

# eQUEST Building Energy Modeling Guide for LG Multi V™



	Jan	Feb	Mar	Apr	Mary	Jun	Jul	Aug	Sep	Oct	Nav	Dec	Total
Space Cool	17.8	16.1	19.D	21.D	51.4	98.7	131.8	124.6	75.9	35.4	19.7	17.8	629.Z
Heat Reject.	-	-	-	D. D	D.5	2.7	4.6	4.3	1.4	D.1	D.1	-	11.7
Refrigeration	-	-				-	-	-		-		-	
Space Heat	-	-	-	-		-	-		-	-	-		
HP Supp.			-	-		-	-	-		-		-	
Hot Water	-	-		-	-	-	-	-		-	-	-	-
Vent. Fans	46.2	41.7	47.5	59.D	74.9	72.5	73.2	74.8	75.9	68.6	49.1	46.3	729.7
Pumps & Aux.	33.2	3 D. D	33.3	32.5	35.4	37.3	4D.2	39.8	36.D	34.6	32.3	33.2	417.7
Ext. Usage						-		-				-	
Misc. Equip.	183.4	165.7	181.4	177.5	183.4	177.5	181.4	183.4	177.5	181.4	177.5	181.4	2,159.6
Task Lights	-	-	-	-	-	-	-		-	-	-	-	-
Area Lights	173.1	156.3	173.1	167.5	173.1	167.5	173.1	173.1	167.5	171.1	167.5	173.1	2,038.D
Total	453.7	409.8	456.3	457.5	518.8	556.1	6D6.3	60D.D	534.2	495.3	446.1	451.8	5,987.8



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## Introduction

### **Overview**

The eQUEST Building Energy Modeling Guide for LG Multi V contains stepby-step instructions for modeling LG Multi V system options. This document primarily draws from the DOE-2.2 Building Energy Use and Cost Analysis Program, Volume 1 and Volume 2. To download or learn more about eQUEST, please visit http://www.doe2.com/equest/.

## Disclaimer

This Building Energy Modeling Guide should be used as a guideline only. Building load and energy have been approximated for modeling purposes and vary with the input value of equipment (capacity, power input, etc.), and actual results will vary accordingly. The conclusions of this Modeling Guide do not guarantee actual energy costs or savings.

This Modeling Guide and its associated eQUEST library file are intended as design and analysis guides to help designers optimize the design of LG Multi V VRF systems based on energy utilization. Modeling accuracy is highly dependent on user-supplied data. It is the user's responsibility to understand how the data entered affects program output and any predefined libraries are used only as guidelines for entering that data. The calculation results and reports shown in this guide and the eQUEST library file are meant to aid the system designer and are not a substitute for design services, judgment, or experience.



## **Program Installation**

To install eQUEST:

- 1. Download the latest version of eQUEST from the DOE Website by going to http://www.doe2.com/download/equest/eQUEST\_3-64\_Setup.exe.
- 2. Download the eQUEST\_3-64\_Setup.exe file to a location of your choice.
- 3. Double click the eQUEST\_3-64\_Setup.exe file to begin the installation.
- 4. Follow the program prompts to install the program using the default settings.



# **Importing Multi V Library File**

## **Importing the Library File**

To import the Multi V library file into eQUEST:

- 1. Obtain the Multi V library file (Bdllib.dat) from your LG Sales Representative.
- 2. Double click the eQUEST icon on your desktop to launch eQUEST. The eQUEST Startup Options dialog box appears:

eQUEST Startup Options	×
	eQUEST 3.64, build 7130
O Open Recent Project:	
	<b>Y</b>
C Select an Existing Project to Open	
Create a New Project via the Wizard	
C Generate SkyCalc Weather File	
ок	View Overview Exit

Figure 1: eQUEST startup options dialog box.

**Note:** If this is not your first time opening eQUEST, open an existing project instead.

3. Click the **OK** button to create a new project. The Which Wizard dialog box appears:





Figure 2: Which Wizard dialog box.

