ESL-TR-98/12-01

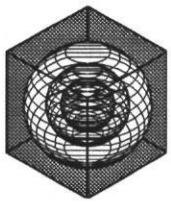
DRAFT

Energy Analysis, Baselining and Modeling of Prairie View A&M University Campus

Prepared by

Bass Abushakra, David E. Claridge, Ph.D., P.E., Jeff S. Haberl, Ph.D., P.E., James Eggebrecht and Kimberly Carlson

December 1998



Energy Systems Laboratory

Building Energy Analysis Division
Texas Engineering Experiment Station
Texas A&M University
College Station, Texas 77843-3581

Table of Contents

Executive Summary .....

Deliverable 1

Savings Analysis of the Library (John B. Coleman) Building .....

- Monthly Energy Performance Profiles .....
  - Electricity Consumption (PVAM Team, JC-85) .....
  - Chilled Water Consumption (JC-85) .....
  - Hot Water Consumption (JC-85) .....
- Electricity Consumption (JC-85) .....
  - Pre-Retrofit Model .....
  - Savings Calculations .....
- Chilled Water Consumption (JC-85) .....
  - Pre-Retrofit Model .....
  - Savings Calculations .....
- Hot Water Consumption (JC-85) .....
  - Pre-Retrofit Model .....
  - Savings Calculations .....

Deliverable 2

- **Inspection of JC-85 Metering in Campus Buildings** .....
- **Comments on JC-85 Thermal Metering** .....

Deliverables 3 and 5

- **Analysis of Whole Campus Utility Data** .....
  - 15-Minute Data Profiles .....
  - Utility Bills Data Profiles .....
    - Electricity Consumption .....
    - Coincident Peak Electricity Demand .....
    - Non-Coincident Peak Electricity Demand .....
    - Gas Consumption .....
  - Comparison between the 15-Minute and Utility Bills Electricity Consumption Data .....
- **Baselining of the Whole Campus Energy Consumption** .....
  - Electricity Consumption .....
  - Coincident Peak Electricity Demand .....
  - Non-Coincident Peak Electricity Demand .....
  - Gas Consumption .....

Deliverable 4

Analysis of PVAM Existing Electricity Use Contract .....

Deliverable 6

Annual EUI's of Buildings Served by JC-85 .....

- Monthly Recorded Data by JC-85 .....
- EUI's of Typical Buildings at Texas A&M University .....
- EUI's of PVAM Buildings Served by JC-85 .....

Conclusions .....

Appendix.....

Executive Summary

Analysis of the available data found that electricity savings in the J.B. Coleman Library for June - September, 1998 were 298 MWh, or 38% of the baseline consumption during these months. Extrapolation of these savings to a full year leads would result in savings of 894 MWh/year. This would result in annual electricity cost savings of $42,500 at the average cost of $0.0475/kWh which was paid by the University for the period October, 1997 - September, 1998. Smaller savings were expected in chilled water, but were not evident in the data available. Likewise, no significant increase in hot water use was observed during the June - September period analyzed.

The thermal metering installations in 29 buildings were inspected. They were generally found to be in good condition, with a flow meter and the two required temperature sensors installed in the hot water and chilled water lines. However, in 14 of the installations, it was observed that either the hot water flow meter or the chilled water flow meter was located so close to a bend, valve, or other obstruction in the line that substantial errors in the flow (and Btu) readings are likely. In five of the buildings, both the hot water and chilled water flow meters were located too close to obstructions. Only 10 buildings had both flow meters placed properly. Temperature sensors were generally placed properly, although it was not possible to locate five (of 58) sensors to verify proper placement, and two others were located in the air handler piping rather than in the main building chilled and hot water lines.

The monthly utility bills for electricity and gas were analyzed and plotted as functions of ambient temperature. Both electricity consumption and demand increased during hotter months as is typical on a campus such as Prairie View. Gas consumption shows a strong peak during winter as is expected. Baseline models were developed for electricity consumption, non-coincident electric demand, coincident electric demand, and gas consumption.

The monthly utility bills were compared with 15-minute data, but it appears that we have incomplete information on the meter scaling factors and/or the 15-minute data does not correspond to the same set of meters included on the monthly bills. Consequently, no conclusions can be drawn from these comparisons at this time.

Analysis of the rate schedules and billing data found that

1.) In most months PVAM was billed correctly according to the rate schedule. However, in the 26 months reviewed there appear to be two possible billing errors. One of those errors seems to have been corrected by the utility in a later billing. There is another error in the billing calculations for the month of May, 1998 (consumption from 4/25/98 to 5/25/98) for which PVAM should seek a refund of $689.10.

2.) A new LP-8 rate schedule became effective in November, 1998 for the PVAM electrical billing. This change should reduce the yearly costs by approximately 5% assuming the same consumption of energy and demand as in the last 12-month historical period available to me (October, 1997 to September, 1998).

3.) PVAM should monitor the upcoming discussions concerning deregulation in the state legislature. Under the right circumstances PVAM could benefit from a different electrical supplier, and a change of utility rate structures. However, if deregulation is enacted, the present supplier may also elect to alter its current billing schedules to lower the costs.

The preliminary comparisons of Energy-Use Indices included in this draft report are based on only one month of data. They show that consumption of many buildings on the PVAM and TAMU campuses are comparable when normalized by building areas. There appear to be some significant differences, but annual EUI's are needed to draw meaningful conclusions. These will be included in the final report.

Deliverable 1

Savings Analysis of the Library (John B. Coleman) Building

Summary

Analysis of the available data found that electricity savings in the J.B. Coleman Library for June - September, 1998 were 298 MWh, or 38% of the baseline consumption during these months. Extrapolation of these savings to a full year leads would result in savings of 894 MWh/year. This would result in annual electricity cost savings of $42,500 at the average cost of $0.0475/kWh which was paid by the University for the period October, 1997 - September, 1998. Smaller savings were expected in chilled water, but were not evident in the data available. Likewise, no significant increase in hot water use was observed during the June - September period analyzed.

Monthly Energy Performance Profiles

Monthly energy use data for J.B. Coleman Library were collected from the JC-85 printouts and from the readings taken every month by the PVAM personnel. Table 1 shows the whole data collected and used in the baselining and the savings calculations.

Electricity Consumption (PVAM Team, JC-85)

Figure 1 shows the electricity consumption profile (JC-85 data). The electricity consumption data collected by the PVAM personnel showed frequent negative values and values that are double or four times the JC-85 values. Moreover, the PVAM personnel readings do not show a clear trend that suggests that the consumption decreased in the post-retrofit period.

In Figure 1, the pre-retrofit data shows a flat pattern with an average value of approximately 190 MWh/mo. The post-retrofit data shows also a flat pattern with an average value of approximately 120 MWh/mo.

Figure 4.a shows a scatter plot of the electricity consumption (JC-85 data and PVAM Readings) vs. the average dry bulb temperature. The average dry bulb temperature data was obtained from the Houston Intercontinental Airport National Weather Service, and is included in Table 1. The difference in the order of magnitude between the JC-85 data and the PVAM readings is clear in this plot. Also, the range in the PVAM readings (85 to 429 MWh/mo) is doubtful.

Figure 4.b shows a scatter plot of the JC-85 electricity consumption data split into three groups; pre-retrofit, retrofit construction, and post-retrofit periods. There is a flat pattern in each of these groups of data, which suggests a temperature-independence of the electricity use in the library. Pre-retrofit data points are around a monthly value of 190 MWh/mo, and those of the post-retrofit period are close to a 120 MWh/mo value.

Chilled Water Consumption (JC-85)

Figure 2 shows the chilled water consumption profile (JC-85 data). The pre-retrofit data points appearing in this graph show a scaling problem (note that they are not zeros). The post-retrofit data points show an increase in the consumption, which needs further investigation, to draw a meaningful conclusion. More post-retrofit data should available for establishing the status of the achieved savings.

Figure 5 shows a scatter plot of the chilled water consumption (JC-85 data) vs. the dry bulb temperature. The scatter is wide due to six values close to zero, and which, we believe that, have a scaling problem. The temperature-dependence of the chilled water use is clear in this plot. Finally, the post-retrofit values were high and require a deeper investigation to know the reason. Savings can not be seen in this plot due to the lack of data (only four data points were available for the analysis).

Hot Water Consumption (JC-85)

Figure 3 shows the hot water consumption profile (JC-85 data). More post retrofit data should be available before drawing a conclusion about the achieved savings, noting that the post-retrofit data available are that of a Summer (hot) period. Data from a cold period are required.

Figure 6 shows a scatter plot of the hot water consumption (JC-85 data) vs. the dry bulb temperature. The scatter of the data is narrow which proves a strong temperature-dependence of the hot water use. Finally, the post-retrofit values were close to zero as the period happened to be a summer season (hot weather). Savings can not be seen in this plot due to the lack of data (only four data points were available for the analysis), and more data should become available to calculate the savings.

Electricity Consumption (JC-85 data)

Pre-retrofit model

The JC-85 electricity consumption data was used for baselining (pre-retrofit model) instead of the PVAM readings available. A main reason is the quality of the readings that necessitates further investigation (for instance, the frequent existence of negative readings).

The Pre-retrofit electricity consumption data used for baselining is shown in Table 2. The pre-retrofit model's parameters are listed below:

Y_{CP} = 185.8380 (MWh/mo)
LS = 0
RS = 0.3248 (MWh/mo F)
X_{CP} = 51.6904 (F)

Savings Calculations

Post-retrofit electricity consumption data used to calculate the savings is shown in Table 3. Table 4 shows the calculated savings achieved till September 1998 (298.01 MWh/mo). The projected savings for one whole year are also included in the table (894.04 MWh/yr).

Chilled Water Consumption (JC-85 data)

Pre-retrofit model

The JC-85 chilled water consumption data was used for baselining (pre-retrofit model). The Pre-retrofit chilled water consumption data used for baselining is shown in Table 2. The pre-retrofit model's parameters are listed below:

Y_{CP} = 19.3191 (kTONh/mo)
LS = 0
RS = 0.6505 (kTONh/mo F)
X_{CP} = 54.1720 (F)

Savings Calculations

Post-retrofit chilled water consumption data available for the study (June till September 1998) is shown in Table 3. This post-retrofit data is not conclusive and enough for establishing the savings. However, in these four months of available data, the chilled water consumption seemed to increase in an unexpected way. We are expecting the lighting retrofits in the library to generate positive savings; unless a main change in the operation of the library has occurred, and provided that the JC-85 meters and algorithms generates correct and reliable values.

Hot Water (JC-85 data)

Pre-retrofit model

The JC-85 hot water consumption data was used for baselining (pre-retrofit model). The Pre-retrofit hot water consumption data used for baselining is shown in Table 2. The pre-retrofit model's parameters are listed below:

Y_{CP} = 11.9570 (MBbtu/mo)
LS = -17.0765 (Mbtu/mo F)
RS = 0
X_{CP} = 69.6820 (F)

Savings Calculations

Post-retrofit hot water consumption data available for the study (June till September 1998) is shown in Table 3. This post-retrofit data is not conclusive and enough for establishing the savings. These four months of available data, are Summer months and thus the hot water consumption was very low (close to zero). More data (Winter months) is required in order to establish the savings achieved in Hot Water Consumption.

Figure 1. J.B. Coleman Library Monthly Electricity Consumption (JC-85 data)

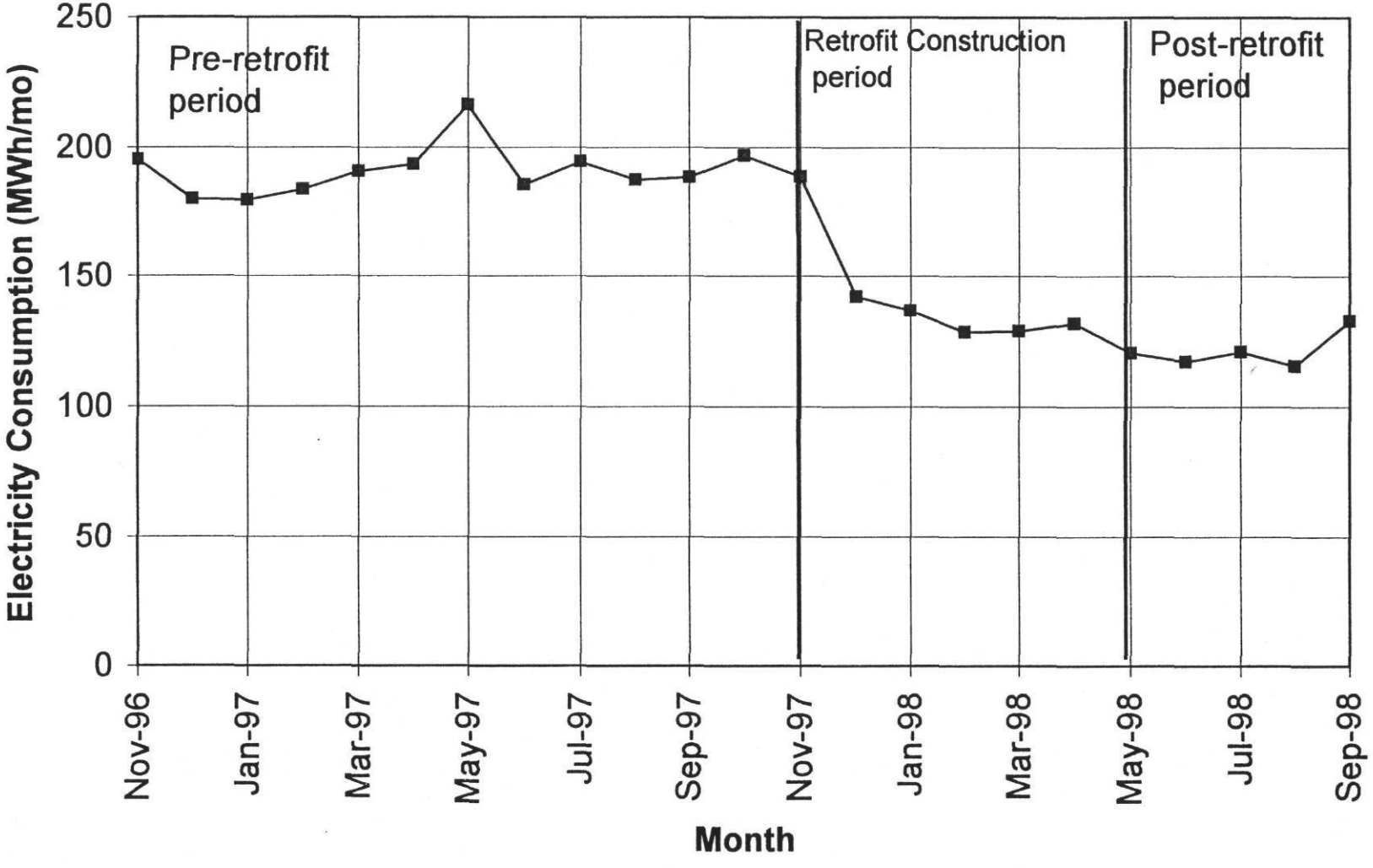


Figure 2. J.B. Coleman Library Monthly Chilled Water Consumption (JC-85 data)

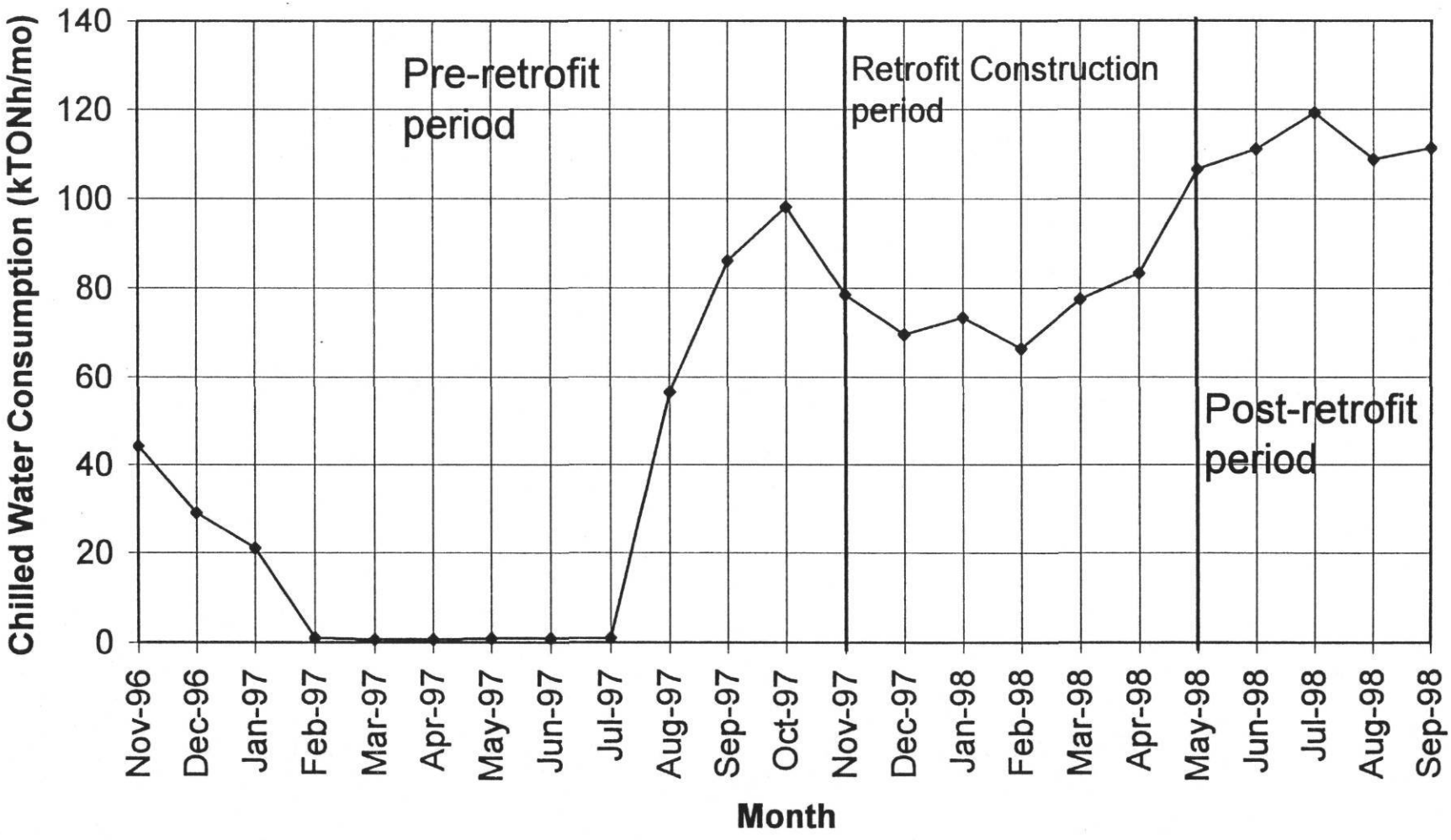


Figure 3. J.B. Coleman Library Hot Water Consumption (JC-85 data)

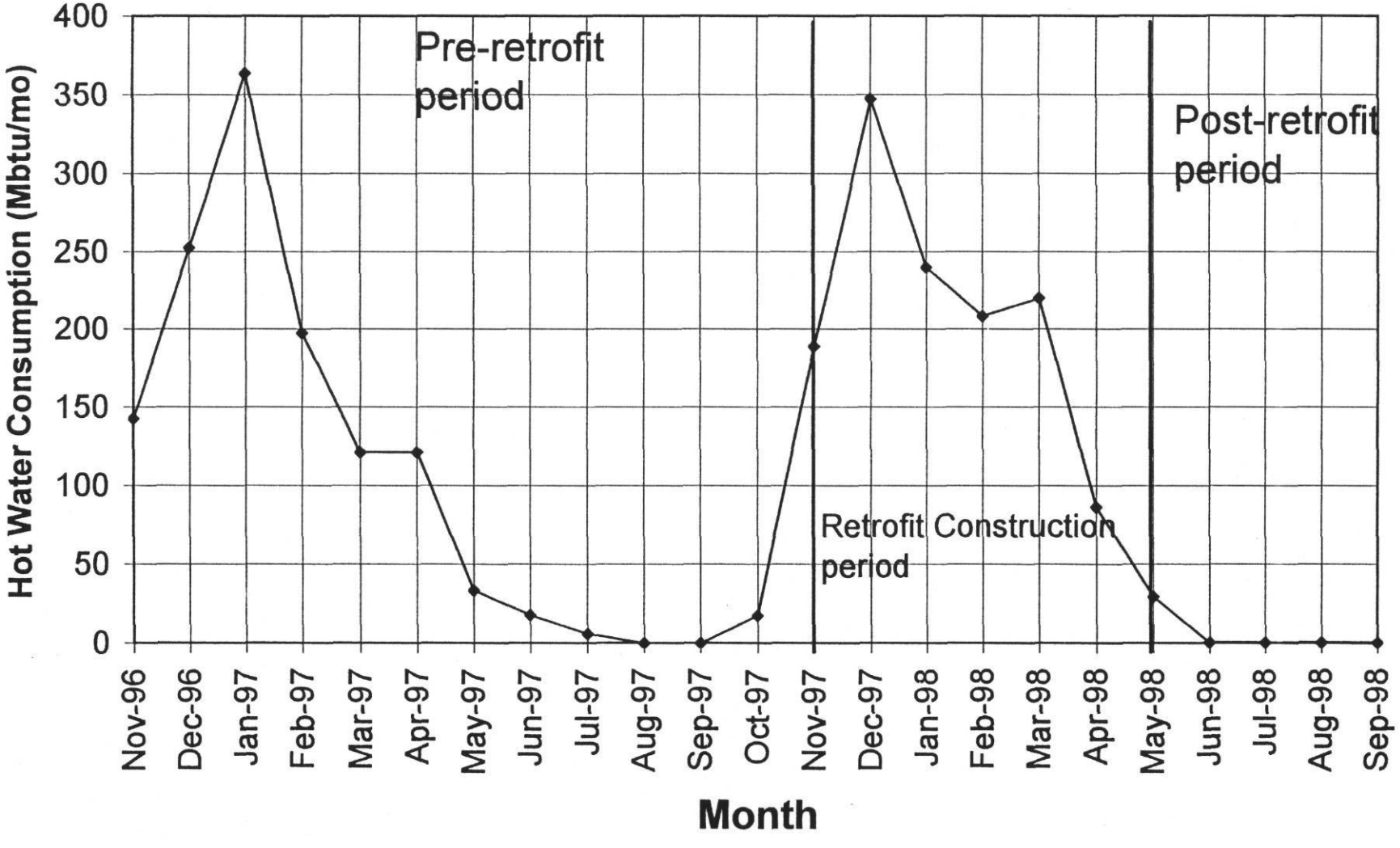


Figure 4.a. J.B Coleman Library Electricity Consumption vs. Average Dry Bulb Temperature

