

# MECHANICAL SYSTEMS EXISTING CONDITIONS



## UNIVERSITY RIDGE AT EAST STROUDSBURG UNIVERSITY EAST STROUDSBURG, PA

PREPARED FOR:  
JAE-WEON JEONG, PH.D.

BY:  
MATTHEW CARR  
MECHANICAL OPTION  
NOVEMBER 21, 2006

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## Executive Summary

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The following report contains a detailed analysis of the existing mechanical systems for University Ridge at East Stroudsburg University. The main design objectives of the project were to provide a comfortable living environment while still meeting energy and ventilation requirements. These requirements had to be dealt with while also trying to meet a strict budget.

The systems major components are the gas and hot water fired duct furnace air handling units. Each of these units also had a dedicated condensing unit for the cooling side. These systems were designed using ASHRAE 90.1 and 62.1 which gave the required maximum energy use and minimum ventilation to maintain occupancy comfort. These design loads obtained from previous Technical Reports were then compared to design information.

Information on the equipment was gathered and put into schedules. The equipment was also analyzed and summarized in schematic drawings. Also, the operation of the system was analyzed and described.

The overall system is also critiqued for University Ridge. It was found that the system has some room for improvement due to cost and time restraints of construction. Long term savings is one area that may contain potential savings but will need further analysis to be determined.

## Design Objectives and Requirements

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The main objective for University Ridge at East Stroudsburg University is to supply conditioned air to maintain a comfortable living environment. Outdoor air requirements were specified based on ASHRAE 62.1-2001 and energy standards based on ASHRAE 90.1-2001. These conditioned spaces consist of individual apartment units and a commons unit made up of spaces of various uses.

The primary factor contributing to the design of the mechanical system was simplicity. The overall design in turn results in a less costly, easily maintained, and easily installed system. Also, each individual apartment was to have control over its thermal comfort. Moreover, operable windows were utilized for outdoor air ventilation which reduces the operating cost of the system due to the decreased energy required to condition outside air.

## Energy Sources and Rates

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The energy supplied to University Ridge is made up of natural gas and electricity. Natural gas is supplied to the complex by PP&L while electricity is supplied by Met-Ed. These utility rates can be viewed in Appendix A which is a bill from July, 2006. The buildings are heated using hot water duct furnaces where the hot water is provided from an adjacent natural gas fired domestic hot water heater or gas fired duct furnaces. Cooling is provided by individual split system condensing units which are electrically run.

## Cost and Site Factors

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The only cost factors that seriously affected the design of the mechanical systems were the design objectives and requirements as stated previously. As mentioned above, the cost of the system was to be held to a minimum and resulted in a system with a low first cost per the owner's request. Also, there were no utility rebates or on-peak demand charges that influenced the design of the system.

During the design of the complex, the site had little effect on the design of the buildings. The only part of the system affected was the placement of the condensing units as they were requested to be kept out of view as much as possible.

## Outdoor and Indoor Design Conditions

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The outdoor design conditions were determined from the use of Trane's Trace 700 load design program which in turn is taken from ASHRAE Fundamentals. The inside temperature requirements are based on ASHRAE comfort levels and are the usual rule of thumb to maintain comfort. Table 1 shows the design data as stated by the designer.

**Table 1**

<b>HVAC Design Data</b>					
<b>Design Area</b>	<b>Summer</b>			<b>Winter</b>	
	Outside		Inside	Outside	Inside
	DBT (°F)	WBT (°F)	DBT (°F)	DBT (°F)	DBT (°F)
Apartments/Community Bldg.	90	73	72	10	68
Crawl Space/Pump House	90	73	90	10	50

Stairwells, commons, and corridors between apartment units are heated only for freeze protection. Also, the crawlspaces are ventilated continuously and heated for freeze protection.

The design relative humidity was assumed to be 50% which was then entered into the calculation of the space loads in Trace 700.

## Design Ventilation Requirements

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As stated previously all spaces except for the commons area are ventilated through the use of operable windows. Table 2 shows the comparison of design outdoor air to the estimated outdoor air from Technical Assignment 1.

**Table 2**

Space	Unit Tag	Design Outdoor Air (cfm)	Estimated Outdoor Air (cfm)
Typical Apartment	DF-1	0**	65
TV/Game Room	DF-2	150	292
Fitness Room/Cyber Lounge	DF-3	260	115
Office/Conference Area	DF-4	300	207

\*\*A value of zero is required due to the use of operable windows for natural ventilation. The required free areas required were checked and all passed the ASHRAE 62.1 requirements.

## Design Heating and Cooling Loads

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Due to time and financial constraints, the designer limited the modeling of the spaces to typical values. In technical assignment 2, a more in depth approach was taken that analyzed every space and only resulted in little variation to the actual design. Table 4 shows the design heating and cooling loads as determined by GPI Engineers. Appendix A contains the estimated heating and cooling loads as determined in Technical Assignment 2. These loads utilized floor multipliers to achieve the given results. Both of these results were obtained using Trace 700.