- 4. Click the Schematic Design Wizard button.
- 5. When the Wizard appears, click the **Finish** button. The Wizard closes.
- Click Tools > View File Locations > View eQUEST Data Directory. The eQUEST data directory appears in Windows Explorer (often C:\Documents and Settings\Administrator\My Documents\eQUEST 3-64 Data\D0E-2):

🖆 eQUEST 3-64 Data							
File Edit View Favorites Tools Help				1			
Back + 🕥 + 🎓 Search 📴 Folders							
Address C:(working Files(eQUEST 3-64 Data		1					
Folders ×	Name A	Size	Туре	Date Modifiec			
🕀 🛅 HP Temp 📃	Compliance		File Folder	4/30/2012 11			
🗉 🚞 Intel			File Folder	4/30/2012 11			
🗄 🚞 Printer Drivers	DOE-2		File Folder	4/30/2012 11			
🗉 🚞 Program Files			File Folder	4/30/2012 11			
🛅 Temp	Libraries		File Folder	4/30/2012 11			
🗉 🚞 WINDOWS	Rates		File Folder	4/30/2012 11			
🗆 🚞 Working Files	Reports		File Folder	4/30/2012 11			
🗉 🧰 ASG	Screens		File Folder	4/30/2012 11			
🛅 Bluetooth Exchange Folder	SkyCalCWthr		File Folder	4/30/2012 11			
🛅 ссмо	Support		File Folder	4/30/2012 11			
Document Naming Conventions	Tutorials		File Folder	4/30/2012 11			
🗉 🗀 Downloads	Weather		File Folder	4/30/2012 11			
🖃 🚞 eQUEST 3-64 Data	Window		File Folder	4/30/2012 11			
Compliance	Wizard		File Folder	4/30/2012 11			
C Documentation	BDLExt32	19 KB	Configuration Settings	6/28/2007 9:1			
DOE-2	BDLLib32	1 KB	Configuration Settings	1/8/2000 8:3			
🗀 Help	eQUEST	3 KB	Configuration Settings	6/4/2012 11:			
🚞 Libraries							
ates							
🕀 🧰 Reports							
🕀 🧰 Screens							
🗉 🚞 SkyCalCWthr							
🗀 Support							
🕀 🧰 Tutorials							
🕀 🚞 Weather							
📄 Window 🖵							
	•						

Figure 3: Locating the library file.

7. Double click the DOE-2 subdirectory. A list of files appears:





Figure 4: DOE-2 subdirectory.

- 8. Rename the Bdllib.dat file to original\_BDllib.dat. That way you can return to the default file if the need arises.
- 9. Drag and drop the replacement Bdllib.dat file that you downloader earlier into the Window Explorer dialog box. The file appears in the dialog box.
- 10. Close the dialog box.
- 11. In eQUEST click **File > Exit** to close the program.

### **Testing the Library File**

To test the Multi V library file in eQUEST:

- 1. On your desktop double click the eQUEST icon again. The program appears.
- 2. Click Mode > Detailed Data Edit.
- 3. Click the Air-Side HVAC button. The Air-Side HVAC pane appears.
- 4. To the left of the pane, locate the **Performance Curves** folder in the tree.
- 5. Right click the folder and select **Create Curve Fit**. The Create Curve Fit dialog box appears:



Create Curve Fit	×
	Load Component From Library
Curve Fit Na	me: Curve Fit 11
Creation Opt	ion: Create from scratch 💌
Curve Fit Ty	rpe:
	UK Cancel

Figure 5: Create Curve Fit dialog box.

6. Click the **Load Component from Library** button. The Curve Fit Library Selection dialog box appears.

Curve Fit Library Selection	×
Category: Elec Meters Entry: Transformer-Loss-fPLR	Library Name: bdllib.dat Library File: c:\t 3-64 data\doe-2\bdllib.dat Library Entry Description:
	OK Cancel

Figure 6: Curve Fit Library Selection dialog box.

