

Montgomery County Equipment Maintenance and Operations Center

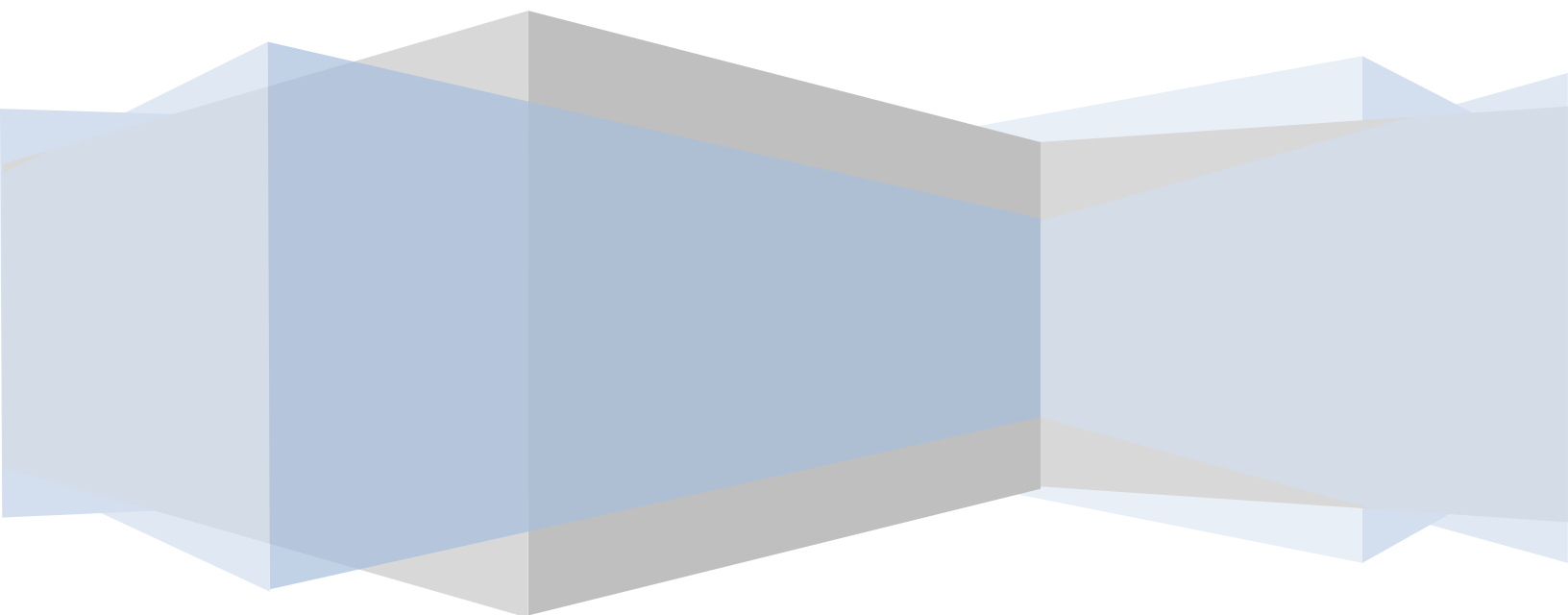
Technical Report 2

Building and Plant Energy Analysis

Michael Tellep

Mechanical Option

Advisor: Moses Ling



Montgomery County Equipment Maintenance and Operations Center-Building 1

Technical Report 2 - Building and Plant Energy Analysis

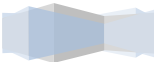
Michael Tellep

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Montgomery County Equipment Maintenance and Operations Center-Building 1

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Executive Summary:

The Montgomery County Equipment Maintenance and Operations Center, Building 1 (EMOC 1) is a 75,000 square foot building in Rockville, Maryland designed to be the new hub for Montgomery County's ground transportation services. EMOC 1 is a multi-purpose building consisting of both garage space for maintenance and office space for operations. The building is still under construction and is scheduled to be finished in February of 2013. The design strives for LEED silver or better.

This report will analyze the energy consumption EMOC 1 based on a model created in Trane TRACE 700. The scope of the report will include an overview of the mechanical system, a description of the modeling process and data used, a summary of the calculation results, and an energy consumption analysis based on the calculations from TRACE 700. Actual energy use data is not available for the building since the building is not yet completed, therefore a comparison of my results to the actual data will not be in the scope of this report.

Mechanical Overview:

EMOC 1 is serviced by 3 rooftop air handling units, 2 energy recovery units, 1 heating and ventilating system, and numerous exhaust fans. The overall layout of the building allows for the different occupancies of garage space and office/storage space to be clearly defined and considered separately in a mechanical sense. The rooftop units (RTU-1, RTU-2, RTU-3) mainly service the office spaces and storage spaces. The schematic of the RTUs is shown below. They are bypass VAV systems with reheat.

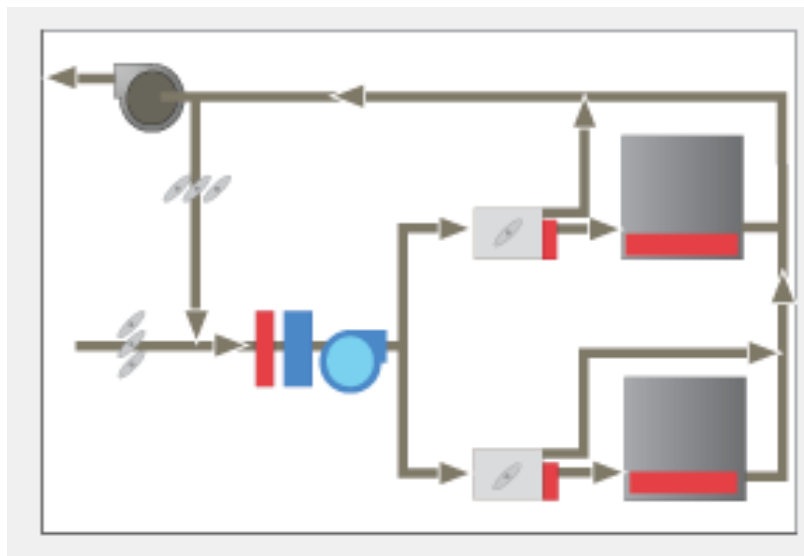


Figure 1 - Bypass VAVV with Reheat

Montgomery County Equipment Maintenance and Operations Center-Building 1

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While these units provide both heating and cooling, the energy recovery units (ERU-1, ERU-2), which service the garage spaces, are for heating and ventilating only. The garage bay doors are open to the outside quite often, so cooling the spaces would not be practical. Heating, however, is required during the winter months. This type of system, however, created a problem in the energy modeling. Trane TRACE 700 does not have a system schematic that is comparable to the ERUs. In order to get a relatively close estimate for this energy analysis, the ERUs were treated as simple heating and ventilating units shown below.

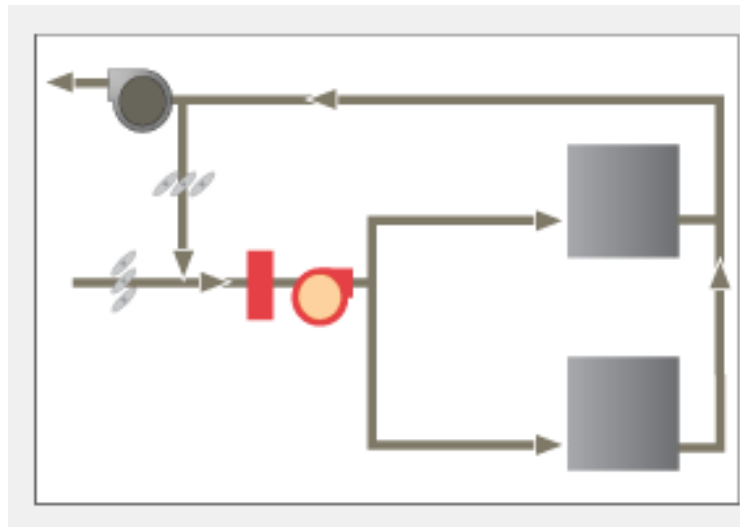


Figure 2 - Heating and Ventilating Unit

This is also the schematic for the heating and ventilating system (HV-1) that services the shipping and receiving areas as well as the machine shop.

Exhaust fans are used throughout the building to service any areas where excess heat or fumes are created. Some rooms, especially in the garage areas, are not serviced by either the RTUs or the ERUs, but only with an exhaust fan therefore drawing the "supply air" for the space from the surrounding rooms.

Montgomery County Equipment Maintenance and Operations Center-Building 1

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Design Load Estimation:

The academic version of Trane TRACE 700 was used to for the analysis of the mechanical system. The analysis was based on square footage of each room, room height, and the existence of exterior walls in each room. Other specific factors for input as shown below. Most information was available in the design documents, however, where information was not available, research was done to find an applicable example for the sake of accuracy.

Modeling Overview:

The model of the building was done in a standardized manner due to the similarity between spaces within each occupancy and the definite boundaries where the occupancy changes from office to garage. First, weather data was selected for Washington, D.C. The building is in Rockville, MD but the weather data for Washington is still applicable due to proximity. Next Templates were created to define mechanical parameters for each type of space. The following templates exist in the model:

- Office Space
- Garage Space
- Storage Space
- Kitchen Space
- Locker Space

These templates were then assigned to each room in the building depending on its occupancy. The use of templates allowed rooms to be created with the Single Sheet entry only. There were some specifics defined for certain spaces that override the template, but this was not needed often.

Weather Data:

The weather data selected for the analysis was from Washington D.C. Even though EMOC 1 is located in Rockville, MD, the data for Washington is consistent with the data for Rockville and is already available in TRACE 700. The specific data used can be found in Appendix A.

Montgomery County Equipment Maintenance and Operations Center-Building 1

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Load Sources:

The load sources for EMOC 1 are consistent with most buildings of its type with a few exceptions. The office spaces are very standard, however, the inconsistencies come in to play in the garage spaces. The garage spaces encounter all manner of activities resulting in mechanical load such as welding, running diesel engines, and many more inconsistent loads. This could be one of the reasons that outside air ventilation was designed as the only method of cooling these spaces. Garage spaces such as this one need to be 100% outside air, so this is a viable option. Other standard load sources and their details are shown below:

Table 1: Load Sources

Source	Load Type	Value
Lighting	Interior	1 W/sf - Garage 2 W/sf - Kitchen 1.5 W/sf - Office 0.5 W/sf - Storage
Misc. Interior Loads	Interior	Estimated on room by room basis
Infiltration	Exterior	Typical U values and infiltration rates from TRACE 700 used
Ventilation	Exterior	Determined from ASHRAE Standard 62.1
People Density	Interior	Determined from ASHRAE Standard 62.1

Occupancy and Ventilation:

As previously stated, EMOC 1 has two split occupancy classifications with distinct boundaries between them. These occupancies are typical office space and garage/maintenance space. Ventilation rates and other factors pertaining to the design of the systems servicing the spaces were determined or confirmed in Technical Report 1 based on ASHRAE Standard 62.1-2007.

