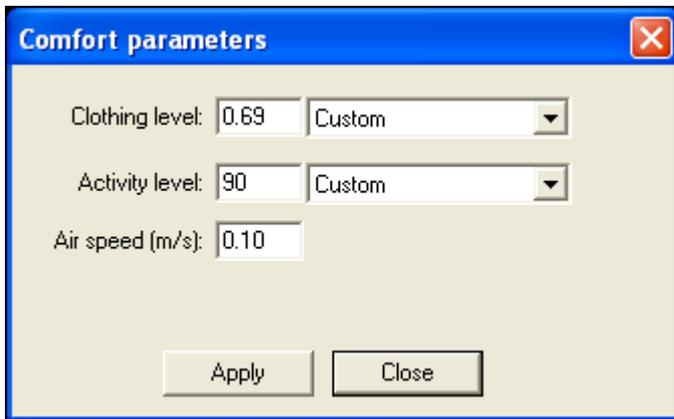
Any changes in this dialog will be immediately reflected in the associated common chart dialog which is displayed at the time.

In the case of a Snapshot the date is taken to be the

4.10. Comfort

4.10.1. Comfort Settings

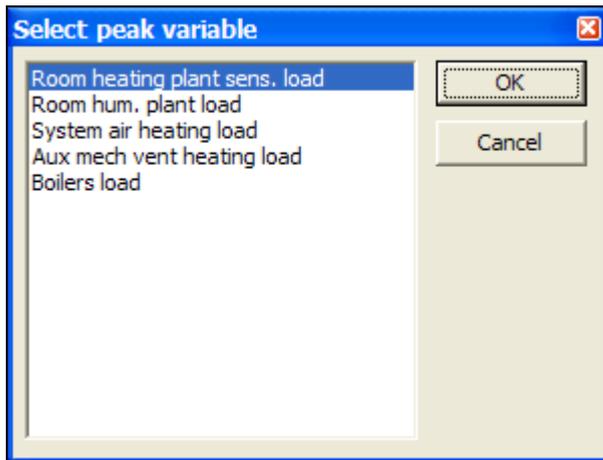
By selecting the comfort settings button on the Vista toolbar, the user is presented with the dialog below, enabling them to define their comfort parameters. By default, the comfort settings are initialised to sensible values.



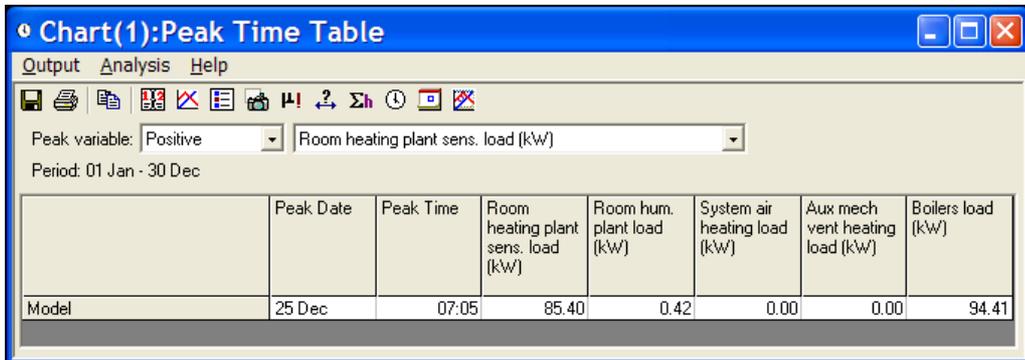
From the drop down list provided, the user may choose from a pre-defined list or opt to enter a customised value. Once the user is happy with their new settings, simply click the Apply button to change the current settings/parameters.

4.11. Peak Time Table

The peak time table takes a variable and shows produces a table that shows the peak time of the peak value of that variable. Firstly the variables have to be selected, this is done from the variables list, then after selecting the peak time table button a dialog appears:



Once the peak variable has been selected the peak time table is shown as below:

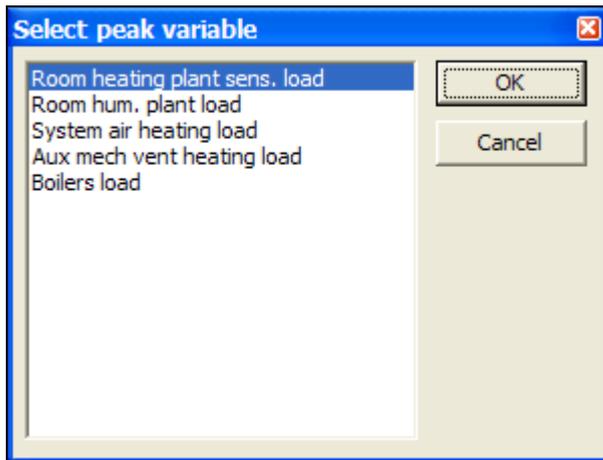


	Peak Date	Peak Time	Room heating plant sens. load (kW)	Room hum. plant load (kW)	System air heating load (kW)	Aux mech vent heating load (kW)	Boilers load (kW)
Model	25 Dec	07:05	85.40	0.42	0.00	0.00	94.41

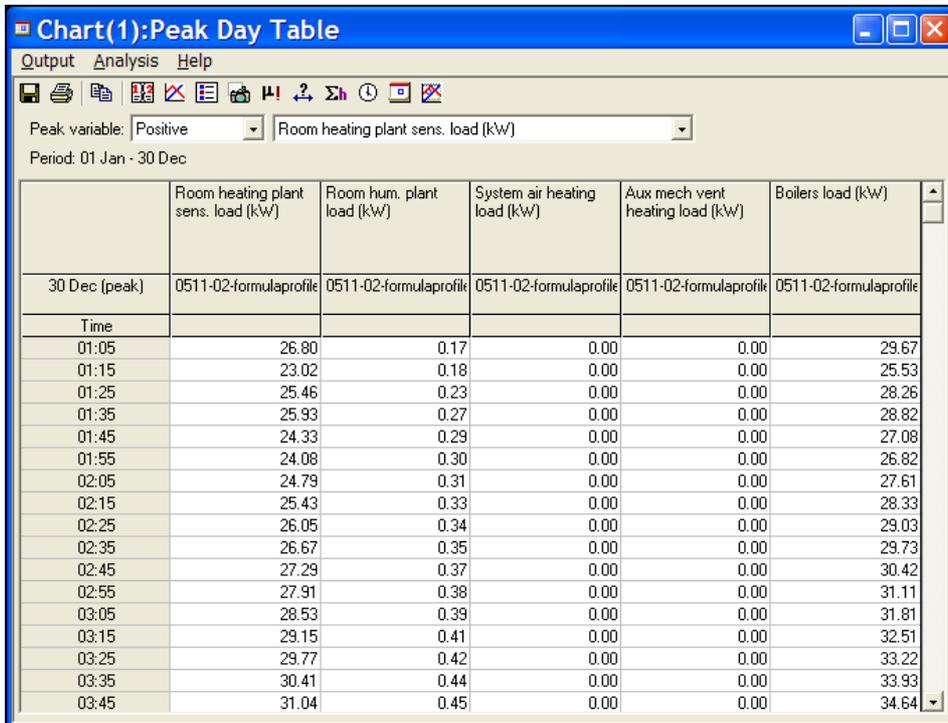
The drop down list at the top of the peak time table will change the peak variable.

