Interfacing HAP Simulations with GLD

The purpose of this document (modified from a HAP ehelp file) is to demonstrate how cooling and heating load data required by the GLD software can be derived from Carrier HAP energy simulation results.

Introduction

GLD considers many variables when calculating the geothermal heat exchangers. For example, in the design of a vertical loop system, GLD analyzes loads requirements, borehole depth, spacing, and quantity, along with piping lengths, soil thermal conductivity, and fluid properties. The role of HAP is to generate the load that GLD uses to optimize the heat exchanger design. Both cumulative loads and peak loads for all months of the year are required to take advantage of GLD's full analysis capability.

GLD Load Requirements:

1. Total monthly cooling coil load (kBTU) (cumulative effects)
2. Maximum hourly cooling coil load (BTUH) (peak magnitude)
3. Total monthly heating coil load (kBTU)
4. Maximum hourly heating coil load (BTUH)

Items 1 and 3 can be obtained directly from the HAP Monthly Simulation Results report for aWSHP air system shown on page 3.The Monthly Simulation Results contains monthly totals of loads and energy consumption for the system.

Finding items 2 and 4 ismore involved.

The procedure is summarized below and then demonstrated with a detailed example.

PROCEDURE SUMMARY

1 Create the geothermal WSHP system model in HAP.

2 Run energy simulation for geothermal WSHP system in HAP and generate the Monthly Simulation Results (tabular version) and Hourly Simulation Results (ASCII text version, Jan 1 thru Dec 31).

3 Use the Monthly Simulation Results report to obtain the monthly cooling and heating load totals.

4 Use Excel to import the TXT file containing the Hourly Simulation Results into an XLS spreadsheet template provided by Carrier. Click link below to download this file.

http://www.groundloopdesign.com/downloads/Other/E20_GSHP_MAX_MONTHLY_COIL_LOAD.xls

5 Use the summary table at the bottom of the XLS spreadsheet to obtain the monthly peak cooling and heating loads. This table uses the Excel MAX function to identify the peak load for each 1 month block of results.

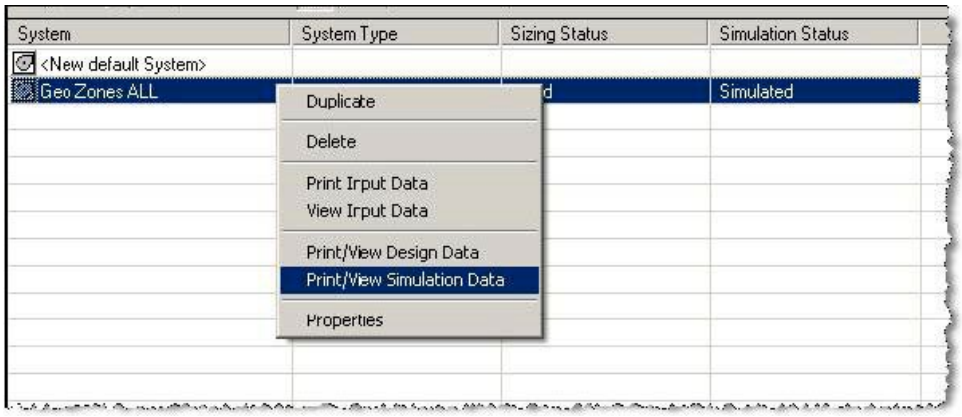
6 Enter the monthly cooling and heating loads plus the monthly peak cooling and heating loads into GLD to perform the heat exchanger sizing analysis.

DETAILED EXAMPLE

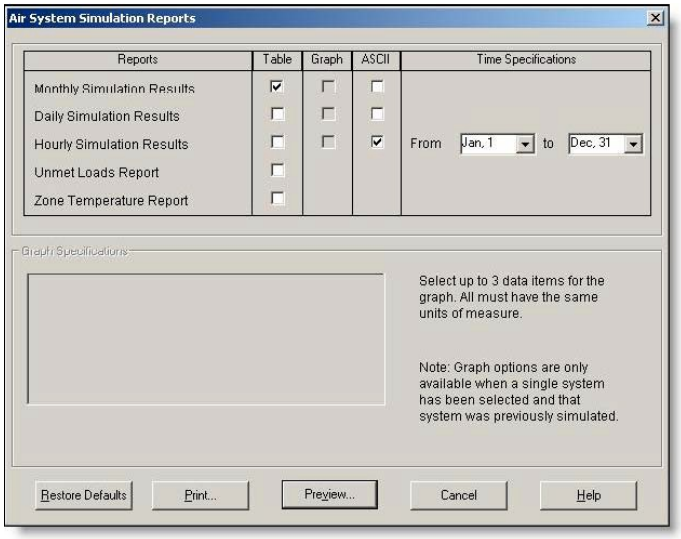
The following example demonstrates the creation and transfer of load data into GLD.