**Table 3**

### Design Cooling and Heating Loads

Space	Total Cooling Load (Tons)	Total Heating Capacity (MBh)
Game/TV	3.0	13.2
Gym/Lounge	2.6	13.3
Offices	3.4	23.8
Northeast Apartment	1.6	5.6
Northeast Top Apartment	1.7	5.7

Northwest Apartment	1.7	5.6
Northwest Top Apartment	1.8	5.6
Southeast Apartment	2.3	5.6
Southeast Top Apartment	2.2	5.6
Southwest Apartment	2.3	5.6
Southwest Top Apartment	2.2	5.6
Typical Stairwell	-	7.3

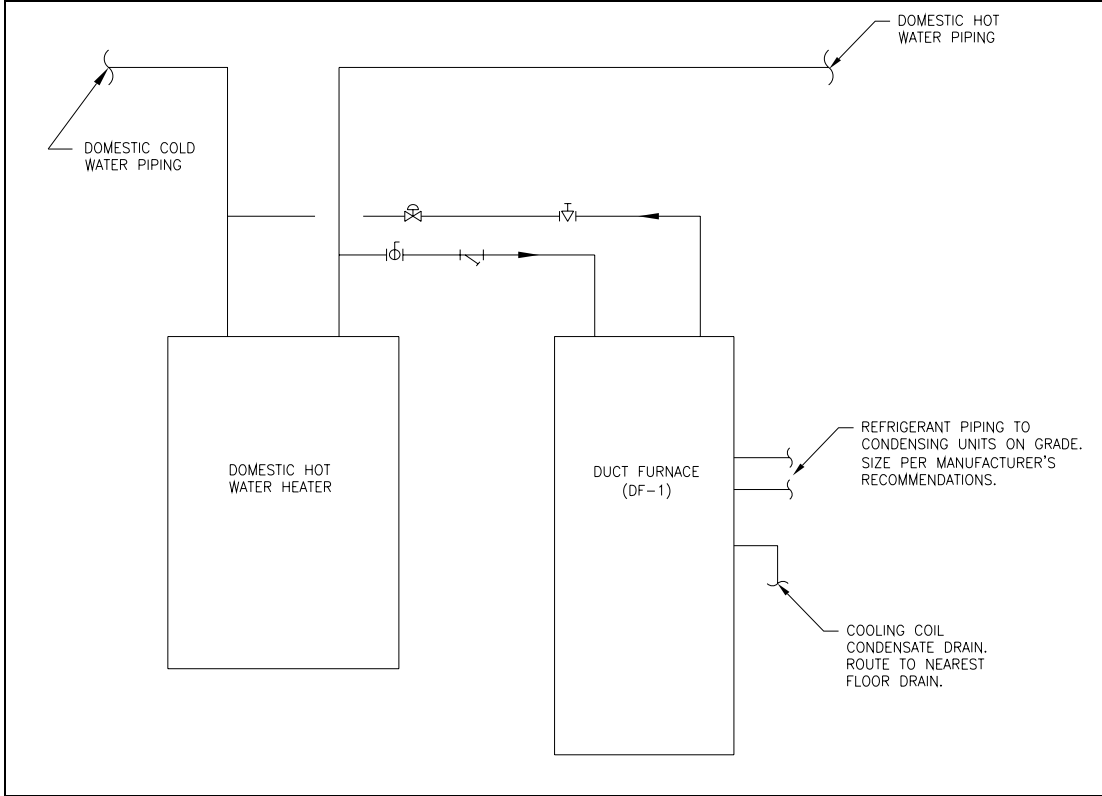
## Annual Energy Use

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The annual energy use was not calculated by GPI Engineers and therefore is not given. Trace 700 was used to calculate the energy used by University Ridge. The simulation found that the buildings will use about 198,852 kBTU/yr. Appendix C contains the energy use summary as obtained from Trace 700.