Montgomery County Equipment Maintenance and Operations Center-Building 1

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Schedules:

The following schedules were used for the energy analysis:

Table 2 - Weekday Cooling

Time Period	Percentage Available
0000 - 0500	30
0500 - 0600	60
0600 - 0700	90
0700 - 2000	100
2000 - 2100	90
2100 - 2200	60
2200 - 0000	30

Table 3 - Weekend Cooling

Time Period	Percentage Available
0000 - 0500	30
0500 - 0700	60
0700 - 0900	90
0900 - 1800	100
1800 - 2000	90
2000 - 2100	60
2100 - 0000	30

Table 4 - Heating Schedule

Time Period	Percent Available
0000 - 0000	100

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Summary of Results:

5 systems were considered for this energy analysis. These systems are RTU-1 through RTU-3, ERU-1&2, and HV-1. The table below shows the results of the calculations from TRACE 700:

Table 5 - TRACE 700 Results by System

System	Parameter	Cooling	Heating
RTU-1	%OA	7.7	7.8
	cfm/sf	1.78	1.75
	cfm/ton	459.45	-
	sf/ton	257.49	-
RTU-2	%OA	18.4	15.3
	cfm/sf	0.97	0.97
	cfm/ton	292.68	-
	sf/ton	301.90	-
RTU-3	%OA	6.0	6.6
	cfm/sf	2.07	2.07
	cfm/ton	463.68	-
	sf/ton	224.35	-
ERU-1	%OA	-	100
	cfm/sf	-	0.25
	cfm/ton	-	-
	sf/ton	-	-
ERU-2	%OA	-	100
	cfm/sf	-	0.25
	cfm/ton	-	-
	sf/ton	-	-
HV-1	%OA	-	100
	cfm/sf	-	0.18
	cfm/ton	-	-
	sf/ton	-	-

One can clearly see how the systems are split to service each specific occupancy in the building by simply looking at the outside air percentages. The RTUs have a relatively normal outside air intake due to the fact that they only service the office spaces. The ERUs and HV unit are 100 percent outside air because of their exclusive service to the garage and maintenance spaces. The project mechanical engineer did not provide data from an energy analysis, however, when compared to other buildings of its type, this analysis shows EMOC 1 to be at the lower end of its type in terms of energy use. This is consistent with the efforts to classify EMOC 1 as LEED silver. These results are similar, but not perfectly consistent with the design documents. The design document values could be including some assumptions made by the engineer that I did not make here.

Montgomery County Equipment Maintenance and Operations Center-Building 1

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Another result of the TRACE 700 analysis is the design heating and cooling capacity of the building. The full report can be seen in Appendix C, but a summary of these capacities is shown below:

Table 6 - Plant Size

Plant	System	Main Coil (tons or MBh)
Heating	RTU-1	79
	RTU-2	158
	RTU-3	77
	ERU-1	611
	ERU-2	714
	HV-1	75
Heating Total:		1,714 MBh
Cooling	RTU-1	28.6
	RTU-2	55.0
	RTU-3	22.0
Cooling Total:		105.6 tons

It can be seen here that the heating total is slightly higher than a typical building of this size. This is due to the considerations taken for the garage bay doors being opened and the extreme infiltration associated with that. The ERUs are clearly sized much larger for this purpose. However, looking just at the RTUs that service the office spaces, the efforts towards a LEED certified building are displayed.

Montgomery County Equipment Maintenance and Operations Center-Building 1

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Energy Analysis:

This section will analyze the overall energy distribution in the building and how it relates to an average building energy distribution figure. The full energy distribution can be found in Appendix C, however, a summary is given below for comparison.

Table 7 - Energy Distribution

System	% Total
Primary Heating	4.7
Primary Cooling	6.9
Lighting	67.9
Receptacle	20.6

For this analysis, the lighting system came out to be quite high. This could be due to a modeling error or due to assumptions made during modeling. For comparison, the US Department of Energy chart for building energy distribution is shown below.

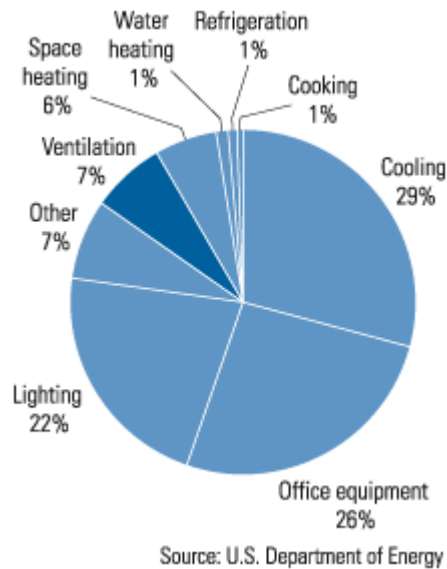


Figure 3 - Energy Distribution

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Cost Analysis:

The cost data produced for EMOC 1 appears to be quite accurate. This is based on typical buildings of its type since no actual data is available for EMOC 1 as of yet. Actual utility cost can vary greatly depending on the accuracy of the design, maintenance of components, use of systems by occupants, and quality of construction. The estimated cost data from TRACE 700 is summarized below. The full reports can be found in Appendix C.

Table 8 - Annual Costs

Utility	Cost (\$/Yr)
Electric	26,061
Gas	363
Total	26,464

The monthly utility costs can also be found in Appendix C. The rates for the utilities service come from information provided by the city of Rockville. The rates are posted in Appendix B.

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Appendix A:

TABLE C1 US Climatic Data

State City	Latitude		Longitude		I-P			No. Hrs. 8 a.m.-4 p.m. 55 < DB < 69°F 13 < DB < 21°C	SI		
					Elev. (ft)	HDD 65°F	CDD 50°F		Elev. (m)	HDD 18°C	CDD 10°C
Virginia											
Washington DC Reagan National AP	38.85	N	77.03	W	66	4,047	4,391	657	20	2,248	2,439
US Minor Outlying Islands											
Midway Island NAS	28.22	N	177.37	W	13	134	8,323	N.A.	4	74	4,624
Wake Island	19.28	N	166.65	E	12	0	11,097	N.A.	4	0	6,165

Montgomery County Equipment Maintenance and Operations Center-Building 1

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Appendix B:

See following pages

Location **Rockville, MD**
 Building owner **Montgomery County**
 Program user **Michael Tellep**
 Company **Penn State AE**
 Comments

By **ACADEMIC**
 Dataset name **C:\Users\Michael Tellep\Desktop\Trace files\Thesis.trc**

Calculation time **02:42 PM on 12/06/2011**
 TRACE® 700 version **6.2.6.5**

Location **Washington, D.C.**
 Latitude **38.0 deg**
 Longitude **77.0 deg**
 Time Zone **5**
 Elevation **14 ft**
 Barometric pressure **29.9 in. Hg**

Air density **0.0760 lb/cu ft**
 Air specific heat **0.2444 Btu/lb·°F**
 Density-specific heat product **1.1147 Btu/h·cfm·°F**
 Latent heat factor **4,906.9 Btu·min/h·cu ft**
 Enthalpy factor **4.5604 lb·min/hr·cu ft**

Summer design dry bulb **91 °F**
 Summer design wet bulb **77 °F**
 Winter design dry bulb **17 °F**

Summer clearness number **0.85**
 Winter clearness number **0.85**
 Summer ground reflectance **0.20**
 Winter ground reflectance **0.20**
 Carbon Dioxide Level **400 ppm**

Design simulation period **January - December**
 Cooling load methodology **TETD-TA1**
 Heating load methodology **UATD**

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MONTHLY UTILITY COSTS

By ACADEMIC

Utility	Jan	Feb	Mar	Apr	----- Monthly Utility Costs -----				Sept	Oct	Nov	Dec	Total
					May	June	July	Aug					
Alternative 1													
Electric													
On-Pk Cons. (\$)	1,671	1,510	1,688	1,667	1,852	3,575	3,804	3,673	3,372	3,230	0	0	26,043
On-Pk Demand (\$)	0	0	0	0	0	0	0	0	0	0	9	9	19
Total (\$):	1,671	1,510	1,688	1,667	1,852	3,575	3,804	3,673	3,372	3,230	9	9	26,061
Gas													
On-Pk Cons. (\$)	86	64	19	18	18	18	18	18	18	18	18	49	363
Monthly Total (\$):	1,757	1,574	1,707	1,685	1,870	3,593	3,822	3,691	3,390	3,249	27	59	26,424

Building Area = 74,991 ft²

Utility Cost Per Area = 0.35 \$/ft²

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SYSTEM SUMMARY

DESIGN COOLING CAPACITIES

By ACADEMIC

Alternative 1

Building Airside Systems and Plant Capacities

Plant	System	Peak Plant Loads							Block Plant Loads									
		Main Coil ton	Aux Coil ton	Opt Vent Coil ton	Misc Load ton	Stg 1	Stg 2	Base Utility ton	Peak Total ton	Time Of Peak mo/hr	Main Coil ton	Aux Coil ton	Opt Vent Coil ton	Misc Load ton	Stg 1	Stg 2	Base Utility ton	Block Total ton
						Desic Cond ton	Desic Cond ton								Desic Cond ton	Desic Cond ton		
Cooling plant - 001		105.6	0.0	0.0	0.0	0.0	0.0	0.0	105.6	7/16	85.4	0.0	0.0	0.0	0.0	0.0	0.0	85.4
	RTU - 1	28.6	0.0	0.0	0.0	0.0	0.0	0.0	28.6	7/16	20.9	0.0	0.0	0.0	0.0	0.0	0.0	20.9
	RTU - 2	55.0	0.0	0.0	0.0	0.0	0.0	0.0	55.0	7/16	48.3	0.0	0.0	0.0	0.0	0.0	0.0	48.3
	RTU - 3	22.0	0.0	0.0	0.0	0.0	0.0	0.0	22.0	7/16	16.3	0.0	0.0	0.0	0.0	0.0	0.0	16.3
Building totals		105.6	0.0	0.0	0.0	0.0	0.0	0.0	105.6		85.4	0.0	0.0	0.0	0.0	0.0	0.0	85.4

Building peak load is 105.6 tons.

Building maximum block load of 85.4 tons occurs in July at hour 16 based on system simulation.