Step 1: Set up the geothermal WSHP HAP model per HAP eHelp 002 dated October 1, 2005, “How to Model WSHP/GSHP Systems Using Carrier HAP Software.” Pay special attention to example C. Ground Coupled WSHP System on page 3.

Step 2: Right click on the WSHP air system and Print View Simulation data. Our example air system is called Geo Zones All.



Step 3: Ask for the Monthly Simulation results and the Hourly Simulation Results TXT file. Hourly results must be for all year.



Step 4: Collect the monthly air system coil loads from the WSHP Cooling Coil and Heating Coil Load columns. These can be seen below.

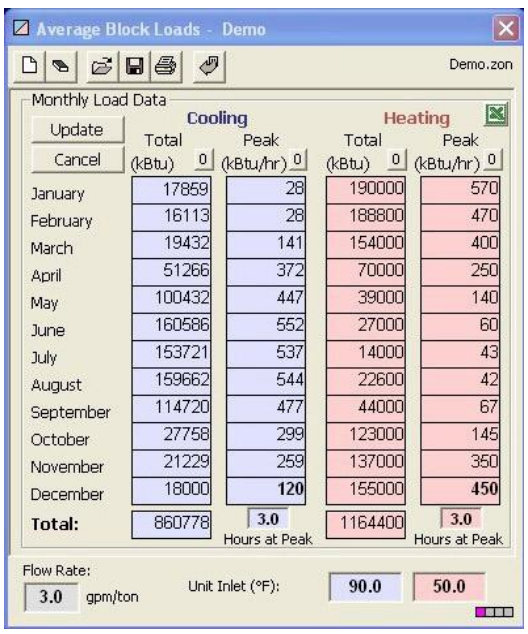
Monthly Simulation Results for Geo Zones ALL

Projec: Name: Geothermal Loads For HAP e-Help — 09/20/2006
Prepared by: Carrier Software — 10:07PM

Air System Simulation Results (Table 1) :

Month	WSHP Cooling Coil Load (kBTU)	WSHP Eqpt Cooling Load (kBTU)	WSHP Clg Compressor (kWh)	WSHP Heating Coil Load (kBTU)	WSHP Eqpt Heating Load (kBTU)	WSHP Htg Compressor (kWh)	WSHP Aux Htg Load (kBTU)
January	21771	19528	1038	44174	43993	3026	181
February	21423	19287	1026	23360	23346	1625	14
March	38318	35620	2240	10439	10431	700	8
April	77491	74603	4614	640	640	44	0
May	116241	112980	7242	56	56	4	0
June	143776	140062	9375	0	0	0	0
July	170696	165951	11885	0	0	0	0
August	144057	140192	9367	0	0	0	0
September	115027	111647	7188	4	4	0	0
October	70143	67054	4184	1240	1240	84	0
November	31578	29277	1557	11313	11313	796	0
December	23294	20834	1105	36117	36085	2502	33
Total	**973815**	**937034**	**60820**	**127343**	**127108**	**8781**	**235**

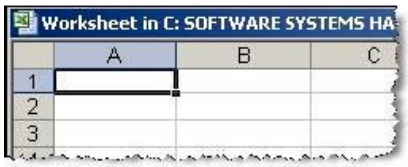
Open a new worksheet in excel and label four columnsso that they follow the format inside the GLD loads module (Please note that the columns MUST be in this order for accurate transfer into GLD: total cooling, peak cooling, total heating, peak heating):