4.12. Peak Day Table

The peak day table takes a variable and shows produces a table that shows the peak day of the peak value of that variable. Firstly the variables have to be selected, this is done from the variables list, then after selecting the peak day table button a dialog appears:



Once the peak variable has been selected the peak day table is shown as below:

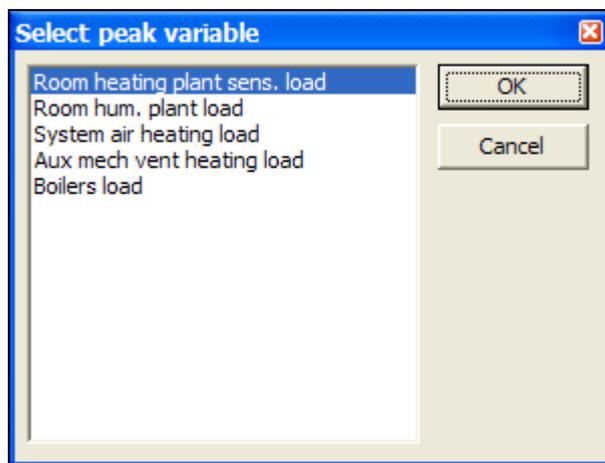


	Room heating plant sens. load (kW)	Room hum. plant load (kW)	System air heating load (kW)	Aux mech vent heating load (kW)	Boilers load (kW)
30 Dec (peak)	0511-02-formulaprofile	0511-02-formulaprofile	0511-02-formulaprofile	0511-02-formulaprofile	0511-02-formulaprofile
Time					
01:05	26.80	0.17	0.00	0.00	29.67
01:15	23.02	0.18	0.00	0.00	25.53
01:25	25.46	0.23	0.00	0.00	28.26
01:35	25.93	0.27	0.00	0.00	28.82
01:45	24.33	0.29	0.00	0.00	27.08
01:55	24.08	0.30	0.00	0.00	26.82
02:05	24.79	0.31	0.00	0.00	27.61
02:15	25.43	0.33	0.00	0.00	28.33
02:25	26.05	0.34	0.00	0.00	29.03
02:35	26.67	0.35	0.00	0.00	29.73
02:45	27.29	0.37	0.00	0.00	30.42
02:55	27.91	0.38	0.00	0.00	31.11
03:05	28.53	0.39	0.00	0.00	31.81
03:15	29.15	0.41	0.00	0.00	32.51
03:25	29.77	0.42	0.00	0.00	33.22
03:35	30.41	0.44	0.00	0.00	33.93
03:45	31.04	0.45	0.00	0.00	34.64

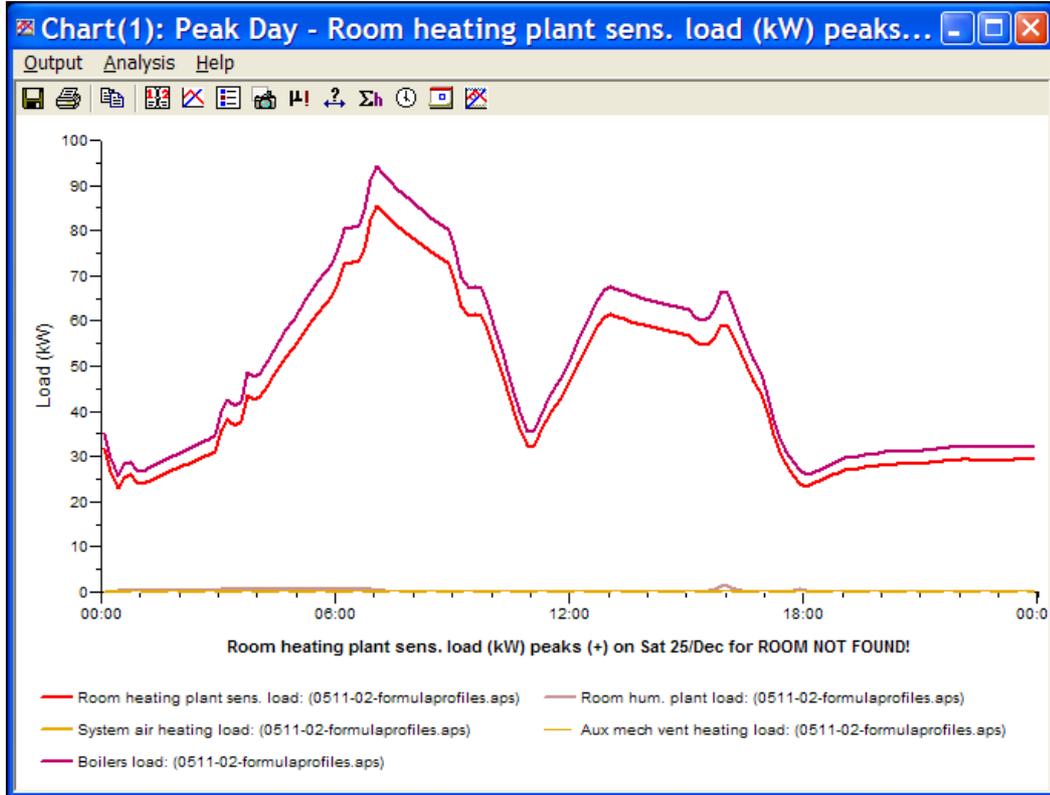
The drop down list at the top of the peak day table will change the peak variable.

4.13. Peak Day Graph

The peak day graph takes a variable and shows produces a table that shows the peak day of the peak value of that variable. Firstly the variables have to be selected, this is done from the variables list, then after selecting the peak day graph button a dialog appears:



Once the peak variable has been selected the peak day graph is shown as below:



The drop down list at the top of the peak day graph will change the peak variable.

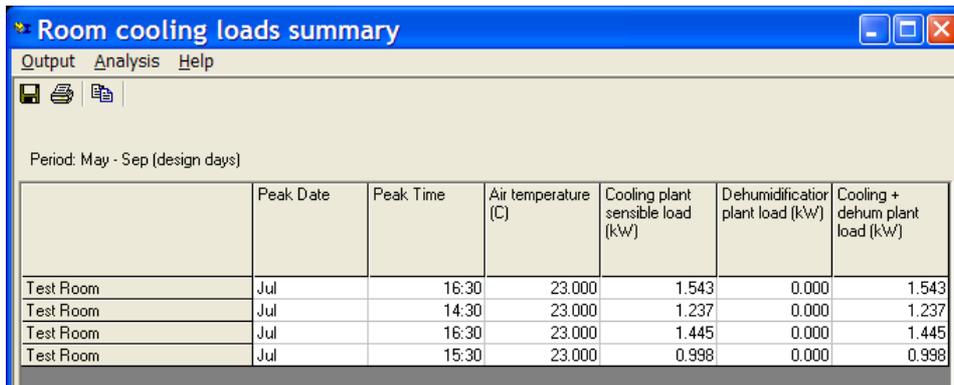
4.14. Heating Loads Summary

The heating loads summary button only appears if heat loss in ApacheCalc or heating loads in ApacheLoads. This summary identifies the heating loads and all the losses that make up the heating load on the room:

Room heating loads summary								
Output Analysis Help								
Jan, 12:00								
	Air temperature (C)	Heating plant sensible load (kW)	External conduction gain (kW)	Internal conduction gain (kW)	Air system input sensible (kW)	Aux mech vent gain (kW)	Natural vent gain (kW)	Infiltration gain (kW)
	0511-02-Foi	0511-02-Foi	0511-02-Foi	0511-02-Fo	0511-02-Foi	0511-02-Foi	0511-02-Foi	0511-02-Foi
Test Room	19.00	1.712	-0.600	-0.001	0.000	-1.111	0.000	0.000
Test Room	19.00	1.712	-0.600	-0.001	0.000	-1.111	0.000	0.000
Test Room	19.00	1.712	-0.600	-0.001	0.000	-1.111	0.000	0.000
Test Room	19.00	1.712	-0.600	-0.001	0.000	-1.111	0.000	0.000

4.15. Cooling Loads Summary

The cooling loads summary button only appears if heat gains in ApacheCalc or cooling loads in ApacheLoads. This summary identifies the cooling loads and all the gains that make up the cooling load on the room:



Room cooling loads summary

Output Analysis Help

Period: May - Sep (design days)

	Peak Date	Peak Time	Air temperature (C)	Cooling plant sensible load (kW)	Dehumidification plant load (kW)	Cooling + dehum plant load (kW)
Test Room	Jul	16:30	23.000	1.543	0.000	1.543
Test Room	Jul	14:30	23.000	1.237	0.000	1.237
Test Room	Jul	16:30	23.000	1.445	0.000	1.445
Test Room	Jul	15:30	23.000	0.998	0.000	0.998

4.16. Cooling Loads Detail

The cooling loads detail button only appears if heat gains in ApacheCalc or cooling loads in ApacheLoads. This dialog identifies the cooling loads and all the gains that make up the cooling load on the room for the currently selected period.