SYSTEM SUMMARY
DESIGN HEATING CAPACITIES
 By ACADEMIC

Alternative 1

System Coil Capacities

System Description	System Type	Main System Btu/h	Aux System Btu/h	Preheat Btu/h	Reheat Btu/h	Humid. Btu/h	Optional Vent Btu/h	Stg 1	Stg 2	Stg 1	Stg 2	Heating Totals Btu/h
								Desic Regen Btu/h	Desic Regen Btu/h	Frost Prevention Btu/h	Frost Prevention Btu/h	
RTU - 1	Bypass VAV with Reheat (30% Min Flow Default)	-79,374	0	-75,166	-163	0	0	0	0	0	0	-154,540
RTU - 2	Bypass VAV with Reheat (30% Min Flow Default)	-158,047	0	-155,506	-6,025	0	0	0	0	0	0	-313,553
RTU - 3	Bypass VAV with Reheat (30% Min Flow Default)	-76,788	0	-51,974	-3,280	0	0	0	0	0	0	-128,761
ERU - 1	Ventilation and Heating	-610,995	0	0	0	0	0	0	0	0	0	-610,995
ERU - 2	Ventilation and Heating	-713,787	0	0	0	0	0	0	0	0	0	-713,787
HV - 1	Ventilation and Heating	-74,674	0	0	0	0	0	0	0	0	0	-74,674
Totals		-1,713,665	0	-282,645	-9,469	0	0	0	0	0	0	-1,996,311

Building Plant Capacities

Plant	System	Peak Loads											Absorption Load MBh	
		Main Coil MBh	Preheat Coil MBh	Reheat Coil MBh	Humid. Coil MBh	Aux Coil MBh	Opt Vent Coil MBh	Misc Load MBh	Stg 1 Desic. Regen. MBh	Stg 2 Desic. Regen. MBh	Stg 1 Frost Prev. MBh	Stg 2 Frost Prev. MBh		Base Utility MBh
		Heating plant - 002	1,714	283	0	0	0	0	0	0	0	0		0
	RTU - 1	79	75	0	0	0	0	0	0	0	0	0	0	0
	RTU - 2	158	156	0	0	0	0	0	0	0	0	0	0	0
	RTU - 3	77	52	0	0	0	0	0	0	0	0	0	0	0
	ERU - 1	611	0	0	0	0	0	0	0	0	0	0	0	0
	ERU - 2	714	0	0	0	0	0	0	0	0	0	0	0	0
	HV - 1	75	0	0	0	0	0	0	0	0	0	0	0	0

Building peak load is 1,996.3 MBh.

Economic Summary

Project Information

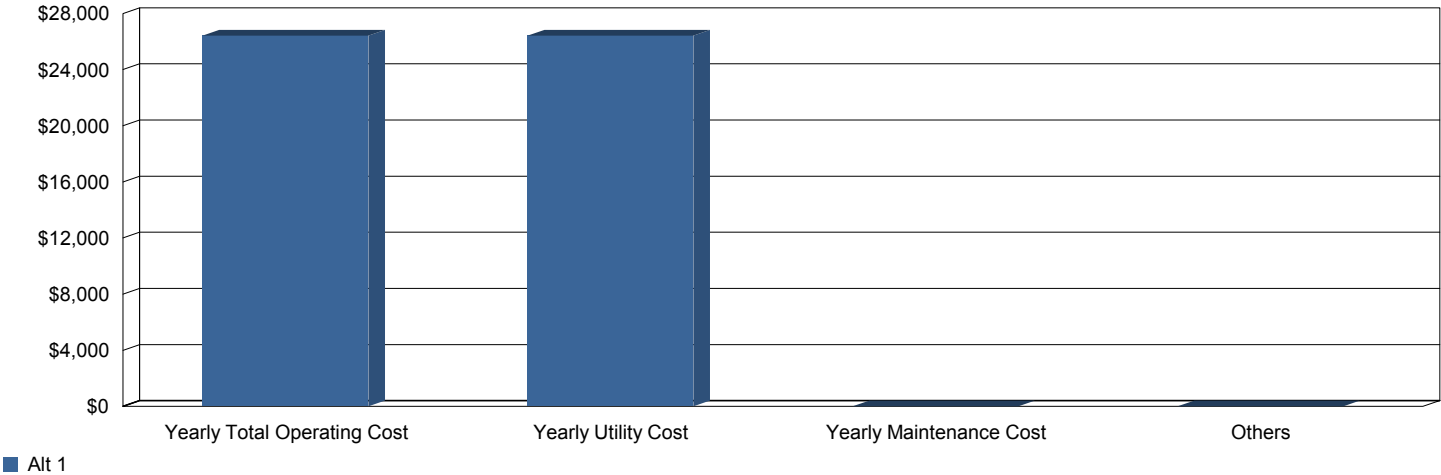
Location: Rockville, MD
 Project Name: EMOC
 User: Michael Tellep
 Company: Penn State AE
 Comments:

Study Life: 20 years
 Cost of Capital: 10 %
 Alternative 1: Thesis

Economic Comparison of Alternatives

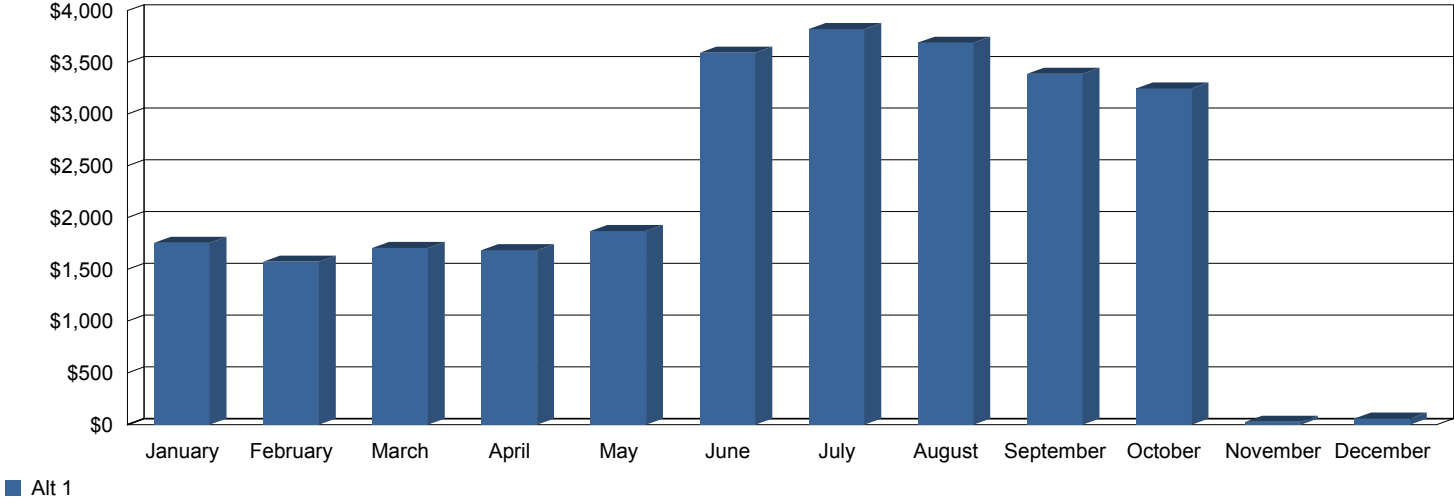
Yearly Savings (\$)	First Cost Difference (\$)	Cumulative Cash Flow Difference (\$)	Simple Payback (yrs.)	Net Present Value (\$)	Life Cycle Payback (yrs.)	Internal Rate of Return (%)	Life Cycle Cost
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Annual Operating Costs



Yearly Total Operating Cost (\$)	Yearly Utility Cost (\$)	Yearly Maintenance Cost (\$)
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Monthly Utility Costs



ENERGY CONSUMPTION SUMMARY

By ACADEMIC

	Elect Cons. (kWh)	Gas Cons. (kBtu)	% of Total Building Energy	Total Building Energy (kBtu/yr)	Total Source Energy* (kBtu/yr)
Alternative 1					
Primary heating					
Primary heating		120,862	3.1 %	120,862	127,223
Other Htg Accessories	18,046		1.6 %	61,590	184,790
Heating Subtotal	18,046	120,862	4.7 %	182,452	312,013
Primary cooling					
Cooling Compressor	67,284		5.9 %	229,639	688,985
Tower/Cond Fans	9,661		0.9 %	32,973	98,928
Condenser Pump			0.0 %	0	0
Other Clg Accessories	847		0.1 %	2,892	8,677
Cooling Subtotal....	77,792		6.9 %	265,504	796,591
Auxiliary					
Supply Fans			0.0 %	0	0
Pumps			0.0 %	0	0
Stand-alone Base Utilities			0.0 %	0	0
Aux Subtotal....			0.0 %	0	0
Lighting					
Lighting	770,727		67.9 %	2,630,490	7,892,260
Receptacle					
Receptacles	233,892		20.6 %	798,274	2,395,060
Cogeneration					
Cogeneration			0.0 %	0	0
Totals					
Totals**	1,100,457	120,862	100.0 %	3,876,720	11,395,924

* Note: Resource Utilization factors are included in the Total Source Energy value .

** Note: This report can display a maximum of 7 utilities. If additional utilities are used, they will be included in the total.

Project Name: EMOG
Dataset Name: Thesis.trc

TRACE® 700 v6.2.6.5 calculated at 02:42 PM on 12/06/2011
Alternative - 1 Energy Consumption Summary report page 1

Energy Cost Budget / PRM Summary

By ACADEMIC

Project Name: EMOC	Date: December 06, 2011
City: Rockville, MD	Weather Data: Washington, D.C.

Note: The percentage displayed for the "Proposed/ Base %" column of the base case is actually the percentage of the total energy consumption.

* Denotes the base alternative for the E-3 study.