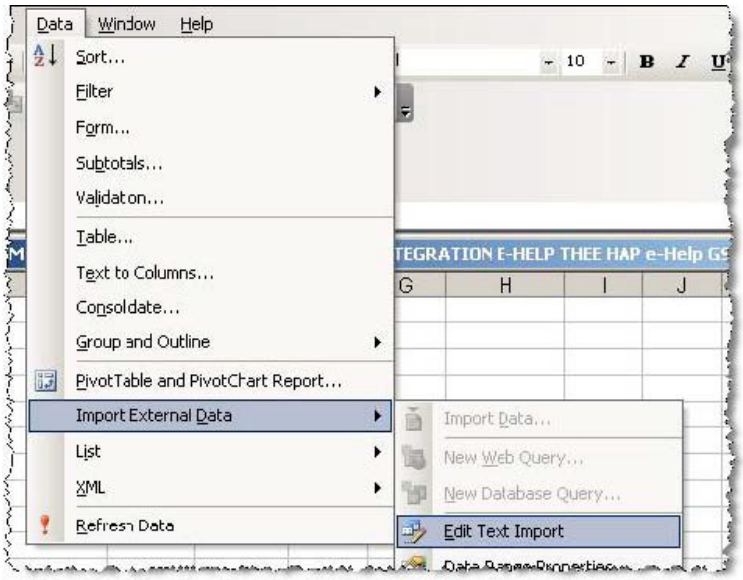
Paste the WSHP Cooling Coil and Heating Coil Load columns into their respective Total cooling and Total heating columns in the new worksheet. Next we will retrieve the remaining load data. The Hourly Simulation Results TXT file is created by checking the box in the Air System Simulation Reports.

Step 5: Open the blank Excel worksheet (GSHP Max Monthly Coil Loads.xls), the link to which is found on page 1 of this document. This Excel file has been provided as a convenience. It is used to import the TXT file created in step 3. It has been configured to accept the TXT file import from HAP and find the maximum hourly heating and cooling load for each month of the year.

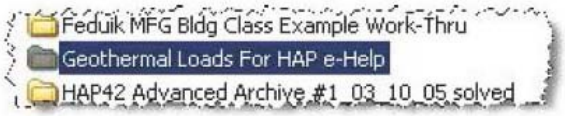
Step 6: Highlight the upper left cell in the Excel worksheet (A1).

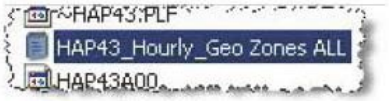


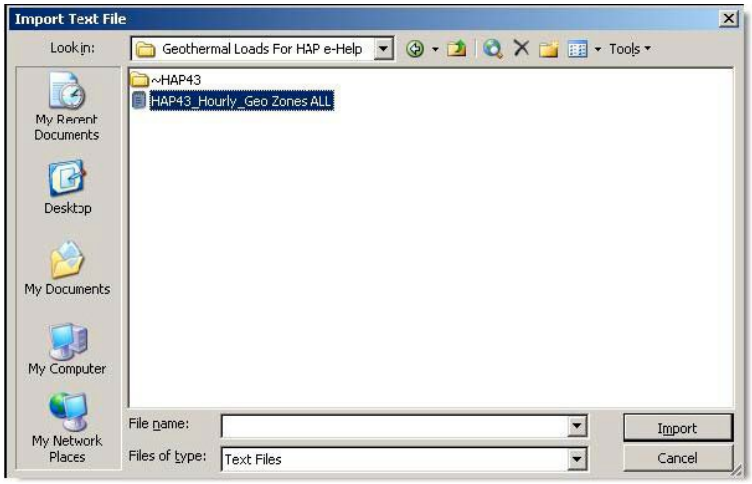
Step 7: Go to: Data > Import External Data >Edit Text Import in the Excel worksheet:



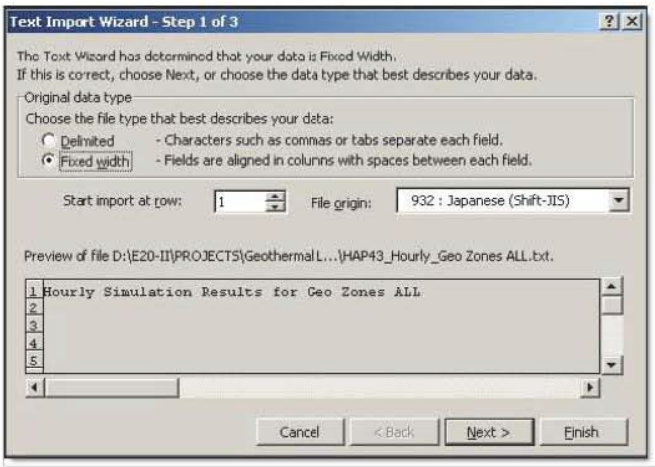
Step 8**:** Browse to the TXT file of the appropriate HAPProject folder under E20II and import it**.** When you generate the ASCII report as we did in Step 3, the program tells you where the file is located as seen below: The TXT file name will always start with program name("HAP43") followed by the report type ("Hourly")followed by the air system name (in this example, our air system was named "Geo Zones All").