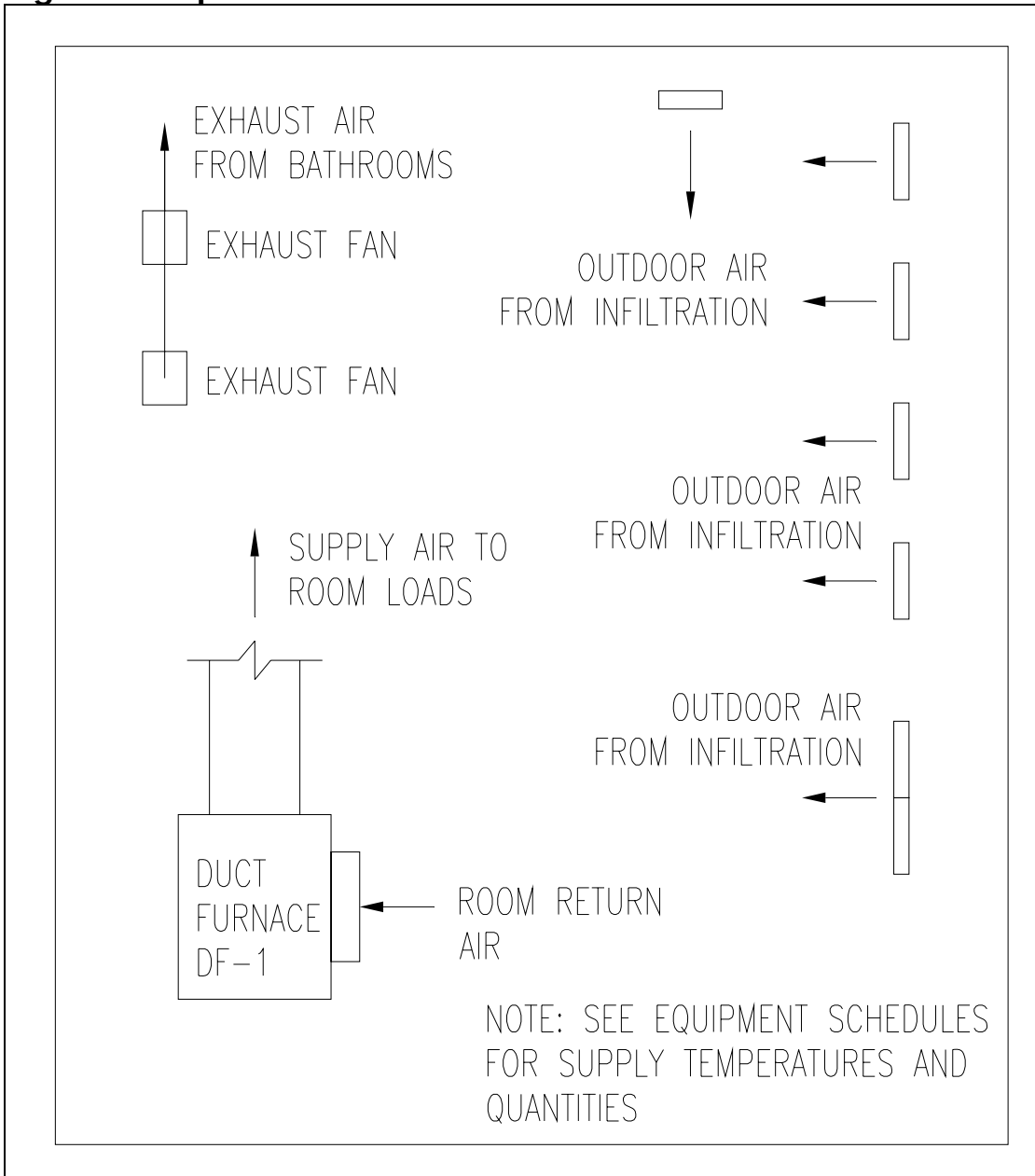
# Schematic Drawings

**Figure 1: Domestic Hot Water and Duct Furnace Flow Diagram**

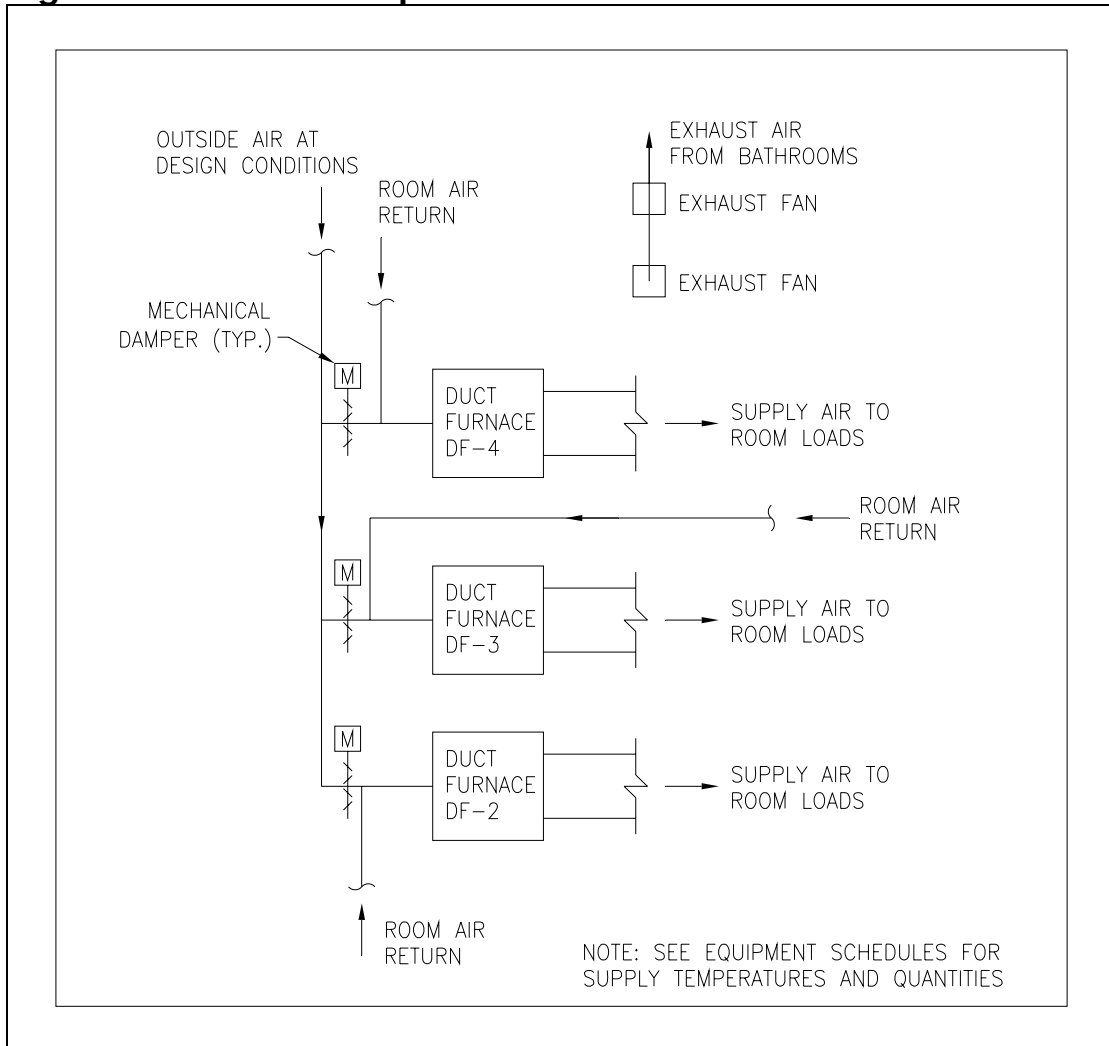




**Figure 2: Apartment Duct Furnace Schematic**



**Figure 3: Commons Space Schematic**



## Summary of Equipment

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The following is a list of major system components based on design data. Equipment data can be found in Appendix D

*Duct Furnaces:* University Ridge contains 153 apartment units with a dedicated duct furnace air handling unit for each of the units. These units are purely re-circulatory. Heating capacity is supplied by hot water coils with hot water supply from the domestic water heaters. Cooling comes from individual condensing units for greater control. The duct furnace air handlers for the commons area are individually gas fired and are cooled in the same was as the apartments.

*Domestic Water Heaters:* The water heaters that supply domestic hot water and hot water for the duct furnaces fired by natural gas and are sized according to the National Plumbing Code with adjustments for the HVAC demand. All other water heaters are electrically heated for spaces such as public bathrooms and mechanical rooms.

## System Operation

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The following describes the basic operation of the mechanical systems.

*Hot Water Duct Furnaces:* The air handling duct furnaces are controlled by analog thermostats located in the occupied spaces. When in heating mode the thermostat cycles the fan, opens the hot water isolation valve, and cycles the integral hot water circulating pump in sequence to maintain the space temperature set-point. The fan stops and the hot water isolation valve closes when the integral hot water circulating pump is off. When in cooling mode the thermostat cycles the fan and the associated condensing unit in sequence to maintain the required space temperature set-point. The fan shall stop when the condensing unit is off. When the fan is enabled at the thermostat, it runs constantly.

*Gas Fired Duct Furnaces:* The gas fired duct furnaces are controlled in the same way as the hot water duct furnace except for the following. When called for heating, the gas fired burner is enabled instead of the hot water section. If the space temperature drops below 40°F a signal is sent to an alarm panel.