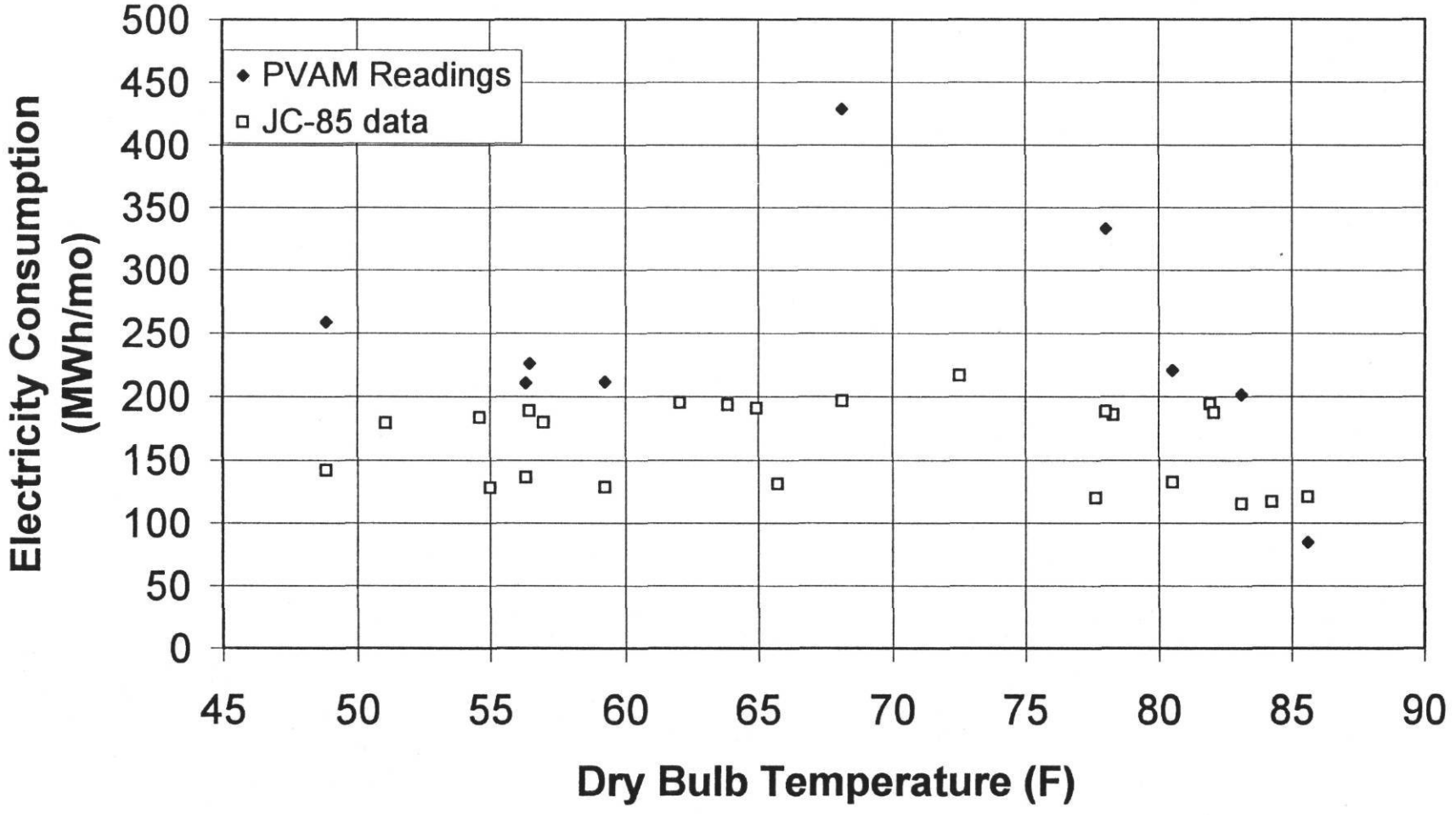


Figure 4.b. J.B. Coleman Library Electricity Consumption (JC-85 data) vs. Average Dry Bulb Temperature

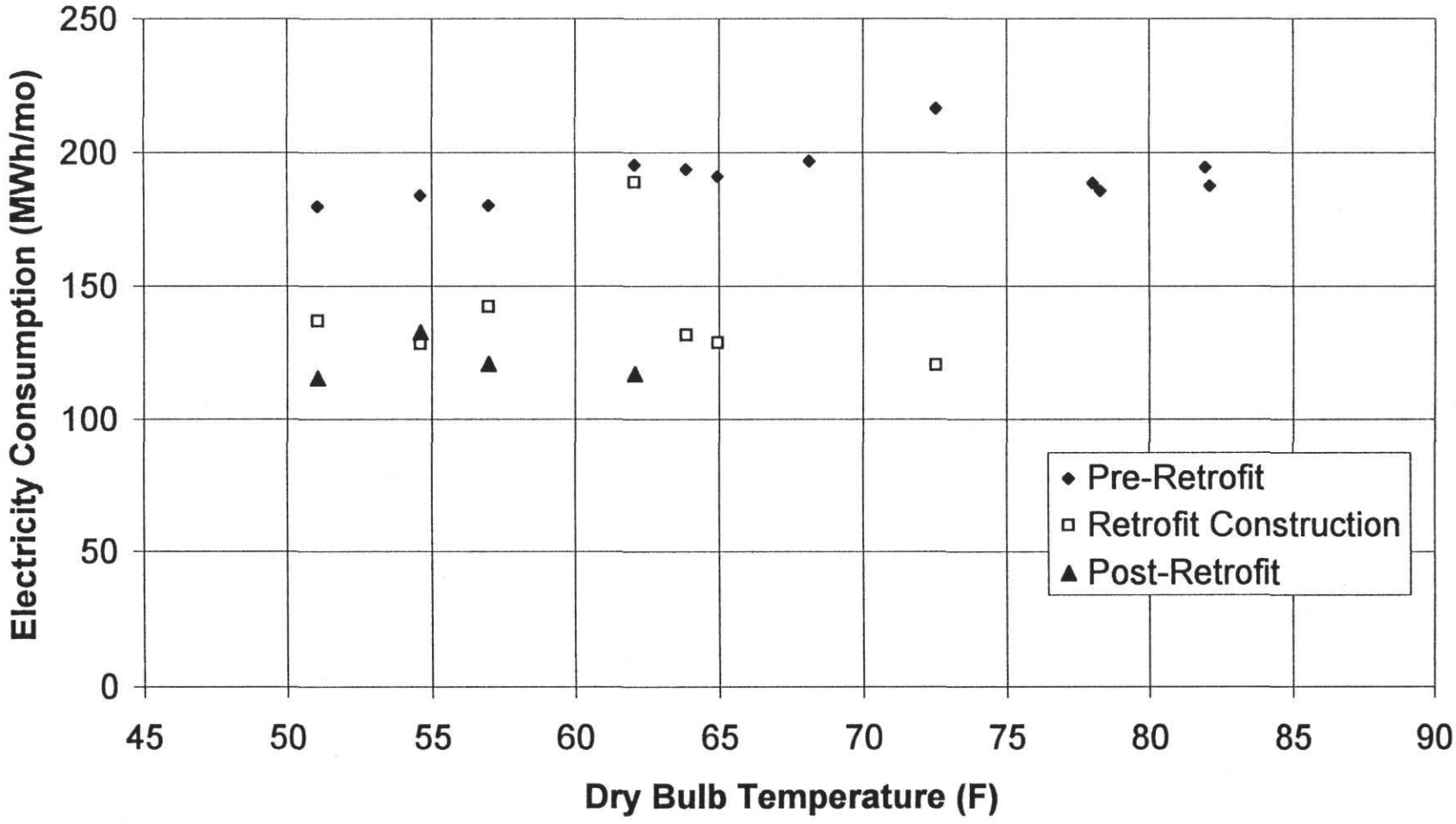


Figure 5. J.B. Coleman Library Chilled Water Consumption vs. Average Dry Bulb Temperature

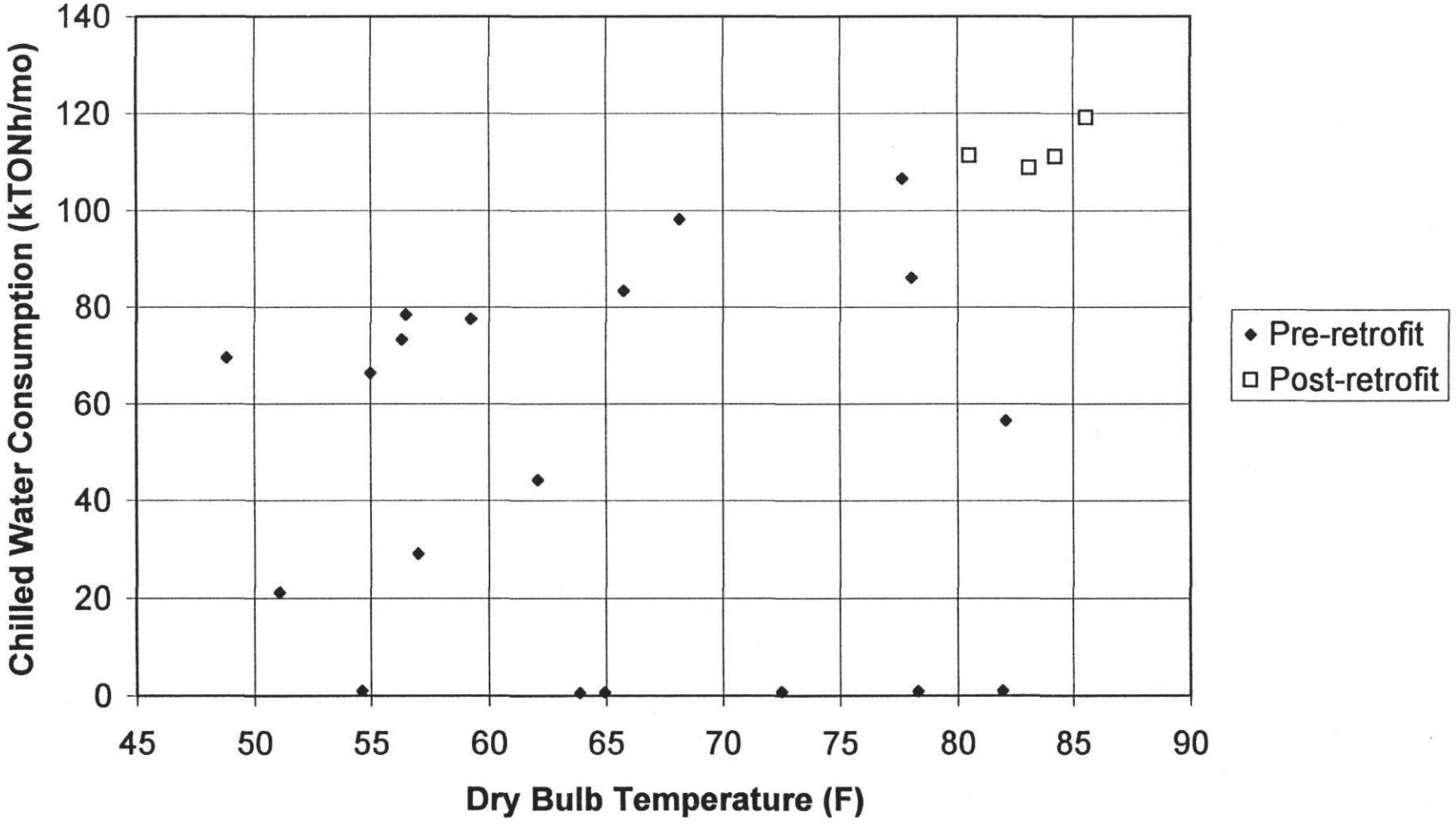
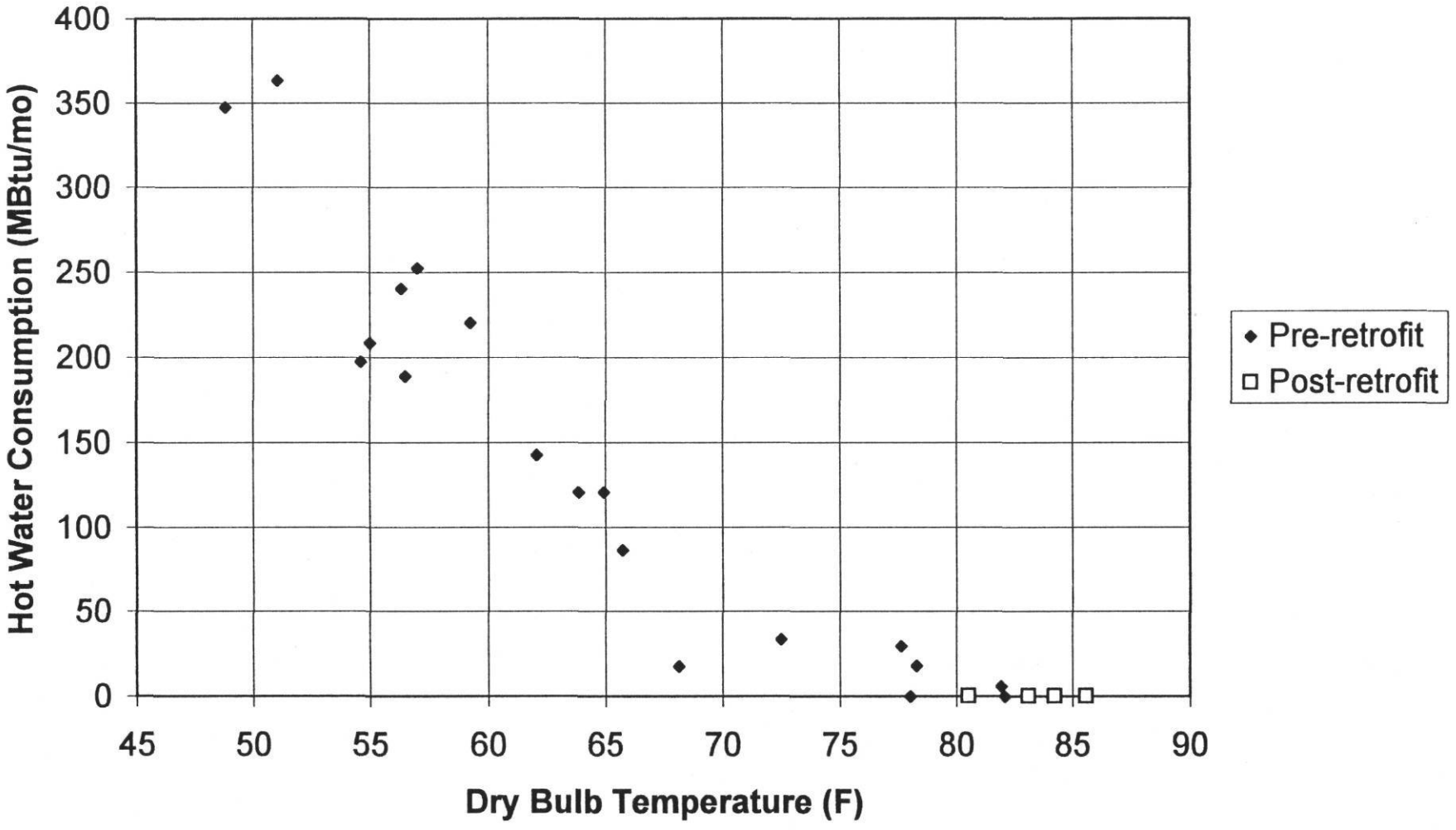


Figure 6. J.B. Coleman Library Hot Water Consumption vs. Average Dry Bulb Temperature



Month	Electricity Consumption		Chilled Water	Hot Water	Average DB Temperature
	PVAM Readings MWh	JC-85 MWh	JC-85 KTONh	JC-85 MBtu	F
Nov-96	*	195.46	44.27	142.74	62.06
Dec-96	*	180.01	29.06	252.49	56.99
Jan-97	*	179.63	21.14	363.49	51.07
Feb-97	*	183.73	1.068	197.27	54.60
Mar-97	*	190.98	0.74	121.03	64.93
Apr-97	*	193.67	0.681	121.05	63.84
May-97	*	216.59	0.931	33.49	72.52
Jun-97	*	185.74	0.937	17.87	78.30
Jul-97	*	194.54	1.08	5.98	81.94
Aug-97	*	187.62	56.6	0	82.09
Sep-97	333	188.52	86.13	0	78.03
Oct-97	429	196.85	98.19	17.58	68.14
Nov-97	226	188.79	78.5	188.87	56.48
Dec-97	259	142.21	69.62	347.34	48.83
Jan-98	211	136.8	73.39	240.17	56.33
Feb-98	-9784	128.36	66.43	208.35	55.00
Mar-98	212	128.87	77.58	220.26	59.23
Apr-98	*	131.75	83.38	86.32	65.72
May-98	-639	120.57	106.66	29.57	77.64
Jun-98	-846	117.16	111.12	0.301	84.25
Jul-98	85	121.01	119.2	0.388	85.59
Aug-98	202	115.61	108.85	0.443	83.10
Sep-98	221	132.71	111.41	0.23	80.52

* N/A

Table 1. J.B. Coleman Library building Energy Use.

Pre-Retrofit Period *	Electricity Consumption		Chilled Water	Hot Water	Average DB Temperature
	PVAM Readings MWh	JC-85 MWh	JC-85 KTONh	JC-85 MBtu	F
Nov-96	*	195.46	44.27	142.74	62.06
Dec-96	*	180.01	29.06	252.49	56.99
Jan-97	*	179.63	21.14	363.49	51.07
Feb-97	*	183.73	1.068	197.27	54.60
Mar-97	*	190.98	0.74	121.03	64.93
Apr-97	*	193.67	0.681	121.05	63.84
May-97	*	216.59	0.931	33.49	72.52
Jun-97	*	185.74	0.937	17.87	78.30
Jul-97	*	194.54	1.08	5.98	81.94
Aug-97	*	187.62	56.6	0	82.09
Sep-97	333	188.52	86.13	0	78.03
Oct-97	429	196.85	98.19	17.58	68.14

* Retrofit Construction Period: Nov-97 to May-98
(Info from Mr. Charles Muse)

Table 2. J.B. Coleman Library building Pre-Retrofit Energy Use.

Post-Retrofit Period *	Electricity Consumption		Chilled Water	Hot Water	Average DB Temperature
	PVAM Readings MWh	JC-85 MWh	JC-85 KTONh	JC-85 MBtu	F
Jun-98	**	117.16	111.12	0.301	84.25
Jul-98	85	121.01	119.2	0.388	85.59
Aug-98	202	115.61	108.85	0.443	83.10
Sep-98	221	132.71	111.41	0.23	80.52

* Retrofit Construction Period: Nov-97 to May-98
(Info from Mr. Charles Muse)

Table 3. J.B. Coleman Library building Post-Retrofit Energy Use.

Post-Retrofit Period *	Electricity Cons. JC-85 MWh	Average DB Temperature F	Predicted Electricity Consumption MWh	Electricity Savings MWh
Jun-98	117.16	84.25	196.41	79.25
Jul-98	121.01	85.59	196.85	75.84
Aug-98	115.61	83.10	196.04	80.43
Sep-98	132.71	80.52	195.20	62.49
		Total Savings till September 1998 (MWh) =		298.01
		Projected Savings for One Year (MWh/yr) =		894.04

Table 4. J.B. Coleman Library building Electricity Consumption Savings (based on JC-85 data).

Deliverable 2

- **Inspection of JC-85 Metering in Campus Buildings**
- **Comments on JC-85 Thermal Metering**

Summary

The thermal metering installations in 29 buildings were inspected. They were generally found to be in good condition, with a flow meter and the two required temperature sensors installed in the hot water and chilled water lines. However, in 14 of the installations, it was observed that either the hot water flow meter or the chilled water flow meter was located so close to a bend, valve, or other obstruction in the line that substantial errors in the flow (and Btu) readings are likely. In five of the buildings, both the hot water and chilled water flow meters were located too close to obstructions. Only 10 buildings had both flow meters placed properly. Temperature sensors were generally placed properly, although it was not possible to locate five (of 58) sensors to verify proper placement, and two others were located in the air handler piping rather than in the main building chilled and hot water lines.