Room cooling loads detail - Test Room

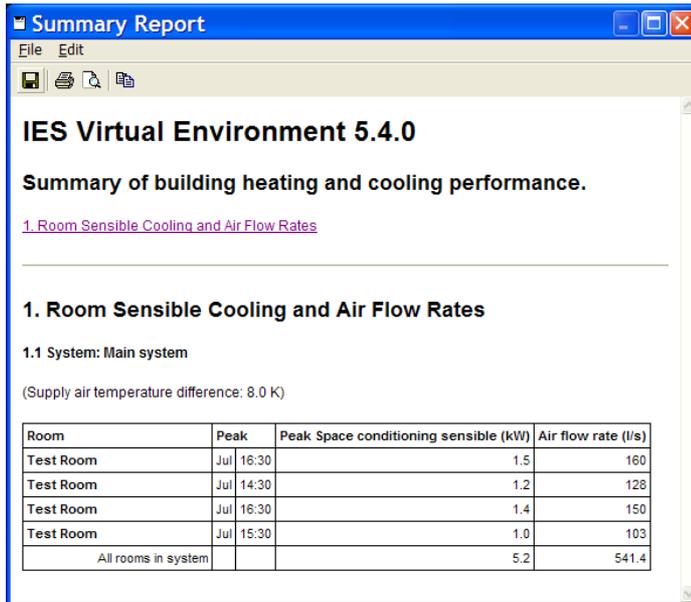
Output Analysis Help

Period: May - Sep (design days)

	Air temperature (C)	Cooling plant sensible load (kW)	Dehumid plant	Cooling + dehum plant load (kW)	Operative temperature (C)	Internal gain (kW)	Solar gain (kW)	External conductive gain	Internal conductive gain	Aux mech vent gain (kW)	Natural vent gain (kW)	Infiltration gain (kW)
Aug (peak)	Test Room	Test Room	Test Room	Test Room	Test Room	Test Room	Test Room	Test Room	Test Room	Test Room	Test Room	Test Room
Time	0511-02-	0511-02-	0511-02-	0511-02-	0511-02-	0511-02-	0511-02-	0511-02-	0511-02-	0511-02-	0511-02-	0511-02-
01:30	22.44	0.000	0.000	0.000	22.43	0.000	0.000	-0.025	0.022	0.000	0.000	0.000
02:30	22.31	0.000	0.000	0.000	22.30	0.000	0.000	-0.027	0.024	0.000	0.000	0.000
03:30	22.17	0.000	0.000	0.000	22.17	0.000	0.000	-0.029	0.026	0.000	0.000	0.000
04:30	22.04	0.000	0.000	0.000	22.04	0.000	0.000	-0.030	0.028	0.000	0.000	0.000
05:30	21.92	0.000	0.000	0.000	21.92	0.000	0.000	-0.031	0.029	0.000	0.000	0.000
06:30	22.34	0.017	0.000	0.017	22.43	0.000	0.267	-0.234	0.001	0.000	0.000	0.000
07:30	22.97	0.263	0.000	0.263	23.45	0.000	0.795	-0.475	-0.054	0.000	0.000	0.000
08:30	23.00	0.584	0.000	0.584	23.99	0.000	1.223	-0.550	-0.090	0.000	0.000	0.000
09:30	23.00	0.375	0.000	0.375	24.23	0.096	1.293	-0.492	-0.096	-0.426	0.000	0.000
10:30	23.00	0.488	0.000	0.488	24.19	0.096	1.127	-0.356	-0.081	-0.298	0.000	0.000
11:30	23.00	0.500	0.000	0.500	23.96	0.096	0.791	-0.182	-0.053	-0.153	0.000	0.000
12:30	23.00	0.419	0.000	0.419	23.63	0.048	0.428	-0.032	-0.022	-0.002	0.000	0.000
13:30	23.00	0.506	0.000	0.506	23.52	0.096	0.315	-0.015	-0.013	0.124	0.000	0.000
14:30	23.00	0.591	0.000	0.591	23.51	0.096	0.307	-0.014	-0.013	0.214	0.000	0.000
15:30	23.00	0.629	0.000	0.629	23.49	0.096	0.288	-0.008	-0.011	0.264	0.000	0.000
16:30	23.00	0.606	0.000	0.606	23.45	0.096	0.259	-0.005	-0.009	0.264	0.000	0.000

4.17. Air Flow Sizing Summary

The air flow sizing summary button only appears if heat gains in ApacheCalc or cooling loads in ApacheLoads. This dialog identifies the air flows into all chosen rooms.



Summary Report
File Edit

IES Virtual Environment 5.4.0
Summary of building heating and cooling performance.

[1. Room Sensible Cooling and Air Flow Rates](#)

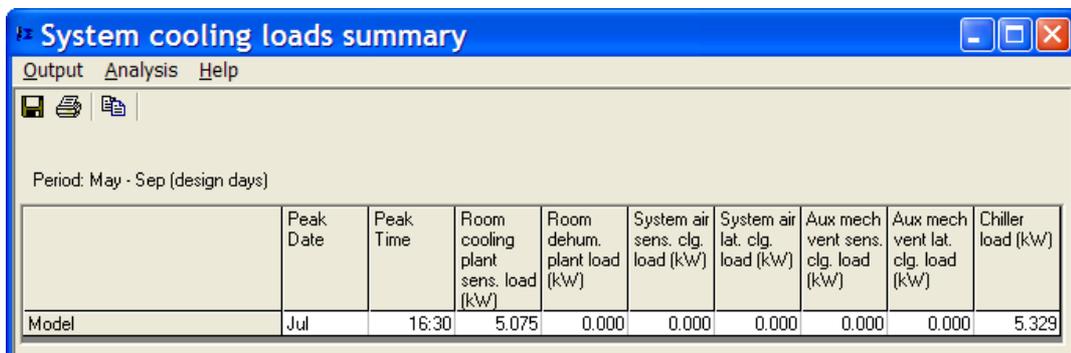
1. Room Sensible Cooling and Air Flow Rates

1.1 System: Main system
(Supply air temperature difference: 8.0 K)

Room	Peak	Peak Space conditioning sensible (kW)	Air flow rate (l/s)
Test Room	Jul 16:30	1.5	160
Test Room	Jul 14:30	1.2	128
Test Room	Jul 16:30	1.4	150
Test Room	Jul 15:30	1.0	103
All rooms in system		5.2	541.4

4.18. System Cooling Loads Summary

The system cooling loads summary button only appears if heat gains in ApacheCalc or cooling loads in ApacheLoads. This dialog identifies the loads on the apache system that are used in the model.



System cooling loads summary

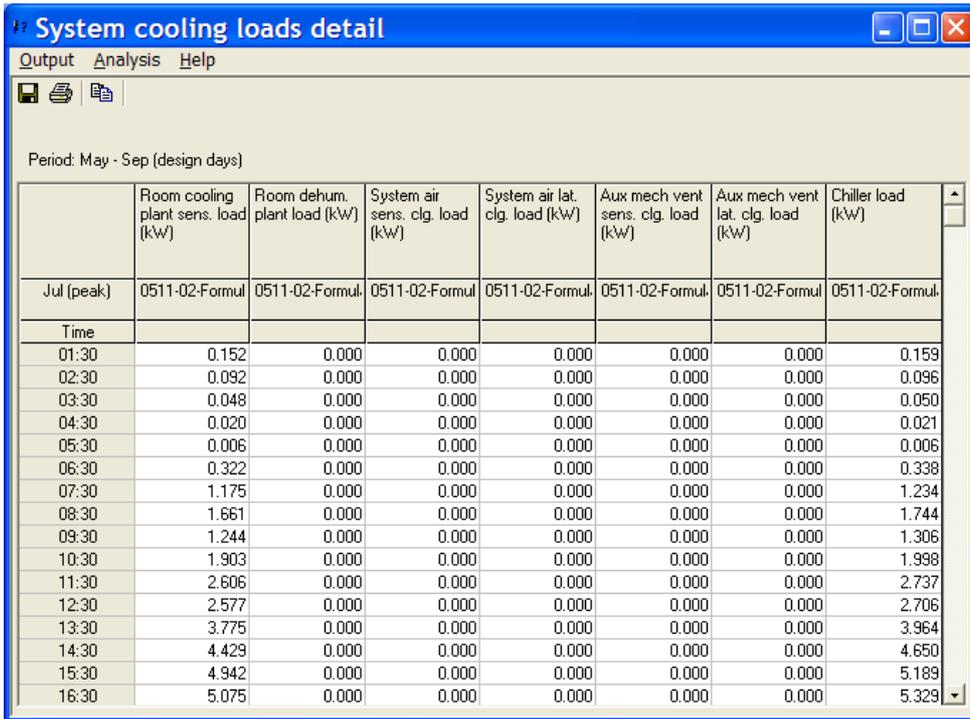
Output Analysis Help

Period: May - Sep (design days)

	Peak Date	Peak Time	Room cooling plant sens. load (kW)	Room dehum. plant load (kW)	System air sens. clg. load (kW)	System air lat. clg. load (kW)	Aux mech. vent sens. clg. load (kW)	Aux mech. vent lat. clg. load (kW)	Chiller load (kW)
Model	Jul	16:30	5.075	0.000	0.000	0.000	0.000	0.000	5.329

4.19. System Cooling Loads Detail

The system cooling loads detail button only appears if heat gains in ApacheCalc or cooling loads in ApacheLoads. This dialog identifies the loads on the apache system that are used in the model detailed by the current selected time step.