*Exhaust Fans:* Exhaust fans are controlled intermittently by a wall switch by the occupants.

## Operating History

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Although University Ridge has been constructed for over a year, the system operating history is not available.

## Critique of System

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Matthew Carr AE 481W November 21, 2006

# Appendix A: Energy Bill



### FAST BILL INFORMATION

The balance of your last bill 336.37  
 Payments Track you 336.37CB  
 Balance Before this Bill .00

AUG 07 2006

6535

Account Number: 0798478-0

### CURRENT BILL

**DELIVERY CHARGES**  
 Delivery Charge 15.00  
 Distribution Charge  
 -Ret 5.0 DT 4.5085 22.69  
 Next 11.5 DT 2.2208 25.57  
 Total 18.5 DT 49.26

Bill for Service to:  
Capstone Management Corp

F Room- St #BLDG 2  
 East Stroudsburg, PA  
 Rate Class:  
 Landlord/Resiliuous heat  
 Statement Date:  
 August 02, 2006  
 Next Scheduled Meter  
 Reading On or About:  
 August 31, 2006

**GAS CHARGES**  
 Gas Cost Adj. Chg @ 1.4422/DT 29.60  
 Gas Supply Charge @11.3997/DT 195.95  
**TAXES & SUIV-APGFS**  
 State Tax Adjustment .6708  
 Pennsylvania State Tax 17.02

If you have any  
 questions, please  
 call us at:  
 (800)652-0550  
 or write us at  
 PPL Gas Utilities  
 PO Box 508  
 Lock Haven, Pa 17745-0508

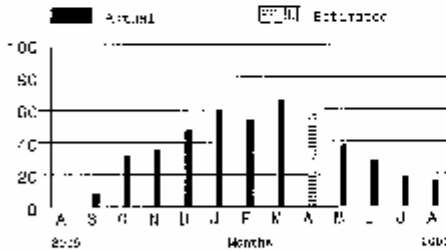
Current Charges 301.84  
 Balance as of this bill  
 due by August 22, 2006 301.84

9:030311305

For Emergency Service  
 (800)652-0550

Your Gas Usage			Meter Reading Information					
Average	This Year	Last Year	Meter Number	Present Reading	Last Reading	OCF Used	RTU Factor	Dekalturnus
per Day	.6168		0000100098	41904	41700	161	1.0270	15.5
Av. Temperature	50.0° F	50.0° F						

Usage per Month (CF)



Actual 8/31/06  
 Actual 8/10/06  
 22 Days in Billing period

### Messages from PPL Gas Utilities

\*\*\*SCAN ALERT\*\*\* PPL Gas would like to warn our customers about a potential phone scam. If you fall behind on your gas bill, you will receive one or more written notices BEFORE a PPL Gas representative will phone you. The CSR will NEVER ask for your CREDIT or DEBIT card information. PPL utilizes a secure third party vendor for these payments. You may access this payment option via PPL Gas's automated phone menu - OPTION # 9.