		* Alt-1 Thesis		
		Proposed Base	Peak	Prk
		(Cost/yr)	(%)	(kWh/yr)
Lighting - Conditioned	Electricity	2,630.5	68	300
Space Heating	Electricity	61.6	2	9
	Gas	120.9	3	332
Space Cooling	Electricity	232.5	6	302
Heat Rejection	Electricity	33.0	1	32
Receptacles - Conditioned	Electricity	798.3	21	91
Total Building Consumption		3,876.7		

		* Alt-1 Thesis
Total	Number of hours heating load not met	188
	Number of hours cooling load not met	0

		* Alt-1 Thesis	
		Energy 10 ⁶ Btu/yr	Cost/yr \$/yr
Electricity		3,755.9	26,061
Gas		120.9	363
Total		3,877	26,424

ENGINEERING CHECKS

By ACADEMIC

System	Zone	Room	Type	Floor Area ft ²	COOLING					HEATING		
					% OA	cfm/ft ²	cfm/ton	ft ² /ton	Btu/hr-ft ²	% OA	cfm/ft ²	Btu/hr-ft ²
Alternative 1												
		1101 - Corridor	Zone	1,519	0.00	0.00	0.0	0.0	0.00	100.00	0.14	-15.17
		1117 - Tool Storage	Zone	479	0.00	0.00	0.0	0.0	0.00	100.00	0.18	-21.31
		1133 - Tire Shops	Zone	1,000	0.00	0.00	0.0	0.0	0.00	100.00	0.22	-26.65
		1134 - Corridor	Zone	2,569	0.00	0.00	0.0	0.0	0.00	100.00	0.18	-21.31
		1168-1173 - Maintenance Bays	Zone	5,935	0.00	0.00	0.0	0.0	0.00	100.00	0.29	-34.59
		1174-1179 - Maintenance Bays	Zone	5,962	0.00	0.00	0.0	0.0	0.00	100.00	0.29	-34.53
		1184 - Welding Bay	Zone	1,761	0.00	0.00	0.0	0.0	0.00	100.00	0.31	-37.21
		1185 - Welding Shop	Zone	771	0.00	0.00	0.0	0.0	0.00	100.00	0.21	-25.48
ERU - 1		System - Ventilation and Heating		19,996	0.00	0.00	0.0	0.0	0.00	100.00	0.25	-30.56
		1139 - Tire Shop/Storage - Bus Tires	Zone	1,119	0.00	0.00	0.0	0.0	0.00	100.00	0.29	-34.88
		1149 - Body/Welding Bay	Zone	1,536	0.00	0.00	0.0	0.0	0.00	100.00	0.23	-27.86
		1150 - Chassis Wash	Zone	1,475	0.00	0.00	0.0	0.0	0.00	100.00	0.24	-29.31
		1151-1159 - Maintenance Bays	Zone	9,869	0.00	0.00	0.0	0.0	0.00	100.00	0.26	-31.88
		1160-1167 - Maintenance Bays	Zone	8,483	0.00	0.00	0.0	0.0	0.00	100.00	0.27	-32.31
ERU - 2		System - Ventilation and Heating		22,481	0.00	0.00	0.0	0.0	0.00	100.00	0.26	-31.75
		1122 - Shipping & Receiving	Zone	1,244	0.00	0.00	0.0	0.0	0.00	100.00	0.27	-32.14
		1123 - Parts Room	Zone	1,842	0.00	0.00	0.0	0.0	0.00	100.00	0.12	-13.19
		1182 - Machine Shop	Zone	527	0.00	0.00	0.0	0.0	0.00	100.00	0.16	-19.72
HV - 1		System - Ventilation and Heating		3,613	0.00	0.00	0.0	0.0	0.00	100.00	0.18	-20.67
		1204 - Misc	Zone	3,414	15.92	0.88	295.2	336.1	35.71	15.92	0.88	-14.86
		1205 - Bunks/Bulk Storage	Zone	202	4.19	3.34	556.0	166.7	71.99	4.19	3.34	-33.55
		1206 - Conference	Zone	273	17.69	0.79	265.4	335.7	35.75	17.69	0.79	-12.02
		1207 - Break Room	Zone	304	18.33	0.76	259.6	340.2	35.27	18.33	0.76	-11.96
		1209 - Fleet Serv Manager	Zone	165	3.88	3.60	563.6	156.5	76.67	3.88	3.60	-35.27
		1210 - Visiting Staff	Zone	102	11.22	1.25	342.7	274.9	43.65	11.22	1.25	-13.03
		1211 - Coord Manager	Zone	156	3.33	4.20	577.3	137.4	87.35	3.33	4.20	-40.15
		1212 - Supply STG	Zone	68	7.67	0.33	187.4	574.8	20.88	36.80	0.33	-11.25
		1213 - File Room	Zone	74	7.67	0.33	187.4	574.8	20.88	36.80	0.33	-11.25
		1214 - Coord Manager	Zone	162	3.44	4.06	574.3	141.4	84.85	3.44	4.06	-39.08
		1215 - Electrical	Zone	147	13.66	1.02	308.7	301.6	39.79	13.66	1.02	-12.53
		1216 - Admin Spec	Zone	141	3.20	4.38	580.8	132.7	90.44	3.20	4.38	-41.30
		1217 - Division Chief	Zone	230	3.70	3.78	573.5	151.6	79.17	3.70	3.78	-36.97
		1218 - Prog Mngr	Zone	113	3.03	4.62	592.0	128.1	93.64	3.03	4.62	-41.80
		1220 - Senior Spec	Zone	111	2.64	5.30	603.5	113.8	105.46	2.64	5.30	-47.31
		1221 - Admin Serv Coord Mngr	Zone	160	2.58	5.43	581.1	107.1	112.04	2.58	5.43	-57.40
		1222 - Prog Mngr	Zone	137	4.16	3.36	491.7	146.2	82.09	4.16	3.36	-30.89
		1223 - Prog Mngr	Zone	128	4.08	3.43	494.2	144.2	83.20	4.08	3.43	-31.17
		1224 - Prog Mngr	Zone	133	4.05	3.45	495.0	143.5	83.63	4.05	3.45	-31.48
		1225 - IT Spec III	Zone	118	3.97	3.52	498.0	141.3	84.94	3.97	3.52	-31.67

System	Zone	Room	Type	Floor Area	COOLING					HEATING		
				ft²	% OA	cfm/ft²	cfm/ton	ft²/ton	Btu/hr-ft²	% OA	cfm/ft²	Btu/hr-ft²
		1226 - IT Spec II	Zone	133	4.05	3.45	495.0	143.5	83.63	4.05	3.45	-31.48
		1227 - IT Spec II	Zone	129	3.95	3.54	498.3	140.7	85.26	3.95	3.54	-32.10
		1228 - Conference	Zone	446	20.41	0.69	242.4	353.8	33.92	20.41	0.69	-11.79
		1231 - Men	Zone	141	13.38	1.05	312.3	298.8	40.16	13.38	1.05	-12.58
		1232 - Women	Zone	167	14.52	0.96	298.4	309.7	38.74	14.52	0.96	-12.40
RTU - 1		System - Bypass VAV with Reheat (30% Min Flow Default)		7,354	7.71	1.78	459.4	257.5	46.60	7.82	1.78	-21.01
		1105 - Crew Chief	Zone	539	21.90	0.64	235.0	367.9	32.61	21.90	0.64	-11.89
		1106 - QA Tech	Zone	656	22.64	0.62	230.3	372.8	32.19	22.64	0.62	-11.85
		1107 - Conferance	Zone	351	19.94	0.70	248.3	354.0	33.90	19.94	0.70	-12.01
		1108 - Equipment Service Coordinator	Zone	101	12.19	1.15	320.0	279.0	43.01	12.19	1.15	-12.85
		1110 - Break Room	Zone	122	9.45	1.48	349.1	235.7	50.90	9.45	1.48	-27.45
		1111 - Men	Zone	230	17.57	0.80	266.6	334.9	35.83	17.57	0.80	-12.19
		1112 - Women	Zone	59	8.78	1.59	366.6	230.3	52.11	8.78	1.59	-13.69
		1113 - Tech Library	Zone	66	100.00	1.39	157.9	113.6	105.66	30.00	1.39	-76.36
		1114 - Depot Crew Chief	Zone	64	100.00	1.39	157.9	113.6	105.66	30.00	1.39	-76.36
		1115 - Crew Chief - Heavy Equipment	Zone	431	100.00	1.39	158.5	114.0	105.24	30.00	1.39	-76.36
		1116 - Equipment Service Coordinator	Zone	157	15.14	0.92	288.3	312.1	38.45	15.14	0.92	-12.43
		1126 - Supply Clerk II & III	Zone	748	23.08	0.61	227.6	375.6	31.95	23.08	0.61	-11.83
		1127 - Shipping & Receiving Office	Zone	104	12.39	1.13	317.7	281.4	42.64	12.39	1.13	-12.82
		1128 - Senior Supply Clerk	Zone	127	13.73	1.02	302.7	297.1	40.39	13.73	1.02	-12.61
		1130 - Bolts Bins Storage	Zone	120	7.00	0.36	215.9	604.1	19.86	33.58	0.36	-12.11
		1200 - Lobby	Zone	683	22.78	0.61	229.4	373.7	32.11	22.78	0.61	-11.84
		1203 - Training Room	Zone	1,984	11.54	1.21	362.8	299.5	40.07	11.54	1.21	-22.60
		1234 - Men Locker	Zone	698	22.85	0.61	229.0	374.2	32.07	22.85	0.61	-11.84
		1235 - Men	Zone	409	20.69	0.68	243.0	359.5	33.38	20.69	0.68	-11.96
		1237 - Women Locker	Zone	124	13.57	1.03	304.4	295.3	40.64	13.57	1.03	-12.63
		1239 - Break Room	Zone	1,342	18.60	0.75	256.1	340.5	35.24	18.60	0.75	-15.99
		1240 - Kitchen	Zone	207	4.62	1.14	354.2	312.1	38.45	10.57	1.14	-17.05
		1241 - STG	Zone	92	7.00	0.36	215.9	604.1	19.86	33.58	0.36	-12.11
		1242 - Vending	Zone	114	13.00	1.08	310.6	288.8	41.55	13.00	1.08	-12.71
		1245 - Corridor	Zone	762	23.14	0.60	227.3	376.0	31.91	23.14	0.60	-11.82
		1247 - Women	Zone	348	19.19	0.73	253.8	348.2	34.46	19.19	0.73	-12.06
		1248 - Men	Zone	430	20.29	0.69	245.8	356.6	33.65	20.29	0.69	-11.99
		1249 - Lockers	Zone	621	13.71	1.02	300.4	294.6	40.74	13.71	1.02	-20.08
		1251 - Driver Mail	Zone	116	13.12	1.07	453.5	425.4	28.21	13.12	1.07	-12.70
		1252 - Dispatch Window	Zone	211	17.04	0.82	271.1	330.2	36.34	17.04	0.82	-12.23
		1254 - Lobby	Zone	305	11.29	1.24	325.2	262.6	45.70	11.29	1.24	-24.44
		1255 - Dirvers Room	Zone	1,945	9.80	1.43	392.4	274.9	43.65	9.80	1.43	-20.82
		1256 - Kitchenette	Zone	144	4.62	1.14	354.2	312.1	38.45	10.57	1.14	-17.05
		1257 - Vending	Zone	142	3.67	3.81	543.0	142.6	84.16	3.67	3.81	-39.11
		1258 - Quiet Room	Zone	247	18.00	0.78	263.1	338.5	35.45	18.00	0.78	-12.15
		1260 - Dispatch Coordinator	Zone	906	11.74	1.19	318.0	266.9	44.96	11.74	1.19	-27.35
		1284 - Corridor	Zone	478	21.40	0.65	238.3	364.5	32.92	21.40	0.65	-11.92
		1293 - Recycling	Zone	123	3.21	0.78	317.2	406.9	29.49	15.39	0.78	-29.88
		1295 - Lockers	Zone	311	12.81	1.09	305.4	279.7	42.90	12.81	1.09	-25.87