- 7. Select **MultiV 3 (HP)** in the **Category** list. The Entry list populates with Multi V III outdoor units.
- 8. Click the applicable outdoor unit in the **Entry** list.
- 9. Click the **OK** button. The dialog box disappears, and the outdoor unit appears in the Curve Fit Name box on the Create Curve Fit dialog box.
- 10. Click the **OK** button. The dialog box disappears, and the Performance Curve Properties dialog box appears:



Currently Active Curve: ARUN096BT3-CoolEIR-fEWB&OAT Type: Bi-Quadratic in T	
Basic Specifications Data Points	
Curve Name: ARUNU96BT3-CoolEIR-fEWB&OAT	
Curve Type: Bi-Quadratic in T Minimum Output: -1,000,000.00	
Input Type: Curve Coefficients 💌 Maximum Output: 1,000,000.00	
Curve Formula: $Z = a + bX + cX^2 + dY + eY^2 + fXY$	
Where 112622005 b 0.05474610 c 0.00041054	
Where: a = -1.12632635 B = 0.05474610 C = -0.00041034	
Dc	ne

Figure 7: Performance Curve Properties dialog box.

11. Click the **Done** button. The outdoor unit now appears in the Performance Curves folder.



# **Case Study**

This document uses multiple sources of information to streamline the energy modeling process for variable refrigerant flow (VRF) systems. This case study features a building that is served by a VRF system. This study demonstrates how to model the indoor units, piping, and outdoor units.



Figure 8: eQUEST main window.

To model the building's energy use:

1. We determine systems loads by space or zone, using the load calculation results from eQUEST. For example, if four arbitrary zones are created, the peak loads of the might appear as follows:

Zone 1 = 24,000 Btu/hr Zone 2 = 24,000 Btu/hr Zone 3 = 24,000 Btu/hr

Zone 4 = 24,000 Btu/hr

- 2. Our building's location is Atlanta, so the design temperature is 94°F.
- 3. We select an indoor unit (IDU) for each zone or space using the LG Multi V III product line. We decide on four Four-Way Ceiling Cassettes.
- 4. We inspect the indoor unit capacity tables for those units, considering the indoor and outdoor temperatures. Select units whose capacity is the nearest to or greater than the anticipated load. Are choices were as follows:



5.

Note:	Individual indoor unit capacity is subject to change depending on what outdoor units are used. Actual capacity has to be calculated according to the combination by using the outdoor unit capacity table.
• Zone 1	= 24,000 Btu/hr: ARUN243TMC2. 24,000 Btu/hr load: one
2.0 ton	unit, 24,000 Btu/h. Capacity index (CI) = 24
• Zone 2	= 24,000 Btu/hr: ARUN243TMC2. 24,000 Btu/hr load: one
2.0 ton	unit, 24,000 Btu/h. CI = 24
• Zone 3	= 24,000 Btu/hr: ARUN243TMC2. 24,000 Btu/hr load: one
2.0 ton	unit, 24,000 Btu/h. CI = 24
• Zone 4 2.0 ton	= 24,000 Btu/hr: ARUN243TMC2. 24,000 Btu/hr load: one unit, 24,000 Btu/h. CI = 24
We select a	n outdoor unit for the loads from our LG Multi V III product
line. We vie	w allowable unit combinations in the Indoor Unit
Combination	on Total Capacity Index Table in the appropriate LG
Engineerin	g Product Data Book (EPDB). In general, we choose outdoor
units based	l on the location of the unit, zoning, and purpose of the
rooms. The combinatio	indoor and outdoor unit combination is determined by their on ratios, which is the ratio of the indoor unit capacity to the it capacity expressed as a percentage. Optimally we shoet
for a 100%	ratio or slightly under. Based on the following:

Total Load = 8 tons = 96,000 Btu/h = 96, CI = 96

IDU Capacity = 8 tons = 96,000 Btu/h, CI = 96

We chose an LG Multi V III ARUN096DT3 (8 tons = 96,000 Btu/h, CI = 96).



Figure 9 LG Multi V III ARUN096DT3



- 6. We know the combination ratio is good because 96/96 = 1 = 100%.
- 7. Next, we modify the indoor unit capacity index based on an indoor temperature of 67°F WB, once again using the appropriate EPDB. We arrive at the following results:
  - Zone 1: Initial CI = 24. Adjusted CI = 24.2 MBH (20.3 MBH sensible).
  - Zone 2: Initial CI = 24. Adjusted CI = 24.2 MBH (20.3 MBH sensible).
  - Zone 3: Initial CI = 24. Adjusted CI = 24.2 MBH (20.3 MBH sensible).
  - Zone 4: Initial CI = 24. Adjusted CI = 24.2 MBH (20.3 MBH sensible).