Make checks payable to PPL GAS UTILITIES

Keep this bill for your records

1/1

**Met-Ed Basic Charges**

 When contacting an Electric Generation Supplier, please provide the customer numbers below.  
 Call Met-Ed at 1-800-545-7741 with questions on these charges.

**Met-Ed Basic Charges**

<b>Customer Number: 0604331178-0006411045 - General Secondary 3 Phase Service - ME_GS3_B1F</b>			
<b>Customer Charge</b>			16.74
<b>Generation Charges</b>	34,050 KWH	x 0.048070	1,638.23
<b>Transmission Charges</b>	32,050 KWH	x 0.000000	0.00
	2,000 KWH	x 0.002800	5.60
	102.5 KW	x 0.780000	79.95
	5.0 KW	x 0.000000	0.00
<b>Total Transmission Charges</b>			<u>85.61</u> 85.61
<b>Distribution Charges</b>	12,550 KWH	x 0.006600	83.03
	19,550 KWH	x 0.007200	140.40
	2,000 KWH	x 0.038000	76.00
	102.5 KW	x 4.570000	468.43
	5.0 KW	x 0.000000	0.00
<b>Total Distribution Charges</b>			<u>761.86</u> 761.86
<b>Transition Charges</b>	2,500 KWH	x 0.002010	4.02
	19,500 KWH	x 0.000860	16.77
	12,500 KWH	x -0.000510	-6.38
	5.0 KW	x 0.000000	0.00
	102.5 KW	x 4.610000	472.53
<b>Total Transition Charges</b>			<u>420.23</u> 420.23
<b>State Tax Surchage</b>			32.44
<b>State Sales Tax</b>			177.31
<b>Total Met-Ed Charges</b>			<u>\$ 3,132.42</u>

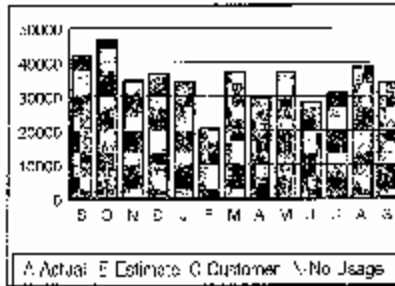
**Payments and Adjustments**

Date	Reference	Amount
Payments:		
08/22/06		-3,280.64
<b>Total Payments</b>		<u>-3,280.64</u>
<b>Total Payments and Adjustments</b>		<u>-\$3,280.64</u>

**General Secondary 3 Phase Service**

<b>Meter Number</b>	029337850
Present KWH Reading (Actual)	2,821
Previous KWH Reading (Actual)	2,638
Difference	213
Multiplier	100
Kilowatt Hours Used	34,050
Metered Load in KW	0.6/2
Billed Load in KWKVA	107.5

Usage Comparison



Average Daily Use (KWH)	Sep 05	Sep 06
Average Daily Temperature	72	69
Days in Billing Period	33	30
Last 12 Months Use (KWH)		408,250
Average Monthly Use (KWH)		34,187

Generation prices and charges are set by the electric generation supplier you have chosen.

The Public Utility Commission regulates distribution prices and services.  
 The Federal Energy Regulatory Commission regulates transmission prices and services.