System	Zone	Room	Type	Floor Area ft ²	COOLING				HEATING			
					% OA	cfm/ft ²	cfm/ton	ft ² /ton	Btu/hr-ft ²	% OA	cfm/ft ²	Btu/hr-ft ²
RTU - 2			System - Bypass VAV with Reheat (30% Min Flow Default)	16,617	18.35	0.97	292.7	301.9	39.75	15.31	0.97	-18.87
		1245 - Misc Rooms	Zone	242	6.46	2.17	417.0	192.5	62.33	6.46	2.17	-23.31
		1250 - Dispatch Coord Locker	Zone	186	11.38	1.23	323.6	263.4	45.55	11.38	1.23	-23.17
		1261 - Training Room	Zone	859	9.56	1.46	407.0	278.1	43.15	9.56	1.46	-19.81
		1262 - Men	Zone	204	16.80	0.83	267.6	321.4	37.34	16.80	0.83	-12.14
		1263 - Women	Zone	204	16.80	0.83	267.6	321.4	37.34	16.80	0.83	-12.14
		1264 - Training Storage	Zone	114	8.37	0.30	170.9	571.8	20.99	40.16	0.30	-11.21
		1265 - Uniform Storage	Zone	262	10.23	1.37	340.2	248.7	48.24	10.23	1.37	-26.33
		1266 - Personnel Records Storage	Zone	146	0.51	4.90	561.0	114.4	104.90	2.45	4.90	-65.07
		1267 - Conference Room	Zone	314	3.77	3.71	491.5	132.4	90.64	3.77	3.71	-32.94
		1268 - Break Room	Zone	195	3.53	3.96	496.3	125.4	95.73	3.53	3.96	-37.40
		1269 - Lost and Found	Zone	69	1.49	4.71	493.0	104.8	114.55	2.97	4.71	-60.78
		1271 - Chair/Table Storage	Zone	160	8.37	0.30	170.9	571.8	20.99	40.16	0.30	-11.21
		1272 - Transit Operations Supervisor	Zone	122	4.16	3.36	541.8	161.2	74.42	4.16	3.36	-33.05
		1273 - Transit Operations Supervisor	Zone	111	4.11	3.40	543.2	159.6	75.18	4.11	3.40	-33.05
		1274 - Transit Operations Supervisor	Zone	105	4.08	3.43	543.9	158.7	75.62	4.08	3.43	-33.02
		1275 - Transit Operations Supervisor	Zone	123	4.19	3.34	541.1	162.2	73.98	4.19	3.34	-32.87
		1276 - Transit Operations Supervisor	Zone	122	4.19	3.33	541.1	162.3	73.95	4.19	3.33	-32.83
		1277 - Transit Operations Supervisor	Zone	116	4.11	3.41	543.2	159.4	75.27	4.11	3.41	-33.26
		1278 - Transit Operations Supervisor	Zone	112	3.11	4.49	546.0	121.6	98.68	3.11	4.49	-58.57
		1279 - Transit Operations Supervisor	Zone	110	5.58	2.51	452.5	180.4	66.51	5.58	2.51	-35.97
		1280 - Transit Operation Supervisor	Zone	105	5.37	2.61	457.5	175.5	68.36	5.37	2.61	-37.15
		1281 - Seciton Chief	Zone	166	4.28	3.27	455.3	139.4	86.09	4.28	3.27	-53.50
		1296 - Vehicle Condition Report Storage	Zone	296	8.37	0.30	170.9	571.8	20.99	40.16	0.30	-11.21
		1297 - Copy/Work Room	Zone	236	17.81	0.79	258.2	328.8	36.49	17.81	0.79	-12.04
		1298 - Schedule/Transfer Storage	Zone	251	18.23	0.77	254.6	331.8	36.17	18.23	0.77	-12.00
RTU - 3			System - Bypass VAV with Reheat (30% Min Flow Default)	4,930	5.96	2.07	463.7	224.3	53.49	6.63	2.07	-26.12

ONLY

MONTHLY ENERGY CONSUMPTION

By ACADEMIC

----- Monthly Energy Consumption -----

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Alternative: 1 Thesis													
Electric													
On-Pk Cons. (kWh)	87,437	79,010	88,353	87,224	96,915	98,903	105,236	101,604	93,268	89,361	85,575	87,572	1,100,456
On-Pk Demand (kW)	127	132	144	151	180	204	212	203	186	149	142	129	212
Gas													
On-Pk Cons. (therms)	398	297	87	31	14	8	8	10	14	39	72	230	1,209
On-Pk Demand (therms/hr)	3	3	1	0	0	0	0	0	0	0	0	2	3

Energy Consumption	
Building	51,695 Btu/(ft2-year)
Source	151,963 Btu/(ft2-year)
Floor Area	74,991 ft2

Environmental Impact Analysis	
CO2	4,105,348 lbm/year
SO2	10,791 gm/year
NOX	5,732 gm/year

ONLY

System Checksums

By ACADEMIC

ERU - 1

Ventilation and Heating

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES		
Peaked at Time:		Mo/Hr: 0 / 0		Mo/Hr: 0 / 0		Mo/Hr: Heating Design						Cooling	Heating	
Outside Air:		OADB/WB/HR: 0 / 0 / 0		OADB: 0		OADB: 17						SADB	0.0	124.6
Space Sens. + Lat.	Plenum Sens. + Lat	Net Total	Percent Of Total (%)	Space Sensible	Percent Of Total (%)	Space Peak	Coil Peak	Percent Of Total	Space Sens	Tot Sens	Percent Of Total	Ra Plenum	0.0	48.2
Btu/h	Btu/h	Btu/h		Btu/h		Btu/h	Btu/h		Btu/h	Btu/h		Ret/OA	0.0	17.0
Envelope Loads				Envelope Loads								Fn MtrTD	0.0	0.1
Skylite Solar	0	0	0	0	0	0	0	0.00	0	0	0.00	Fn BldTD	0.0	0.1
Skylite Cond	0	0	0	0	0	0	0	0.00	0	0	0.00	Fn Frict	0.0	0.3
Roof Cond	0	0	0	0	0	0	0	0.00	0	-133,169	21.80			
Glass Solar	0	0	0	0	0	0	0	0.00	0	0	0.00			
Glass/Door Cond	0	0	0	0	0	-77,059	-77,059	12.61	-77,059	-77,059	12.61			
Wall Cond	0	0	0	0	0	-21,884	-26,910	4.40	-21,884	-26,910	4.40			
Partition/Door	0	0	0	0	0	0	0	0.00	0	0	0.00			
Floor	0	0	0	0	0	0	0	0.00	0	0	0.00			
Adjacent Floor	0	0	0	0	0	0	0	0.00	0	0	0.00			
Infiltration	0	0	0	0	0	-72,776	-72,776	11.91	-72,776	-72,776	11.91			
Sub Total ==>	0	0	0	0	0	-171,718	-309,915	50.72	-171,718	-309,915	50.72			
Internal Loads				Internal Loads								AIRFLOWS		
Lights	0	0	0	0	0	0	0	0.00	0	0	0.00	Cooling	Heating	
People	0	0	0	0	0	0	0	0.00	0	0	0.00	Diffuser	0	5,096
Misc	0	0	0	0	0	0	0	0.00	0	0	0.00	Terminal	0	5,096
Sub Total ==>	0	0	0	0	0	0	0	0.00	0	0	0.00	Main Fan	0	5,096
Ceiling Load				Ceiling Load								Sec Fan	0	0
Ventilation Load	0	0	0	0	0	-138,196	0	0.00	-138,196	0	0.00	Nom Vent	0	5,096
Adj Air Trans Heat	0	0	0	0	0	0	-301,080	49.28	0	-301,080	49.28	AHU Vent	0	5,096
Dehumid. Ov Sizing	0	0	0	0	0	0	0	0.00	0	0	0.00	Infil	0	1,232
Ov/Undr Sizing	0	0	0	0	0	0	0	0.00	0	0	0.00	MinStop/Rh	0	0
Exhaust Heat	0	0	0	0	0	0	0	0.00	0	0	0.00	Return	0	0
Sup. Fan Heat	0	0	0	0	0	0	0	0.00	0	0	0.00	Exhaust	0	0
Ret. Fan Heat	0	0	0	0	0	0	0	0.00	0	0	0.00	Rm Exh	0	6,328
Duct Heat Pkup	0	0	0	0	0	0	0	0.00	0	0	0.00	Auxiliary	0	0
Underflr Sup Ht Pkup	0	0	0	0	0	0	0	0.00	0	0	0.00	Leakage Dwn	0	0
Supply Air Leakage	0	0	0	0	0	0	0	0.00	0	0	0.00	Leakage Ups	0	0
Grand Total ==>	0	0	0	100.00	0	100.00	-309,915	-610,995	100.00	-309,915	-610,995	ENGINEERING CKS		
												% OA	0.0	100.0
												cfm/ft²	0.00	0.25
												cfm/ton	0.00	
												ft²/ton	0.00	
												Btu/hr-ft²	0.00	-30.56
												No. People	103	

COOLING COIL SELECTION										AREAS			HEATING COIL SELECTION			
	Total Capacity		Sens Cap. MBh	Coil Airflow cfm	Enter DB/WB/HR			Leave DB/WB/HR			Gross Total	Glass ft² (%)	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
	ton	MBh			°F	°F	gr/lb	°F	°F	gr/lb						
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.0	124.6	
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.0	0.0	
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.0	0.0	
Total	0.0	0.0														
HEATING COIL SELECTION																
Main Htg																
Aux Htg																
Preheat																
Humidif																
Opt Vent																
Total																