For a sum of IDU outputs of 96.8 MBH.

8. Next, we modify ODU capacity for any piping losses. For this calculation we assume that we have 65 feet of pipe from the ODU to farthest IDU, where the main pipe is 30 feet long and there is 40 feet of branch pipe. Our farthest IDU is 9.8 feet below the ODU, which is placed on the roof. Our overall equivalent pipe length, L, is as follows:

$$L = (L_{main} \times Cf) + L_{branch}$$

 $L = 30 \text{ ft} \times 1.0 + 130 \text{ ft.} = 160.0 \text{ ft.}$ 

Cf represents the correction factor, which also comes for the EPDB. We then correct for the elevation change, Hp. Using Cf and Hp, we determine our overall capacity correction factor using the following chart:



#### **Figure 10 Capacity Correction Factor**

The result is a cooling capacity of  $\alpha$  = 0.98 based on the overall equivalent pipe length, L, and the level difference, Hp.



Note:	If you are interested in learning more about piping losses and Multi V III system design, download the EPDB from LG- VRF.com.
Note:	The LG Air-Conditioner Technical Solution software automates much of the piping loss calculation. You can

- 9. Next, we correct for temperature effects on outdoor unit capacity using the following input data:
  - CR = 100%
  - Tout\_db =  $94^{\circ}F$
  - Tin\_wb =  $67^{\circ}F$

We arrive at a new total cooling capacity of 95.79 MBH with an electrical power input of 6.64 kW for the compressors and the outdoor unit's fan motor.

10. Next, we correct with a safety factor. A 100% safety factor is assumed to be sufficient with a 100% CR, so there is zero net change.

95,790[Btu/hr] × 100% = 95,790Btu/hr

download it at LG-VRF.com.

- 11. We then ensure that the indoor unit capacity divided by the modified outdoor unit capacity is greater than the peak cooling or heating load. Otherwise the indoor unit capacity must be increased.
- 12. Next, we input the air-side HVAC system parameters in eQUEST:

ics Fans Outdoor Air Cooling Heating	Preconditioner   Meters   Refrigeratio	on	
ioil Capacity / Control Unitary Power Condenser	Capacity Curves Evaporative C	ooling   Economizer   Staged-Volume	
Cooling Power			
Cooling Electric Input Ratio: 0.3457 Btu/Btu			
	Performance Curves		
	f(t entering wetbulb,	Electric Input Ratio	Low Speed Electric Input Ratio
		ARUNBULI 3-COOIEIR-TEWB&OAT	
Cooling Compressor	t enter condenser):	PVVT-Bypass-Factor-fEWB&EDB	
Cooling Compressor Compressor Type: Variable Speed Violater Value 4 2 dia	t enter condenser): f(part load ratio):	PVVT-Bypass-Factor-fEWB&EDB PVVT-Cool-EIR-fEWB&OAT PVVT-Heat-Cap-fEDB&OAT	
Compressor Compressor Type: Variable Speed • Minimum Unload Ratio: 0.15 ratio	t enter condenser): f(part load ratio): f(RPM): f(t entering wetbulb.	PVVT-Bypass-Factor-fEWB&EDB PVVT-Cool-EIR-fEWB&OAT PVVT-Heat-Cap-fEDB&OAT PVVT-Heat-EIR-fEDB&OAT PVVT-Heat-EIR-fEDB&OAT	
Compressor Type: Variable Speed  Minimum Unload Ratio: 0.15 ratio Min Hot Gas Bypass Ratio: 0.15 ratio	t enter condenser): f(part load ratio): f(RPM): f(t entering wetbulb, t outdoor drybulb):	PVVT-Bypass-Factor-fEWB&EDB PVVT-cool-EIR-FEWB&OAT PVVT-Heat-EIR-FEDB&OAT PVVT-Heat-EIR-FEDB&OAT RESVVT-Cool-EIR-LoSpeed-fEWB&OAT RESVVT-Heat-EIR-LoSpeed-fEWB&OAT RESVVT-Heat-EIR-LOSpeed-fEWB&OAT	RESVVT-Cool-EIR-LoSpeed-fEWB&OA
Compressor Type: Variable Speed  Minimum Unload Ratio: 0.15 ratio Min Hot Gas Bypass Ratio: 0.15 ratio	t enter condenser): f(part load ratio): f(RPM): f(t entering wetbulb, t outdoor drybulb):	PVVT-Bypass-Factor-fEWB&EDB PVVT-cool-EIR-fEWB&CAT PVVT-heat-EIR-fEDB&CAT PVVT-heat-EIR-fEDB&CAT RESVVT-Cool-EIR-LoSpeed-fEWB&CAT RESVVT-Cool-EIR-LoSpeed-fEDB&CAT Defrost-ResisTime-Frac-fOWB&CDB Defrost-ReversTime-Frac-fOWB&CDB	RESVVT-Cool-EIR-LoSpeed-fEWB&OA
Cooning Compressor Compressor Type: Variable Speed Minimum Unload Ratio: 0.15 ratio Min Hot Gas Bypass Ratio: 0.15 ratio Crankcase Power	f enter condensery): f(part load ratio): f(RPM): f(t entering wetbulb, t outdoor drybulb): Gas Heat Pump Auxiliary	PVVT-bypass-Factor-fEWB&EDB PVVT-cool-ER-4EWB&OAT PVVT-heat-Cap-fEDB&OAT PVVT-heat-Cap-fEDB&OAT RESVVT-leat-ER-4EDB&OAT RESVVT-beat-ER-LoSpeed-fEDB&OAT Defrost-ReverSTime-Frac-fOWB&ODB Defrost-ReverSTime-Frac-fOWB&ODB Defrost-ReverSDem-Frac-fOWB&ODB	RESVVT-Cool-EIR-LoSpeed-fEWB&OA
Compressor Type: Variable Speed  Minimum Unload Ratio: 0.15 ratio Min Hot Gas Bypass Ratio: 0.15 ratio Crankcase Power Crankcase Heat: 0.050 kW	f enter condensery): f(part load ratio): f(RPM): f(t entering wetbulb, t outdoor drybulb): Gas Heat Pump Auxiliary Gas HP Pump kW:	PVUT-bypass-Factor-fEWB&EDB PVUT-cool-ER-fEWB&CAT PVUT-heat-Cap-fEDB&CAT PVUT-heat-ER-fEDB&CAT RESVUT-cool-ER-LOSpeed-fEWB&CAT RESVUT-cool-ER-LOSpeed-fEDB&CAT Defrost-ReversTime-frac-fOWB&CDB Defrost-ReversTime-frac-fOWB&CDB Defrost-ReversTime-frac-fOWB&CDB Defrost-ReversTime-frac-fOWB&CDB ARUINBOLT3-CoolCap-fEWB&CAT ARUNBOLT3-CoolCap-fEWB&CAT ARUNBOLT3-CoolCap-fEWB&CAT	RESVVT-Cool-EIR-LoSpeed-fEWB&OA

Figure 11: Unitary Power (Cooling) Tab.



Cooling data:

- COOLING-CAPACITY : 95,790
- Cooling EIR = *0.2399*
- (Cooling Capacity: 96.0 Mbh, Power Input: 6.75kW, EER =14.2)
- Compressor type: Variable Speed
- Minimum Unload ratio: 0.15
- Min hot gas bypass ratio: 0.15
- Crankcase heat: 0.060kW
- Crankcase Max Temperature: 40°F
- Performance Curves:
  - COOL-EIR-FT : ARUN096DT3
  - COOL-EIR-FPLR : *ARUN096DT3*
  - COOL-EIR-LS-FT : RESVVT cool Lo speed EIR-FRPM
  - COOL-CAP-FT : ARUN096DT3
  - COOL-SH-FT : *ARUN096DT3*