# Appendix B: Heating and Cooling Loads

## Load / Airflow Summary

By ae

Description **		Floor Area ft²	People #	Coil Cooling Sensible Btu/h	Coil Cooling Total Btu/h	Space Design Max SA cfm	Air Changes ach/hr	VAV Minimum SA cfm	Main Coil Heating Sensible Btu/h	Heating Fan Max SA cfm	Percent OA Cfg	ASHRAE 62-89 Htg OA fraction
Bldg 1 - NE Apartments	Rm/Zn Tot	2,745	12.0	50,824	55,126	2,849	6.56	0	-13,072	2,849	0.0	0.0
Bldg 1 - SE Apartment	Rm/Zn Tot	2,745	12.0	50,680	55,982	2,839	6.53	0	-13,072	2,839	0.0	0.0
Bldg 1 - SW Apartment	Rm/Zn Tot	1,830	8.0	41,704	45,048	2,469	8.52	0	-9,342	2,469	0.0	0.0
Bldg 1 - NW Apartments	Rm/Zn Tot	1,830	8.0	41,114	44,458	2,427	8.38	0	-9,342	2,427	0.0	0.0
Bldg 1 - 2nd SW Apt	Rm/Zn Tot	776	3.0	20,051	21,390	1,226	9.98	0	-4,892	1,226	0.0	0.0
Bldg 1 - 2nd NW Apt	Rm/Zn Tot	776	2.0	19,519	20,659	1,218	9.91	0	-5,142	1,218	0.0	0.0
Bldg 2 - NE Apt	Rm/Zn Tot	3,572	16.0	42,867	50,313	2,096	3.71	0	-15,175	2,096	0.0	0.0
Bldg 2 - SE Apt	Rm/Zn Tot	2,679	12.0	53,020	55,447	3,412	8.04	0	-11,840	3,412	0.0	0.0
Bldg 2 - SW Apt	Rm/Zn Tot	2,679	12.0	50,341	52,769	3,216	7.58	0	-9,196	3,216	0.0	0.0
Bldg 2 - NW Apt	Rm/Zn Tot	3,572	16.0	39,795	47,322	1,994	3.53	0	-11,649	1,994	0.0	0.0
Bldg 3 - NW Apt	Rm/Zn Tot	3,572	16.0	49,271	55,882	2,592	4.58	0	-15,175	2,592	0.0	0.0
Bldg 3 - NE Apt	Rm/Zn Tot	3,572	16.0	39,724	47,252	1,888	3.34	0	-11,649	1,888	0.0	0.0
Bldg 3 - SE Apt	Rm/Zn Tot	2,679	12.0	50,923	53,350	3,259	7.68	0	-9,196	3,259	0.0	0.0
Bldg 3 - SW Apt	Rm/Zn Tot	2,679	12.0	53,166	55,590	3,423	8.07	0	-11,840	3,423	0.0	0.0
Bldg 5 - NW Apt	Rm/Zn Tot	2,679	12.0	37,612	42,570	1,988	4.69	0	-11,840	1,988	0.0	0.0
Bldg 5 - NE Apt	Rm/Zn Tot	2,679	12.0	30,326	35,972	1,449	3.42	0	-9,196	1,449	0.0	0.0
Bldg 5 - SE Apt	Rm/Zn Tot	3,572	16.0	67,691	70,928	4,330	7.66	0	-11,649	4,330	0.0	0.0
Bldg 5 - SW Apt	Rm/Zn Tot	3,572	16.0	70,538	73,771	4,538	8.02	0	-15,175	4,538	0.0	0.0
Bldg 6 - NE Apt	Rm/Zn Tot	2,679	12.0	32,586	38,170	1,599	3.77	0	-11,840	1,599	0.0	0.0
Bldg 6 - SE Apt	Rm/Zn Tot	3,572	16.0	70,487	73,724	4,534	8.02	0	-15,175	4,534	0.0	0.0
Bldg 6 - SW Apt	Rm/Zn Tot	3,572	16.0	66,916	70,152	4,273	7.56	0	-11,649	4,273	0.0	0.0
Bldg 6 - NW Apt	Rm/Zn Tot	2,679	12.0	30,379	36,025	1,538	3.63	0	-9,196	1,538	0.0	0.0
Bldg 7 - NW Apt	Rm/Zn Tot	2,679	12.0	37,612	42,570	1,988	4.69	0	-11,840	1,988	0.0	0.0
Bldg 7 - NE Apt	Rm/Zn Tot	2,679	12.0	30,326	35,972	1,449	3.42	0	-9,196	1,449	0.0	0.0
Bldg 7 - SE Apt	Rm/Zn Tot	3,572	16.0	67,691	70,928	4,330	7.66	0	-11,649	4,330	0.0	0.0
Bldg 7 - SW Apt	Rm/Zn Tot	3,572	16.0	70,538	73,771	4,538	8.02	0	-15,175	4,538	0.0	0.0
Bldg 8 - NE Apt	Rm/Zn Tot	2,679	12.0	32,586	38,170	1,599	3.77	0	-11,840	1,599	0.0	0.0
Bldg 8 - SE Apt	Rm/Zn Tot	3,572	16.0	70,487	73,724	4,534	8.02	0	-15,175	4,534	0.0	0.0
Bldg 8 - SW Apt	Rm/Zn Tot	3,572	16.0	66,916	70,152	4,273	7.56	0	-11,649	4,273	0.0	0.0
Bldg 8 - NW Apt	Rm/Zn Tot	2,679	12.0	30,379	36,025	1,538	3.63	0	-9,196	1,538	0.0	0.0
Bldg 9 - NW Apt	Rm/Zn Tot	2,679	12.0	37,612	42,570	1,988	4.69	0	-11,840	1,988	0.0	0.0

\*\* This report does not display heating only systems.

Project Name: University Ridge at East Stroudsburg  
 Dataset Name: C:\CDS\TRACE700\Projects\ESU-AQUATHERM.TRC

TRACE® 700 v4.1 calculated at 11:54 AM on 10/27/2006  
 Alternative - 1 Load/Airflow Summary report page 1