System Checksums

By ACADEMIC

ERU - 2

Ventilation and Heating

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES		
Peaked at Time:		Mo/Hr: 0 / 0		Mo/Hr: 0 / 0		Mo/Hr: Heating Design						Cooling	Heating	
Outside Air:		OADB/WB/HR: 0 / 0 / 0		OADB: 0		OADB: 17						SADB	0.0	125.0
Space Sens. + Lat.	Plenum Sens. + Lat	Net Total	Percent Of Total	Space Sensible	Percent Of Total	Space Peak	Coil Peak	Percent Of Total	Space Sens	Tot Sens	Percent Of Total	Return	0.0	48.2
Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Btu/h	Btu/h	(%)	Btu/h	Btu/h	(%)	Ret/OA	0.0	17.0
Envelope Loads				Envelope Loads								Fn MtrTD	0.0	0.1
Skylite Solar	0	0	0	0	0	Skylite Solar	0	0.00				Fn BldTD	0.0	0.1
Skylite Cond	0	0	0	0	0	Skylite Cond	0	0.00				Fn Frict	0.0	0.4
Roof Cond	0	0	0	0	0	Roof Cond	0	20.99				AIRFLOWS		
Glass Solar	0	0	0	0	0	Glass Solar	0	0.00				Cooling	Heating	
Glass/Door Cond	0	0	0	0	0	Glass/Door Cond	-99,164	13.89				Diffuser	0	5,929
Wall Cond	0	0	0	0	0	Wall Cond	-20,592	3.64				Terminal	0	5,929
Partition/Door	0	0	0	0	0	Partition/Door	0	0.00				Main Fan	0	5,929
Floor	0	0	0	0	0	Floor	0	0.00				Sec Fan	0	0
Adjacent Floor	0	0	0	0	0	Adjacent Floor	0	0				Nom Vent	0	5,929
Infiltration	0	0	0	0	0	Infiltration	-88,548	12.41				AHU Vent	0	5,929
Sub Total ==>	0	0	0	0	0	Sub Total ==>	-208,304	50.93				Infil	0	1,499
Internal Loads				Internal Loads								MinStop/Rh	0	0
Lights	0	0	0	0	0	Lights	0	0.00				Return	0	0
People	0	0	0	0	0	People	0	0.00				Exhaust	0	0
Misc	0	0	0	0	0	Misc	0	0.00				Rm Exh	0	7,428
Sub Total ==>	0	0	0	0	0	Sub Total ==>	0	0.00				Auxiliary	0	0
Ceiling Load				Ceiling Load								Leakage Dwn	0	0
Ventilation Load	0	0	0	0	0	Ventilation Load	-155,199	0.00				Leakage Ups	0	0
Adj Air Trans Heat	0	0	0	0	0	Adj Air Trans Heat	0	49.07				ENGINEERING CKS		
Dehumid. Ov Sizing	0	0	0	0	0	Ov/Undr Sizing	0	0.00				% OA	0.0	100.0
Ov/Undr Sizing	0	0	0	0	0	Exhaust Heat	0	0.00				cfm/ft²	0.00	0.26
Exhaust Heat	0	0	0	0	0	OA Preheat Diff.	0	0.00				cfm/ton	0.00	
Sup. Fan Heat	0	0	0	0	0	RA Preheat Diff.	0	0.00				ft²/ton	0.00	
Ret. Fan Heat	0	0	0	0	0	Additional Reheat	0	0.00				Btu/hr-ft²	0.00	-31.75
Duct Heat Pkup	0	0	0	0	0	Underflr Sup Ht Pkup	0	0.00				No. People	112	
Underflr Sup Ht Pkup	0	0	0	0	0	Supply Air Leakage	0	0.00						
Supply Air Leakage	0	0	0	0	0	Grand Total ==>	-363,503	100.00						
Grand Total ==>	0	0	100.00	0	100.00	Grand Total ==>	-363,503	100.00						

COOLING COIL SELECTION										AREAS			HEATING COIL SELECTION				
	Total Capacity		Sens Cap.	Coil Airflow	Enter DB/WB/HR			Leave DB/WB/HR			Gross Total	Glass	Lvg	Capacity	Coil Airflow	Ent	Lvg
	ton	MBh			MBh	cfm	°F	°F	gr/lb	°F							
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0			Main Htg	-713.8	5,929	17.0	125.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0			Aux Htg	0.0	0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0			Preheat	0.0	0	0.0	0.0
Total	0.0	0.0											Humidif	0.0	0	0.0	0.0
													Opt Vent	0.0	0	0.0	0.0
													Total	-713.8			

System Checksums

By ACADEMIC

HV - 1

Ventilation and Heating

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK			TEMPERATURES			
Peaked at Time:		Mo/Hr: 0 / 0		Mo/Hr: 0 / 0		Mo/Hr: Heating Design			Cooling			Heating		
Outside Air:		OADB/WB/HR: 0 / 0 / 0		OADB: 0		OADB: 17			SADB			Ra Plenum		
Space Sens. + Lat.	Plenum Sens. + Lat	Net Total	Percent Of Total (%)	Space Sensible	Percent Of Total (%)	Space Peak	Coil Peak	Percent Of Total	Return	Fn MtrTD	Fn BldTD	Fn Frict		
Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Space Sens	Tot Sens	(%)	0.0	0.0	0.0	0.0		
Envelope Loads				Envelope Loads										
Skylite Solar	0	0	0	0	0	Skylite Solar	0	0.00	0.0	0.0	0.0	0.0		
Skylite Cond	0	0	0	0	0	Skylite Cond	0	0.00	0.0	0.0	0.0	0.0		
Roof Cond	0	0	0	0	0	Roof Cond	0	34.86	0.0	0.0	0.0	0.0		
Glass Solar	0	0	0	0	0	Glass Solar	0	0.00	0.0	0.0	0.0	0.0		
Glass/Door Cond	0	0	0	0	0	Glass/Door Cond	-3,721	4.98	0.0	0.0	0.0	0.0		
Wall Cond	0	0	0	0	0	Wall Cond	-4,152	6.57	0.0	0.0	0.0	0.0		
Partition/Door	0	0	0	0	0	Partition/Door	0	0.00	0.0	0.0	0.0	0.0		
Floor	0	0	0	0	0	Floor	0	0.00	0.0	0.0	0.0	0.0		
Adjacent Floor	0	0	0	0	0	Adjacent Floor	0	0	0.0	0.0	0.0	0.0		
Infiltration	0	0	0	0	0	Infiltration	-6,975	9.34	0.0	0.0	0.0	0.0		
Sub Total ==>	0	0	0	0	0	Sub Total ==>	-14,849	55.76	0.0	0.0	0.0	0.0		
Internal Loads				Internal Loads										
Lights	0	0	0	0	0	Lights	0	0.00	0	0	0	0		
People	0	0	0	0	0	People	0	0.00	0	0	0	0		
Misc	0	0	0	0	0	Misc	0	0.00	0	0	0	0		
Sub Total ==>	0	0	0	0	0	Sub Total ==>	0	0.00	0	0	0	0		
Ceiling Load	0	0	0	0	0	Ceiling Load	-22,044	0.00	0	0	0	0		
Ventilation Load	0	0	0	0	0	Ventilation Load	0	50.59	0	0	0	0		
Adj Air Trans Heat	0	0	0	0	0	Adj Air Trans Heat	0	0	0	0	0	0		
Dehumid. Ov Sizing	0	0	0	0	0	Ov/Undr Sizing	0	0.00	0	0	0	0		
Ov/Undr Sizing	0	0	0	0	0	Exhaust Heat	0	-6.35	0	0	0	0		
Exhaust Heat	0	0	0	0	0	OA Preheat Diff.	0	0.00	0	0	0	0		
Sup. Fan Heat	0	0	0	0	0	RA Preheat Diff.	0	0.00	0	0	0	0		
Ret. Fan Heat	0	0	0	0	0	Additional Reheat	0	0.00	0	0	0	0		
Duct Heat Pkup	0	0	0	0	0	Underflr Sup Ht Pkup	0	0.00	0	0	0	0		
Underflr Sup Ht Pkup	0	0	0	0	0	Supply Air Leakage	0	0.00	0	0	0	0		
Supply Air Leakage	0	0	0	0	0	Grand Total ==>	-36,893	100.00	-74,674	100.00	18	0.0		
Grand Total ==>	0	0	100.00	0	100.00	Grand Total ==>								

	Cooling	Heating
SADB	0.0	121.8
Ra Plenum	0.0	50.7
Return	0.0	50.7
Ret/OA	0.0	17.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS		
	Cooling	Heating
Diffuser	0	639
Terminal	0	639
Main Fan	0	639
Sec Fan	0	0
Nom Vent	0	639
AHU Vent	0	639
Infil	0	118
MinStop/Rh	0	0
Return	0	221
Exhaust	0	221
Rm Exh	0	537
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS		
	Cooling	Heating
% OA	0.0	100.0
cfm/ft²	0.00	0.18
cfm/ton	0.00	
ft²/ton	0.00	
Btu/hr-ft²	0.00	-20.67
No. People	18	

COOLING COIL SELECTION										
	Total Capacity		Sens Cap.	Coil Airflow	Enter DB/WB/HR			Leave DB/WB/HR		
	ton	MBh	MBh	cfm	°F	°F	gr/lb	°F	°F	gr/lb
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0								

AREAS			
	Gross Total	Glass	(%)
		ft²	
Floor	3,613		
Part	0		
Int Door	0		
ExFlr	0		
Roof	3,613	0	0
Wall	1,375	138	10
Ext Door	0	0	0

HEATING COIL SELECTION				
	Capacity	Coil Airflow	Ent	Lvg
	MBh	cfm	°F	°F
Main Htg	-74.7	639	17.0	121.8
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-74.7			

System Checksums

By ACADEMIC

RTU - 1

Bypass VAV with Reheat (30% Min Flow Default)