	Room cooling plant sens. load (kW)	Room dehum. plant load (kW)	System air sens. clg. load (kW)	System air lat. clg. load (kW)	Aux mech vent sens. clg. load (kW)	Aux mech vent lat. clg. load (kW)	Chiller load (kW)
Jul (peak)	0511-02-Formul	0511-02-Formul	0511-02-Formul	0511-02-Formul	0511-02-Formul	0511-02-Formul	0511-02-Formul
Time							
01:30	0.152	0.000	0.000	0.000	0.000	0.000	0.159
02:30	0.092	0.000	0.000	0.000	0.000	0.000	0.096
03:30	0.048	0.000	0.000	0.000	0.000	0.000	0.050
04:30	0.020	0.000	0.000	0.000	0.000	0.000	0.021
05:30	0.006	0.000	0.000	0.000	0.000	0.000	0.006
06:30	0.322	0.000	0.000	0.000	0.000	0.000	0.338
07:30	1.175	0.000	0.000	0.000	0.000	0.000	1.234
08:30	1.661	0.000	0.000	0.000	0.000	0.000	1.744
09:30	1.244	0.000	0.000	0.000	0.000	0.000	1.306
10:30	1.903	0.000	0.000	0.000	0.000	0.000	1.998
11:30	2.606	0.000	0.000	0.000	0.000	0.000	2.737
12:30	2.577	0.000	0.000	0.000	0.000	0.000	2.706
13:30	3.775	0.000	0.000	0.000	0.000	0.000	3.964
14:30	4.429	0.000	0.000	0.000	0.000	0.000	4.650
15:30	4.942	0.000	0.000	0.000	0.000	0.000	5.189
16:30	5.075	0.000	0.000	0.000	0.000	0.000	5.329

4.20. Building and System Loads Summary

This summary creates a HTML report that shows a summary of both the heat loss/heating loads and heat gains/cooling loads. An example of this output is shown below:

IES Virtual Environment 5.4.0

Summary of building heating and cooling performance.

1. General Summary

Model Data

Project file: "0511-02-FormulaProfiles.mit"

Model total floor area = 42.7 m²

Cooling Calculation Data

Cooling results file: "0511-02-FormulaProfiles.clg"

Calculated at 14:49 on 03/Nov/05

Heating Calculation Data

Heating results file: "0511-02-FormulaProfiles.htg"

Calculated at 14:49 on

03/Nov/05

 Model total volume = 110.6 m³ Calc. Period: May - Sep
 Number of rooms = 4

Calc. Period: January

2. Building Heating Loads Summary

System	Room load (kW)		Air heating load (kW)		Boiler load	
	Heating plant sens.	Hum. plant	System air	Aux mech vent	(kW)	(W/m ²)
Main system	6.85	1.31	0.00	0.00	8.98	210.25
Auxiliary Mech Vent	0.00	0.00	0.00	0.00	0.00	n/a
Total	6.85	1.31	0.00	0.00	8.98	210.25

3. Room Heating Plant Loads

Room	Air temp. (C)	Conduction gain (kW)		Air system input sensible (kW)	Ventilation gain (kW)			Heating plant sensible load (kW)
		External	Internal		Aux mech vent	Infiltration	Natural vent	
Test Room	19.00	-0.60	-0.00	0.00	-1.11	0.00	0.00	1.71
Test Room	19.00	-0.60	-0.00	0.00	-1.11	0.00	0.00	1.71
Test Room	19.00	-0.60	-0.00	0.00	-1.11	0.00	0.00	1.71
Test Room	19.00	-0.60	-0.00	0.00	-1.11	0.00	0.00	1.71

4. Building Cooling Loads Summary

Peak	Room load (kW)		System air clg. load (kW)		Aux mech vent clg. load (kW)		Chillers load		
Day	Date	Cooling plant sens.	Dehum. plant	Sens.	Lat.	Sens.	Lat.	(kW)	(W/m ²)
Jul	16:30	5.07	0.00	0.00	0.00	0.00	0.00	5.33	124.81

5. System Cooling Loads

System	Peak		Room load (kW)		System air clg. load (kW)		Aux mech vent clg. load (kW)		Chiller load	
	Day	Date	Cooling plant sens.	Dehum. plant	Sens.	Lat.	Sens.	Lat.	(kW)	(W/m ²)
Main system	Jul	16:30	5.07	0.00	0.00	0.00	0.00	0.00	5.33	124.81
Auxiliary Mech Vent	May	00:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a

6. Room Sensible Cooling and Air Flow Rates

6.1 System: Main system

(Supply air temperature difference: 8.0 K)

Room	Peak		Peak Space conditioning sensible (kW)	Air flow rate (l/s)
Test Room	Jul	16:30	1.5	160
Test Room	Jul	14:30	1.2	128

Test Room	Jul	16:30	1.4	150
Test Room	Jul	15:30	1.0	103
All rooms in system			5.2	541.4

7. Room Cooling Plant Loads

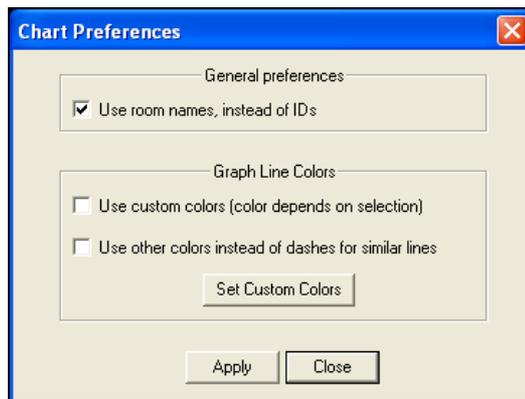
Room	Peak		Air temp. (C)	Load (kW)		
	Day	Date		Cooling plant sensible	Dehumidification plant	Cooling + dehum plant
Test Room	Jul	16:30	23.00	1.54	0.00	1.54
Test Room	Jul	14:30	23.00	1.24	0.00	1.24
Test Room	Jul	16:30	23.00	1.44	0.00	1.44
Test Room	Jul	15:30	23.00	1.00	0.00	1.00

5. General Settings

General settings for Vista can be set using the Settings menu items.

5.1. Graph Line Colours

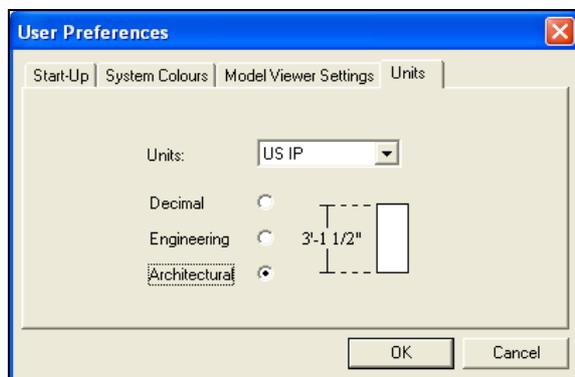
This menu item executes the dialogue shown below:



From here we can customise the colour for each variable that is to be displayed in the graph.

5.2. Units Display

By default, the units are displayed in metric format. To display then in an alternative format, select the desired format from the main Virtual Environment menu (Settings -> Preferences... -> Units):