Side HVAC System Paramet	ers		
Currently Active Syst	tem: S1 Sys (PSZ) Air Cooling Heating Preconditioner   M	System Type: Pkgd Var Vol Var Temp Meters   Refrigeration	
Coil Capacity / Control	Unitary Power Condenser Capacity Curv	ves Evaporative Cooling Economizer Staged-Volume	
f(t entering wetbulb, t entering drybulb): f(t entering wetbulb,	Total Capacity         Sensible           ARUN80LT3-CoolCap-fEV         PVVT-Sens-C           PVVT-Bypass-Factor-fEWB&EDB         PVVT-Cool-ETB.FfWB&OAT	Capacity Bypass Factor Cap-fEWB&C PVVT-Bypass-Factor-fEW	
t entering water): f(flow)	PVVT-Heat-Cap-fED8&OAT PVVT-Heat-EIR-fED8&OAT RESVVT-Cool-EIR-LoSpeed-fEW8&OA' RESVVT-Heat-EIR-LoSpeed-fED8&OA' Defrost-ResisTime-Frac-fOW8&OD8	Bypass Factor	
f(CHW flow):	Defrost-ReversTime-Frac-F0WB&ODB Defrost-ReversDem-Frac-F0WB&ODB ARUN80LT3-CoolER-fEWB&OAT ARUN80LT3-CoolER-fEWB&OAT ARUN80LT3-HeatER-fEWB&OAT		
f(cycling on/off):	ARUN80LT3-HeatCap-fEWB&OAT	Bypass Factor DX-Bypass-Factor-fPLR	
f(RPM): Min temp used in cooling	DX-Cool-Cap-fRPM&OAT ▼		
			Dr

Figure 12: Capacity Curves (Cooling) Tab.



Air-Side HVAC System Parameters	
Currently Active System: S1 Sys (PSZ) Basics Fans Outdoor Air Cooling Heating Preconditioner Met Coil Cap / Control Unitary Power Preht / Basebrd Supp Heat/Defrost	System Type: Pkgd Var Vol Var Temp ters   Refrigeration   Cap Curves/Waste Ht   Stages
Heating Electric Power Heating Heating Electric Input Ratio: 0.3164 Btu/Btu f(t er	Electric Input Ratio Curves Low Speed Electric Input Ratio Curve ntering wetbulb, ARUN80LT3-HeatEIR-fEv f(t entering wetbulb), RESVVT-Heat-EIR-LoSp
Furnace f(par	- undefined - t load ratio): - create -
Furnace Heat Input Ratio: n/a Btu/Btu f(RPI	- IDFATY - PVVT-Cool-Cap-FEWB&OAT PVVT-Sens-Cap-FEWB&OAT
Furnace Fuel Auxiliary: n/a Btu/h Furnace Electric Auxiliary: n/a kw Gas Hea	PVVI-Bybass-rador-retWbacDB PVVT-Cole-EIR-feWB&0AT it Pump Auxiliary Elet
Furnace HIR = f(pir): n/a Gas	PVVT-Heat-EIR-fEDB&OAT HP Pump kW: RESVVT-Cool-EIR-LoSpeed-fEWB&OAT
Furnace Off Loss: n/a 💽 Gas I	HP Aux kW: Defrost-ResisTime-frac-foWB&ODB Defrost-ResisTime-frac-foWB&ODB Defrost-ReversTime-frac-foWB&ODB ARUN80LT3-coolCap-fEWB&OAT ARUN80LT3-coolCap-fEWB&OAT ARUN80LT3-HeatCap-fEWB&OAT
	Done

#### Figure 13: Unitary Power (Heating) Tab.

Heating data:

- HEAT-SOURCE : *HEAT-PUMP*
- HEATING-CAPACITY : -101,370
- HEATING EIR = *0.2167*
- (HEATING Capacity: 108.0 Mbh, Power Input: 6.86kW, COP = 4.61)
- MAX-SUPPLY-T : *105*
- Performance Curves:
  - HEAT-EIR-FT : ARUN096DT3
  - HEAT-EIR-FPLR: ARUN096DT3
  - HEAT-EIR-LS-FT : RESVVT heat Lo speed EIR-FRPM