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK			TEMPERATURES			
Peaked at Time:		Mo/Hr: 7 / 16		Mo/Hr: 9 / 16		Mo/Hr: Heating Design			Cooling			Heating		
Outside Air:		OADB/WB/HR: 91 / 76 / 115		OADB: 83		OADB: 17			SADB			Ra Plenum		
	Space Sens. + Lat.	Plenum Sens. + Lat.	Net Total	Percent Of Total (%)	Space Sensible	Percent Of Total (%)	Space Peak	Coil Peak	Percent Of Total	Return	Ret/OA	Fn MtrTD	Fn BldTD	Fn Frict
	Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Btu/h	Btu/h	(%)					
Envelope Loads				Envelope Loads				Envelope Loads						
Skylite Solar	0	0	0	0	0	0	0	0	0.00					
Skylite Cond	0	0	0	0	0	0	0	0	0.00					
Roof Cond	0	108,135	108,135	32	0	0	0	-63,551	41.08					
Glass Solar	41,607	0	41,607	12	100,503	48	0	0	0.00					
Glass/Door Cond	7,626	0	7,626	2	2,089	1	-27,008	-27,008	17.46					
Wall Cond	19,207	7,933	27,141	8	26,567	13	-23,147	-31,984	20.68					
Partition/Door	0	0	0	0	0	0	0	0	0.00					
Floor	0	0	0	0	0	0	0	0	0.00					
Adjacent Floor	0	0	0	0	0	0	0	0	0					
Infiltration	0	0	0	0	0	0	0	0	0.00					
Sub Total ==>	68,440	116,068	184,508	54	129,159	61	-50,155	-122,543	79.22					
Internal Loads				Internal Loads				Internal Loads						
Lights	29,731	7,433	37,164	11	29,731	14	0	0	0.00					
People	23,086	0	23,086	7	12,804	6	0	0	0.00					
Misc	27,475	0	27,475	8	27,475	13	0	0	0.00					
Sub Total ==>	80,292	7,433	87,724	26	70,010	33	0	0	0.00					
Ceiling Load	18,175	-18,175	0	0	12,036	6	-29,198	0	0.00					
Ventilation Load	0	0	54,238	16	0	0	0	-60,600	39.18					
Adj Air Trans Heat	0	0	0	0	0	0	0	0	0					
Dehumid. Ov Sizing	0	0	0	0	0	0	0	0	0.00					
Ov/Undr Sizing	0	0	0	0	0	0	0	0	0.00					
Exhaust Heat	0	-75	-75	0	0	0	0	28,461	-18.40					
Sup. Fan Heat	0	0	16,330	5	0	0	0	0	0.00					
Ret. Fan Heat	0	0	0	0	0	0	0	0	0.00					
Duct Heat Pkup	0	0	0	0	0	0	0	0	0.00					
Underflr Sup Ht Pkup	0	0	0	0	0	0	0	0	0.00					
Supply Air Leakage	0	0	0	0	0	0	0	0	0.00					
Grand Total ==>	166,906	105,251	342,725	100.00	211,204	100.00	-79,353	-154,682	100.00					

AIRFLOWS		
	Cooling	Heating
Diffuser	13,122	14
Terminal	13,122	14
Main Fan	13,122	14
Sec Fan	0	0
Nom Vent	958	1,026
AHU Vent	958	1,026
Infil	0	0
MinStop/Rh	3,937	14
Return	12,168	14,134
Exhaust	4	2,038
Rm Exh	954	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS		
	Cooling	Heating
% OA	7.7	7.8
cfm/ft²	1.78	1.78
cfm/ton	459.45	
ft²/ton	257.49	
Btu/hr-ft²	46.60	-21.01
No. People	51	

COOLING COIL SELECTION										
	Total Capacity	Sens Cap.	Coil Airflow	Enter DB/WB/HR			Leave DB/WB/HR			
	ton	MBh	cfm	°F	°F	gr/lb	°F	°F	gr/lb	
Main Clg	28.6	342.7	295.7	13,122	83.4	65.9	67.7	59.4	57.5	67.7
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	28.6	342.7								

AREAS			
	Gross Total	Glass	
		ft²	(%)
Floor	7,354		
Part	0		
Int Door	0		
ExFlr	0		
Roof	7,354	0	0
Wall	2,495	998	40
Ext Door	0	0	0

HEATING COIL SELECTION				
	Capacity	Coil Airflow	Ent	Lvg
	MBh	cfm	°F	°F
Main Htg	-79.4	14	59.4	5,185.9
Aux Htg	0.0	0	0.0	0.0
Preheat	-75.2	13,122	54.3	59.4
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-154.5			

System Checksums

By ACADEMIC

RTU - 2

Bypass VAV with Reheat (30% Min Flow Default)

COOLING COIL PEAK					CLG SPACE PEAK					HEATING COIL PEAK					TEMPERATURES		
Peaked at Time:		Mo/Hr: 7 / 16			Mo/Hr: 7 / 15		Mo/Hr: Heating Design										
Outside Air:		OADB/WB/HR: 91 / 76 / 115			OADB: 91		OADB: 17										
Space Sens. + Lat.	Plenum Sens. + Lat	Net Total	Percent Of Total	Space Sensible	Percent Of Total	Space Peak	Coil Peak	Percent Of Total	Space Sens	Tot Sens	Percent Of Total	Cooling	Heating				
Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Btu/h	Btu/h	(%)	Btu/h	Btu/h	(%)						
Envelope Loads					Envelope Loads										AIRFLOWS		
Skylite Solar	0	0	0	0	0	Skylite Solar	0	0	0	0	0.00	Diffuser	16,109	405			
Skylite Cond	0	0	0	0	0	Skylite Cond	0	0	0	0.00	Terminal	16,109	405				
Roof Cond	0	226,005	34	0	0	Roof Cond	0	0	-133,753	42.66	Main Fan	16,109	405				
Glass Solar	29,632	0	4	74,680	25	Glass Solar	0	0	0	0.00	Sec Fan	0	0				
Glass/Door Cond	9,414	0	1	2,761	1	Glass/Door Cond	-33,340	10.63	-33,340	10.63	Nom Vent	2,956	2,466				
Wall Cond	24,563	6,998	5	28,439	9	Wall Cond	-37,295	15.66	-49,089	15.66	AHU Vent	2,956	2,466				
Partition/Door	0	0	0	0	0	Partition/Door	0	0.00	0	0.00	Infil	37	37				
Floor	0	0	0	0	0	Floor	0	0.00	0	0.00	MinStop/Rh	4,833	405				
Adjacent Floor	0	0	0	0	0	Adjacent Floor	0	0	0	0	Return	13,605	17,986				
Infiltration	1,984	1,984	0	646	0	Infiltration	-2,210	0.70	-2,210	0.70	Exhaust	452	4,342				
Sub Total ==>	65,593	233,002	45	106,527	35	Sub Total ==>	-72,845	69.65	-218,392	69.65	Rm Exh	2,542	313				
Internal Loads					Internal Loads										ENGINEERING CKS		
Lights	66,855	16,714	13	66,855	22	Lights	0	0.00	0	0.00	% OA	18.4	15.3				
People	51,936	0	8	28,716	9	People	0	0.00	0	0.00	cfm/ft²	0.97	0.97				
Misc	50,540	0	8	50,540	17	Misc	0	0.00	0	0.00	cfm/ton	292.68					
Sub Total ==>	169,331	16,714	28	146,111	48	Sub Total ==>	0	0.00	0	0.00	ft²/ton	301.90					
Ceiling Load	65,918	-65,918	0	52,005	17	Ceiling Load	-79,189	0.00	0	0.00	Btu/hr-ft²	39.75	-18.87				
Ventilation Load	0	0	24	0	0	Ventilation Load	0	46.46	-145,690	46.46	No. People	114					
Adj Air Trans Heat	0	0	0	0	0	Adj Air Trans Heat	0	0	0	0							
Dehumid. Ov Sizing	0	0	0	0	0	Ov/Undr Sizing	0	0.00	0	0.00							
Ov/Undr Sizing	0	0	0	0	0	Exhaust Heat	71,268	-22.73	0	0.00							
Exhaust Heat	-6,303	-6,303	-1	0	0	OA Preheat Diff.	-21,676	6.91	0	0.00							
Sup. Fan Heat	0	24,820	4	0	0	RA Preheat Diff.	926	-0.30	0	0.00							
Ret. Fan Heat	0	0	0	0	0	Additional Reheat	0	0.00	0	0.00							
Duct Heat Pkup	0	0	0	0	0	Underflr Sup Ht Pkup	0	0.00	0	0.00							
Underflr Sup Ht Pkup	0	0	0	0	0	Supply Air Leakage	0	0.00	0	0.00							
Supply Air Leakage	0	0	0	0	0	Grand Total ==>	-152,034	100.00	-313,565	100.00							
Grand Total ==>	300,842	177,495	660,499	304,644	100.00	Grand Total ==>	-152,034	100.00	-313,565	100.00							

COOLING COIL SELECTION										
	Total Capacity		Sens Cap. MBh	Coil Airflow cfm	Enter DB/WB/HR			Leave DB/WB/HR		
	ton	MBh			°F	°F	gr/lb	°F	°F	gr/lb
Main Clg	55.0	660.5	529.7	16,109	88.1	68.6	73.6	56.7	55.8	65.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	55.0	660.5								

AREAS			
	Gross Total	Glass ft²	(%)
Floor	16,617		
Part	0		
Int Door	0		
ExFlr	0		
Roof	16,501	0	0
Wall	3,550	1,232	35
Ext Door	0	0	0

HEATING COIL SELECTION				
	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Aux Htg	0.0	0	0.0	0.0
Preheat	-155.5	16,109	48.0	56.7
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-313.6			

System Checksums

By ACADEMIC

RTU - 3

Bypass VAV with Reheat (30% Min Flow Default)