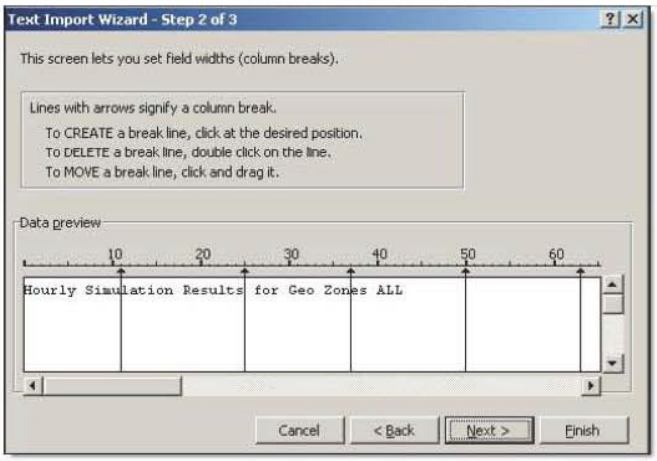


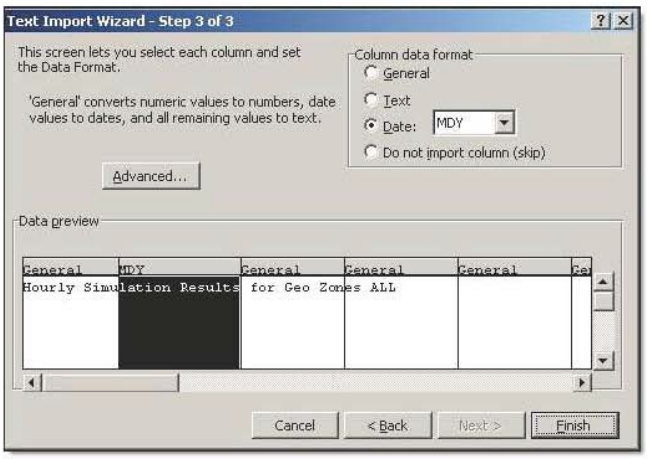




Step 9: This launches a 3 step import Wizard in Excel. Just press **"Next" twice then "Finish"** using all default import settings.







Step 10: Using the vertical slider **scroll down to the bottom (below row 8760)** and you see a table for each of the 12 months containing max cooling and heating coil loads for each month!

Worksheet in C:\SOFTWARE SYSTEMS\HAP\GSHP\New-help\GREF\LON\GHP\INTERATION\BIN-HELP\TREE\NEW-help\GHP\Hourly...

	A	B	C	D	E	F	G	H	I	J	K	L
1	Hourly Simulation Results for Geo Zone ALL											
2												
3												
4												
5						WSHP	WSHP		WSHP	WSHP		WSHP
6						Cooling	Eqpt	WSHP	Heating	Eqpt	WSHP	Aux
7				Dry Bulb	Wet Bulb	Coil	Cooling	Clg	Coil	Heating	Htg	Htg
8				temp	temp	Load	Load	Compressor	Load	Load	Compressor	Load
9	Month	Day	Hour	(oF)	(oF)	(MBH)	(MBH)	(kW)	(MBH)	(MBH)	(kW)	(MBH)
10												
11	Jan	1	[illegible]	27	25.1	8.6	7.5	0.4	1.8	1.8	0.1	0
12	Jan	1	1	34	30.8	8.6	7.5	0.4	1.8	1.8	0.1	0
13	Jan	1	2	34	30.8	8.5	7.5	0.4	1.8	1.8	0.1	0
14	Jan	1	[illegible]	34	30.9	8.5	7.5	0.4	1.8	1.8	0.1	0
15	Jan	1	4	34	31.3	8.5	7.6	0.4	1.9	1.9	0.1	0
16	Jan	1	5	34	31.8	8.5	7.6	0.4	8	8	0.1	0
17	Jan	1	[illegible]	35.5	31.8	32.4	25.7	1.4	144.6	144.6	0.5	0
18	Jan	1	7	37.7	31.7	47.1	40.7	2.2	96.6	96.7	0.7	0
19	Jan	1	8	38.3	31.8	63.7	56.6	3	82.2	82.2	1.3	0
20	Jan	1	9	38.3	32	66.2	58.1	3.1	52.6	52.6	3.3	0
21	Jan	1	10	38.5	32.5	66.6	58.5	3.1	41.3	41.3	[illegible]	0
22	Jan	1	11	38.5	32.9	66.2	58.1	3.1	32.7	32.7	2.4	0
23	Jan	1	12	34	33.2	67.1	60.3	3.2	29.8	29.8	2.2	0

