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.

System	System Type	Sizing Status	Simulation Status	
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🖉 Geo Zones ALL	Duplicate	d and a second se	Simulated	
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	Print/View Simulation	n Data		1
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Step 3: Ask for the Monthly Simulation results and the Hourly Simulation Results TXT file. Hourly results must be for all year.

4	Table	Graph	ASCII	Time Specifications
Monthly Simulation Results	V	Г		
Daily Simulation Results	Г	Г	Г	
Hourly Simulation Results		Г	~	From Jan, 1 👻 to Dec, 31 👻
Unmet Loads Report				
Zone Temperature Report				
				Select up to 3 data items for the graph. All must have the same units of measure
			_	Select up to 3 data items for the graph. All must have the same units of measure.
				Select up to 3 data items for the graph. All must have the same units of measure. Note: Graph options are only available when a single system has been selected and that

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

Projec: Name: G	eothermal Loads F	or HAP e-Help	imulation l	Results for	Geo Zones	ALL	09/20/20
Prepared by: Ca	rrier Software						10:07F
Air System Sime	ulation Results (Ta	ble 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

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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):

🛛 Average Blo	ock Loads -	Demo		Demo.zor
Monthly Load	l Data Cool Total	ing Peak	Hea Total	ting 📕 Peak
Cancel	(kBtu) 의	(kBtu/hr)	(kBtu) 0 ((kBtu/hr) 의
January	17859	28	190000	570
February	16113	28	188800	470
March	19432	141	154000	400
April	51266	372	70000	250
May	100432	447	39000	140
June	160586	552	27000	60
July	153721	537	14000	43
August	159662	544	22600	42
September	114720	477	44000	67
October	27758	299	123000	145
November	21229	259	137000	350
December	18000	120	155000	450
Total:	860778	3.0 Hours at Peak	1164400	3.0 Hours at Peak
Flow Rate:	on Unit I	nlet (°F):	90.0	50.0

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).

📲 Worksheet in C: SOFTWARE SYSTEMS HA								
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3								

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



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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").

Report Selection Message	<u> </u>	X
The ASCII version of one or more repor current project. This folder is D:\E20-II\Projects\Geothe	ts has been selected. These reports will be written in rmal Loads For HAP e-Help\	nto .TXT files in the folder for the
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	nd Folder Tasks & E20-II
	Rename this folder
	PROJECTS PROJECTS CRPD40
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Look in:	🛅 Geothermal Loads For HAP e-Help 💌 🎯 + 🍱 🔍 🗙 📷 🎫 Tools +
My Recent Documents	≥~HAP43 HAP43_Hourly_Geo Zones ALL
Desktop	
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Step 9: This launches a 3 step import Wizard in Excel. Just press "**Next**" twice then "Finish" using all default import settings.

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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!

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0												
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2	Jar	1	1	34	30.6	8.6	75	0.4	1.4	1.4	0.1	1
3	Jar.	1	2	34	30.6	8.5	7.5	0.4	1.6	1.5	0.1	
4	Jer	1	-	- 34	30.9	8.5	15	U 4	1.8	1.=	U.1	1
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0	Jar	1	3	33.3	32	E6.3	581	31	52.6	50.5	3.5	0
-	Jar	1	1.	335	32.5	65.6	58.5	3.1	41.3	41.4	-	1
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8768 Dec	31	21	19.5	15	8.8	7.5	0.4	1.2	1.2	0.1	0
8789 Dec	31	22	19.9	15	8.6	7.5	0.4	1.3	19	0.1	0
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8785 .hd	593.8	70									
C705 Aug	552.0	3.0									
8787 Sep	505.5	28									
E788 Oct	367.7	203.9									
6789 Nov	264.0	265.6									
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	A	B	C		
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8772					
8773		Max Monthly Coil Loads			
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8775		Coil	Coil		
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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	654.0	7.7		
8784	Jun	579.8	0.0		
8785	Jul	593.8	0.0		
8786	puA	557.8	0.0		
8787	Sep	505.5	2.8		
8788	Oct	367.7	200.9		
8769	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:

🛛 Average Block Loads - Demo 🛛 🔀							
	8 5 0	Demo.zon					
Monthly Load Data							
Update	Cooling		Heating				
Cancel		ADD ADD 0		Peak			
	17050			570			
January	17009	20	190000	570			
February	16113	28	188800	470			
March	19432	141	154000	400			
April	51266	372	70000	250			
May	100432	447	39000	140			
June	160586	552	27000	60			
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November	21229	259	137000	350			
December	18000	120	155000	450			
Total:	860778	3.0 Hours at Peak	1164400	3.0 Hours at Peak			
Flow Rate:							
3.0 gpm/ton Unit Iniet (°F): 90.0 50.0							

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 <u>www.groundloopdesign.com</u>