Air-Side HVAC System Parameters
Air-Side HVAC System Parameters Currently Active System: S1 Sys (PS2) Currently Active System: S1 Sys (PS2) System Type: Pkgd Var Vol Var Temp Basics Fans Outdoor Air Cooling Heating Preconditioner Meters Refrigeration Coil Cap / Control Unitary Power Preht / Basebrd Supp Heat/Defrost: Cap Curves/Waste Ht Stages Total Capacity as f(temperatures) Waste Heat f(t entering drybub); f(t entering drybub); VT-Cool-EBI-EWBB0AT FVVT-Heat-EI-EFDB80AT FVVT-Heat-EI-Cap-EBB0AT FVVT-Heat-EI-LoSpeed-fEVB80AT f(cupply air flow): Perforst-Reversitime-Frace-OWB80DB ff(tw flow): Perforst-Reversitime-Frace-OWB80DB ff(tw flow): Perforst-Reversitime-Frace-OWB80DB ff(tudoor drybub); ff(cupply air flow): Perfor

Figure 14: Cap Curves/Waste Ht (Heating) Tab.

Air-Side HVAC System Parameters	? 🗙
Currently Active System: S1 Sys (PS2) System Type: Pkgd Var Vol Var Temp Basics Fans Outdoor Air Cooling Heating Preconditioner Meters Refrigeration	
Coil Cap / Control       Unitary Power       Preht / Basebrd       Supp Heat/Defrost       Cap Curves/Waste Ht       Stages         Supplemental Heat	
	Done

#### Figure 15: Supp Heat/Defrost (Heating) Tab.

- HP-SUPP-SOURCE: Not installed
- DEFROST-TYPE : *REVERSE-CYCLE*
- DEFROST-CTRL : ON-DEMAND
- DEFROST-T : Set to 40°F.



13. We then add fan parameters. We enter the total static pressure (TSP) or fan power (kW/cfm) of the system supply fan.

**Note:** TSP includes also includes pressure drops across filters and other internal air handler components.

Depending on the system type, you can set fans to cycle at night. Select "no OA at night" if there is no economizer or "no OA at night + economizer" plus the economizer type if your system has an economizer.

**Note:** You may need to remove the economizer low limit in detail mode.

For our system, we have four 4-Way Ceiling cassettes (ARUN243TMC2), each with a 30W fan motor moving air at 600 cfm.

Air-Side HVAC Syste	em Parameters				
Currently	y Active System:	S1 Sys (PS	Z)		System Type: Pkgd Var Vol Var Temp
Basics Fans	Outdoor Air	Cooling He	eating Precondition	er   Meters   R	Refrigeration
Fan Power and	d Control   Fl	low Parameters	Night Cycle Cont	rol	
Fan Power Pa	rameters for sing Design kW/cfm	gle-duct systems Delta T ຜ	Static Tot E in WG Fra	ff Mech Eff c Frac	Fan EIR = f(PLR)
Supply:	0.000050	0.15	0	.53 n/a	a n/a
Unused:	n/a	n/a	n/a	n/a n/a	a n/a
Return:		n/a	0	.53	n/a
Fan Control ar Cooling: Unused: Return: Exhaust:	nd Placement — Fan Sch S1 Sys1 (PS2) n/a - undefined -	edules Fan Sch v	Fan Control Variable Speed n/a n/a	Fan Pl	lacement Motor Placement
					Done

Figure 16: Fan Power and Control (Fans) Tab.

Refer to the EPDB for the indoor units you intend to model to find the TSP and other data. Pressure losses should include filters, coils, and the distribution system. You should use the full-load power of the supply fan per unit of supply air flow rate at sea level, using either SUPPLY-STATIC or SUPPLY-KW/FLOW. eQUEST calculates the part-load power consumption of the supply fan versus the part-load characteristics



corresponding to the control mode selected. You should choose the variable speed option, specify the supply fan placement, and specify the design air flow capacity of the indoor units' supply fans.