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time:		Mo/Hr: 7 / 17		Mo/Hr: 7 / 17		Mo/Hr: Heating Design						Cooling	Heating		
Outside Air:		OADB/WB/HR: 89 / 76 / 114		OADB: 89		OADB: 17						SADB	60.0	318.0	
Space Sens. + Lat.	Plenum Sens. + Lat.	Net Total	Percent Of Total (%)	Space Sensible	Percent Of Total (%)	Space Peak	Coil Peak	Percent Of Total	Space Sens	Tot Sens	Percent Of Total	Ra Plenum	82.2	57.0	
Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Btu/h	Btu/h	(%)	Btu/h	Btu/h	(%)	Ret/OA	82.6	54.4	
Envelope Loads				Envelope Loads				Envelope Loads				Fn MtrTD	0.1	0.0	
Skylite Solar	0	0	0	0	0	0	0	0.00	Skylite Solar	0	0	0.00	Fn BldTD	0.2	0.0
Skylite Cond	0	0	0	0	0	0	0	0.00	Skylite Cond	0	0	0.00	Fn Frict	0.7	0.0
Roof Cond	0	74,397	28	0	0	0	-42,121	32.71	Roof Cond	0	0	0.00	AIRFLOWS		
Glass Solar	42,278	42,278	16	76,052	44	0	0	0.00	Glass Solar	0	0	0.00	Diffuser	10,189	266
Glass/Door Cond	5,974	5,974	2	2,850	2	-22,275	-22,275	17.30	Glass/Door Cond	-22,275	17.30	0.00	Terminal	10,189	266
Wall Cond	26,619	35,551	13	32,788	19	-30,949	-40,180	31.20	Wall Cond	-30,949	31.20	0.00	Main Fan	10,189	266
Partition/Door	0	0	0	0	0	0	0	0.00	Partition/Door	0	0	0.00	Sec Fan	0	0
Floor	0	0	0	0	0	0	0	0.00	Floor	0	0	0.00	Nom Vent	548	675
Adjacent Floor	0	0	0	0	0	0	0	0.00	Adjacent Floor	0	0	0.00	AHU Vent	548	675
Infiltration	0	0	0	0	0	0	0	0.00	Infiltration	0	0	0.00	Infil	0	0
Sub Total ==>	74,870	83,330	60	111,690	65	-53,225	-104,576	81.21	Sub Total ==>	-53,225	-104,576	81.21	MinStop/Rh	2,939	266
Internal Loads				Internal Loads				Internal Loads				Return	9,657	10,796	
Lights	18,236	4,559	9	18,236	11	0	0	0.00	Lights	0	0	0.00	Exhaust	16	1,282
People	15,230	0	6	8,352	5	0	0	0.00	People	0	0	0.00	Rm Exh	532	0
Misc	25,086	0	10	25,086	15	0	0	0.00	Misc	0	0	0.00	Auxiliary	0	0
Sub Total ==>	58,552	4,559	24	51,674	30	0	0	0.00	Sub Total ==>	0	0	0.00	Leakage Dwn	0	0
Ceiling Load	11,210	-11,210	0	7,632	4	-20,290	0	0.00	Ceiling Load	-20,290	0	0.00	Leakage Ups	0	0
Ventilation Load	0	0	12	0	0	0	-39,897	30.98	Ventilation Load	0	0	0.00	ENGINEERING CKS		
Adj Air Trans Heat	0	0	0	0	0	0	0	0.00	Adj Air Trans Heat	0	0	0.00	% OA	6.0	6.6
Dehumid. Ov Sizing	0	0	0	0	0	0	0	0.00	Ov/Undr Sizing	0	0	0.00	cfm/ft²	2.07	2.07
Ov/Undr Sizing	0	0	0	0	0	0	15,705	-12.20	Exhaust Heat	0	0	0.00	cfm/ton	463.68	
Exhaust Heat	-221	-221	0	0	0	0	0	0.00	OA Preheat Diff.	0	0	0.00	ft²/ton	224.35	
Sup. Fan Heat	0	11,472	4	0	0	0	0	0.00	RA Preheat Diff.	0	0	0.00	Btu/hr-ft²	53.49	-26.12
Ret. Fan Heat	0	0	0	0	0	0	0	0.00	Additional Reheat	0	0	0.00	No. People	33	
Duct Heat Pkup	0	0	0	0	0	0	0	0.00	Underflr Sup Ht Pkup	0	0	0.00			
Underflr Sup Ht Pkup	0	0	0	0	0	0	0	0.00	Supply Air Leakage	0	0	0.00			
Supply Air Leakage	0	0	0	0	0	0	0	0.00	Grand Total ==>	-73,514	-128,768	100.00			
Grand Total ==>	144,632	76,457	263,698	100.00	170,995	100.00	-73,514	-128,768	100.00						

COOLING COIL SELECTION										
	Total Capacity		Sens Cap. MBh	Coil Airflow cfm	Enter DB/WB/HR			Leave DB/WB/HR		
	ton	MBh			°F	°F	gr/lb	°F	°F	gr/lb
Main Clg	22.0	263.7	235.4	10,189	82.6	65.5	66.7	58.9	57.1	66.7
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	22.0	263.7								

AREAS			
	Gross Total	Glass	
		ft²	(%)
Floor	4,930		
Part	0		
Int Door	0		
ExFlr	0		
Roof	4,930	0	0
Wall	2,636	774	29
Ext Door	0	0	0

HEATING COIL SELECTION				
	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Aux Htg	0.0	0	0.0	0.0
Preheat	-52.0	10,189	54.4	58.9
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-128.8			

Montgomery County Equipment Maintenance and Operations Center-Building 1

Technical Report 2 - Building and Plant Energy Analysis

Michael Tellep

Appendix C:

See following pages.



A PHI Company

**MARYLAND
GENERAL SERVICE
SCHEDULE GS
UPDATED DECEMBER 1, 2011**

Standard Offer Service (Generation, Transmission including GRT, and PCA)

	<u>06/01/11 - 09/30/11</u>	<u>10/01/11 – 05/31/12</u>	<u>06/01/12 – 09/30/12</u>
Generation¹			
All kwh	\$ 0.09195 per kwh	\$ 0.08138 per kwh	\$ 0.08571 per kwh
Procurement Cost Adj.	www.pepco.com/md-rates for monthly rate		
	Billing Months of June – October (Summer)	Billing Months of November – May (Winter)	
Transmission²			
All kwh	\$ 0.00408 per kwh	\$ 0.00408 per kwh	
Gross Receipts Tax	2.0408% applied to transmission bill		
Distribution Service³			
Customer Charge	\$ 9.31 per month	\$ 9.31 per month	
All kwh	\$ 0.03615 per kwh	\$ 0.01911 per kwh	
Delivery Tax	www.pepco.com/md-rates for monthly rate		
MD Environmental Surcharge	www.pepco.com/md-rates for monthly rate		
Montgomery County Surc. or Prince Georges County Surc.	www.pepco.com/md-rates for monthly rate		
Universal Service Charge⁴	See page 28 of Pepco's MD Electric Rate Schedules		
Gross Receipts Tax	2.0408% applied to distribution bill excluding the GPC, and the Montgomery or Prince Georges County Surcharge		
Administrative Credit	www.pepco.com/md-rates for monthly rate		
Bill Stabilization Credit (BSA)⁵	www.pepco.com/md-rates for monthly rate		
EmPower MD Charge⁶	\$ 0.000167 per kwh	\$ 0.000167 per kwh	

¹ Effective Usage on and after June 1, 2012
² Effective Usage on and after August 10, 2011
³ Effective Usage on and after August 19, 2010
⁴ Effective March 1, 2005
⁵ Effective Billing Month of November, 2007
⁶ Effective Billing Month of March 2010

WASHINGTON GAS LIGHT COMPANY

MARYLAND

Firm Commercial and Industrial Sales Service

Rate Schedule No. 2

AVAILABILITY

Sales service under this schedule is available in the Maryland portion of the Company's service area for firm gas sales service to any customer classified Commercial and Industrial as defined in Section 1A. of the General Service Provisions.

RATE FOR MONTHLY CONSUMPTION

System Charge

Heating and/or Cooling

All billing months

(a) Normal Weather Annual Usage
less than 3,000 Therms \$18.15 per customer

(b) Normal Weather Annual Usage
3,000 Therms or more \$36.25 per customer

Applicability of (a) or (b) shall be determined each year in accordance with Section 1A. of the General Service Provisions.

Non-Heating and Non-Cooling

All billing months \$15.00 per customer

Distribution Charge

All gas used during the billing month:

First 300 therms	31.58¢ per therm
Next 6,700 therms	21.52¢ per therm
Over 7,000 therms	15.73¢ per therm

MARYLAND FRANCHISE TAX SURCHARGE

The Distribution Charge shall be subject to the Maryland Franchise Tax Surcharge in accordance with General Service Provision No. 27.

ISSUED: May 25, 2010

EFFECTIVE: For service rendered on and after June 1, 2010

Roberta W. Sims – Vice President, Regulatory Affairs & Energy Acquisition

Firm Commercial and Industrial Sales Service - Rate Schedule No. 2 (Continued)

Purchased Gas Charge

The Purchased Gas Charge per therm shall be computed in accordance with Section 16 of the General Service Provisions and applies to all gas used during the billing month.

REVENUE NORMALIZATION ADJUSTMENT

The Distribution Charge shall be subject to the Revenue Normalization Adjustment (RNA) in accordance with General Service Provision No. 30.

MINIMUM MONTHLY BILL

The minimum monthly bill for sales service shall be the System Charge.

LATE PAYMENT CHARGE

All bills are due and payable when rendered and the charges stated apply when the bills are paid within twenty days after date of rendition. If bills are not paid within twenty days after rendition, a late payment charge will be added equal to one and one-half percent of the unpaid bill and at the end of the first nominal thirty-day billing interval after that, an additional charge of one and one-half percent of any portion of the original amount which remains unpaid, and at the end of the second thirty-day nominal billing interval, an additional charge will be made equal to 2 percent of any portion of the original amount which remains unpaid at that time; however, the total of such charges shall not exceed 5%.

FIRM CREDIT ADJUSTMENT

The charges for sales service specified in this schedule shall be subject to the Firm Credit Adjustment (FCA) in accordance with General Service Provision No. 20.

GAS SUPPLY REALIGNMENT ADJUSTMENT

The distribution charge shall be subject to the Gas Supply Realignment Adjustment (GSRA) in accordance with General Service Provision No. 26.

SPECIAL PROVISION – UNMETERED GAS FOR LIGHTING

- A. Unmetered gas sales service is available under this schedule for outdoor gas lights installed on the Company's side (upstream) of the meter on or before September 29, 1999, provided:
1. The lights conform with the Company's General Service Provisions; and,
 2. The posts and lamps are owned by and installed and maintained at the expense of the customer or property owner.

ISSUED: September 1, 2005

EFFECTIVE: For meter readings on and after October 1, 2005

Adrian P. Chapman - Vice President, Regulatory Affairs & Energy Acquisition

Firm Commercial and Industrial Sales Service - Rate Schedule No. 2 (Continued)

SPECIAL PROVISION – UNMETERED FOR GAS LIGHTING (Continued)

- B. The monthly gas consumption of the light or lights used in each installation shall be determined by multiplying the aggregate rated hourly input capacity of the light(s) by 730 hours, adjusted to reflect hours of use if applicable, and converting the product (rounded to the nearest 100 cubic feet) to therms.
- C. Where the customer does not use metered gas for other purposes under this schedule, unmetered gas used for lighting shall be billed at the rates contained herein. But where the customer also uses metered gas under this schedule, the unmetered gas used for lighting shall be added to the metered usage and the total usage billed at the rates contained herein.

CHARGE FOR TEMPORARY DISCONTINUANCE OF SERVICE

Whenever sales service under this rate schedule has been temporarily discontinued at the request of the customer, a charge equal to the System Charge times the number of months of discontinued service will be made for reestablishing such service.

GROSS RECEIPTS TAX SURCHARGE

Amounts billed to customers shall include a surcharge to reflect any increase or decrease in the effective gross receipts tax rate from the effective gross receipts tax rate in effect at the time the sales agreement became effective for service. The surcharge factor shall be computed as follows where R represents the decimal equivalent of the changed rate and E represents the existing gross receipts tax rate.

$$\text{Surcharge Factor} = (R - E) / (1 - R)$$

Such surcharge factor or any subsequently revised factor shall become effective along with the billing of revenues to which the changed gross receipts tax rate first applies. The amount of such charge shall be shown separately on bills rendered to customers.

GENERAL SERVICE PROVISIONS

Except as otherwise specifically provided herein, the application of this schedule is subject to the General Service Provisions of the Company as they may be in effect from time to time, and as filed with the Public Service Commission.

ISSUED: September 27, 2002

EFFECTIVE: For meter readings on and after September 30, 2002

Adrian P. Chapman - Vice President, Regulatory Affairs & Energy Acquisition