### Load / Airflow Summary

By ae

Description **		Floor Area ft²	People #	Coil Cooling Sensible Btu/h	Coil Cooling Total Btu/h	Space Design Max SA cfm	Air Changes ach/hr	VAV Minimum SA cfm	Main Coil Heating Sensible Btu/h	Heating Fan Max SA cfm	Percent OA Clg	ASHRAE 62-89 OA fraction Htg
Bldg 9 - NE Apt	Rm/Zn Tot	2,679	12.0	30,326	35,972	1,449	3.42	0	-9,196	1,449	0.0	0.0
Bldg 9 - SE Apt	Rm/Zn Tot	3,572	16.0	67,691	70,928	4,330	7.66	0	-11,649	4,330	0.0	0.0
Bldg 9 - SW Apt	Rm/Zn Tot	3,572	16.0	70,538	73,771	4,538	8.02	0	-15,175	4,538	0.0	0.0
Bldg 10 - NE Apt	Rm/Zn Tot	2,679	12.0	32,586	38,170	1,599	3.77	0	-11,840	1,599	0.0	0.0
Bldg 10 - SE Apt	Rm/Zn Tot	3,572	16.0	70,487	73,724	4,534	8.02	0	-15,175	4,534	0.0	0.0
Bldg 10 - SW Apt	Rm/Zn Tot	3,572	16.0	66,916	70,152	4,273	7.56	0	-11,649	4,273	0.0	0.0
Bldg 10 - NW Apt	Rm/Zn Tot	2,679	12.0	30,379	36,025	1,538	3.63	0	-9,196	1,538	0.0	0.0
Bldg 4 - NE Apt	Rm/Zn Tot	2,679	12.0	32,586	38,170	1,599	3.77	0	-11,840	1,599	0.0	0.0
Bldg 4 - SE Apt	Rm/Zn Tot	2,679	12.0	53,020	55,447	3,412	8.04	0	-11,840	3,412	0.0	0.0
Bldg 4 - NW Apt	Rm/Zn Tot	2,679	12.0	37,612	42,570	1,988	4.69	0	-11,840	1,988	0.0	0.0
Bldg 4 - SW Apt	Rm/Zn Tot	2,679	12.0	53,166	55,590	3,423	8.07	0	-11,840	3,423	0.0	0.0
Terminal A/C	Sys Tot/Ave	121,434	541.0	1,998,987	2,177,296	118,078			-485,106	118,078	0.0	0.0
Terminal A/C	Sys Block	121,434	541.0	1,670,815	1,923,345	118,078			-485,106	118,078	0.0	0.0
Bldg 1 - Game/TV	Rm/Zn Tot	1,123	10.0	18,701	23,012	1,225	6.89	0	-11,225	1,225	12.2	12.2
Bldg 1 - Office/Reception	Rm/Zn Tot	281	4.0	6,769	8,724	328	7.38	0	-5,137	328	18.3	18.3
Bldg 1 - Group Meeting	Rm/Zn Tot	633	8.0	9,966	13,877	444	4.43	0	-7,650	444	27.0	27.0
Bldg 1 - Conference	Rm/Zn Tot	175	8.0	4,787	7,704	129	4.65	0	-7,650	129	93.1	93.1
Bldg 1 - Office - C009	Rm/Zn Tot	281	3.0	2,534	3,849	86	1.92	0	-2,869	86	52.6	52.6
Bldg 1 - File/Closet	Rm/Zn Tot	145	0.0	593	593	49	2.15	0	-677	49	0.0	0.0
Bldg 1 - Cyber Lounge	Rm/Zn Tot	653	10.0	12,273	14,950	1,225	11.85	0	-9,563	1,225	12.2	12.2
Bldg 1 - Corridor/Bathroom	Rm/Zn Tot	280	0.0	956	956	1,225	27.63	0	0	1,225	0.0	0.0
Bldg 1 - Fitness	Rm/Zn Tot	212	4.0	3,755	4,532	1,225	36.49	0	-6,057	1,225	7.8	7.8
Commons	Sys Tot/Ave	3,783	47.0	57,959	75,820	5,936			-50,828	5,936	12.5	12.5
Commons	Sys Block	3,783	47.0	56,637	73,618	5,936			-47,178	5,936	12.5	12.5

\*\* This report does not display heating only systems.

Project Name: University Ridge at East Stroudsburg  
 Dataset Name: C:\CDS\TRACE700\Projects\ESU-AQUATHERM.TRC

TRACE700 v4.1 calculated at 11:54 AM on 10/27/2006  
 Alternative - 1 Load/Airflow Summary report page 2

## Appendix C: Energy Use

### MONTHLY ENERGY CONSUMPTION

By ae

Alternative: 1 University Ridge

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

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
<b>Electric</b>													
On-Pk Cons. (kWh)	61,646	55,288	72,480	69,062	82,871	88,862	84,584	94,726	78,781	77,104	69,513	60,591	895,507
Off-Pk Cons. (kWh)	83,482	75,260	79,528	83,862	89,152	88,251	108,611	91,561	91,389	84,425	80,879	86,920	1,043,321
On-Pk Demand (kW)	322	321	348	355	374	390	398	394	385	351	347	346	398
Off-Pk Demand (kW)	346	346	371	366	353	365	375	366	358	352	358	366	375
<b>Gas</b>													
On-Pk Cons. (therms)	64	59	20	4	0	0	0	0	0	4	10	40	201
Off-Pk Cons. (therms)	28	28	14	1	0	0	0	0	0	0	9	19	99
On-Pk Demand (therms/hr)	3	1	0	0	0	0	0	0	0	0	0	0	3
Off-Pk Demand (therms/hr)	5	1	0	0	0	0	0	0	0	0	0	1	5

Building Energy Consumption = 51,711 Btu/(ft<sup>2</sup>-year)  
 Source Energy Consumption = 154,893 Btu/(ft<sup>2</sup>-year)  
 Floor Area = 128,647 ft<sup>2</sup>

## ENERGY CONSUMPTION SUMMARY

By ae

	Elect Cons. (kWh)	Gas Cons. (therms)	Percent of Total Energy	Total Source Energy* (kBtu/yr)
<b>Primary heating</b>				
Primary heating	6,003.1	300.3	0.8 %	930.9
<b>Primary cooling</b>				
Cooling Compressor	313,170.7		16.1 %	32,068.8
Tower/Cond Fans	44,656.4		2.3 %	4,572.8
Condenser Pump			0.0 %	0.0
Other CLG Accessories	1,204.5		0.1 %	123.3
Cooling Subtotal....	359,031.5		18.4 %	36,764.9
<b>Auxiliary</b>				
Supply Fans			0.0 %	0.0
Circ Pumps	5,036.0		0.3 %	515.7
Base Utilities			0.0 %	0.0
Aux Subtotal....	5,036.0		0.3 %	515.7
<b>Lighting</b>				
Lighting	563,035.8		28.9 %	57,655.0
<b>Receptacle</b>				
Receptacles	1,005,722.6		51.6 %	102,986.2
<b>Heating plant load</b>				
Base Utilities			0.0 %	0.0
<b>Cogeneration</b>				
Cogeneration			0.0 %	0.0
<b>Totals</b>				
Totals**	1,938,828.9	300.3	100.0 %	198,852.7

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

\*\* Note: This report can display a maximum of 6 utilities. If additional utilities are used, they will be included in the total.