Currently Active System:       S1 Sys (PS2)       System Type: Pkgd Var Vol Var Temp         Isics:       Fan:       Outdoor Air       Cooling       Heating       Preconditioner       Meters       Refrigeration         Fan:       Pow Parameters:       Night Cycle Control       Image: System Type: Pkgd Var Vol Var Temp         Flow Parameters for single-duct systems       Design       Min Flow       Max Flow       Min Fan       Max Fan         Supply Flow:       2,400       min Flow       Max Flow       Ratio       Ratio       0.25       1.00         Heating Mode:       n/a       m/a       Min Flow       Ratio       1.00         Dual Speed Fan/Compressor Ratios       Min Flow       Max Elow       N/a       Min         m/a       m/a       m/a       m/a       N/a       Return Cap Ratio:       m/a	ide HVAC System Parameters				
Fan Power and Control       Flow Parameters       Night Cycle Control         Flow Parameters for single-duct systems       Design       Min Flow       Max Flow       Min Fan       Max Fan         Supply Flow:       2,400       0       0.25       1.00         Heating Mode:       n/a       n/a       n/a         Min Flow       Max Flow       Min Fan       Max Fan         Return Flow:       n/a       n/a       1.00         Min Flow Source:       n/a       N/a       Induction Ratio:       n/a         Noder Fan/Compressor Ratios       Min Flow Source:       n/a       n/a       Return Cap Ratio:       n/a         N/a       n/a       n/a       n/a       n/a       n/a       Return Cap Ratio:       n/a	Currently Active System: asics Fans Outdoor Air Co	S1 Sys (PSZ) cooling   Heating   Preconditi	System Type: ioner   Meters   Refrigeration	Pkgd Var Vol Var Temp	
Design ofm     Min Flow fm, Flow Ratio     Max Flow Ratio     Max Fan Ratio       Supply Flow:     2,400     0.25     1.00       Heating Mode:     n/a     n/a       Return Flow:     n/a         Min Flow Source:     n/a         Min Flow Source:     n/a         Dual Speed Fan/Compressor Ratios     Min Flow Source:     n/a       n/a     n/a     n/a         Min Flow Cap Ratio:     n/a	Fan Power and Control Flow F	Parameters Night Cycle Co ystems	ontrol		
Supply How: 2,400 Heating Mode: n/a Return Flow: n/a Dual Speed Fan/Compressor Ratios Induction Ratio: n/a n/a n/a n/a n/a Return Cap Ratio: n/a ratio	Surgely Flamm	Design Min Flow cfm cfm/ft2	Min Flow Max Flow Ratio Ratio	Min Fan Max Fan Ratio Ratio	
Return Flow:       n/a         Min Flow Source:       n/a         Indoor Fan Mode:       Intermittent         Induction Ratio:       n/a         n/a       n/a       n/a         n/a       n/a       n/a         n/a       n/a       n/a         n/a       n/a       n/a	Heating Mode:	2,400	n/a	0.25 1.00	
Juai Speed ran/Compressor Katos     Induction Ratio:     n/a       n/a     n/a     n/a     Return Cap Ratio:     n/a			Min Flow Source: n/a Indoor Fan Mode: Intermitte	r nt v	
	Dual Speed Fan/Compressor R	latios	Induction Ratio: n/a Return Cap Ratio: n/a	ratio	

Figure 17: Flow Parameters (Fan) Tab.

Both the minimum and maximum air flow rates through a supply fan are expressed as a fraction of the design flow rate. We chose to set the rate to INTERMITTENT where the indoor unit fan operates as with the CONTINIOUS setting but only for a fraction of an hour required for space heating or cooling.

14. Next, we run the simulation.





Figure 18: Simulation calculation in progress.





Figure 19: Simulation results.



The results consist of reports in three main categories:

- Verification reports that summarize the model input, as well as design values calculated by the program.
- Summary reports that present the results of the program simulation.
- Hourly reports that tabulate the hourly values of a user-selected set of simulation variables.



### References

- DOE-2.2 Building Energy Use and Cost Analysis Program, Volume 1 Basic, Lawrence Berkeley National Laboratory and James J. Hirsch & Associates (JJH).
- DOE-2.2 Building Energy Use and Cost Analysis Program, Volume 2 Dictionary, Lawrence Berkeley National Laboratory and James J. Hirsch & Associates (JJH).
- ASHRAE/IESNA Standard 90.1-2007 : http://www.ashrae.org.