1. Inspection of JC-85 Metering in Campus Buildings

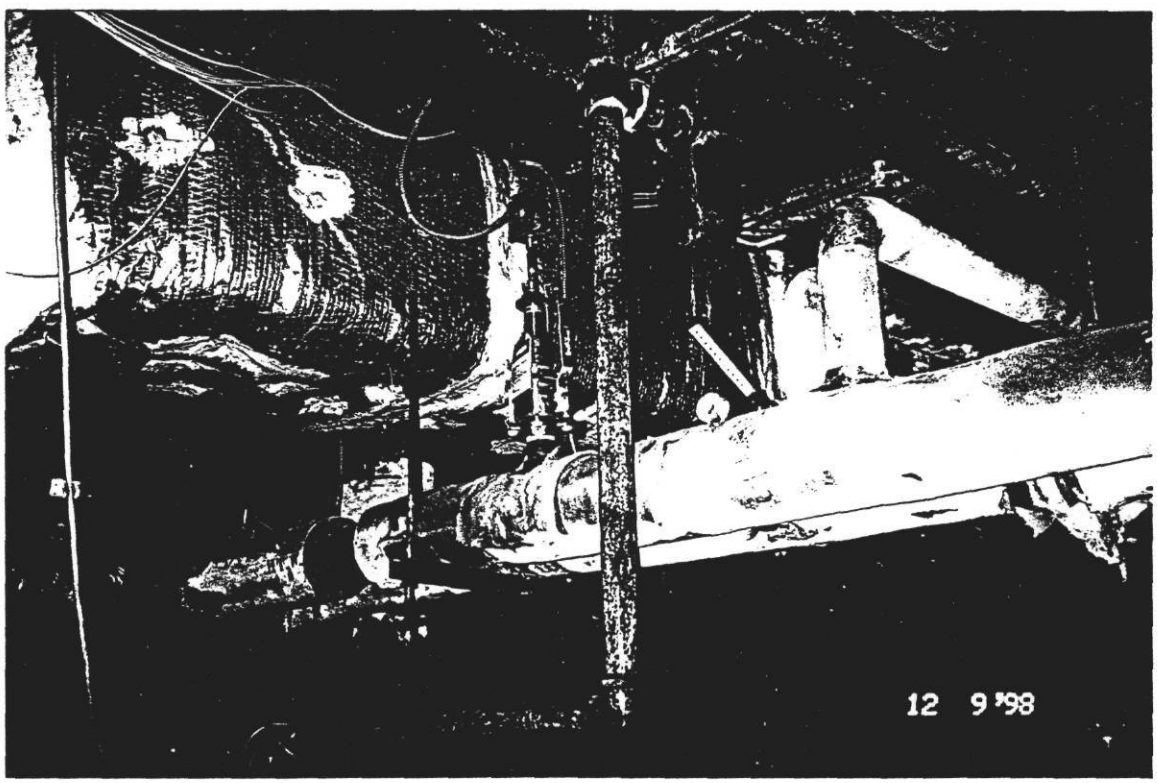
During the inspection of the mechanical rooms of each building listed in Table 5, we collected necessary information that helped in drawing conclusions about the status of the JC-85 metering. The notes on each building are included in a table and a photo that, in most cases, tries to show a problematic feature. Table 6 shows the condition of the mechanical room in Fuller Hall, a dormitory. Picture 1 shows the Hot Water Flowmeter. Similar tables and pictures for the rest of the buildings are included in the appendix.

Building Code	Building Name	Function	Conditioned Area (ft^2)
FULL	Fuller Hall	Dormitory	44,718
AG	Agricultural Research Bldg.	Classrooms, Labs,Offices	21,408
LIB	John B. Coleman Library	Library	100,352
ET	Sam Collins Eng'g Tech. Bldg.	Classrooms, Labs,Offices	47,388
NEW	C.L. Wilson New Eng'g Bldg.	Classrooms, Labs,Offices	46,724
GIL	Gilchrist Eng'g Bldg.	Classrooms, Labs,Offices	11,107
BD	Banks Hall	Dormitory	44,718
GEN	General Offices Bldg. (DELCO)	Classrooms,Offices	36,547
DREW	Drew Hall	Dormitory	77,796
FH	Field House (DOME)	Gymnasium, Swim. Pool	67,594
MEM	Memorial Student Center (MSC)	Kitchen, Dining, Barber	24,588
HOB	Hobart Taylor Hall	Classrooms, Band Hall	57,349
MTH	M.T. Harrington Science Center	Classrooms, Labs,Offices	38,198
ADMIN	Administration Bldg.	Offices	15,408
ALUM	Alumni Dining Hall	Dining Hall, Kitchen	69,682
AND	Anderson Hall	Offices	8,145
EV	Evans Hall	Offices	11,963
ANIM	Animal Industrial Bldg.	Classrooms, Animal Products Shop	18,219
BURL	Burleson-Ware Hall	Classrooms, ROTC	4,557
ALL	All Faiths Chapel	Church	4,107
CHEM	Austin Greaux Chemical Eng'g Bldg.	Classrooms, Labs,Offices	7,172
ECON	Home Economics Bldg.	Cooking, Sewing, Classrooms	12,965
PHY	Physical Plant Administration Bldg.	Offices	7,224
REC	Central Receiving - DPS	Warehouse, and University Police	17,006
HILL	Hilliard Hall	Radio Station, Offices	22,109
NG	New Gym	Gymnasium	26,846
OWEN	Owens Franklin Health Center	Health Center (X-Ray), Offices	21,395
OLD	Old Education Bldg.	Classrooms, Offices	10,850
COOP	COOP Extension Bldg.	Offices, Conference Room	13,899

Table 5. List of PVAM Buildings Metered by JC-85 and Metasys, and inspected by ESL.

Building	FULL - Fuller Hall	Thermometer Reading (F)
Function	Dormitory	
Conditioned Area (ft^2)	44,718	
Mech. Room Condition	Old, Rusty	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	50
Chilled Water Return EMCS Thermistor	YES	52
Hot Water Supply EMCS Thermistor	YES	180
Hot Water Return EMCS Thermistor	YES	168
Chilled Water Flowmeter	DI	
Hot Water Flowmeter	DI	
Thermometers Notes		
Flowmeters Notes CW HW	 Upstream OK, Valve 1' Downstream "90" 5' Upstream, "T" 3' Downstream	 Bad Location OK
General Notes		
Picture	# 1	

Table 6. Notes on the mechanical room of Fuller Hall building.



Picture 1. The Hot Water Flowmeter in the mechanical room of Fuller Hall building.

2. Comments on JC-85 Thermal Metering

During the inspection of the mechanical rooms of PVAM we noticed a general problematic feature that affects the readings of the JC-85 Control system. Briefly, these problems were:

1. **Location of the flowmeters:**
   In most buildings, the flowmeters were placed too close to a bend or a valve (control valve). We used the rule of having a distance of 10 times the nominal diameter of the pipe upstream and five times the nominal diameter downstream, to evaluate the location of these flowmeters.

2. **Availability of thermistors (and thermometers):**
   We were not able to find and locate the temperature sensors and thermometers in few buildings.

3. **Broken meters:**
   Some buildings had broken thermometers, and thus, a survey checking of the temperature of chilled water or hot water flow in or out of the building was not possible.

4. **Location of the thermistors (and thermometers):**
   In few buildings, the thermistors are placed at the air-handlers supply and return pipes, instead of measuring the main supply and return to and from the buildings. This will leads to inaccurate temperature readings due to losses through the pumps, and the piping layout.

Deliverables 3 and 5

- **Analysis of Whole Campus Utility Data**
- **Baselining of the Whole Campus Energy Consumption**

Summary

The monthly utility bills for electricity and gas were analyzed and plotted as functions of ambient temperature. Both electricity consumption and demand increased during hotter months as is typical on a campus such as Prairie View. Gas consumption shows a strong peak during winter as is expected. Baseline models were developed for electricity consumption, non-coincident electric demand, coincident electric demand, and gas consumption.

The monthly utility bills were compared with 15-minute data, but it appears that we have incomplete information on the meter scaling factors and/or the 15-minute data does not correspond to the same set of meters included on the monthly bills. Consequently, no conclusions can be drawn from these comparisons at this time.

15-Minute Data Profiles

We obtained 15-minutes electricity consumption data from San Bernard Electric (through Mr. Harold Huff). We calculated the monthly consumption and demand from the 15-minutes data (Table 8). The results were inconsistent with the utility bills. Further study is required to know how exactly San Bernard Electric use the 15-minutes data that was provided. Figure 7.a shows the 15-minutes and the utility bills electricity consumption. A difference in the order of magnitude of 2 (approximately) is noticed in this plot. Figure 7.b shows the 15-minutes and the utility bills electricity demand. A difference in the order of magnitude of 2 (approximately) is noticed in this plot between the 15-minutes data values and the utility bills coincident and non-coincident demand, separately.

Utility Bill Data Profiles

Two years of utility bills (electricity and gas) were available to our study. Tables 9 and 11 show the electricity and gas utility bills data, respectively, and the corresponding average dry bulb temperature for the billing periods. The dry bulb temperature was obtained from Houston Intercontinental Airport NWS. Tables 10 and 12 show the calculated minimum, maximum, and average values of the dry bulb temperature corresponding to the electricity and gas billing periods, respectively.

Electricity Consumption

Figure 8 shows the electricity consumption, and the coincident and non-coincident demand of the whole PVAM campus based on the utility bills. The non-coincident demand shows one unusually high and one unusually low value. The high value occurred in October 1996 and the analysis of utility bills in Deliverable 4 suggests that a refund was received. The savings in the electricity consumption of the library (around 75 MWh/mo) do not show up at the Whole Campus level, and therefore it is important to meter individual buildings.

Figure 9.a shows the calculated dry bulb temperature for the electricity billing periods that is required to develop the baselines of the electricity use.

Figure 10 shows the whole campus electricity consumption. The slope in the trend is clear and shows a strong temperature-dependency of the electricity use, which is mainly driven by the air-conditioning load.

Coincident Peak Electricity Demand

Figure 11 shows the whole campus coincident electricity demand. There are three trends shown in this plot. Below a temperature of approximately 60 F, the demand value is around 4000 kW and

constant (temperature-independent). Between temperature values of 60 and 75 F, the demand is temperature-dependent. And, above 75 F the demand is almost constant with a value of approximately 6500 kW.

Non-Coincident Peak Electricity Demand

Figure 12 shows the whole campus non-coincident electricity demand. There are three trends shown in this plot. Below a temperature of approximately 60 F, the demand value is around 6000 kW and constant (temperature-independent). Between temperature values of 60 and 75 F, the demand is temperature-dependent. And, above 75 F the demand is almost constant with a value of approximately 7000 kW. In general, the non-coincident electricity demand ranges between 6000 and 7000 kW over a wide range of temperatures.

Gas Consumption

Figure 13 shows the gas consumption profile of the whole campus. The peaks in the cold season are noticeable.

Figure 9.b (in the Appendix, Deliverables 3&5) shows the calculated dry bulb temperature for the gas billing periods that is required to develop the baselines of the gas use.

Figure 14 shows a scatter plot of the whole campus gas consumption vs. the average dry bulb temperature. In this plot the temperature dependency of the gas use is clear (narrow scatter). However, we noticed two unusually high and low values (in two years of utility bills). The high value occurred in March 1997, and the low value occurred in December 1997. At temperatures above 75-80 F, the gas use is almost constant at a value of 10,000 MMBtu/mo).

Comparison between the 15-Minutes and Utility Bills Electricity Consumption Data

Table 13 shows the 15-minutes and the utility bills monthly electricity consumption and demand. There is a major inconsistency in the values, and we were not able to draw conclusion based on the information that we had. Further study and contact should be made before understanding this feature. Figures 7.a and b illustrate the differences, in both consumption and demand, between the 15-minute data and the utility bills.

Baselining of the Whole Campus Energy Consumption

Baseline models were developed for the whole campus electricity consumption, coincident demand, non-coincident demand, and gas consumption. The whole data of two years in the Table 9 (electricity) and Table 11 (gas) was used for baselining.

Electricity Consumption

The Baseline model of the whole campus electricity consumption has the following parameters:

Y_{CP} = 3031.1222 (MWh/mo)
LS = 0
RS = 26.6912 (MWh/mo F)
X_{CP} = 59.6536 (F)

Coincident Electricity Demand

The Baseline model of the whole campus coincident electricity demand has the following parameters:

Y_{CP} = 3877.9130 (kW/mo)
LS = 0
RS = 83.4783 (kW/mo F)
X_{CP} = 54.4728 (F)

Non-Coincident Electricity Demand

The Baseline model of the whole campus non-coincident electricity demand has the following parameters:

Y_{CP} = 6040.4165 (kW/mo)
LS = 0
RS = 33.5065 (kW/mo F)
X_{CP} = 57.0632 (F)

Gas Consumption

The Baseline model of the whole campus gas consumption has the following parameters:

Y_{CP} = 8557.9549 (MMBtu/mo)
LS = - 460.4978 (MMBtu/mo F)
RS = 0
X_{CP} = 84.1196 (F)

Figure 7.a. Comparison between Utility Bills and 15-Minute Data Electricity Consumption

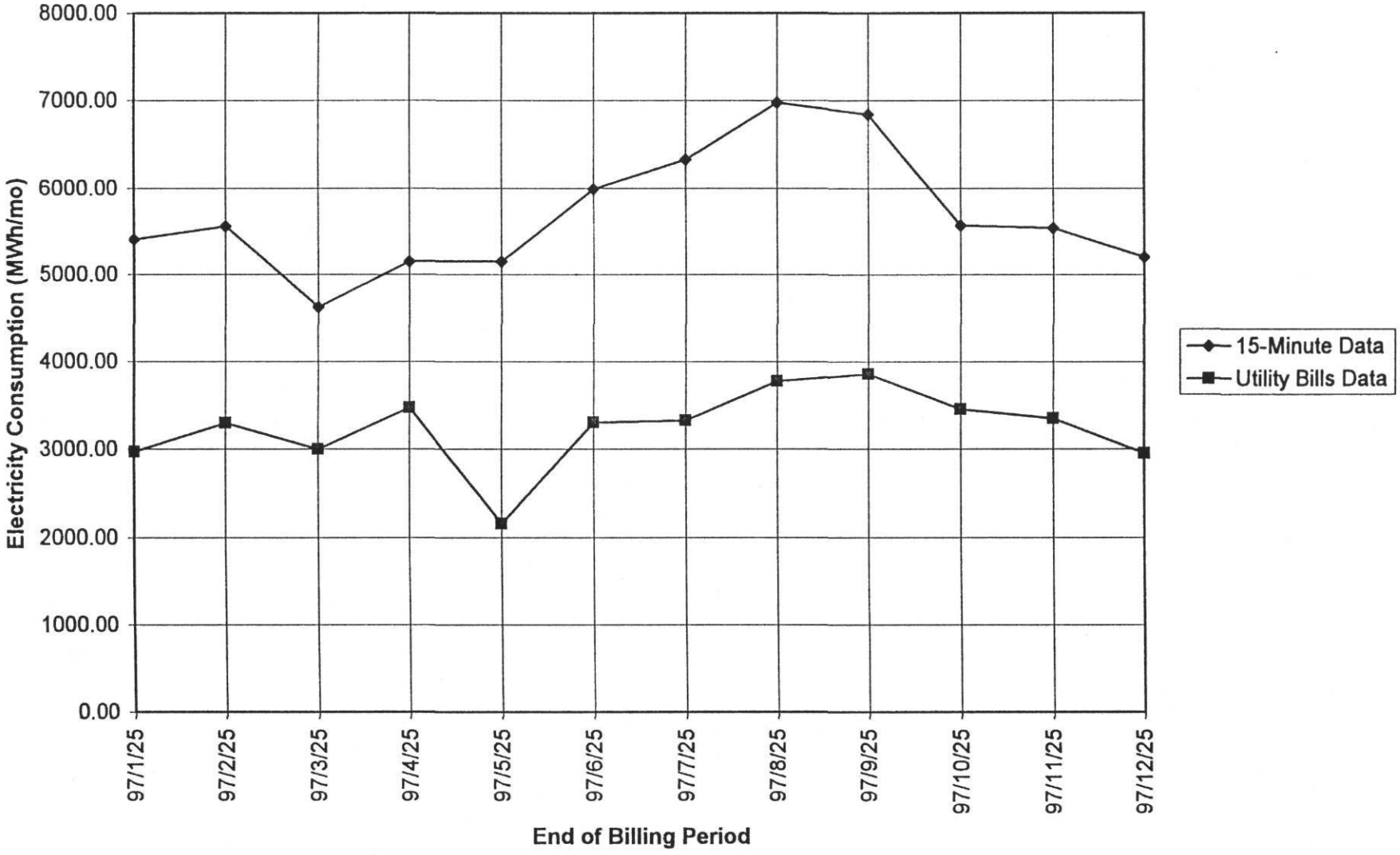
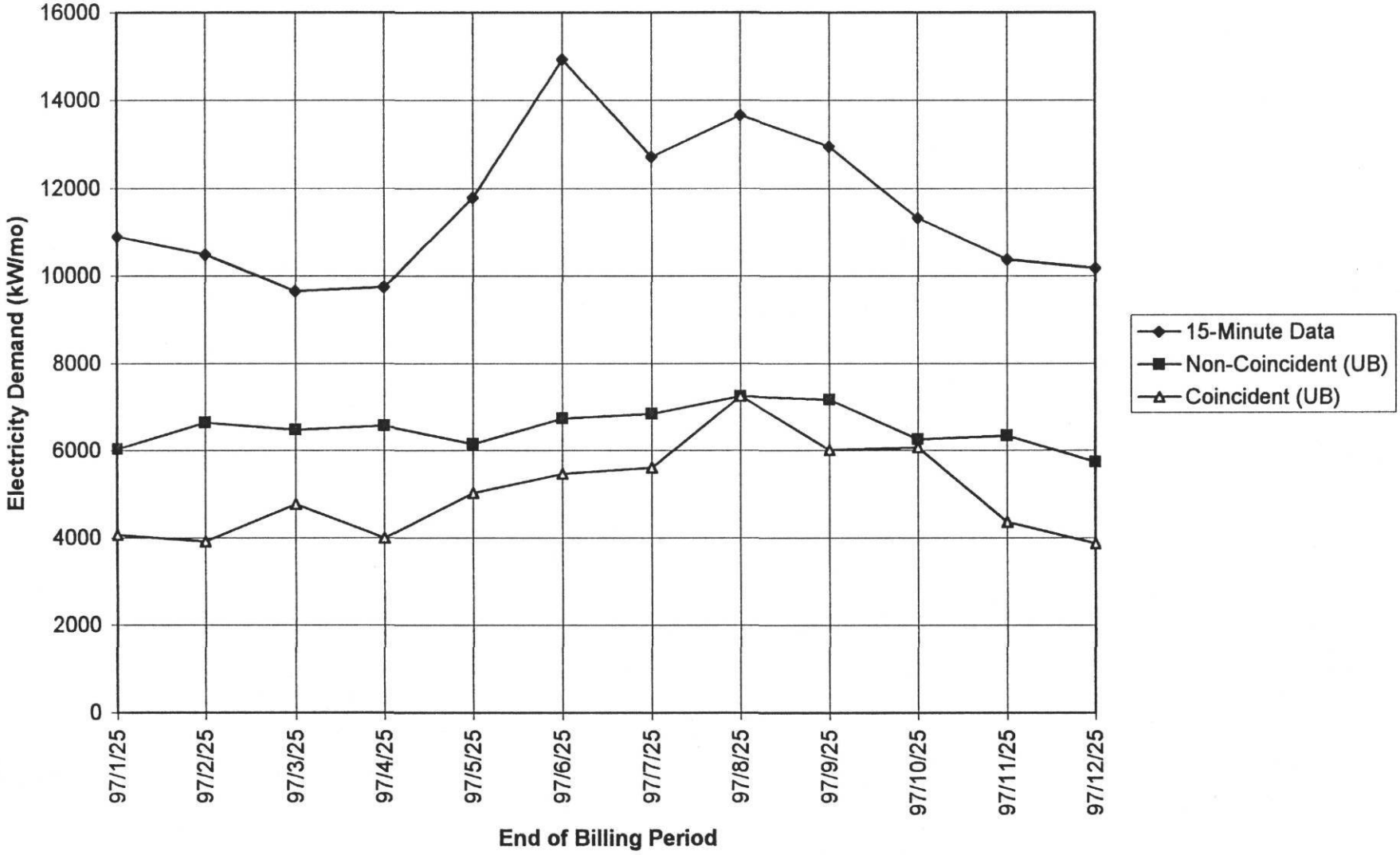


Figure 7.b. Comparison between Utility Bills and 15-Minute Data Electricity Demand



Billing Period Start	End	Electricity Consumption MWh	Electricity Demand kW
96/12/25	97/1/25	5406.94	10880
97/1/25	97/2/25	5556.61	10478
97/2/25	97/3/25	4622.82	9662
97/3/25	97/4/25	5150.81	9746
97/4/25	97/5/25	5150.26	11781
97/5/25	97/6/25	5991.53	14949
97/6/25	97/7/25	6332.60	12720
97/7/25	97/8/25	6976.33	13660
97/8/25	97/9/25	6841.72	12954
97/9/25	97/10/25	5571.20	11321
97/10/25	97/11/25	5541.41	10368
97/11/25	97/12/25	5201.98	10167

Table 8. 15-Minute Data provided by San Bernard Electric for PVAM Whole Campus Electricity Use