Project Name: University Ridge at East Stroudsburg  
 Dataset Name: C:\CDS\TRACE700\Projects\ESU-AQUATHERM.TRC

TRACE® 700 v4.1 calculated at 11:54 AM on 10/27/2006  
 Alternative - 1 Energy Consumption Summary report page 1

**MONTHLY UTILITY COSTS**

By ae

Alternative: 1

Utility	----- Monthly Utility Costs -----												Total
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
<b>Electric</b>													
On-Pk Cons. (\$)	5,965	5,350	7,013	6,682	8,019	8,598	8,184	9,166	7,623	7,461	6,726	5,863	86,649
On-Pk Demand (\$)	3,156	3,151	3,413	3,487	3,677	3,833	3,918	3,872	3,782	3,451	3,405	3,400	42,544
<b>Total (\$):</b>	<b>9,121</b>	<b>8,501</b>	<b>10,426</b>	<b>10,169</b>	<b>11,695</b>	<b>12,431</b>	<b>12,102</b>	<b>13,038</b>	<b>11,405</b>	<b>10,912</b>	<b>10,131</b>	<b>9,262</b>	<b>129,193</b>
<b>Gas</b>													
On-Pk Cons. (\$)	257	246	92	18	0	0	0	0	0	18	47	182	661
<b>Monthly Total (\$):</b>	<b>9,378</b>	<b>8,747</b>	<b>10,519</b>	<b>10,187</b>	<b>11,695</b>	<b>12,431</b>	<b>12,102</b>	<b>13,038</b>	<b>11,405</b>	<b>10,930</b>	<b>10,178</b>	<b>9,444</b>	<b>130,054</b>

# Appendix D: Equipment Data

Duct Furnace Schedule																	
		Fan Section			Motor Characteristics			Heating Coil Section			Cooling Coil Section						
Tag	Area Served	Type	Total CFM	Min. OA	External Static Pressure	HP	Volts	Phase	Type	Total Capacity (MBH)	GPM	WPD (FT)	EMT (°F)	LWT (°F)	Total Capacity (MBH)	Refrigerant Type	Bank of Design
DF-1	Apartment Units	Wall Mounted	1400	0	0.25	1/2	115	1	Hot Water	30.7	3	1.25	120	100	30	R-22	FW CO. MODEL R6A3
DF-2	Game Room/TV Room	Floor Mounted	1225	150	0.25	3/4	115	1	NEUR/DR	54.1	N/A	N/A	N/A	N/A	38	R-22	CONSTRAL AH SERIES
DF-3	Gen/Cyber Lounge	Floor Mounted	1225	250	0.25	3/4	115	1	NEUR/DR	54.1	N/A	N/A	N/A	N/A	38	R-22	CONSTRAL AH SERIES
DF-4	Classroom	Floor Mounted	1100	350	0.25	1	115	1	NEUR/DR	70.1	N/A	N/A	N/A	N/A	42	R-22	CONSTRAL AH SERIES

Condensing Unit Schedule												
Tag	Unit Served	Nominal Capacity (tons)	Minimum EER	No. of Compressor	Capacity Steps	CFM	No. of Fans	Motor Watts	FLA	Volts	Phase	Bank of Design
CU-1	DF-1	2.5	10.0	1	1	2545	1	195	19.5	230	1	LARIKON H15294D12
CU-2	DF-2	3.0	10.0	1	1	2500	1	195	21.1	230	1	LARIKON H15294D12S
CU-3	DF-3	3.0	10.0	1	1	2500	1	195	21.1	230	1	LARIKON H15294D12S
CU-4	DF-4	3.5	10.0	1	1	2810	1	195	26.5	230	1	LARIKON H15294D12

Fan Schedule											
Tag	Area Served	Type	Airflow	Static Pressure (In.H <sub>2</sub> O)	HPM	Drive	Watts	Volts	Phase	Model	
EF-1	Bedrooms	Ceiling	300	0.5	1000	Direct	129	115V	1	89-2-150	
EF-2	Class Room	Frogsaver	4000	0.25	1000	Ball	127HP	200V	1	GREENROCK SER-2150-5	

Water Heater Schedule											
Tag	Location	Model	Total Storage	Input (MBH)	Recovery Flow	Source					
WH-1	Apartment	A.O. Smith	50 Gall	65,000	98	N. Gas					
WH-2	Mechanical Rooms	A.O. Smith	10 Gall	-	-	Electric					

## References

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1. ASHRAE. 2004. "*ANSI/ASHRAE Standard 62.1-2004 – Ventilation for Acceptable Indoor Air Quality*." American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
2. ASHRAE. 2004. "*ANSI/ASHRAE Standard 90.1-2004 – Energy Standard*." American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
3. TRANE TRACE 700 v 4.1.1 2001.