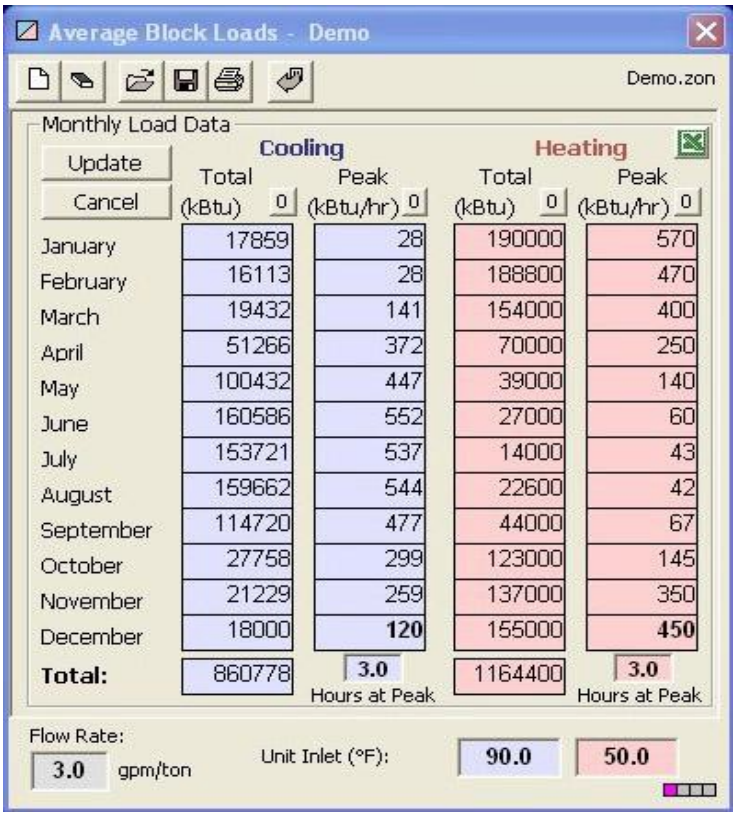
8767	Dec	31	20	20.0	19.7	9	7.5	0.4	3	0	0	0
8768	Dec	31	21	19.8	19	8.8	7.5	0.4	1.2	1.2	0.1	0
8769	Dec	31	22	19.9	19	8.8	7.5	0.4	1.3	1.3	0.1	0
8770	Dec	31	23	19.9	19	8.8	7.5	0.4	3	3	0.2	0
8771												
8772												
8773		**Peak Values Each Month**										
8774		Cooling	Heating									
8775		Coil	Coil									
8776		Load	Load									
8777		(MBH)	(MBH)									
8778												
8779	Jan	102.4	387.1									
8780	Feb	119.4	304.6									
8781	Mar	273.9	324.7									
8782	Apr	449.2	76.7									
8783	May	554.0	7.7									
8784	Jun	579.8	0.0									
8785	Jul	593.8	0.0									
8786	Aug	557.8	0.0									
8787	Sep	505.5	2.8									
8788	Oct	367.7	200.9									
8789	Nov	264.0	265.5									
8790	Dec	99.3	322.6									

Worksheet in C:\SOFTWARE SYSTEMS\HAP\GSH

	A	B	C
8771			
8772			
8773		**Max Monthly**	**Coil Loads**
8774		Cooling	Heating
8775		Coil	Coil
8776		Load	Load
8777		(MBH)	(MBH)
8778			
8779	Jan	102.4	387.1
8780	Feb	119.4	304.6
8781	Mar	273.9	324.7
8782	Apr	449.2	76.7
8783	May	554.0	7.7
8784	Jun	579.8	0.0
8785	Jul	593.8	0.0
8786	Aug	557.8	0.0
8787	Sep	505.5	2.8
8788	Oct	367.7	200.9
8789	Nov	264.0	265.5
8790	Dec	99.3	322.6

Copy these data into the excel worksheet that you created in Step 4 above.

Again, confirm that the four columns follow this format:



Step 11: Select and copy (ctrl-C) the four columns of data (be sure to copy only the data and not any column labels that you might have added. In GLD, hit the Excel icon (as can be seen above) to import the data into the AVERAGE BLOCK loads module.

Questions?

Contact us at www.groundloopdesign.com