Figure 8. PVAM Whole Campus Utility Bills

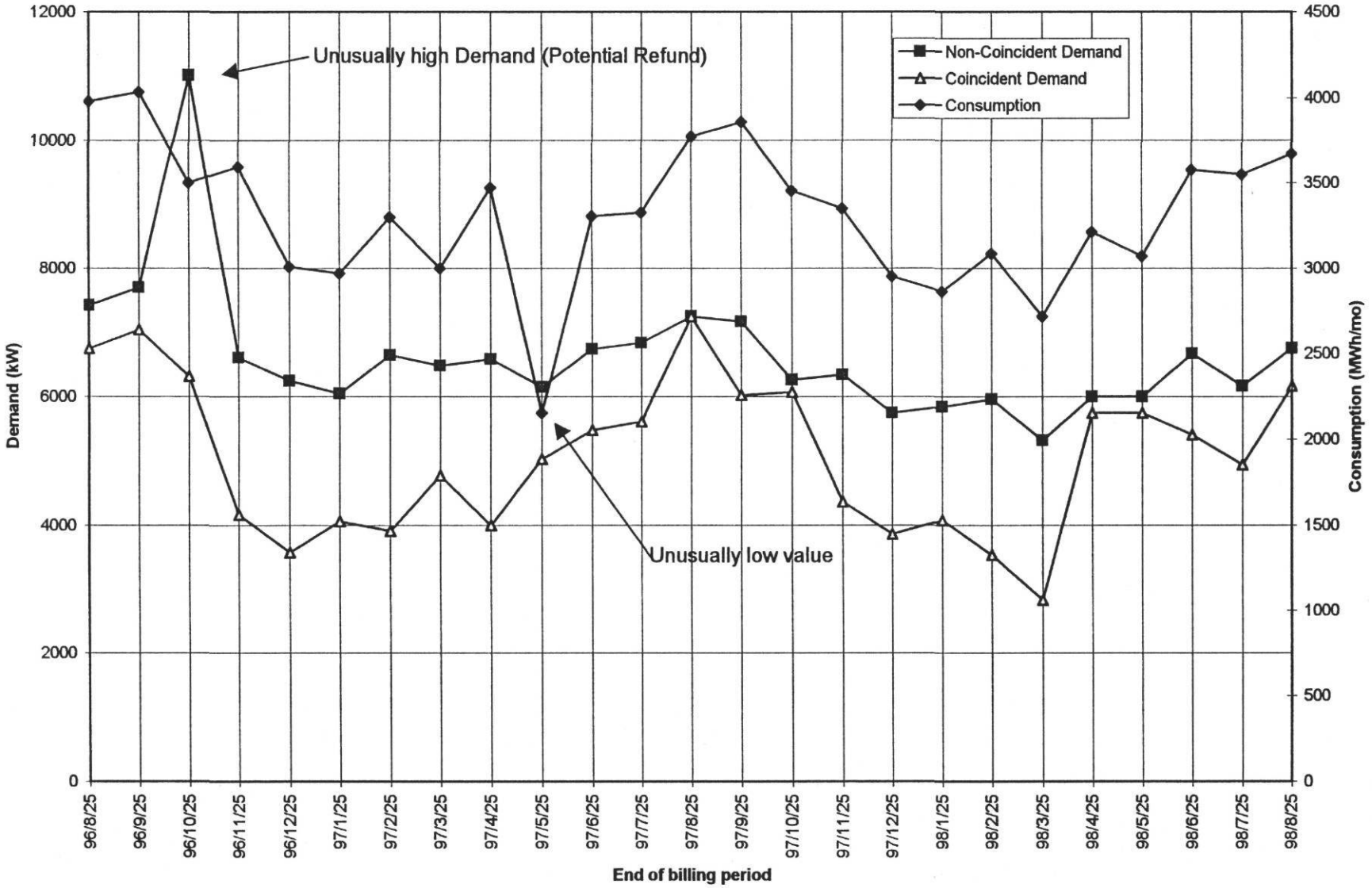


Figure 9.a. Dry Bulb Temperature from IAH - NWS

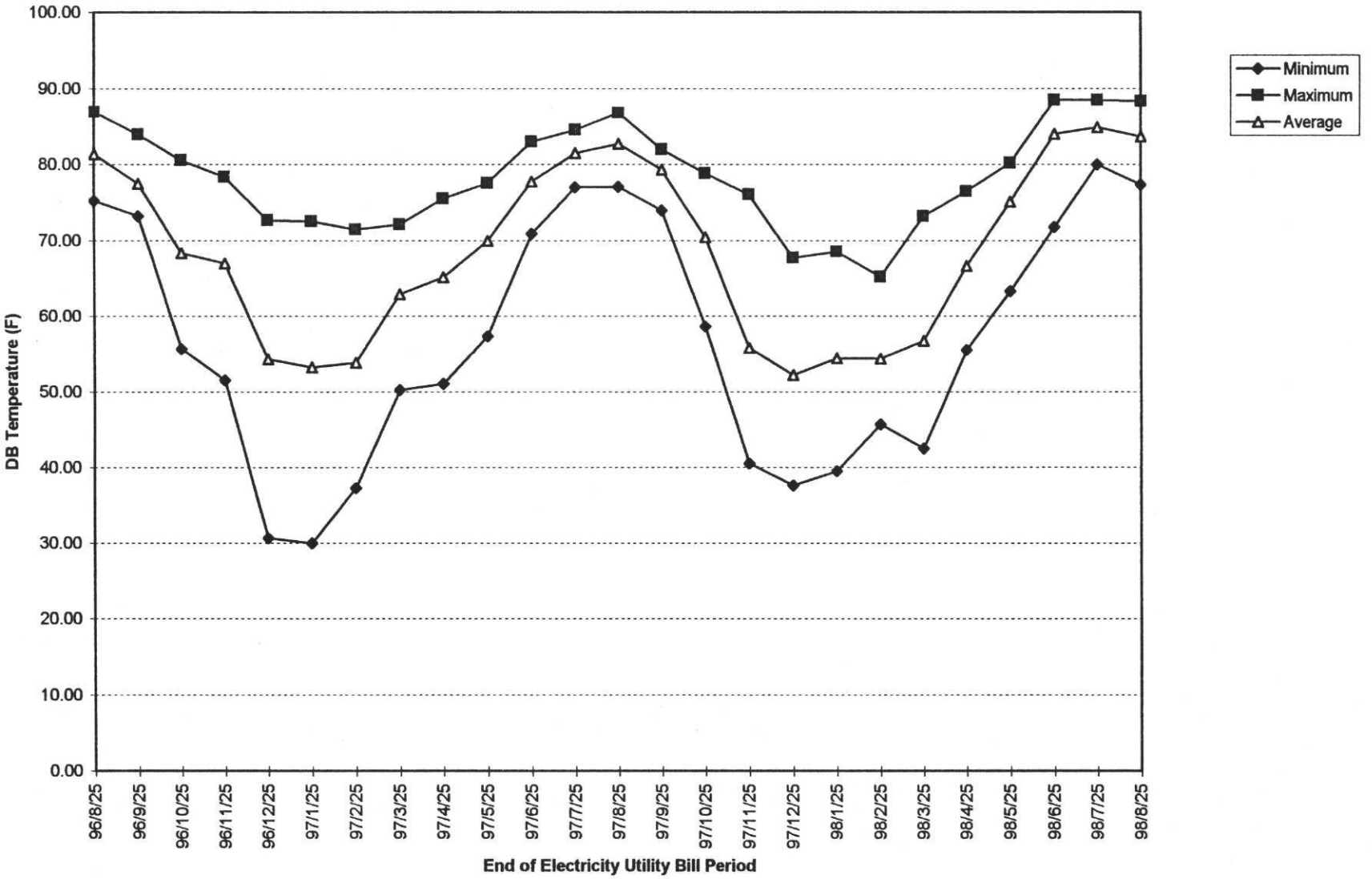


Figure 10. PVAM Whole Campus Electricity Consumption vs. Average DB Temperature

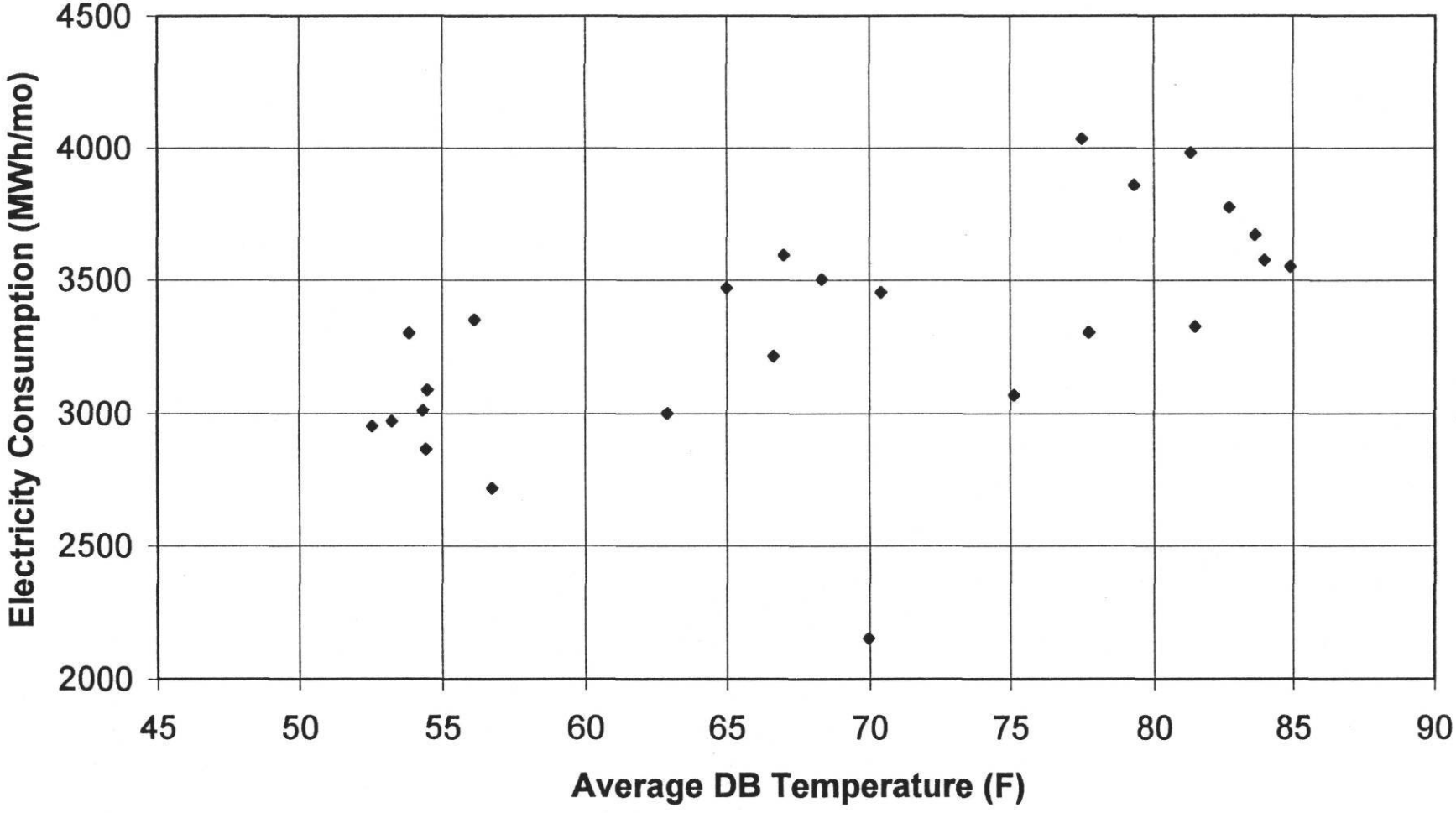


Figure 11. PVAM Whole Campus Coincident Electricity Demand vs. Average DB Temperature

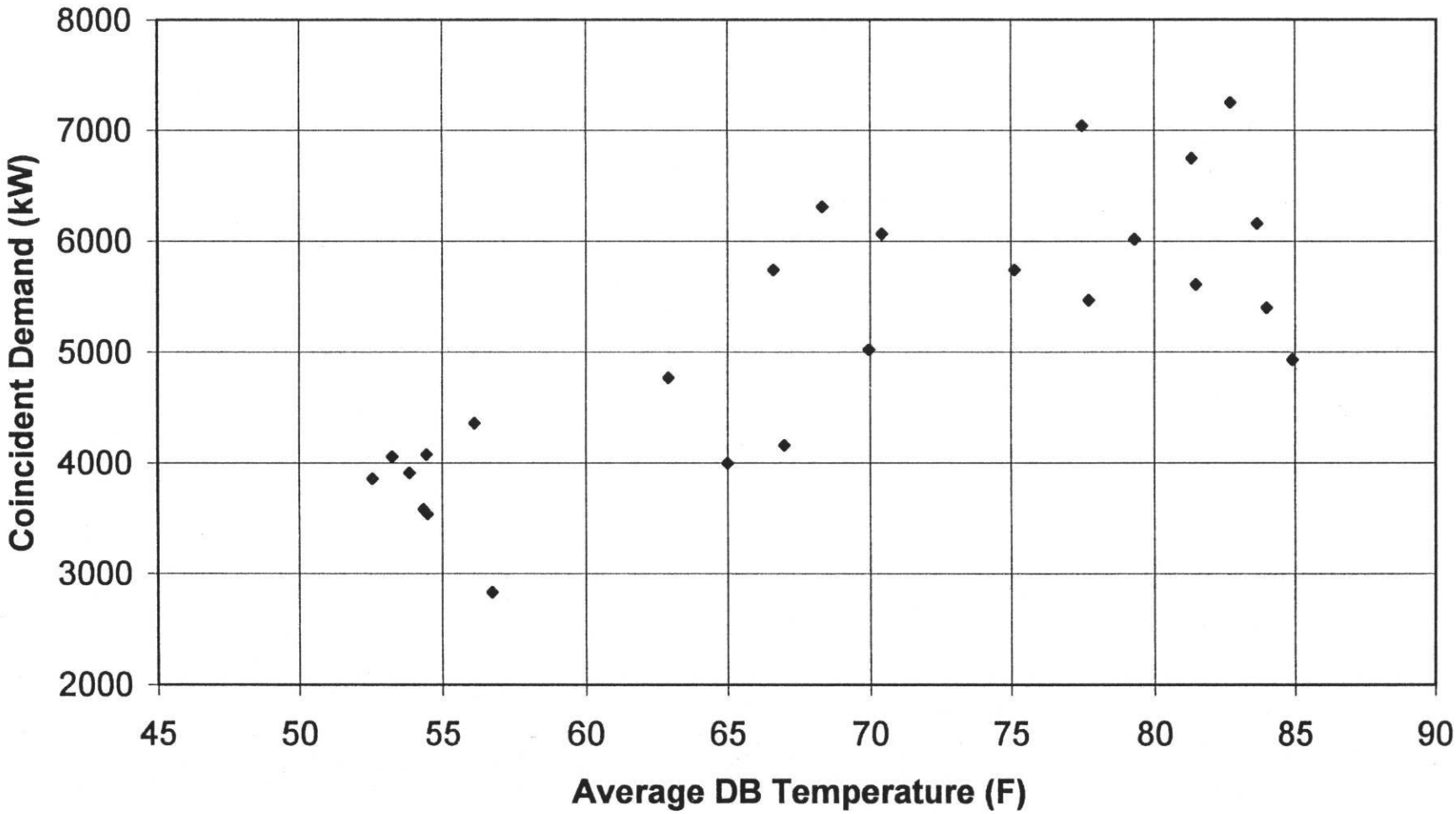
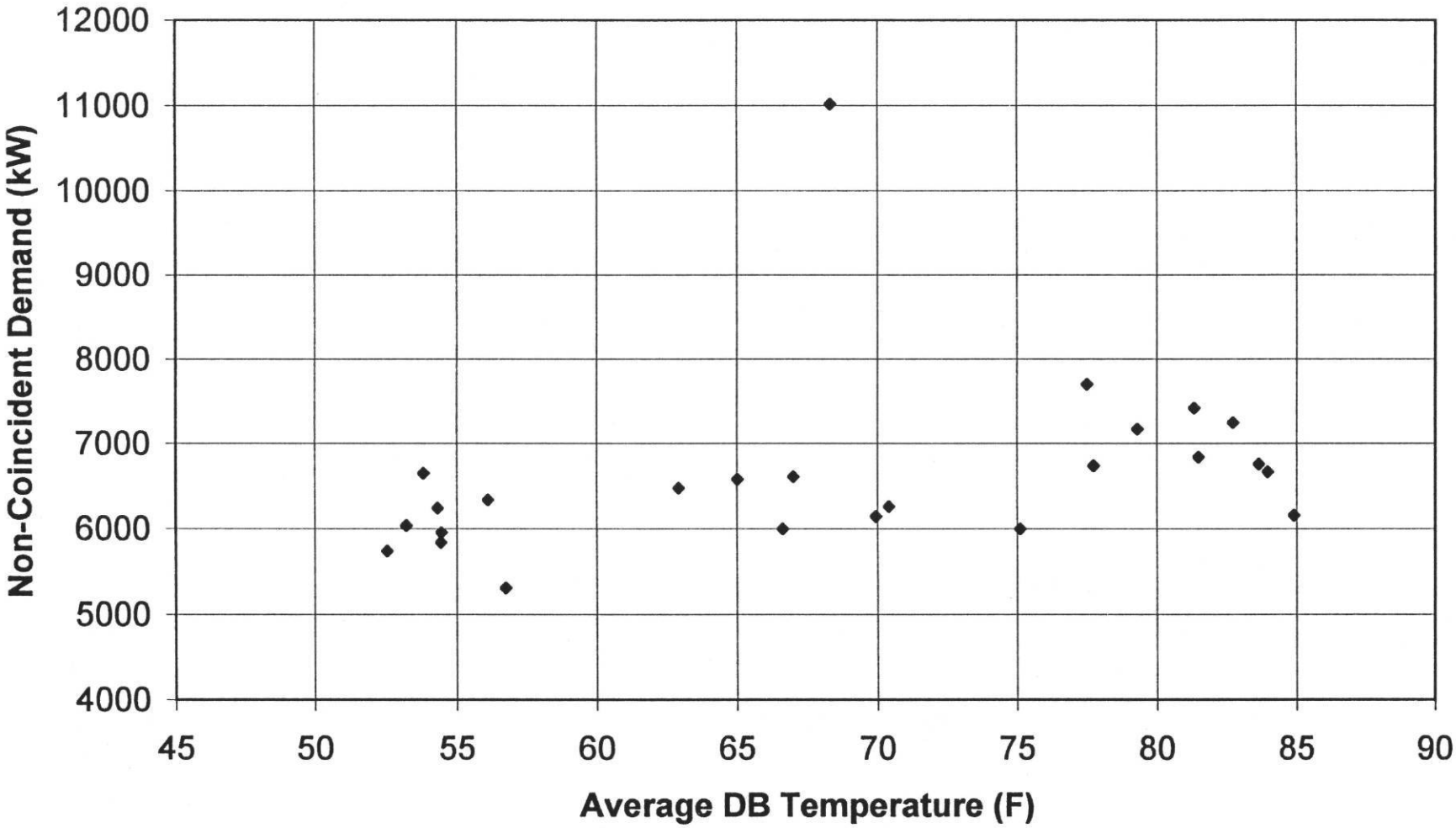


Figure 12. PVAM Whole Campus Non-Coincident Electricity Demand vs. Average DB Temperature



Billing Period Start	End	AVG DB F	Non-Coinc. Demand kW	Coinc. Demand kW	Consumption MWh
96/7/25	96/8/25	81.33	7420	6750	3983.78
96/8/25	96/9/25	77.51	7700	7040	4036.23
96/9/25	96/10/25	68.35	11020	6310	3503.58
96/10/25	96/11/25	67.01	6610	4160	3595.22
96/11/25	96/12/25	54.32	6240	3580	3011.31
96/12/25	97/1/25	53.22	6040	4060	2971.05
97/1/25	97/2/25	53.83	6650	3910	3301.88
97/2/25	97/3/25	62.91	6480	4770	3001.01
97/3/25	97/4/25	65.01	6580	4000	3472.53
97/4/25	97/5/25	69.96	6150	5020	2152.77
97/5/25	97/6/25	77.74	6740	5470	3306.02
97/6/25	97/7/25	81.47	6840	5610	3328.54
97/7/25	97/8/25	82.71	7250	7250	3775.57
97/8/25	97/9/25	79.32	7170	6020	3859.83
97/9/25	97/10/25	70.41	6260	6070	3456.39
97/10/25	97/11/25	56.13	6340	4360	3351.76
97/11/25	97/12/25	52.53	5740	3860	2953.22
97/12/25	98/1/25	54.43	5840	4080	2864.83
98/1/25	98/2/25	54.46	5960	3540	3088.09
98/2/25	98/3/25	56.76	5310	2830	2719.81
98/3/25	98/4/25	66.63	6000	5740	3215.68
98/4/25	98/5/25	75.12	6000	5740	3071.03
98/5/25	98/6/25	83.98	6670	5400	3576.63
98/6/25	98/7/25	84.91	6160	4930	3552.48
98/7/25	98/8/25	83.65	6760	6160	3672.87

Table 9. Electricity Utility Bills - PVAM - Whole Campus (San Bernard Electric Coop).

Period Start	End	Min DB (F)	Max DB (F)	Avg DB (F)
96/7/25	96/8/25	75.25	86.92	81.33
96/8/25	96/9/25	73.25	83.91	77.46
96/9/25	96/10/25	55.67	80.57	68.35
96/10/25	96/11/25	51.50	78.38	67.01
96/11/25	96/12/25	30.67	72.67	54.32
96/12/25	97/1/25	30.00	72.52	53.22
97/1/25	97/2/25	37.32	71.43	53.83
97/2/25	97/3/25	50.21	72.13	62.91
97/3/25	97/4/25	51.08	75.50	65.17
97/4/25	97/5/25	57.35	77.54	69.96
97/5/25	97/6/25	70.92	83.00	77.74
97/6/25	97/7/25	77.00	84.54	81.47
97/7/25	97/8/25	77.08	86.81	82.71
97/8/25	97/9/25	73.96	82.00	79.32
97/9/25	97/10/25	58.67	78.83	70.41
97/10/25	97/11/25	40.57	76.04	55.83
97/11/25	97/12/25	37.63	67.71	52.18
97/12/25	98/1/25	39.54	68.54	54.43
98/1/25	98/2/25	45.71	65.22	54.35
98/2/25	98/3/25	42.50	73.25	56.76
98/3/25	98/4/25	55.50	76.50	66.63
98/4/25	98/5/25	63.33	80.21	75.12
98/5/25	98/6/25	71.79	88.50	83.98
98/6/25	98/7/25	80.00	88.46	84.91
98/7/25	98/8/25	77.33	88.35	83.65

- Minimum and Maximum Temperature is the value from the day having a minimum or a maximum temperature during that period.
- Average Temperature is the average value of daily temperatures during that period.
- The Daily Temperature values are averages from Hourly values.

Table 10. Dry Bulb Temperature from Houston Intercontinental Airport NWS Compiled for the Electricity Utility Bills Periods.