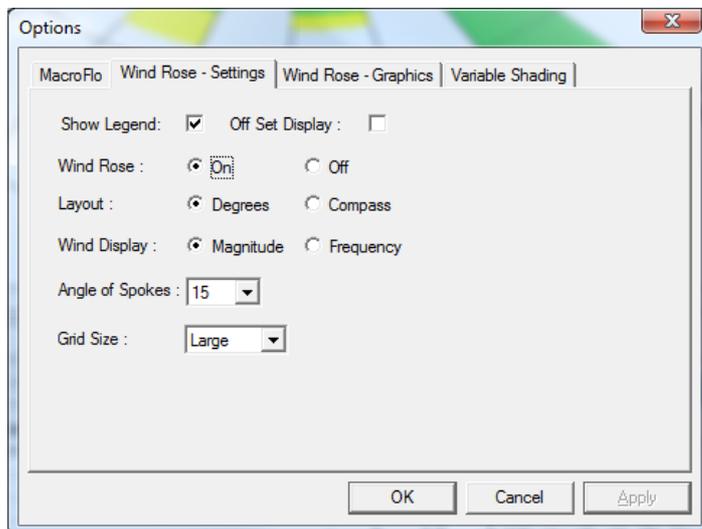
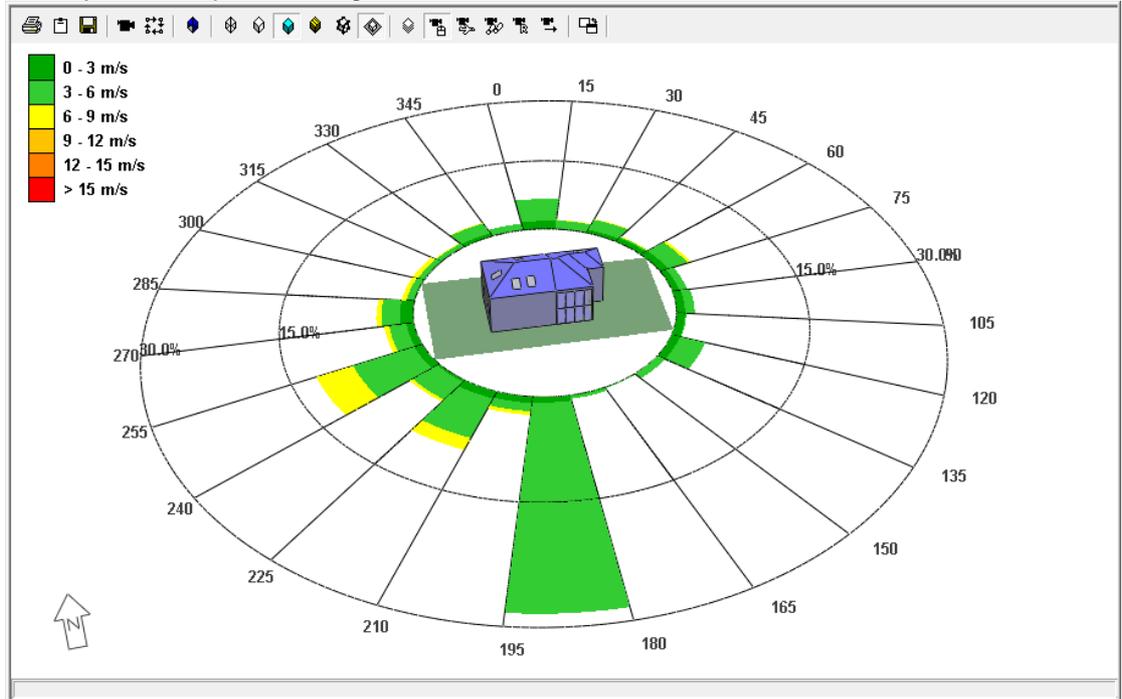


5.3. Automatic Graph Saving

See section 3.3 Multiple Room Graph Plotter.

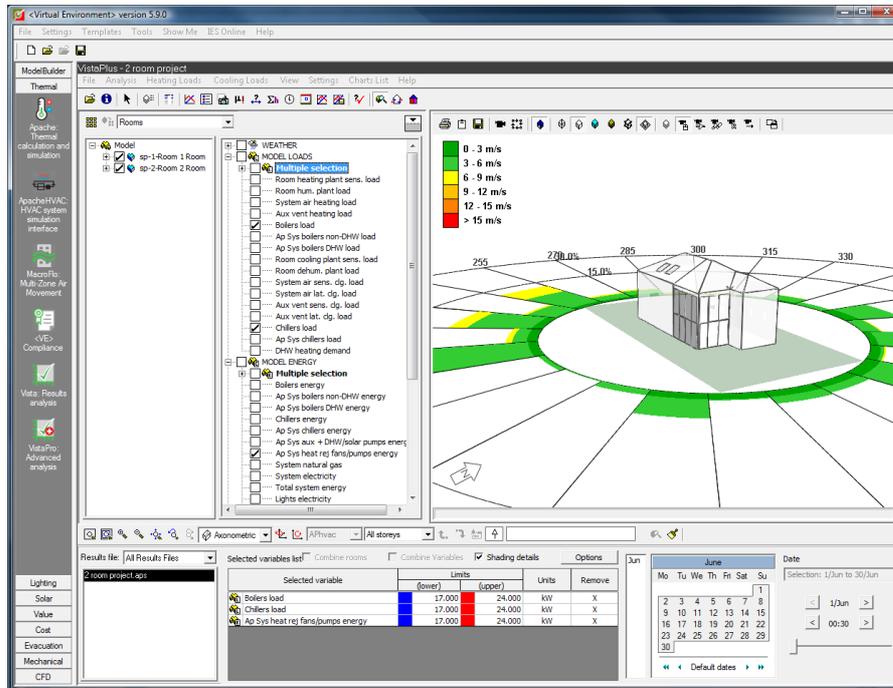
6.4. Wind Rose

A visual representation of the main wind directions for the chosen location. View settings for the wind rose can be adjusted in *Options* dialog.

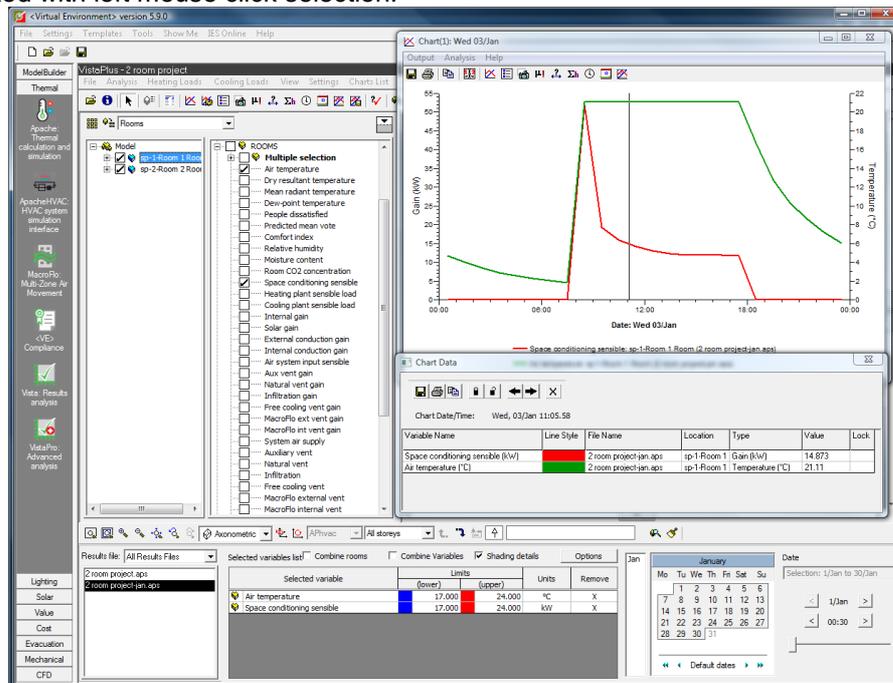


6.5. Look & Feel

New look & feel features include tree representation of results data, colour coding for model shading by result and Time / Day / Date animation selection.



The tree control for Vista-Pro[BETA] results allows multi-selection at different levels. Graph values can be tracked with left mouse click selection.



7. Vista Variables

The meanings of the Vista variables are defined below. Any variables appearing in Vista that are not listed here are obsolete variables generated by earlier versions of the software, and are identified as such by the tag '(obs)' in the variable name.

7.1. Weather Variables

Dry-bulb temperature: The external air temperature measured in a standard meteorological screen.

Wet-bulb temperature: The temperature measured by a wet-bulb thermometer in a standard meteorological screen.

External dew-point temperature: The dew-point temperature of the external air (the temperature at which the air would become saturated if cooled)

Wind direction: The direction from which the wind is blowing, measured clockwise from true north.

The wind speed measured at a height of 10m above the ground.

Direct radiation: The intensity (irradiance) of the solar beam emanating from the sun's disc and the region of sky immediately around it, measured perpendicular to the beam.

Diffuse radiation: The intensity (irradiance) of solar radiation emanating from the sky, excluding that portion immediately around the sun, measured on the horizontal plane.

Global radiation: The intensity (irradiance) of solar radiation falling on the horizontal plane.

Solar altitude: The angular elevation of the centre of the sun's disc above the horizontal plane.

Solar azimuth: The horizontal angle between the vertical plane containing the centre of the sun's disc and the vertical plane running in a true north-south direction, measured clockwise from true north.

Cloud cover: The proportion of the sky covered by cloud.

Atmospheric pressure: The pressure exerted by the atmosphere.

External relative humidity: The relative humidity of the external air (water vapour pressure expressed as a percentage of saturated vapour pressure)

External moisture content: The moisture content of the external air (mass of water vapour expressed as a fraction of mass of dry air)

7.2. Model Level Variables

These variables are accessed by clicking on 'Model' in the browser. They are organized in three groups: Loads, Energy and Carbon.