Figure 13. PVAM Whole Campus Gas Utility Bills

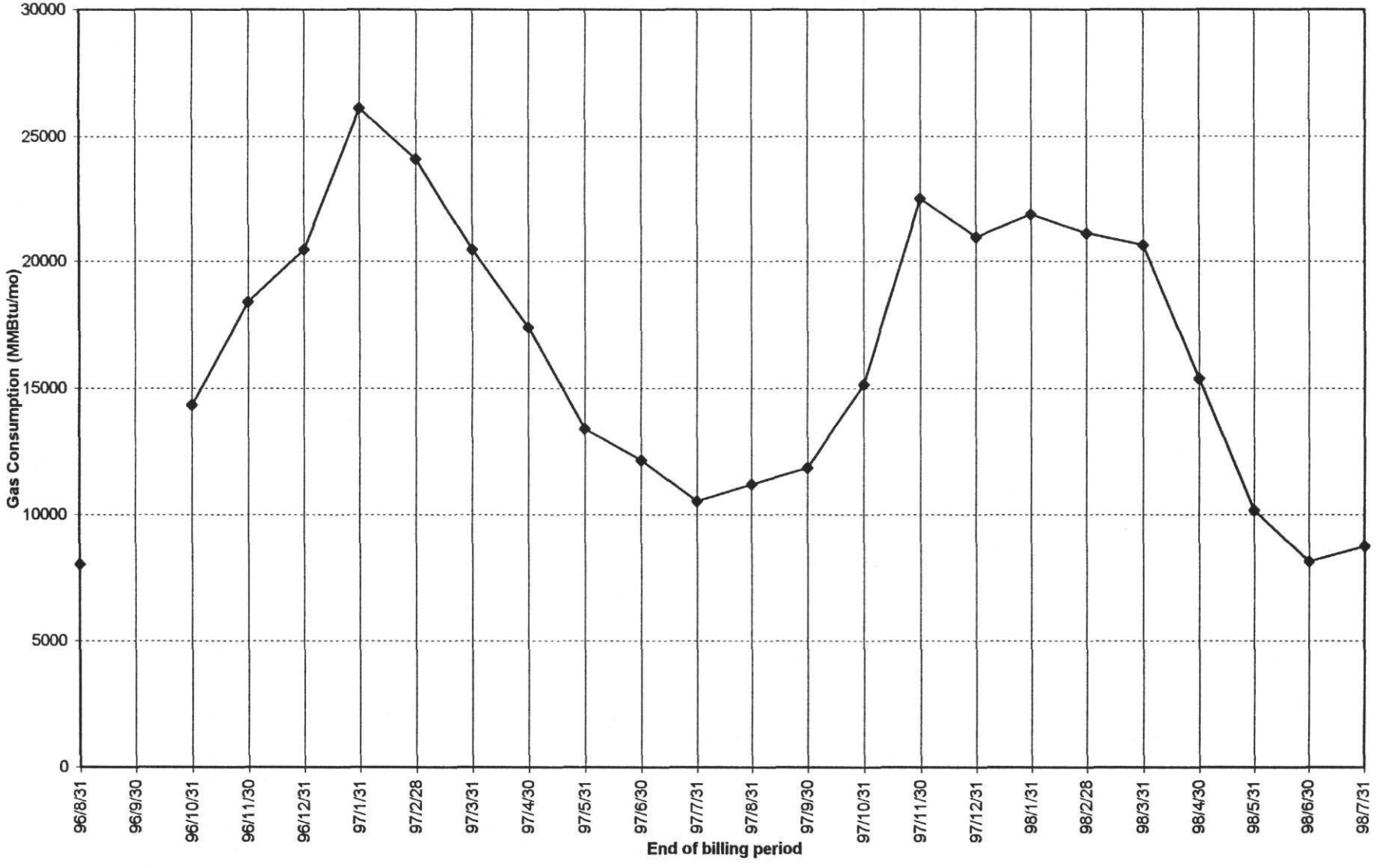
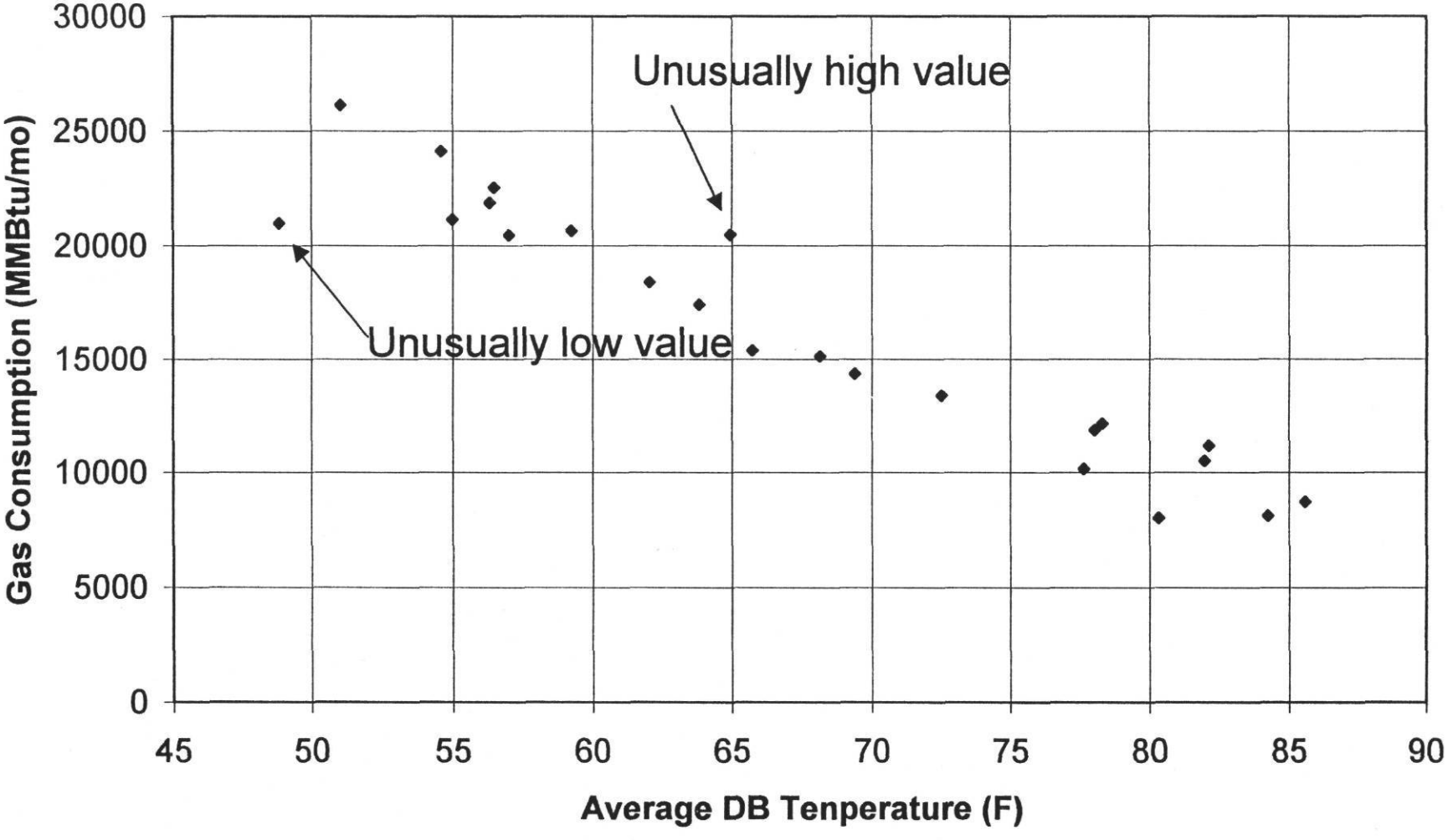


Figure 14. PVAM Whole Campus Gas Consumption vs. Average Dry Bulb Temperature



Period		AVG DB	Consumption
Start	End	F	MMBtu
96/7/31	96/8/31	80.32	8032
96/8/31	96/9/30	76.53	
96/9/30	96/10/31	69.39	14347
96/10/31	96/11/30	62.06	18401
96/11/30	96/12/31	56.99	20471
96/12/31	97/1/31	51.07	26122
97/1/31	97/2/28	54.60	24116
97/2/28	97/3/31	64.93	20474
97/3/31	97/4/30	63.84	17406
97/4/30	97/5/31	72.52	13400
97/5/31	97/6/30	78.30	12156
97/6/30	97/7/31	81.94	10532
97/7/31	97/8/31	82.09	11193
97/8/31	97/9/30	78.03	11852
97/9/30	97/10/31	68.14	15139
97/10/31	97/11/30	56.48	22521
97/11/30	97/12/31	48.83	20974
97/12/31	98/1/31	56.33	21881
98/1/31	98/2/28	55.00	21132
98/2/28	98/3/31	59.23	20654
98/3/31	98/4/30	65.72	15382
98/4/30	98/5/31	77.64	10174
98/5/31	98/6/30	84.25	8128
98/6/30	98/7/31	85.59	8745

Table 11. Gas Utility Bills - PVAM - Whole Campus (Texas Southeastern Gas).

Period Start	End	Min DB (F)	Max DB (F)	Avg DB (F)
96/7/31	96/8/31	73.25	86.92	80.32
96/8/31	96/9/30	62.04	83.91	76.53
96/9/30	96/10/31	55.67	78.38	69.39
96/10/31	96/11/30	39.21	76.88	62.06
96/11/30	96/12/31	30.67	72.67	56.99
96/12/31	97/1/31	30.00	72.52	51.07
97/1/31	97/2/28	44.33	71.43	54.60
97/2/28	97/3/31	52.63	75.50	64.93
97/3/31	97/4/30	51.08	73.96	63.84
97/4/30	97/5/31	66.42	80.27	72.52
97/5/31	97/6/30	70.92	83.00	78.30
97/6/30	97/7/31	78.87	84.54	81.94
97/7/31	97/8/31	76.71	86.81	82.09
97/8/31	97/9/30	70.33	82.00	78.03
97/9/30	97/10/31	49.46	78.83	68.14
97/10/31	97/11/30	40.57	73.75	56.48
97/11/30	97/12/31	37.63	63.79	48.83
97/12/31	98/1/31	45.29	68.54	56.33
98/1/31	98/2/28	45.71	68.21	55.00
98/2/28	98/3/31	42.50	74.33	59.23
98/3/31	98/4/30	55.50	76.50	65.72
98/4/30	98/5/31	66.29	84.00	77.64
98/5/31	98/6/30	71.79	88.50	84.25
98/6/30	98/7/31	80.42	88.46	85.59

- **Monthly Minimum and Maximum Temperature is the value from the day having a minimum or a maximum temperature during that month.**
- **Monthly Average Temperature is the average value of daily temperatures during that month.**
- **The Daily Temperature values are averages from Hourly values.**

Table 12. Dry Bulb Temperature from Houston Intercontinental Airport NWS Compiled for the Gas Utility Bills Periods.

		15-Minute Data		Utility Bills		
		Electricity Consumption	Electricity Demand	Electricity Consumption	Non-Coincident Electricity Demand	Coincident Electricity Demand
Billing Period		MWh	kW	MWh	kW	kW
96/12/25	97/1/25	5406.94	10880	2971.05	6040	4060
97/1/25	97/2/25	5556.61	10478	3301.88	6650	3910
97/2/25	97/3/25	4622.82	9662	3001.01	6480	4770
97/3/25	97/4/25	5150.81	9746	3472.53	6580	4000
97/4/25	97/5/25	5150.26	11781	2152.77	6150	5020
97/5/25	97/6/25	5991.53	14949	3306.02	6740	5470
97/6/25	97/7/25	6332.60	12720	3328.54	6840	5610
97/7/25	97/8/25	6976.33	13660	3775.57	7250	7250
97/8/25	97/9/25	6841.72	12954	3859.83	7170	6020
97/9/25	97/10/25	5571.20	11321	3456.39	6260	6070
97/10/25	97/11/25	5541.41	10368	3351.76	6340	4360
97/11/25	97/12/25	5201.98	10167	2953.22	5740	3860

Table 13. A Comparison between the 15-Minute data and Utility Bills Monthly Electricity Consumption and Demand of PVAM Whole Campus.

Deliverable 4

Analysis of PVAM Electricity Use Contract

Summary

The Prairie View A&M University (PVAM) electrical bills provided have been analyzed with an eye toward answering the following questions:

1.) Is PVAMU being correctly billed according to the published rate schedule of the San Bernard Electric Cooperative (SBEC) for the Large Power – 8 rate schedule (LP-8)?

2.) What trends are evident from the energy consumption and demand consumption?

3.) What impact is the new LP-8 rate schedule (effective November, 1998) expected to make on the utility bills?

4.) Could PVAMU benefit from another supplier's electric billing schedule, i.e. purchasing their electrical energy from another utility?

The following conclusions have been made:

4.) In most months PVAM is being billed correctly according to the rate schedule. However, in the 26 month billing history that was provided by Bass Abushraka and SBEC personnel, there appears to be two possible billing errors. One of those errors, the 11,020 kW demand we talked about for the electrical service from 9/25/96 to 10/25/96, seems to have been corrected by the utility in a later months billing. There is another error in the billing calculations for the month of May, 1998 (consumption from 4/25/98 to 5/25/98) for which PVAM should seek a refund of $689.10.

5.) There is a well established seasonal nature to the PVAM electrical energy consumption and demand consumption. Costs in a low usage month (February or March) are about $120,000, and for a high usage month (August or September) are about $210,000.

6.) Comparison of the August and September bills for the each of the years 1996, 1997, 1998 indicates that the total costs, electrical consumption, and demand consumption show a downward trend in successively later years.

7.) A new LP-8 rate schedule became effective in November, 1998 for the PVAM electrical billing. This change should reduce the yearly costs by approximately 5% assuming the same consumption of energy and demand as in the last 12-month historical period available to me (October, 1997 to September, 1998).

8.) PVAM should monitor the upcoming discussions concerning deregulation in the state legislature. Under the right circumstances PVAM could benefit from a different electrical supplier, and a change of utility rate structures. However, in the case that deregulation is enacted, the present supplier may also elect to alter its current billing schedules to lower the costs.

9.) The latest historical consumption information have been evaluated with a rate schedule similar in nature to the LP-8, that of Houston Light and Power (HL&P) LOS(A) and Supplemental Agreement for State Owned Educational Institutions (SEI) rate schedule. It appears that the LOS(A) and SEI schedules would be only slightly more advantageous to PVAM than the LP-8 under the same circumstances of energy and demand consumption.

Billing Calculation Check

Twenty-five (25) months (August, 1996 to August, 1998) of billing data for PVAM were provided, and SBEC personnel Caroline Kemper furnished an additional month (September, 1998) of data. Robyn Lowe of SBEC was also contacted, and he furnished the up-to-date rate schedule for PVAM's account that became effective in November, 1998 (See Appendix A) and the previously effective rate schedule (See Appendix B) that covers the period for which we had data. The SBEC personnel were very helpful in providing information necessary for our analysis.

Using the utility bills and the effective rate schedule, we recalculated the bills. There are two anomalies that we believe are billing errors in this period. In all other months the calculated total matches the actual billed amounts, indicating no errors.

The October, 1996 bill shows a Non-Coincident Peak (NCP) demand of 11,020 kW. This is very different from the NCP demands seen elsewhere in the data. The minimum demand registered is 5,740 kW in December, 1997; and, the maximum demand except for this 11,020 kW is 7,700 kW in September, 1996. We believe this has already been resolved by SBEC and PVAMU as there appears a "demand adjustment" and "interest on demand adjustment" that refunds a total of $18,566.29 on the bill for February, 1997.

The second billing error was less obvious; and, we believe results from a minor clerical mistake in entering parameters of the demand usage. The May, 1998 bill (for the period of 4/25/98 to 5/25/98) shows the following values for demand.

	kW metered	kW Billed
Non-Coincident Peak	6,090	6,000
LCRA Coincident Peak (CP)	5,530	5,740

Table 14

San Bernard Electric Cooperative, Inc.

Rate Schedule LP-8 for Prairie View A&M University

Electrical Consumption & Charges							Facilities Charges		Demand & Charges				Total Charges		
Month	Start of Billing Period	End of Billing Period	No. Days in Period	Electrical Consumption (kWh)	Electrical Consumption Charge ($)	PCRF Billing Charge ($)	Lease Credit ($)	Customer Charge ($)	Non-Coincident Peak Demand (kW)	Non-Coincident Peak Demand Charge ($)	LCRA Coincident Peak Demand (kW)	LCRA Coincident Peak Demand Charge ($)	Total Billed Charges - Actual ($)	Total Billed Charges - Computed ($)	Difference Actual - Computed ($)
Aug-96	7/25/96	8/25/96	31	3,983,780	138,018.06	20,515.06	3,488.67	4,480.00	7,420	20,405.00	6,750	30,105.00	210,034.45	210,034.45	(0.00)
Sep-96	8/25/96	9/25/96	31	4,036,230	139,835.19	22,070.76	3,488.67	4,480.00	7,700	21,175.00	7,040	31,398.40	215,470.68	215,470.68	(0.00)
Oct-96	9/25/96	10/25/96	30	3,503,580	121,381.53	5,518.49	3,488.67	4,480.00	11,020	30,305.00	6,310	28,142.60	186,338.95	186,338.95	(0.00)
Nov-96	10/25/96	11/25/96	31	3,595,220	124,556.40	(3,046.64)	3,488.67	4,480.00	6,610	18,177.50	4,160	18,553.60	159,232.19	159,232.19	(0.00)
Dec-96	11/25/96	12/25/96	30	3,011,310	104,326.83	(2,159.95)	3,488.67	4,480.00	6,240	17,160.00	3,580	15,966.80	136,285.01	136,285.01	0.00
Jan-97	12/25/96	1/25/97	31	2,971,050	102,932.03	(9,010.55)	3,488.67	4,480.00	6,040	16,610.00	4,060	18,107.60	129,630.41	129,630.41	(0.00)
Feb-97	1/25/97	2/25/97	31	3,301,880	114,393.63	(11,062.85)	3,488.67	4,480.00	6,650	18,287.50	3,910	17,438.60	121,481.92	140,048.21	18,566.29
Mar-97	2/25/97	3/25/97	28	3,001,010	103,969.99	(7,772.89)	3,488.67	4,480.00	6,480	17,820.00	4,770	21,274.20	136,282.63	136,282.63	0.00
Apr-97	3/25/97	4/25/97	31	3,472,530	120,305.80	(11,828.58)	3,343.33	4,480.00	6,580	18,095.00	4,000	17,840.00	145,548.89	145,548.89	0.00
May-97	4/25/97	5/25/97	30	2,152,770	74,582.72	(2,713.67)	3,343.33	4,480.00	6,150	16,912.50	5,020	22,389.20	112,307.42	112,307.42	(0.00)
Jun-97	5/25/97	6/25/97	31	3,306,020	114,537.06	14,868.25	3,343.33	4,480.00	6,740	18,535.00	5,470	24,396.20	173,473.18	173,473.18	0.00
Jul-97	6/25/97	7/25/97	30	3,328,540	115,317.27	15,681.36	3,343.33	4,480.00	6,840	18,810.00	5,610	25,020.60	175,965.90	175,965.90	(0.00)
Aug-97	7/25/97	8/25/97	31	3,775,570	130,804.62	23,065.38	3,343.33	4,480.00	7,250	19,937.50	7,250	32,335.00	207,279.17	207,279.17	0.00
Sep-97	8/25/97	9/25/97	31	3,859,830	133,723.81	15,174.06	3,343.33	4,480.00	7,170	19,717.50	6,020	26,849.20	196,601.24	196,601.24	0.00
Oct-97	9/25/97	10/25/97	30	3,456,390	119,746.63	(8,171.93)	3,343.33	4,480.00	6,260	17,215.00	6,070	27,072.20	156,998.57	156,998.57	0.00
Nov-97	10/25/97	11/25/97	31	3,351,760	116,121.73	(10,566.42)	3,343.33	4,480.00	6,340	17,435.00	4,360	19,445.60	143,572.58	143,572.58	(0.00)
Dec-97	11/25/97	12/25/97	30	2,953,220	102,314.31	(8,704.94)	3,343.33	4,480.00	5,740	15,785.00	3,860	17,215.60	127,746.64	127,746.64	(0.00)
Jan-98	12/25/97	1/25/98	31	2,864,830	99,252.04	(2,419.27)	3,343.33	4,480.00	5,840	16,060.00	4,080	18,196.80	132,226.24	132,226.24	(0.00)
Feb-98	1/25/98	2/25/98	31	3,088,090	106,986.88	(9,020.27)	3,343.33	4,480.00	5,860	16,115.00	3,540	15,788.40	131,006.66	131,006.68	0.02
Mar-98	2/25/98	3/25/98	28	2,719,810	94,227.82	(3,441.95)	3,343.33	4,480.00	5,310	14,602.50	2,830	12,621.80	119,146.84	119,146.84	(0.00)
Apr-98	3/25/98	4/25/98	31	3,215,680	111,407.23	(5,385.44)	3,343.33	4,480.00	6,000	16,500.00	5,740	25,600.40	149,258.86	149,258.86	0.00
May-98	4/25/98	5/25/98	30	3,071,030	106,395.83	(4,725.73)	3,204.75	4,480.00	6,090	16,747.50	5,530	24,663.80	145,045.75	144,356.65	(689.10)
Jun-98	5/25/98	6/25/98	31	3,576,630	123,912.35	19,321.92	3,204.75	4,480.00	6,670	18,342.50	5,400	24,084.00	186,936.02	186,936.02	(0.00)
Jul-98	6/25/98	7/25/98	30	3,552,480	123,075.67	15,862.14	3,204.75	4,480.00	6,160	16,940.00	4,930	21,987.80	179,140.86	179,140.86	(0.00)
Aug-98	7/25/98	8/25/98	31	3,672,870	127,246.58	21,268.89	3,204.75	4,480.00	6,760	18,590.00	6,160	27,473.60	195,854.32	195,854.32	0.00
Sep-98	8/25/98	9/25/98	31	3,871,610	134,131.93	21,027.54	3,204.75	4,480.00	6,920	19,030.00	6,260	27,919.60	203,384.32	203,384.32	(0.00)

Note: For this evaluation the NCP and CP demands in May-98 have been changed to reflect the metered NCP demand (6,090 kW) and CP demand (5,530 kW) instead of the billed NCP demand (6,000 kW) and CP demand (5,740 kW). It may be possible that there is a billing error on the demand for May-98.