7.2.1. Loads

Room heating plant sens. load: The sum of the room heating plant sensible loads for all rooms in the building.

ApHVAC room units heating load: When an ApacheHVAC system is in use, the sum of the heating loads on all radiators and direct acting heaters.

Room hum. plant load: The sum of the room humidification plant sensible loads for all rooms in the building.

System air heating load: The total of the system air heating loads for all Apache Systems.

Aux vent heating load: The total auxiliary ventilation heating load for the building (handled by Apache Systems).

ApHVAC heating coils load: When an ApacheHVAC system is in use, the sum of the heating loads on all heating coils.

ApHVAC steam humidifiers load: When an ApacheHVAC system is in use, the sum of the loads on all steam humidifiers.

Boilers load: The sum of the loads (outputs) for all boilers (in both Apache Systems and ApacheHVAC systems).

ApHVAC heat pumps load: When an ApacheHVAC system is in use, the sum of the loads on all heat pumps.

Room cooling plant sens. load: The sum of the room cooling plant sensible loads for all rooms in the building.

ApHVAC room units cooling load: When an ApacheHVAC system is in use, the sum of the cooling loads on all direct acting coolers and chilled beams.

Room dehum. plant load: The sum of the dehumidification plant sensible loads for all rooms in the building.

System air sens. clg load: The total of the system air sensible cooling loads for all Apache Systems.

System air lat. clg. load: The total of the system air latent cooling loads for the building (handled by Apache Systems).

Aux vent sens. clg. load: The total auxiliary ventilation sensible cooling load for the building (handled by Apache Systems).

Aux vent lat. clg. load: The total auxiliary ventilation latent cooling loads for the building (handled by Apache Systems).

ApHVAC cooling coils load: When an ApacheHVAC system is in use, the sum of the cooling loads on all cooling coils (including any latent component).

Chillers load: The sum of the loads (outputs) for all chillers (in both Apache Systems and ApacheHVAC systems).

ApHVAC recovered sensible heat: When an ApacheHVAC system is in use, the net sensible heat (or if negative, net sensible cooling) recovered by heat recovery components.

ApHVAC recovered latent heat: When an ApacheHVAC system is in use, the net latent heat (or if negative, net latent cooling) recovered by heat recovery components.

DHW heating demand: The total DHW heating demand at the hot water outlets (i.e. excluding pipe and tank losses) calculated on the basis of a 50K temperature rise from the cold water main.

CHP generated heat: The heat contributed by the CHP plant, if present. This heat is assumed to be input at the same point as heat from boilers – i.e. upstream of distribution losses.

7.2.2. Energy

Boilers energy: The total energy consumption for boilers (in both Apache Systems and ApacheHVAC systems).

Chillers energy: The total energy consumption for chillers (in both Apache Systems and ApacheHVAC systems).

ApHVAC direct acting heaters energy: When an APhvac system is in use, the energy consumption for direct acting heaters.

ApHVAC direct acting coolers energy: When an APhvac system is in use, the energy consumption for by direct acting coolers (direct acting heaters working in cooling mode).

ApHVAC heat pumps energy: When an APhvac system is in use, the energy consumption for heat pumps.

ApHVAC fans energy: The total energy consumption for fans (in both Apache Systems and ApacheHVAC systems).

ApHVAC pumps energy: The total energy consumption for central plant pumps (in both Apache Systems and ApacheHVAC systems).

ApHVAC HR & spray pumps energy: When an APhvac system is in use, the total energy consumption for heat recovery components and spray pumps.

Ap Sys fans/pumps/ctrls energy: Energy consumed by fans, pumps and controls within Apache Systems. Includes auxiliary energy, chiller heat rejection pump energy, and pump energy associated with DHW and solar water heating systems.

PV generated electricity: Electricity generated by a photovoltaic system, if present. Negative by convention.

Wind generated electricity: Electricity generated by a wind turbine, if present. Negative by convention.

CHP generated electricity: Electricity generated by a CHP system, if present. Negative by convention.

System electricity: The system electrical energy consumption.

System <fuel>: The system energy consumption associated with the named fuel. In the case of grid displaced electricity includes a negative contribution from any electricity generated by PV, wind turbine and CHP systems.

Total system energy: The total system energy consumption, calculated as the sum of the energy consumptions for system components, or alternatively as the sum of system fuel consumptions. Includes a negative contribution from any electricity generated by PV, wind turbine and CHP systems.

Equipment electricity: Electrical energy consumption associated with equipment gains (internal gains excluding lighting). This variable is not reduced by electricity generation by PV, wind turbines and CHP systems

Equipment <fuel>: Energy consumption associated with equipment gains (internal gains excluding lighting) using the named fuel. This variable is not reduced by

electricity generation by PV, wind turbines and CHP systems

Total equipment energy: Total energy consumption associated with equipment gains (internal gains excluding lighting). This variable is not reduced by electricity generation by PV, wind turbines and CHP systems

Lights electricity: Electrical energy consumption associated with lighting. This variable is not reduced by electricity generation by PV, wind turbines and CHP systems.

Lights <fuel>: Energy consumption associated with lighting. This variable is not reduced by electricity generation by PV, wind turbines and CHP systems.

Total lights energy: Total energy consumption associated with lighting. This variable is not reduced by electricity generation by PV, wind turbines and CHP systems.

Total electricity: Total electrical energy consumption for systems, lights and small power. This variable is not reduced by electricity generation by PV, wind turbines and CHP systems.

Total <fuel>: Total energy consumption for systems, lights and small power using the named fuel. In the case of the 'fuel' grid displaced electricity – electricity generated by PV, wind turbine and CHP systems – the variable is negative by convention.

Total energy: Total energy consumption for systems, lights and small power. Includes a negative contribution from any electricity generated by PV, wind turbine and CHP systems.

7.2.3. Carbon

System elec. CE: Carbon emissions produced by system electrical consumption.

System <fuel> CE: Carbon emissions produced by consumption of the named fuel by systems. In the case of grid displaced electricity includes a negative contribution from any electricity generated by PV, wind turbine and CHP systems.

Total system CE: Total carbon emissions produced by systems. Includes a negative contribution from any electricity generated by PV, wind turbine and CHP

Equipment elec. CE: Carbon emissions produced by electrical energy consumption associated with equipment gains (internal gains excluding lighting).

Equipment <fuel> CE: Carbon emissions associated with equipment gains (internal gains excluding lighting) powered by the named fuel.

Total equipment CE: Total carbon emissions associated with equipment gains (internal gains excluding lighting).

Total electricity CE: Total carbon emissions associated with electrical energy consumption for systems, lights and small power. This variable is not reduced by electricity generation by PV, wind turbines and CHP systems.

Total <fuel> CE: Total carbon emissions associated with consumption of the named fuel. In the case of grid displaced electricity – electricity generated by PV, wind turbine and CHP systems – the variable is negative by convention.

Total CE: Total carbon emissions for the building and its systems. Includes a negative contribution from any electricity generated by PV, wind turbine and CHP systems.

Total CE ex equip: Total carbon emissions for the building and its systems, excluding emissions associated with equipment (which do not feature in the

emission calculations for the UK Building Regulations). Includes a negative contribution from any electricity generated by PV, wind turbine and CHP systems.

7.3. Apache System Variables

These variables are accessed by selecting the Systems browser and clicking on one of the Apache Systems in the list (but not an ApacheHVAC system if one is present). They are organized in three groups: System, Energy and Carbon.

Note that if results from a linked ApacheHVAC system were requested (see Section 7), rooms served by such an ApacheHVAC system do not contribute to the variables listed here.

7.3.1. System

Room heating plant sens. load: The sum of the room heating plant sensible loads for all rooms served by the system.

Room hum. plant load: The sum of the room humidification plant sensible loads for all rooms served by the system.

System air heating load: The (non-negative) sensible heat required to raise the temperature of outside air to the specified supply temperature. Only applies when the supply temperature is specified as 'Temperature From Profile'.

Aux vent heating load: For Auxiliary Ventilation air supplies, the (non-negative) sensible heat required to raise the temperature of outside air to the temperature specified. Only applies to those Auxiliary Ventilation air exchanges for which the supply temperature is specified as 'Temperature From Profile'.

DHW heating demand: The DHW heating demand at the hot water outlets (i.e. excluding pipe and tank losses) calculated on the basis of a 50K temperature rise from the cold water main.

DHW boiler load: The DHW heating load at the boiler, after allowing for pipe and tank losses and any contribution from a solar water heating system.

DHW solar heating system input: The heat input from the solar heating system, if present. This is the amount by which the DHW boiler load is reduced by preheating of the cold water supply by the solar water heating system.

DHW solar htg system tank temp: The mean temperature of water in the solar heating system tank, if present.

DHW solar heat input: The heat input from the solar panel (if present) to the solar heating system storage tank.

Boiler load: The load on the Apache System boiler, calculated as the sum of the room heating plant and air heating loads (both system and aux mech vent) met by the system, with an adjustment applied for distribution losses.

CHP heat contribution: The heat contributed to the Apache System by the CHP system, if present. This heat is assumed to be input at the same point as heat from the boiler – i.e. upstream of distribution losses.

Room cooling plant sens. load: The sum of the room cooling plant sensible loads for all rooms served by the system.

Room dehum. plant load: The sum of the room dehumidification plant sensible loads for all rooms served by the system.

System air sens. clg. load: The (non-negative) sensible cooling required to cool the outside air to the specified supply temperature. Only applies when the supply

temperature is specified as 'Temperature From Profile'.

System air lat. clg. load: The (non-negative) latent load incurred in lowering the temperature of outside air to the specified supply temperature, calculated on the basis of a maximum off-coil percentage saturation of 90%. Only applies when the supply temperature is specified as 'Temperature From Profile'.

Aux vent sens. clg. load: For Auxiliary Ventilation air supplies, the (non-negative) sensible cooling required to lower the temperature of outside air to the temperature specified. Only applies to those Auxiliary Ventilation air exchanges for which the supply temperature is specified as 'Temperature From Profile'.

Aux vent lat. clg. load: For Auxiliary Ventilation air supplies, the (non-negative) latent load incurred in lowering the temperature of outside air to the temperature specified, calculated on the basis of a maximum off-coil percentage saturation of 90%. Only applies to those Auxiliary Ventilation air exchanges for which the supply temperature is specified as 'Temperature From Profile'.

Chiller load: The load on the Apache System chiller, calculated as the sum of the room cooling plant and air cooling loads (both system and aux mech vent, sensible plus latent) met by the system, with an adjustment applied for distribution losses.

System air flow rate: The total volume flow rate of air supplied by the system (excluding auxiliary mechanical ventilation). In the case of a system of type Generic, this is the total outdoor air supply.

System air supply temperature: The temperature of air supplied by the system to the rooms.

System air supply moisture content: The moisture content of air supplied by the system to the rooms.

Aux vent flow rate: The total volume flow rate of auxiliary ventilation supplied by the system.

7.3.2. Energy

Boiler energy: The energy consumption of the boiler.

Boiler pump energy: The energy consumption of the boiler pumps.

Chiller energy: The energy consumption of the chiller.

Chiller heat rej. pump energy: The energy consumption of chiller heat rejection pumps and fans.

System auxiliary energy: The auxiliary energy consumption of the system.

DHW & solar heating pump energy: The energy consumed by DHW and solar heating system pumps.

7.3.3. Carbon

Boiler CE: Carbon emissions produced by the energy consumption of the boiler.

Chiller CE: Carbon emissions produced by the energy consumption of the chiller.

Chiller heat rej. CE: Carbon emissions produced by the energy consumption of chiller heat rejection pumps and fans.

System auxiliary energy CE: Carbon emissions produced by the auxiliary energy consumption of the system.

DHW & solar heating pump CE: Carbon emissions produced by the energy consumed by DHW and solar heating system pumps.

7.4. Room Variables

These variables are accessed by selecting a room or a set of rooms in the browser or the building graphic.

Note that a room may be served by either an Apache System or an ApacheHVAC system, if one is present (see Section 7).

Air temperature: The mean temperature of the air in the room.

Dry resultant temperature: The mean of the room air and mean radiant temperatures.

Environmental temperature: A 2:1 weighted average of mean radiant temperature and air temperature

Mean radiant temperature: The uniform temperature of an imaginary enclosure in which radiant heat exchange with the human body would equal the radiant heat exchange occurring in the room.

Dew-point temperature: The dew-point temperature of the air (the temperature at which the air would become saturated if cooled).

People dissatisfied: An index that predicts the percentage of occupants expressing dissatisfaction with the room thermal environment.

Predicted mean vote: An index that predicts the mean value of the votes of a large group of occupants on the following 7-point thermal sensation scale: +3 hot +2 warm +1 slightly warm 0 neutral -1 slightly cold -2 cool -3 cold

Comfort index: An index predicting comfort within the space based on the following scale:

- 1: very cold, danger
- 2: cold, shivering
- 3: cool, unpleasant
- 4: cool, acceptable
- 5: slightly cool/acceptable
- 6: comfortable, pleasant/cool
- 7: comfortable, pleasant
- 8: comfortable, pleasant/warm
- 9: slightly warm/acceptable
- 10: warm, acceptable
- 11: warm, unpleasant
- 12: hot, very uncomfortable
- 13: very hot, danger
- 14: unoccupied
- 15: non-sedentary

Relative humidity: The water vapour pressure of the air expressed as a percentage of the saturation vapour pressure.

Moisture content: The water vapour content of the air (mass of water vapour expressed as a fraction of mass of dry air).

Room CO2 concentration: the volumetric concentration of carbon dioxide in the room (parts per million).

Space conditioning sensible: Sensible heat (or if negative, cooling) supplied to the room by its Apache System or ApacheHVAC system. This consists in general of two terms: a contribution from the room conditioning plant (or HVAC radiators, direct acting heaters and chilled beams) and a contribution from the system air supply.

Steady state heating plant load: Heating plant sensible load calculated under steady state conditions by CIBSE Loads (heating plant sensible load is calculated from this by application of an intermittency factor).

Heating plant sensible load: Sensible heating (non-negative) supplied to the room by its Apache System room conditioning plant or ApacheHVAC room units (radiators, direct acting heaters and chilled beams)

Cooling plant sensible load: Sensible cooling (non-negative) supplied to the room by its Apache System room conditioning plant or ApacheHVAC room units (radiators, direct acting heaters and chilled beams).

Internal gain: Sensible heat (or if negative, cooling) supplied to the room by equipment, lights, people and other heat sources specified as Internal Gains.

Solar gain: Solar radiation absorbed on the internal surfaces of the room, plus solar radiation absorbed in glazing and transferred to the room by conduction.

External conduction gain: Heat conducted into (or if negative, out of) the room through the internal surfaces of externally exposed elements, including ground floors.

Internal conduction gain: Heat conducted into (or if negative, out of) the room through the internal surfaces of wall partitions, internal floors/ceilings and elements with adjacent condition 'Temp from profile' or 'Outside air with offset temp.'

Conduction gain: Combined external and internal conduction gain (CIBSE Loads only)

Air system input sensible: The sensible heat gain (or if negative loss) from the air system. In the case of an Apache System of type Generic, this is the sensible gain from the (possibly conditioned) outdoor air supply.

Aux vent gain: The sensible heat gain (or if negative loss) from Auxiliary Ventilation air exchanges.

Natural vent gain: The sensible heat gain (or if negative loss) from Natural Ventilation air exchanges.

Infiltration gain: The sensible heat gain (or if negative loss) from Infiltration air exchanges.

MacroFlo ext vent gain: The sensible heat gain (or if negative loss) from

MacroFlo-calculated air flows entering the room from the external environment.

MacroFlo int vent gain: The sensible heat gain (or if negative loss) from MacroFlo-calculated air flows entering the room from adjacent rooms.

System air supply: The air supply associated with the system. In the case of an Apache System of type Generic, this is the outdoor air supply.

Aux mech vent: The flow of air into the room from Auxiliary Mechanical Ventilation air exchanges.

Natural vent: The flow of air into the room from Natural Ventilation air exchanges.

Infiltration: The flow of air into the room from Infiltration air exchanges.

MacroFlo ext vent: The sum of MacroFlo-calculated air flows entering the room from the external environment.

MacroFlo int vent: The sum of MacroFlo-calculated air flows entering the room from adjacent rooms.

Space conditioning latent: The latent heat equivalent of water vapour added to (or if negative, removed from) the room by its Apache System or ApacheHVAC system. This consists in general of two terms: a contribution from the room conditioning plant (or HVAC radiators, direct acting heaters and chilled beams) and a contribution from the system air supply.

Humidification plant load: The (non-negative) latent heat equivalent of water vapour added to the room by its Apache System room conditioning plant (if present).

Dehumidification plant load: The (non-negative) latent heat equivalent of water vapour removed from the room by its Apache System room conditioning plant (if present).

Cooling + dehum plant load: the sum of cooling and dehumidification plant loads.