Figure 15
Prairie View A&M University Electrical Cost

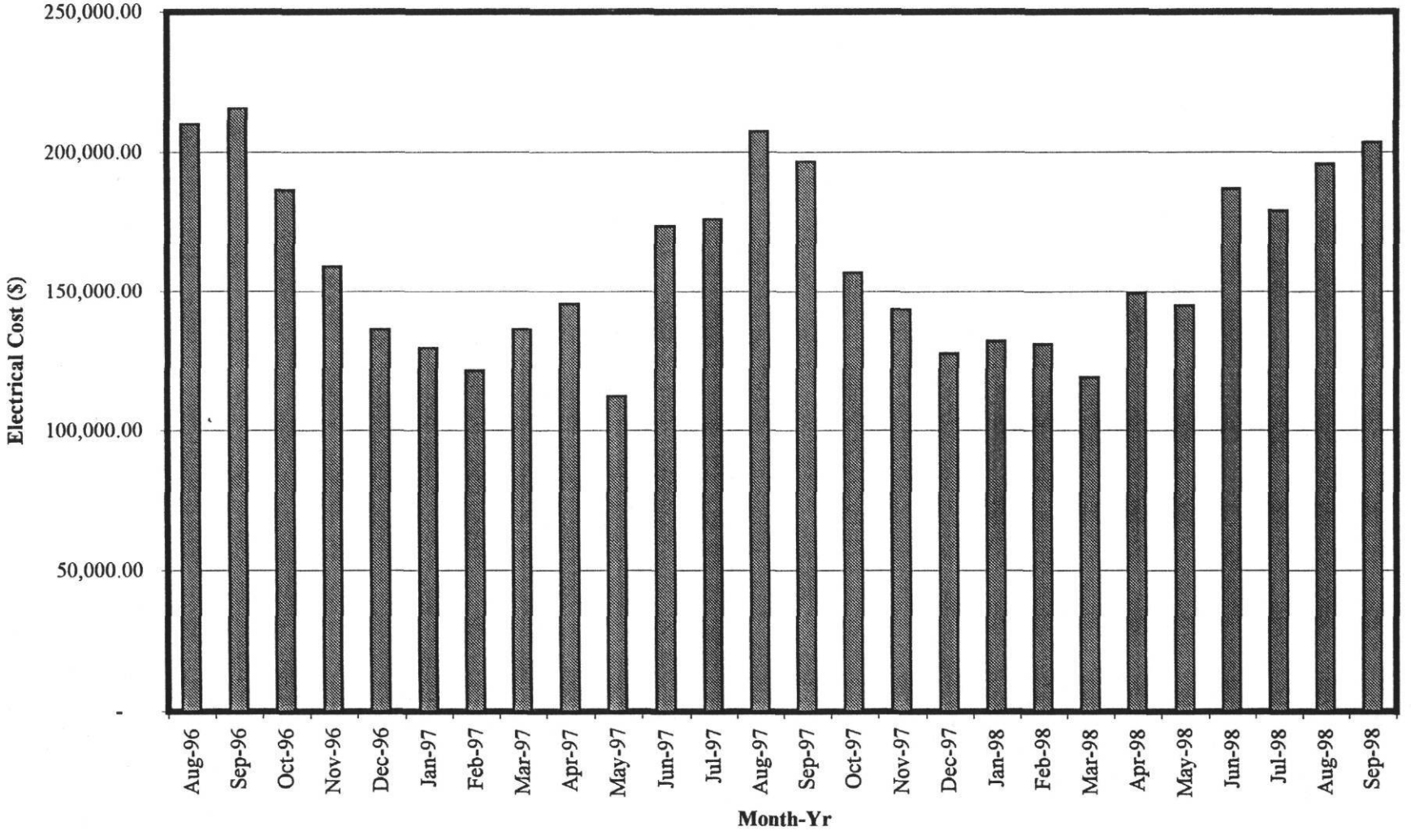


Figure 16
Prairie View A&M University Electrical Consumption

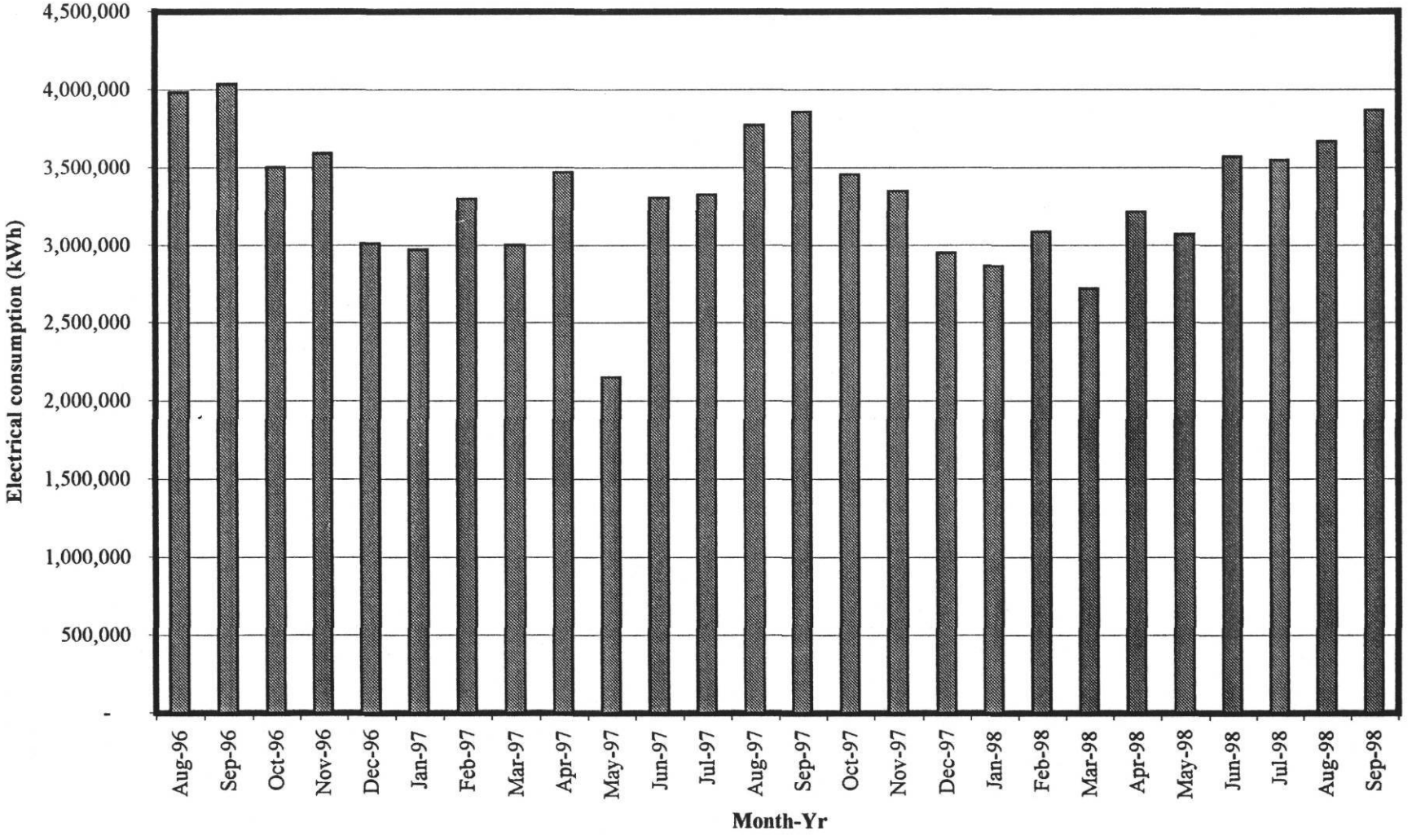


Figure 17
Prairie View A&M University Non-Coincident Peak Demand

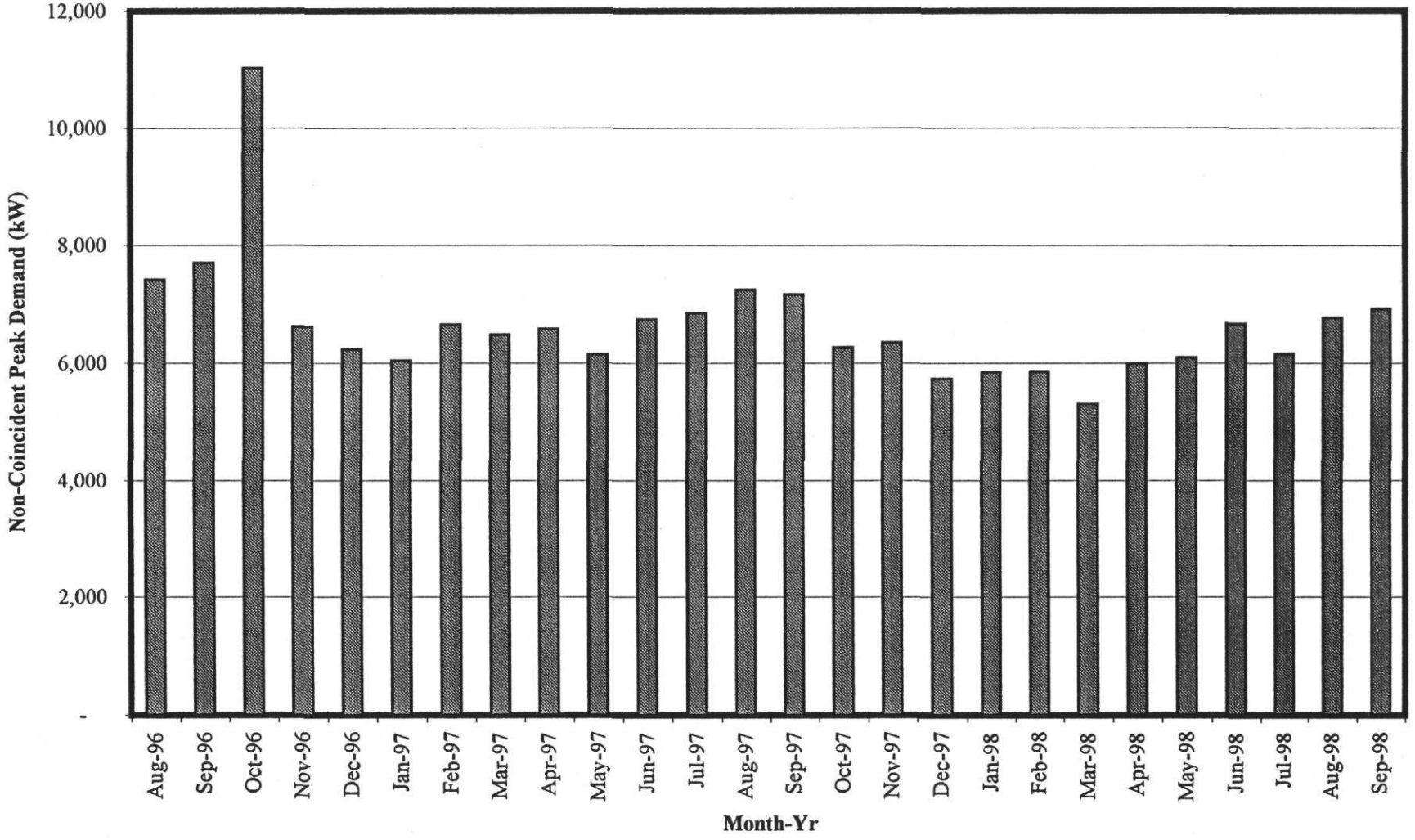
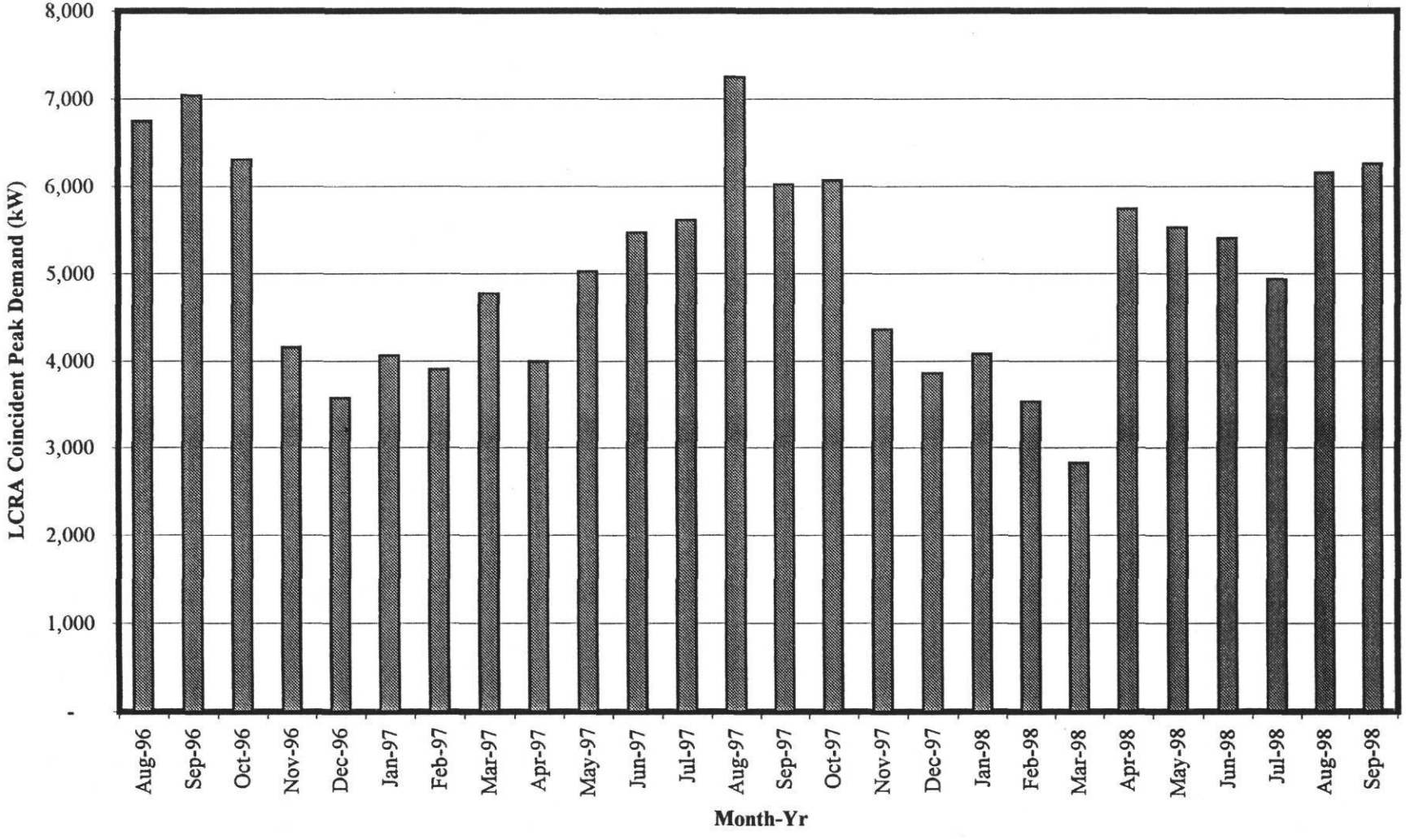


Figure 18
Prairie View A&M University LCRA Coincident Peak Demand



There is an unexplained difference between the metered and billed demand values. However, we believe the error is due to a clerical data entry error because the metered and billed demand values for the previous month were 6,000 kW and 5,740 kW respectively; and, probably did not get corrected by data entry in the May, 1998 bill. Using the "correct" demands in recalculating the bills for this month leads to an overcharge by SBEC of $689.10. We have not discussed this error with SBEC personnel so the University should seek to contact them, confirm this analysis, and seek an appropriate refund of the amount.

Table 14 shows the complete billing analysis broken into blocks for Energy Consumption and Charges, Facilities Charges, Demand & Charges, and Total Charges. Information from the bills is entered into the spreadsheet and the appropriate charge rates are used to re-calculate the bills. The last column in the Total Charges block is the difference between the actual billed amounts from the bills and the computed charges using the rate schedule analysis. The difference column reflects the billing adjustments and errors as mentioned above.

Trends of Energy and Demand Consumption

Figures 15, 16, 17, and 18 illustrate the electrical cost, electrical energy consumption, NCP demand, and LCRA CP demand consumption of PVAM, respectively. Figure 15, the cost graph, indicates a pretty regular trend of data with costs being high in the summer AC months and low in the winter months. The same can be said for the energy consumption shown in Figure 16 and the NCP demand shown in Figure 17. Perusal of Figure 17 highlights the demand anomaly found in October, 1996 that is discussed above.

Figure 18, the LCRA CP demand plot, shows a very erratic nature which is due entirely to the manner in which the CP demand is determined. The CP demand is the amount of demand being pulled from the electrical supplier (SBEC) by PVAM at the same time that LCRA experiences its highest demand level draw from its system, which feeds the SBEC system. The CP demand varies from a low of 2,830 kW in March, 1998 to a high of 7,250 kW in August, 1997. The high in August, 1997 obviously is due to summertime AC load. The low value in March, 1998 occurred because LCRA hit a peak value in that month in a one-hour time period in which PVAM demand was considerably lower than normal, possibly at night or some other off-peak time for PVAM.

Another trend that is noticeable is found by studying Figures 15, 16, and 17. In August and September for every year (1996, 1997, and 1998) the figures illustrate a progressively lower level on each plot from one year to the next. In 1996 the average cost for those two months is about $212,000, in 1997 it is about $202,000, and in 1998 it is about $201,000. Figures 16 and 17 show that it has been both the energy consumption and the demand that have been reduced in succeeding years. This may be due to overt attempts by PVAM to reduce usage or to other factors.

New SBEC LP-8 Rate Schedule Initiated in November, 1998—Its Effects

In talking with Robyn Lowe of SBEC it was learned that a new rate schedule went into effect for the LP-8 rate in November, 1998, subsequent to the bills that we had to evaluate. This new schedule has some features that make it simpler than the previous rate schedule, at least outwardly. The LCRA CP demand charge was explicitly stated to be $4.46/kW in the previous rate schedule, but the newer one rolls this into the PCRF charge calculations. The newer rate schedule drops the explicit reference to the LCRA CP in the demand cost calculations. However, the PCRF is now more sensitive to the CP demand than possibly before.

Some other changes from the old to the newer rate schedule include:

1.) The energy charge rate has decreased from a value of $0.034656/kWh under the old schedule to a new value of $0.008568/kWh, about 75% lower.

2.) The customer charge has decreased from a value of $4,480 under the old schedule to $4,400 under the newer schedule.

3.) Robyn Lowe, SBEC, stated in one phone call that the PCRF for the November, 1998 period would be $0.0304719/kWh (under the newer schedule). As a comparison, the effective value for September, 1998 was about $ 0.0054312. The higher value under the new rate schedule reflects the roll-in of the CP demand charges into the PCRF. The PCRF under the old schedule fluctuated every month, sometimes being a charge and sometimes being a credit, depending upon the nature of the purchases and sales of energy and demand across the LCRA and SBEC systems. It should be expected that the PCRF under the newer schedule will also fluctuate and won't be the constant value of $0.0304719/kWh in the future.

Table 15 presents the analysis of the last 12-month period electrical bills (October, 1997 to September, 1998) using the newer rate schedule. The same energy consumption and demand consumption was assumed as had occurred in that time period, but the appropriate charges are for the new schedule are used, along with an assumption that the PCRF would be constant (as noted above this is not probably a good assumption, but it is one that had to be made to complete the analysis). As shown in the last column under Total Charges the newer rate schedule would generate bills that are generally cheaper than the old schedule. The net change over a 12-month period under these assumptions is found to be slightly less than 5%.

Could PVAM benefit from another Electrical Supplier Under De-regulation

To investigate this question we evaluated the HL&P LOS(A) rate schedule with the Supplemental Agreement for State Owned Educational Institutions (SEI). A copy of these rate schedules is included in Appendix C. Again, the same consumption and demand history was assumed as that which occurred during October, 1997 to September, 1998. The appropriate charges for each feature of the billing calculation were used as stated in the rate schedules from HL&P. This is compared to the charges under the newest LP-8 rate schedule.

One slightly different aspect of the billing for HL&P versus that for SBEC is that under HL&P the demand is measured in kVA versus the kW used by SBEC. These two numbers differ by the power factor relation. In order to convert the demand values from kW to kVA it is necessary to divide the kW by the power factor. Since the power factor is always a value between 0.0 and 1.0, the kVA values that result will be larger than the corresponding kW values.

Both the old and new SBEC LP-8 rate schedules had a power factor clause that allowed the utility to increase the NCP demand charges if the power factor dropped below a value of 0.90. In the 26 month history of bills available to me I saw no indication that this had been done. One of two assumptions can be made:

1.) The power factor is between 0.90 and 1.0 and it was not necessary for the utility to increase the demand values.

2.) The power factor is lower than 0.90, but the utility has never as a matter of agreement or practice invoked this clause of the rate schedule.

We will make the first assumption, that the power factor is between 0.90 and 1.0.

To show the possible ranges of this factor we have used a value for the power factor of 0.90 and of 1.0 and used the two resulting sets of billed demand in separate analyses of the LOS(A) and SEI rate schedule. Table 16 shows the results of the analysis, comparing the HL&P and SBEC rate schedules for a power factor of 1.0 assumed in converting the demands from kW to kVA. The last column in the Total Charges

portion shows a difference in cost of $66,072.83, reflecting a lower cost using the HL&P rate schedules. Table 17 shows the similar analysis using a power factor of 0.90. It can be noted that the demand values are different in the Demand Charges portion of the table between Tables 16 and 17. The difference column in the Total Charges portion indicates that the HL&P rate schedule has a lower cost of$13,397.77 compared to the SBEC rate schedule.

This analysis is not meant to reflect any actual difference in cost outside of the assumptions that are made and noted above. It is wisely suspected that the PCRF under the newer SBEC LP-8 rate schedule will continue to fluctuate and could substantially alter the costs and advisability of one rate schedule over the other.

Table 15

San Bernard Electric Cooperative, Inc.