Internal latent gain: The latent heat equivalent of water vapour added to (or if negative, removed from) the room by equipment, people and other heat sources specified as Internal Gains.

Equipment latent gain: The internal sensible gain from equipment.

People latent gain: The internal sensible gain from people.

Number of people: The number of people in the room.

DHW heating demand: The DHW heating demand at the room's hot water outlets (i.e. excluding pipe and tank losses) calculated on the basis of a 50K temperature rise from the cold water main.

Air system input latent: The latent heat equivalent of water vapour added to (or if negative removed from) from the space by the air system. In the case of an Apache System of type Generic, this is the latent gain from the (possibly conditioned) outdoor air supply.

Vent/infiltr. latent gain: The combined latent heat gain (or if negative loss) from Auxiliary Mechanical Ventilation, Natural Ventilation and Infiltration air exchanges.

Aux vent lat gain: The latent heat gain (or if negative loss) from Auxiliary Ventilation air exchanges.

Natural vent lat gain: The latent heat gain (or if negative loss) from Natural Ventilation air exchanges.

Infiltration vent lat gain: The latent heat gain (or if negative loss) from Infiltration air exchanges.

MacroFlo ext vent lat gain: The latent heat gain (or if negative loss) from MacroFlo-calculated air flows entering the room from the external environment.

MacroFlo int vent lat gain: The latent heat gain (or if negative loss) from MacroFlo-calculated air flows entering the room from adjacent rooms.

Convective room plant load: The convective component of the sensible heat input from Apache System room conditioning plant or ApacheHVAC room units (provided as an input to MicroFlo).

Convective lighting gain: The convective component of the sensible heat input from lights (provided as an input to MicroFlo).

Convective equipment gain: The convective component of the sensible heat input from equipment (provided as an input to MicroFlo).

Convective people gain: The convective component of the sensible heat input from people (provided as an input to MicroFlo).

7.5. *Surface Variables*

These variables are accessed by selecting a room surface or opening (window or door) in the browser or the building graphic.

Surface temperature: The temperature of the inner surface of the element.

Incident solar flux: The solar flux (irradiance) incident on the surface.

Incident solar power: The solar power (area-integrated irradiance) incident on the surface.

Volume flow in: The volume flow entering through a MacroFlo opening.

Volume flow out: The volume flow leaving through a MacroFlo opening.

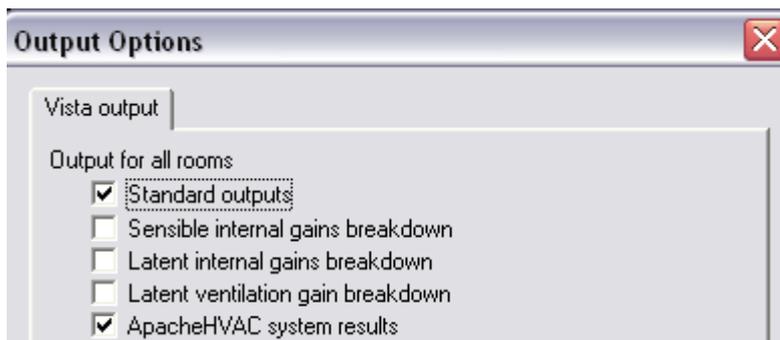
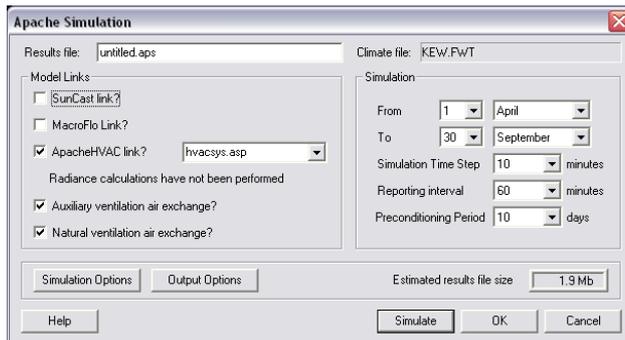
Mass flow in: The mass flow entering through a MacroFlo opening.

Mass flow out: The mass flow leaving through a MacroFlo opening.

Aero/Eqv area: The aerodynamic (or equivalent) area of a MacroFlo opening.

8. ApacheHVAC Results

To view HVAC results in Vista, the ApacheHVAC link must be selected on the Apache Simulation dialog and ApacheHVAC system results must be selected in Output Options:



In Vista, select Systems in the Model browser, then the ApacheHVAC system will be visible as the last System in the list, called 'ApHVAC: <asp file>'. Selecting this will give you a view of the ApacheHVAC network schematic. The asp filename will be appended to the Vista filename in the title bar.

8.1. Component Variables

This is the default mode and is entered by choosing 'HVAC – Select Components' from the interrogation dropdown list.

Results can be viewed for only a subset of all the ApacheHVAC components, namely coils, fans and rooms. Those components for which results are available are listed in the browser and selectable either there or on the schematic. Other components on the schematic are not selectable.

As in ApacheHVAC itself, multiple components can be selected by drawing a

rectangle, or by using Ctrl-click.

For room components, all the room variables as listed in Section 6.4 are applicable. For coil and fan components the only variable that is applicable is “Air Enthalpy addition”, which represents the load across the component.

8.2. Node Variables

This mode is entered by choosing ‘HVAC – Select Nodes’ from the interrogation dropdown list. Nodes represent ducts in the network, and appear as numbers (10, 20, 30...). A long duct will have its node number repeated at each end.

Nodes appear only on the schematic and not in the browser.

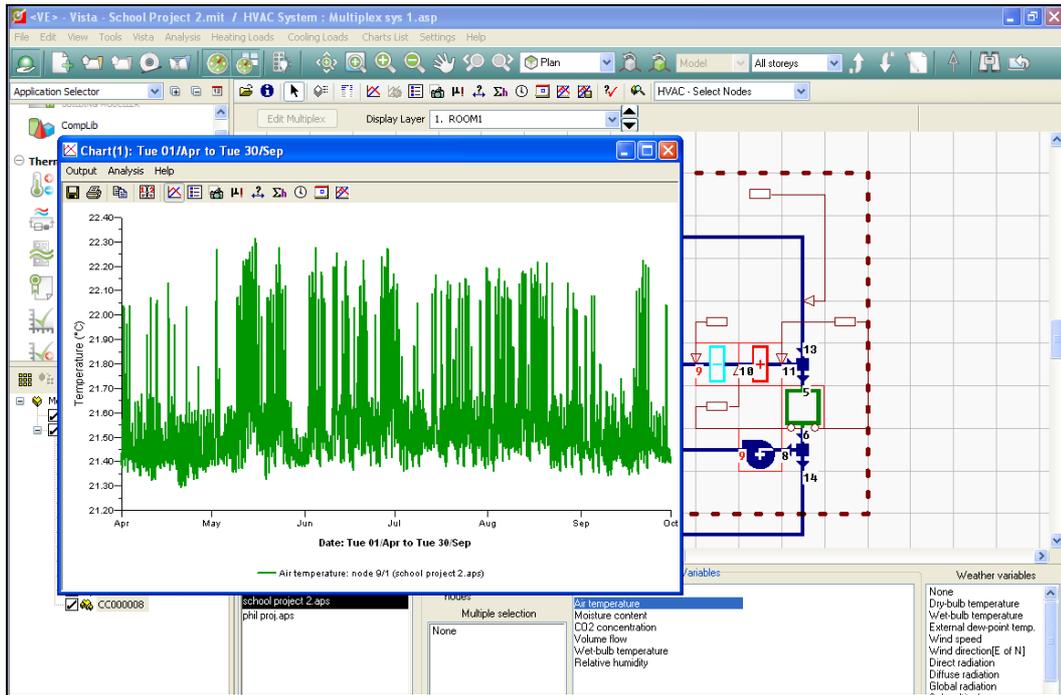
To select a node simply click on or near its number, or anywhere on the duct. In a complex network you may find that you have to select within the nearest component, rather than on the node number, to home in on the right node.

As for components, multiple nodes can be selected by drawing a rectangle, or by using Ctrl-click.

The variables that are available for Nodes are: Mass Flow, Air Temperature, Moisture Content, CO2 Concentration, Volume Flow, Wet-bulb Temperature and Relative Humidity.

8.3. Multiplex Results

Results of any Multiplexed ApacheHVAC system can be viewed in Vista as normal. Select Components or Nodes within the Multiplex to view detailed results. Click within the Multiplex then change the Layer dropdown to the layer you are interested in.



To view the results for **multiple layers** on the same graph use the Lock Variables tool then switch layer. Lock the results for as many layers as required in this way.