Rate Schedule LP-8 for Prairie View A&M University

Evaluated using Newest LP-8 Rate Schedule Initiated in November 1998 Compared to Old Rate Schedule

Electrical Consumption & Charges								Facilities Charges		Demand Charges		Total Charges		
Month	Start of Billing Period	End of Billing Period	No. Days in Period	Electrical Consumption	Electrical Consumption Charge	PCRF Rate	PCRF Billing Charge	Lease Credit	Customer Charge	Non-Coincident Peak Demand	Non-Coincident Peak Demand Charge	Total Billed Charges - Old Schedule	Total Billed Charges - New Schedule	Difference of Old - New
				(kWh)	($)	($/kWh)	($)	($)	($)	(kW)	($)	($)	($)	($)
Oct-97	9/25/97	10/25/97	30	3,456,390	29,614.35	0.0304719	105,322.77	3,204.75	4,400.00	6,260	17,215.00	156,998.57	153,347.37	(3,651.20)
Nov-97	10/25/97	11/25/97	31	3,351,760	28,717.88	0.0304719	102,134.50	3,204.75	4,400.00	6,340	17,435.00	143,572.58	149,482.63	5,910.05
Dec-97	11/25/97	12/25/97	30	2,953,220	25,303.19	0.0304719	89,990.22	3,204.75	4,400.00	5,740	15,785.00	127,746.64	132,273.66	4,527.02
Jan-98	12/25/97	1/25/98	31	2,864,830	24,545.86	0.0304719	87,296.81	3,204.75	4,400.00	5,840	16,060.00	132,226.24	129,097.93	(3,128.31)
Feb-98	1/25/98	2/25/98	31	3,088,090	26,458.76	0.0304719	94,099.97	3,204.75	4,400.00	5,860	16,115.00	131,006.66	137,868.97	6,862.31
Mar-98	2/25/98	3/25/98	28	2,719,810	23,303.33	0.0304719	82,877.78	3,204.75	4,400.00	5,310	14,602.50	119,146.84	121,978.86	2,832.02
Apr-98	3/25/98	4/25/98	31	3,215,680	27,551.95	0.0304719	97,987.88	3,204.75	4,400.00	6,000	16,500.00	149,258.86	143,235.08	(6,023.78)
May-98	4/25/98	5/25/98	30	3,071,030	26,312.59	0.0304719	93,580.12	3,204.75	4,400.00	6,090	16,747.50	145,045.75	137,835.45	(7,210.30)
Jun-98	5/25/98	6/25/98	31	3,576,630	30,644.57	0.0304719	108,986.71	3,204.75	4,400.00	6,670	18,342.50	186,936.02	159,169.03	(27,766.99)
Jul-98	6/25/98	7/25/98	30	3,552,480	30,437.65	0.0304719	108,250.82	3,204.75	4,400.00	6,160	16,940.00	179,140.86	156,823.71	(22,317.15)
Aug-98	7/25/98	8/25/98	31	3,672,870	31,469.15	0.0304719	111,919.33	3,204.75	4,400.00	6,760	18,590.00	195,854.32	163,173.73	(32,680.59)
Sep-98	8/25/98	9/25/98	31	3,871,610	33,171.95	0.0304719	117,975.31	3,204.75	4,400.00	6,920	19,030.00	203,384.32	184,520.27	(18,864.05)
			Totals	35,522,790	304,359.26		1,082,446.90	38,457.00	52,800.00		184,332.50	1,666,933.34	1,584,286.42	(82,646.92)
													% Reduction	-4.96%

Table 16

Comparison between HL&P - Supplemental Agreement for State Owned Educational Institution and LOS (A) Rate Schedule and SBEC LP - 8 Rate Schedule

Energy Charges

Month	Start Period	End Period	No. of Billing Days	Energy Consumed (kWh)	Cons. in Blk 1 (kWh)	Cons. in Blk 2 (kWh)	Cons. in Blk 3 (kWh)	Energy Charge ($)	Fuel Cost Factor ($/kWh)	Fuel Charges ($)	Power Cost Recovery ($/kWh)	Power Cost Recovery Charge ($)	Total Energy Charge ($)
Oct	9/25/97	10/25/97	30	3,456,390	1,846,700	1,609,690	0	26,821.69	0.018788	64,938.66	-0.000166	(573.76)	91,186.59
Nov	10/25/97	11/25/97	31	3,351,760	1,870,300	1,481,460	0	25,517.09	0.018788	62,972.87	-0.000166	(556.39)	87,933.56
Dec	11/25/97	12/25/97	30	2,953,220	1,693,300	1,259,920	0	22,201.72	0.018788	55,485.10	-0.000166	(490.23)	77,196.58
Jan	12/25/97	1/25/98	31	2,864,830	1,722,800	1,142,030	0	21,040.34	0.018788	53,824.43	-0.000166	(475.56)	74,389.21
Feb	1/25/98	2/25/98	31	3,088,090	1,728,700	1,359,390	0	23,475.49	0.018788	58,019.03	-0.000166	(512.62)	80,981.90
Mar	2/25/98	3/25/98	28	2,719,810	1,566,450	1,153,360	0	20,403.73	0.018788	51,099.79	-0.000166	(451.49)	71,052.03
Apr	3/25/98	4/25/98	31	3,215,680	1,770,000	1,445,680	0	24,632.10	0.018788	60,416.20	-0.000166	(533.80)	84,514.50
May	4/25/98	5/25/98	30	3,071,030	1,770,000	1,301,030	0	23,030.68	0.018788	57,698.51	-0.000166	(509.79)	80,219.40
Jun	5/25/98	6/25/98	31	3,576,630	1,967,650	1,608,980	0	27,403.34	0.018788	67,197.72	-0.000166	(593.72)	94,007.35
Jul	6/25/98	7/25/98	30	3,552,480	1,817,200	1,735,280	0	28,068.32	0.018788	66,743.99	-0.000166	(589.71)	94,222.60
Aug	7/25/98	8/25/98	31	3,672,870	1,994,200	1,678,670	0	28,304.29	0.018788	69,005.88	-0.000166	(609.70)	96,700.47
Sep	8/25/98	9/25/98	31	3,871,610	2,041,400	1,830,210	0	30,212.04	0.018788	72,739.81	-0.000166	(642.69)	102,309.16
		Totals	334	35,522,790	19,747,300	15,775,490	0	270,898.79		598,396.30		(5,287.09)	835,703.71
		Averages		2,960,233	1,645,608	1,314,624	0	22,574.90		49,866.36		(440.59)	69,641.98

Demand Charges

Month	Billing Demand (kVA)	Demand Charge ($)
Oct	6,260	52,176.60
Nov	6,340	52,889.40
Dec	5,740	47,543.40
Jan	5,840	48,434.40
Feb	5,860	48,612.60
Mar	5,310	43,712.10
Apr	6,000	49,860.00
May	6,000	49,860.00
Jun	6,670	55,829.70
Jul	6,160	51,285.60
Aug	6,760	56,631.60
Sep	6,920	58,057.20
Total	66,940	556,835.40
Averages	5,578	46,402.95

Miscellaneous Charges

Facilities Charge ($)	Total Misc. Charges ($)
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
31,608.00	31,608.00
2,634.00	2,634.00

Total Charges

HL&P Total ($)	SBEC Total ($)		Difference HL&P - SBEC ($)
145,997.19	153,347.37		7,350.18
143,456.96	149,482.63		6,025.67
127,373.98	132,273.66		4,899.68
125,457.61	129,097.93		3,640.32
132,228.50	137,868.97		5,640.47
117,398.13	121,978.86		4,580.73
137,008.50	143,235.08		6,226.58
132,713.40	137,835.45		5,122.05
152,471.05	159,169.03		6,697.98
148,142.20	156,823.71		8,681.51
155,966.07	163,173.73		7,207.66
163,000.36	184,520.27		21,519.91
1,518,213.59	1,584,286.42		66,072.83
126,517.80	132,023.87		5,506.07

Table 17

Comparison between HL&P - Supplemental Agreement for State Owned Educational Institution and LOS (A) Rate Schedule and SBEC LP - 8 Rate Schedule

Energy Charges

Month	Start Period	End Period	No. of Billing Days	Energy Consumed (kWh)	Cons. in Blk 1 (kWh)	Cons. in Blk 2 (kWh)	Cons. in Blk 3 (kWh)	Energy Charge ($)	Fuel Cost Factor ($/kWh)	Fuel Charges ($)	Power Cost Recovery ($/kWh)	Power Cost Recovery Charge ($)	Total Energy Charge ($)
Oct	9/25/97	10/25/97	30	3,456,390	2,052,020	1,404,370	0	25,549.33	0.018788	64,938.66	-0.000166	(573.76)	89,914.22
Nov	10/25/97	11/25/97	31	3,351,760	2,077,980	1,273,780	0	24,230.09	0.018788	62,972.87	-0.000166	(556.39)	86,646.57
Dec	11/25/97	12/25/97	30	2,953,220	1,881,510	1,071,710	0	21,035.38	0.018788	55,485.10	-0.000166	(490.23)	76,030.24
Jan	12/25/97	1/25/98	31	2,864,830	1,914,255	950,575	0	19,853.89	0.018788	53,824.43	-0.000166	(475.56)	73,202.76
Feb	1/25/98	2/25/98	31	3,088,090	1,920,745	1,167,345	0	22,285.39	0.018788	58,019.03	-0.000166	(512.62)	79,791.80
Mar	2/25/98	3/25/98	28	2,719,810	1,740,500	979,310	0	19,325.14	0.018788	51,099.79	-0.000166	(451.49)	69,973.44
Apr	3/25/98	4/25/98	31	3,215,680	1,966,765	1,248,915	0	23,412.75	0.018788	60,416.20	-0.000166	(533.80)	83,295.14
May	4/25/98	5/25/98	30	3,071,030	1,966,765	1,104,265	0	21,811.33	0.018788	57,698.51	-0.000166	(509.79)	79,000.05
Jun	5/25/98	6/25/98	31	3,576,630	2,186,245	1,390,385	0	26,048.71	0.018788	67,197.72	-0.000166	(593.72)	92,652.71
Jul	6/25/98	7/25/98	30	3,552,480	2,018,980	1,533,500	0	26,817.89	0.018788	66,743.99	-0.000166	(589.71)	92,972.17
Aug	7/25/98	8/25/98	31	3,672,870	2,215,745	1,457,125	0	26,931.37	0.018788	69,005.88	-0.000166	(609.70)	95,327.56
Sep	8/25/98	9/25/98	31	3,871,610	2,267,960	1,603,650	0	28,808.05	0.018788	72,739.81	-0.000166	(642.69)	100,905.17
		Totals	334	35,522,790	21,941,510	13,581,280	0	257,301.27		598,396.30		(5,287.09)	823,479.11
		Averages		2,960,233	1,828,459	1,131,773	0	21,441.77		49,866.36		(440.59)	68,623.26

Demand Charges

Month	Billing Demand (kVA)	Demand Charge ($)
Oct	6,956	58,377.96
Nov	7,044	59,162.04
Dec	6,378	53,227.98
Jan	6,489	54,216.99
Feb	6,511	54,413.01
Mar	5,900	48,969.00
Apr	6,667	55,802.97
May	6,667	55,802.97
Jun	7,411	62,432.01
Jul	6,844	57,380.04
Aug	7,511	63,323.01
Sep	7,688	64,900.08
Total	74,378	623,107.98
Averages	6,198	51,925.67

Miscellaneous Charges

Facilities Charge ($)	Total Misc. Charges ($)
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
2,634.00	2,634.00
31,608.00	31,608.00
2,634.00	2,634.00

Total Charges

HL&P Total ($)	SBEC Total ($)		Difference HL&P - SBEC ($)
150,926.18	153,347.37		2,421.19
148,442.61	149,482.63		1,040.02
131,892.22	132,273.66		381.44
130,053.75	129,097.93		(955.82)
136,838.81	137,868.97		1,030.16
121,576.44	121,978.86		402.42
141,732.11	143,235.08		1,502.97
137,437.02	137,835.45		398.43
157,718.72	159,169.03		1,450.31
152,986.21	156,823.71		3,837.50
161,284.57	163,173.73		1,889.16
168,439.25	184,520.27		16,081.02
1,570,888.65	1,584,286.42		13,397.77
130,907.39	132,023.87		1,116.48

Deliverable 6

Annual EUI's of Buildings Served by JC-85

Summary

The preliminary comparisons of Energy-Use Indices included in this draft report are based on only one month of data. They show that consumption of many buildings on the PVAM and TAMU campuses are comparable when normalized by building areas. There appear to be some significant differences, but annual EUI's are needed to draw meaningful conclusions. These will be included in the final report.

Monthly Recorded Data by JC-85

Monthly recorded energy use data by JC-85 were used to develop "Reasonableness Indices" to be compared with those developed for Texas A&M University typical buildings. We included few typical buildings from PVAM campus for this comparison, and we based the indices on the monthly values of September 1998. More buildings will be included in the final report of this project.

EUI's of Typical Buildings at Texas A&M University

The annual EUI's for typical buildings at Texas A&M were calculated. Tables 18, 19, and 20 show the EUI's of 5 typical buildings including: a Dining Hall, a Multi-floor Office building, a Low-rise Office and Computer Center building, a Library, and a Classrooms/Labs building. The Electricity Consumption, Chilled Water Consumption, and Hot Water Consumption EUI's are shown in Table 18, 19, and 20, respectively.

EUI's of PVAM buildings Served by JC-85

Monthly EUI's for a few PVAM and Texas A&M University typical buildings, based on the month of September 1998, were developed and included in Table 21. Some values seemed consistent, and some other values showed considerable differences. More buildings should be inlcuded in developing the EUI's and more than one month of data will be utilized in the final report.

Electricity Consumption (kWh)					
Building	Sbisa Dining Hall	Harrington Tower	Teague	Evans Library (Old)	Zachry Engineering Center
Function	Dining Hall	Multi-Floor Offices	Low-Rise Offices Computer Center	Library	Classrooms/Labs Offices
Area (ft^2)	137913	130844	63515	812289	324400
Oct-97	293631	108979	127308	*	605435
Nov-97	264427	103360	*	*	547634
Dec-97	*	*	113229	616496	*
Jan-98	199680	101758	117133	*	506038
Feb-98	256802	104533	108912	473270	513606
Mar-98	243634	113143	127348	848602	560275
Apr-98	264032	112023	129949	255884	583657
May-98	215493	109177	142179	*	575921
Jun-98	155999	114861	136866	433866	563345
Jul-98	154208	112387	138649	817057	589904
Aug-98	184653	109340	139801	797130	582085
Sep-98	294769	115482	131901	153158	598390
Annual EUI ($kWh/ft^2/yr$)	20.0	10.0	24.3	8.1	20.9

Table 18. Annual Electricity Consumption EUI of some typical buildings at Texas A&M University.

Chilled Water Consumption (MMBtu)					
Building	**Sbisa Dining Hall**	**Harrington Tower**	**Teague**	**Evans Library (Old)**	**Zachry Engineering Center**
Function	Dining Hall	Multi-Floor Offices	Low-Rise Offices Computer Center	Library	Classrooms/Labs Offices
Area (ft^2)	137913	130844	63515	812289	324400
Oct-97	1837.2	602.2	852.1	*	*
Nov-97	1349.9	324.1	563.2	*	824.2
Dec-97	*	*	484.8	2123.9	*
Jan-98	965.7	173.1	507.2	2563.9	598.9
Feb-98	917.9	143.2	452.7	2797	607.8
Mar-98	1210.5	274.1	515.3	3568.6	801.6
Apr-98	1684.3	456.6	594.4	1271.2	1081.5
May-98	2114.6	895.5	759.7	*	1749.6
Jun-98	1963.5	1246	839.3	3304.6	2016.4
Jul-98	2028	1267.7	876.8	6076.5	2234.8
Aug-98	2099.7	1132.6	857.5	5442.9	2143.1
Sep-98	2612.6	1165	784.1	1025	2033.5
Annual EUI ($kBtu/ft^2/yr$)	148.6	64.0	127.3	46.2	52.1

Table 19. Annual Chilled Water Consumption EUI of some typical buildings at Texas A&M University.

Hot Water Consumption (MMBtu)					
Building	**Sbisa Dining Hall**	**Harrington Tower**	**Teague**	**Evans Library (Old)**	**Zachry Engineering Center**
Function	Dining Hall	Multi-Floor Offices	Low-Rise Offices Computer Center	Library	Classrooms/Labs Offices
Area (ft^2)	137913	130844	63515	812289	324400
Oct-97	244.4	110.1	288.9	*	*
Nov-97	0	*	267.1	341.7	248.1
Dec-97	*	*	460.1	401.2	*
Jan-98	912.6	120.4	370.6	326.1	121.6
Feb-98	734.3	37.1	314.9	297.8	60.7
Mar-98	553.7	44.9	305	213.2	240.8
Apr-98	471	39.1	305.3	40.5	116.6
May-98	307.2	29.2	269.7	*	*
Jun-98	201	35.2	224.3	148.6	*
Jul-98	185.5	17.3	162.8	231.7	109.9
Aug-98	200.3	0	177.9	192.6	189
Sep-98	252.1	0	168.3	26	161.1
Annual EUI ($kBtu/ft^2/yr$)	32.1	4.0	52.2	3.3	5.8

Table 20. Annual Hot Water Consumption EUI of some typical buildings at Texas A&M University.

Function	Electricity Consumption				Chilled Water Consumption				Hot Water Consumption			
	PVAM	EUI (kWh/ft2/mo)	TAMU Reference	EUI (kWh/ft2/mo)	PVAM	EUI (kBtu/ft2/mo)	TAMU Reference	EUI (kBtu/ft2/mo)	PVAM	EUI (kBtu/ft2/mo)	TAMU Reference	EUI (kBtu/ft2/mo)
Classrooms/Labs/Offices	AG	1.61	Zachry	1.84	AG	22.10	Zachry	6.27	AG	0.00	Zachry	0.50
Library	LIB	1.32	Evans Library	0.19	LIB	13.32	Evans Library	1.26	LIB	0.00	Evans Library	0.03
Classrooms/Labs/Offices	ET	2.65	Zachry	1.84	ET	11.27	Zachry	6.27	ET	1.42	Zachry	0.50
Classrooms/Labs/Offices	NEW	1.64	Zachry	1.84	NEW	13.57	Zachry	6.27	NEW	0.00	Zachry	0.50
Classrooms/Labs/Offices	GIL	N/A	Zachry	1.84	GIL	24.75	Zachry	6.27	GIL	0.00	Zachry	0.50
Classrooms/Offices	GEN	1.52	Zachry	1.84	GEN	20.17	Zachry	6.27	GEN	0.00	Zachry	0.50
Classrooms	HOB	4.04	Zachry	1.84	HOB	34.12	Zachry	6.27	HOB	0.00	Zachry	0.50
Classrooms/Labs/Offices	MTH	1.76	Zachry	1.84	MTH	11.76	Zachry	6.27	MTH	0.00	Zachry	0.50
Dining Hall	ALUM	2.20	Sbisa	2.14	ALUM	19.85	Sbisa	18.94	ALUM	0.00	Sbisa	1.83
Multi-Floor Offices	AND	1.44	Harrington	0.88	AND	17.93	Harrington	8.90	AND	0.00	Harrington	0.00
Multi-Floor Offices	EV	2.46	Harrington	0.88	EV	60.88	Harrington	8.90	EV	0.00	Harrington	0.00
Classrooms/Labs/Offices	ANIM	2.76	Zachry	1.84	ANIM	12.38	Zachry	6.27	ANIM	0.00	Zachry	0.50
Classrooms	BURL	1.87	Zachry	1.84	BURL	12.90	Zachry	6.27	BURL	0.00	Zachry	0.50
Classrooms/Labs/Offices	CHEM	2.28	Zachry	1.84	CHEM	16.98	Zachry	6.27	CHEM	0.00	Zachry	0.50
Low-Rise Offices / Comp.	PHY	0.00	Teague	2.08	PHY	24.25	Teague	12.34	PHY	0.00	Teague	2.65

* EUI's are based on the month of September 1998 values.

Table 21. Comparison between Monthly EUI of some typical buildings at PVAM and Texas A&M University.

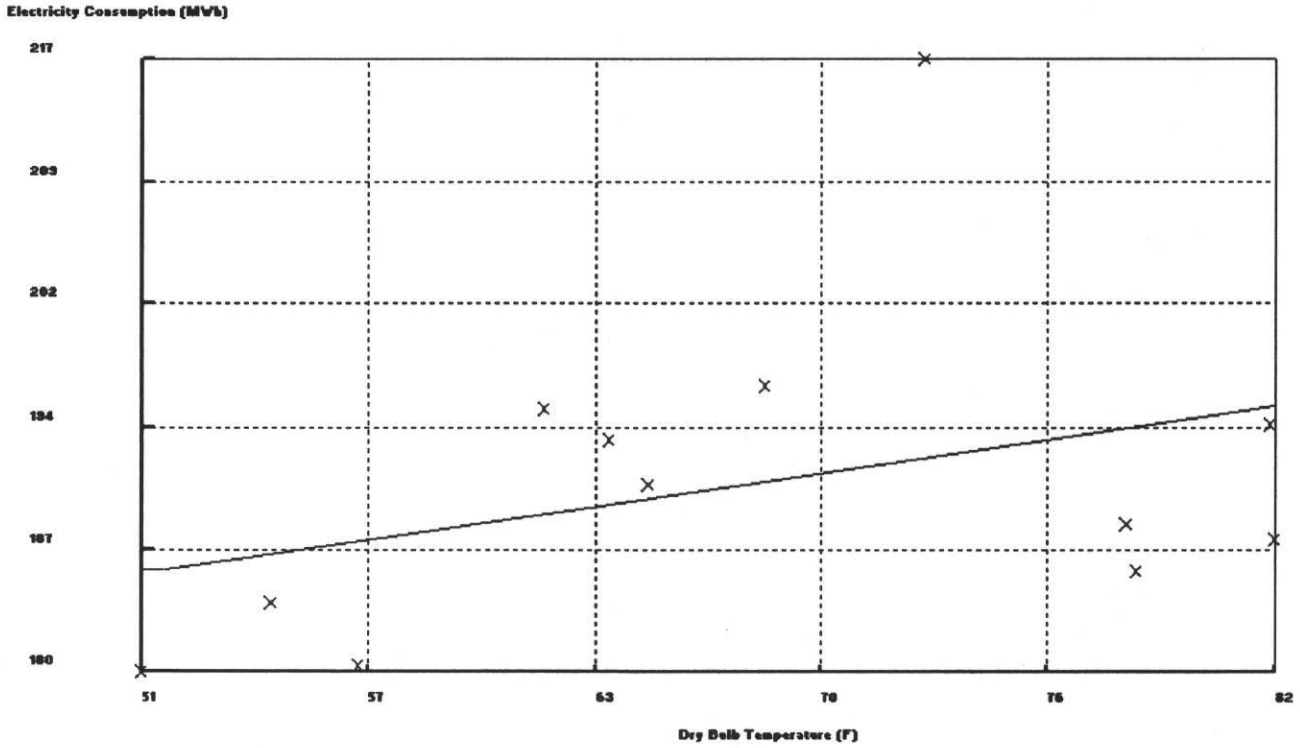
Conclusions

The J.B. Coleman Library JC-85 electricity consumption data showed savings consistent with the audit estimates. The PVAM (Physical Plant) personnel readings were too few for a meaningful evaluation, based on the timing of the retrofit construction period. More data is required to perform a meaningful analysis. However, the PVAM readings available to us showed many negative values which are not physically reasonable. Further study is needed. Chilled water and hot water data from JC-85 seems to be consistent; noting however a probable data problem (metering location and availability, control algorithms and calculations, calculation scaling factor, etc.).

The whole campus energy performance was analyzed based on the utility bills. The 15-minute data that was provided by San Bernard Electric seemed inconsistent with the values billed for. Further study of the 15-minutes data is required to know what does it represent and it is used by the utility company to result in the utility bills that we had available for our study.

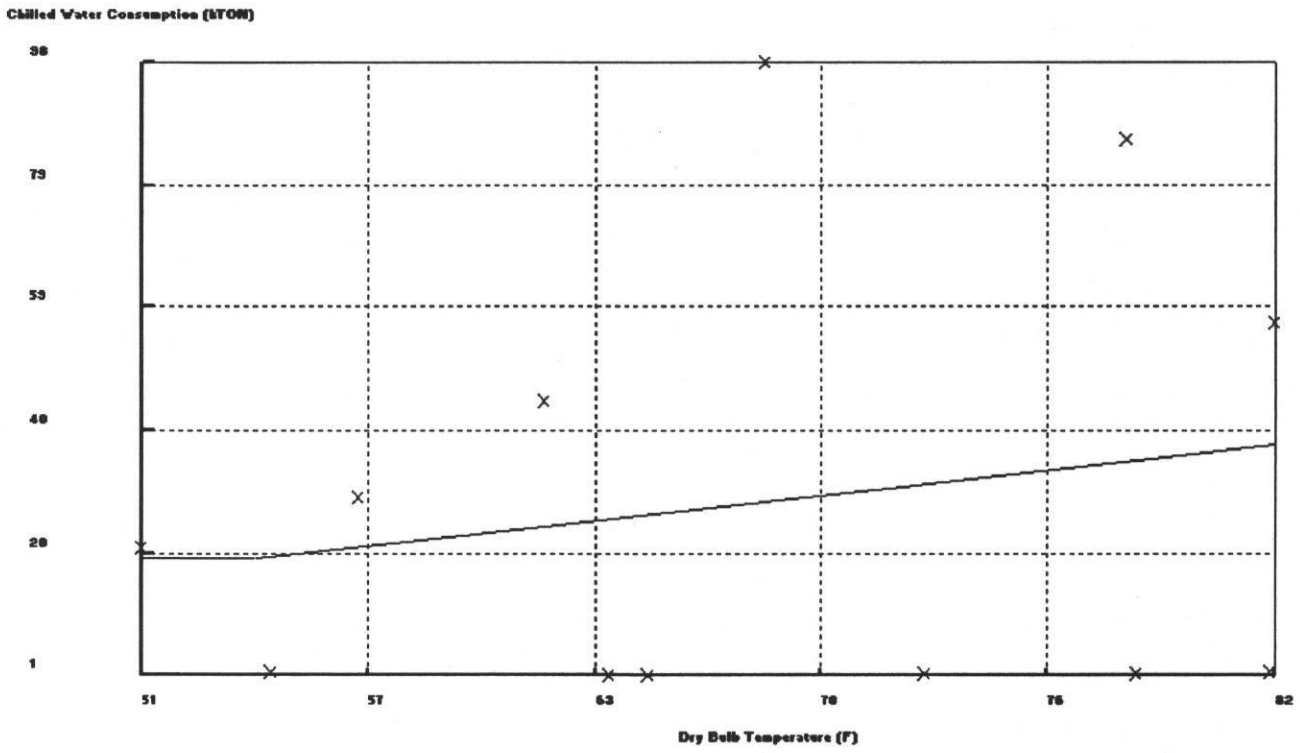
Appendix

Deliverable 1



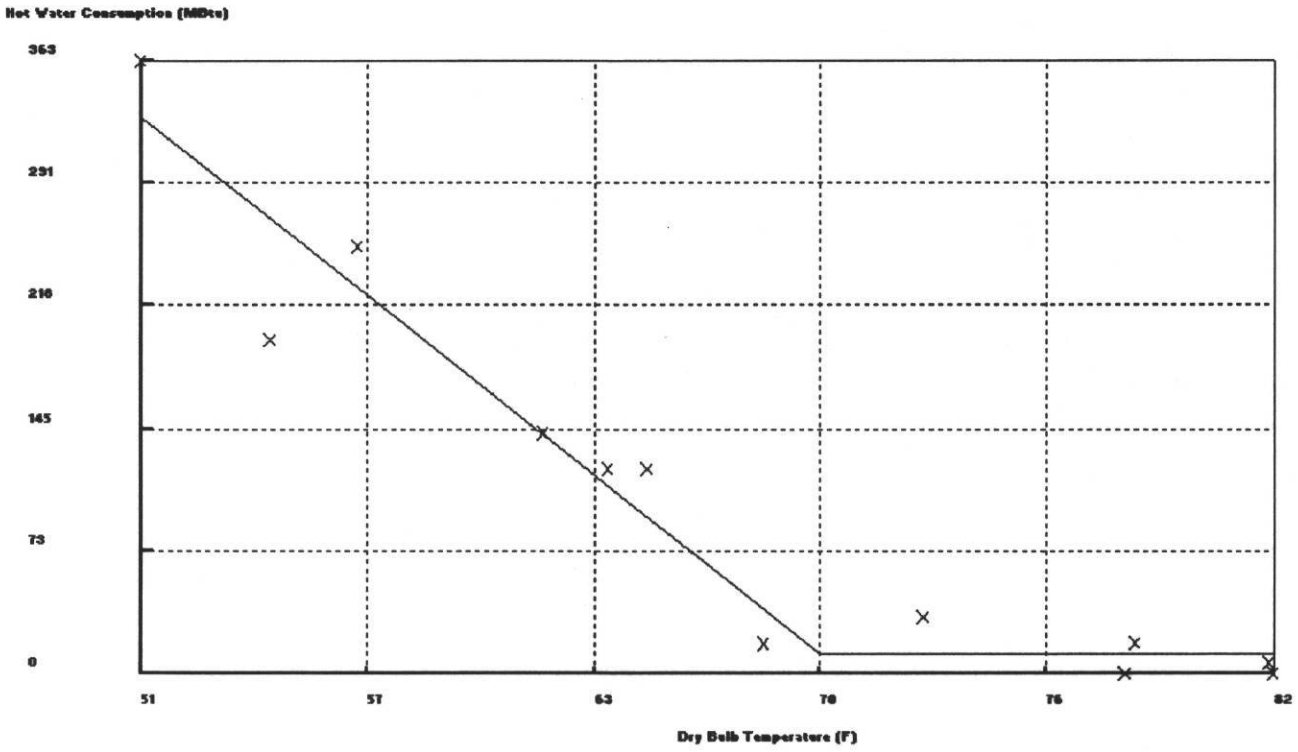
Model: 3P-CP (C). Electricity Consumption (MWh) vs. Dry Bulb Temperature (F)
Ycp = 185.8380 (5.2748) LS = 0.0000 (0.0000) RS = 0.3248 (0.2751) Xcp = 51.6904
N = 12 N1 = 1 N2 = 11 R2 = 0.12 adjR2 = 0.03 RMSE = 9.72 CV-RMSE = 5.1% p = -0.07 DW = 2.06 (i%)

J.B. Coleman Library Electricity Consumption (JC-85) Pre-Retrofit Model.



Model: 3P-CP (C). Chilled Water Consumption (kTONh) vs. Dry Bulb Temperature (F)
Ycp = 19.3191 (18.2424) LS = 0.0000 (0.0000) RS = 0.6505 (1.0662) Xcp = 54.1720
N = 12 N1 = 1 N2 = 11 R2 = 0.04 adjR2 = -0.06 RMSE = 36.53 CV-RMSE = 128.6% p = 0.96
DW = 0.39 (p>0)

J.B. Coleman Library Chilled Water Consumption (JC-85) Pre-Retrofit Model.



Model: 3P-CP (H). Hot Water Consumption (MBtu) vs. Dry Bulb Temperature (F)
Ycp = 11.9570 (11.4725) LS = -17.0765 (1.3614) RS = 0.0000 (0.0000) Xcp = 69.6820
N = 12 N1 = 7 N2 = 5 R2 = 0.94 adjR2 = 0.93 RMSE = 30.06 CV-RMSE = 28.3% p = -0.30
DW = 2.53 (i%)

J.B. Coleman Library Hot Water Consumption (JC-85) Pre-Retrofit Model.

Deliverable 2

Building	FULL - Fuller Hall	Thermometer Reading (F)
Function	Dormitory	
Conditioned Area (ft^2)	44,718	
Mech. Room Condition	Old, Rusty	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	50
Chilled Water Return EMCS Thermistor	YES	52
Hot Water Supply EMCS Thermistor	YES	180
Hot Water Return EMCS Thermistor	YES	168
Chilled Water Flowmeter	DI	
Hot Water Flowmeter	DI	
Thermometers Notes		
Flowmeters Notes CW HW	 Upstream OK, Valve 1' Downstream "90" 5' Upstream, "T" 3' Downstream	 Bad Location OK
General Notes		
Picture	# 1	

Building	AG - Agricultural Research	Thermometer Reading (F)
Function	Classes, Labs, Offices	
Conditioned Area (ft^2)	21,408	
Mech. Room Condition	Good	
Accessibility of Thermometers	Too High	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	52
Chilled Water Return EMCS Thermistor	YES	65
Hot Water Supply EMCS Thermistor	YES	N/A
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Supply	
Thermometers Notes	N/A on HW	
Flowmeters Notes		
CW	Upstream OK, Downstream OK	OK
HW	"T" 6' Upstream, Elbow 2.5' Downstream	OK
General Notes	Bldg. Supplied with Steam, to generate HW with a Heat Exch.	
Picture	# 2	

Building	LIB - John B. Coleman Library	Thermometer Reading (F)
Function	Library	
Conditioned Area (ft^2)	100,352	
Mech. Room Condition	Good	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	52
Chilled Water Return EMCS Thermistor	YES	56
Hot Water Supply EMCS Thermistor	YES	164
Hot Water Return EMCS Thermistor	YES	154
Chilled Water Flowmeter	DI on Supply	
Hot Water Flowmeter	DI on Return	
Thermometers Notes		
Flowmeters Notes CW HW	 "S" 4' Upstream, "S" 1' Downstream "S" 1' Downstream	 Bad Location Bad Location
General Notes		
Picture	# 3	

Building	ET - Sam Collins Eng'g Technology	Thermometer Reading (F)
Function	Classes, Labs, Offices	
Conditioned Area (ft^2)	47,388	
Mech. Room Condition	Average	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	53
Chilled Water Return EMCS Thermistor	YES	55
Hot Water Supply EMCS Thermistor	YES	143
Hot Water Return EMCS Thermistor	YES	139
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Return	
Thermometers Notes		
Flowmeters Notes		
CW	5' Upstream, 5' Downstream	OK
HW	5' Upstream, 5' Downstream	OK
General Notes		
Picture	# 4	

Building	NEW - C.L. Wilson New Eng'g	Thermometer Reading (F)
Function	Classrooms, Labs, Offices	
Conditioned Area (ft^2)	46,724	
Mech. Room Condition	Old	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	50
Chilled Water Return EMCS Thermistor	YES	56
Hot Water Supply EMCS Thermistor	YES	170
Hot Water Return EMCS Thermistor	YES	158
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Return	
Thermometers Notes		
Flowmeters Notes	CW Flowmeter down a ladder in floor	
CW	Good Upstream, Valve 6' Downstream	OK
HW	Good Upstream, Elbow 3' Downstream	OK
General Notes	Bldg. Supplied with Steam, to generate HW with a Heat Exch.	
Picture	# 5	

Building	GIL - Gilchrist Eng'g	Thermometer Reading (F)
Function	Classrooms, Labs, Offices	
Conditioned Area (ft^2)	11,107	
Mech. Room Condition	New	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	52
Chilled Water Return EMCS Thermistor	YES	56
Hot Water Supply EMCS Thermistor	?	N/A
Hot Water Return EMCS Thermistor	YES	120
Chilled Water Flowmeter	DI on Supply	
Hot Water Flowmeter	DI on Return	
Thermometers Notes	HW Supply Thermistor and Thermometer not found	
Flowmeters Notes		
CW	Elbow 1' Upstream, Elbow 1' Downstream	Bad Location
HW	Valve 6" Upstream, "T" 6" Downstream	Bad Location
General Notes	Bldg. Supplied with Steam, to generate HW with a Heat Exch.	
Picture	# 6, and 7	

Building	BD - Banks Hall	Thermometer Reading (F)
Function	Dormitory	
Conditioned Area (ft^2)	44,718	
Mech. Room Condition	Old, Rusty	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	
Chilled Water Return EMCS Thermistor	YES	
Hot Water Supply EMCS Thermistor	YES	N/A
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Supply	
Thermometers Notes	HW Supply and Return *Thermometers not found*	
Flowmeters Notes		
CW	Upstream OK, Valve 5' Downstream	OK
HW	Elbow 2' Upstream, Downstream OK	Bad Location
General Notes	Bldg. Supplied with Steam, to generate HW with a Heat Exch.	
Picture	# 8	

Building	GEN - General Offices	Thermometer Reading (F)
Function	Classrooms, Offices	
Conditioned Area (ft^2)	36,547	
Mech. Room Condition	Old, Very Tight	
Accessibility of Thermometers	HW Broken, Hard to See	
Accessibility of Flowmeters	Hard to See	
Chilled Water Supply EMCS Thermistor	Yes	50
Chilled Water Return EMCS Thermistor	Yes	(53 ?)
Hot Water Supply EMCS Thermistor	Yes	N/A (158 ?)
Hot Water Return EMCS Thermistor	Yes	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter		
Thermometers Notes	HW Supply and Return Thermometers not found	
Flowmeters Notes CW HW	 Upstream OK, Downstream OK Temp-Sensor 1' Upstream, Elbow 1' Downstream	 OK Bad Location
General Notes		
Picture	# 9	

Building	DREW - Drew Hall	Thermometer Reading (F)
Function	Dormitory	
Conditioned Area (ft^2)	77,796	
Mech. Room Condition	Old, Rusty, Hot, Plenty of Space	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	50
Chilled Water Return EMCS Thermistor	YES	58
Hot Water Supply EMCS Thermistor	YES	168
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Supply	
Thermometers Notes	HW Return Thermometer not found	
Flowmeters Notes		
CW	Valve 1' Upstream, Elbow 1' Downstream	Bad Location
HW	Upstream OK, Downstream OK	OK
General Notes	Bldg. Supplied with Steam, to generate HW with a Heat Exch.	
Picture	# 10	

Building	FH - Field House (Dome)	Thermometer Reading (F)
Function	Gym, Swimming Pool	
Conditioned Area (ft^2)	67,594	
Mech. Room Condition	Old, Leaky, Roomy	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	48
Chilled Water Return EMCS Thermistor	YES	64
Hot Water Supply EMCS Thermistor	?	60 (wrong!)
Hot Water Return EMCS Thermistor	?	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	?	
Thermometers Notes		
Flowmeters Notes CW HW	 Upstream OK, Downstream OK Not Found	OK
General Notes	HW circuitry is unclear	
Picture	# 11	

Building	MEM - Memorial Student Center	Thermometer Reading (F)
Function	Kitchen, Dining, Barber	
Conditioned Area (ft^2)	24,588	
Mech. Room Condition	Old, Roomy	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	54
Chilled Water Return EMCS Thermistor	YES	55
Hot Water Supply EMCS Thermistor	?	?
Hot Water Return EMCS Thermistor	?	75 (?)
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Condensate Return	
Thermometers Notes	HW Thermistors and Thermometers are not found	
Flowmeters Notes CW HW	 Upstream OK, Elbow 3' Downstream Control Valve 3' Upstream	 OK Bad Location
General Notes	HW Flowmeter on Condensate Return	
Picture	# 12	

Building	HOB - Hobart Taylor Hall	Thermometer Reading (F)
Function	Classroom, Band Hall	
Conditioned Area (ft^2)	57,349	
Mech. Room Condition	Good, Older Type	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	52
Chilled Water Return EMCS Thermistor	YES	54
Hot Water Supply EMCS Thermistor	YES	155
Hot Water Return EMCS Thermistor	YES	148
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI	
Thermometers Notes		
Flowmeters Notes CW HW	 Valve 3' Upstream, Elbow 5' Downstream Upstream OK, Downstream OK	 Bad Location OK
General Notes	Own Boiler and Chiller (Boiler 2520 kBtu out)	
Picture	# 13	

Building	MTH - M.T. Harrington Science Center	Thermometer Reading (F)
Function	Classrooms, Labs, Offices	
Conditioned Area (ft^2)	38,198	
Mech. Room Condition	Good, Roomy	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	50
Chilled Water Return EMCS Thermistor	YES	55
Hot Water Supply EMCS Thermistor	YES	158
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	DI	
Hot Water Flowmeter	DI	
Thermometers Notes	HW Return Flowmeter not found	
Flowmeters Notes		
CW	Upstream OK, Downstream OK	OK
HW	Valve 4' Upstream, Downstream OK	Bad Location
General Notes	Bldg. Supplied with Steam, to generate HW with a Heat Exch.	
Picture	# 14	

Building	ADMIN - Administration Bldg.	Thermometer Reading (F)
Function	Offices	
Conditioned Area (ft^2)	15,408	
Mech. Room Condition	Clean	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	52
Chilled Water Return EMCS Thermistor	YES	58
Hot Water Supply EMCS Thermistor	YES	184
Hot Water Return EMCS Thermistor	YES	153
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Return	
Thermometers Notes		
Flowmeters Notes		
CW	Upstream OK, Downstream OK	OK
HW	Upstream OK, Elbow 1' Downstream	Bad Location
General Notes	2 Mech. Rooms (1 HW; 1CW)	
Picture	# 15	

Building	ALUM - Alumni Hall	Thermometer Reading (F)
Function	Dining Hall, Kitchen	
Conditioned Area (ft^2)	69,682	
Mech. Room Condition	Dirty, Messy Electrical	
Accessibility of Thermometers	N/A	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	Not Found	N/A
Chilled Water Return EMCS Thermistor	Not Found	N/A
Hot Water Supply EMCS Thermistor	Not Found	N/A
Hot Water Return EMCS Thermistor	Not Found	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI before Pump	
Thermometers Notes	Thermistors and Thermometers are not found	
Flowmeters Notes		
CW	Elbow 2' Upstream, Control Valve 2' Downstream	Bad Location
HW	Elbow 2' Upstream, Elbow 2' Downstream	Bad Location
General Notes		
Picture	# 16	

Building	AND - Anderson Hall	Thermometer Reading (F)
Function	Offices	
Conditioned Area (ft^2)	8,145	
Mech. Room Condition	Small, Very Muddy	
Accessibility of Thermometers	N/A	
Accessibility of Flowmeters	Not Good, Under Crawl Space	
Chilled Water Supply EMCS Thermistor	Not Found	N/A
Chilled Water Return EMCS Thermistor	Yes	56
Hot Water Supply EMCS Thermistor	Not Found	N/A
Hot Water Return EMCS Thermistor	Not Found	N/A
Chilled Water Flowmeter	Pressure Taps	
Hot Water Flowmeter	In-Line	
Thermometers Notes		
Flowmeters Notes CW HW	Outside the Mech. Room, in the Muddy Space	 (Status in Doubt) (Status in Doubt)
General Notes		
Picture	# 17, and 18	

Building	EV - Evans Hall	Thermometer Reading (F)
Function	Offices	
Conditioned Area (ft^2)	11,963	
Mech. Room Condition	OK, Old	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	51
Chilled Water Return EMCS Thermistor	YES	54
Hot Water Supply EMCS Thermistor	YES	135
Hot Water Return EMCS Thermistor	YES	124
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI	
Thermometers Notes		
Flowmeters Notes		
CW	Upstream Ok, Elbow 3' Downstream	OK
HW	Upstream OK, Downstream OK	OK
General Notes		
Picture	# 19	

Building	ANIM - Animal Industrial Bldg.	Thermometer Reading (F)
Function	Classrooms, Animal Product Shop	
Conditioned Area (ft^2)	18,219	
Mech. Room Condition	OK, Roomy	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	53
Chilled Water Return EMCS Thermistor	YES	54
Hot Water Supply EMCS Thermistor	YES	72 (?)
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Return	
Thermometers Notes	HW Thermometers not found	
Flowmeters Notes		
CW	Elbow 3' Upstream, Downstream OK	Bad Location
HW	Upstream OK, "T" 6" Downstream	Bad Location
General Notes	2 Mech. Rooms (1 HW; 1 CW)	
Picture	# 20	

Building	BURL - Burleson-Ware Hall	Thermometer Reading (F)
Function	Classrooms, ROTC	
Conditioned Area (ft^2)	4,557	
Mech. Room Condition	Old, Roomy	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	50
Chilled Water Return EMCS Thermistor	YES	54
Hot Water Supply EMCS Thermistor	YES	N/A
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Return	
Thermometers Notes	HW Thermometers not found	
Flowmeters Notes CW HW	 Elbow 1.5' Upstream, Elbow 1.5' Downstream Upstream OK, Downstream OK	 Bad Location OK
General Notes	Own Boiler 2 Mech. Rooms (1 HW; 1 CW)	
Picture	# 21	

Building	ALL - All Faiths Chapel	Thermometer Reading (F)
Function	Church	
Conditioned Area (ft^2)	4,107	
Mech. Room Condition	OK, Tight	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	NO	
Chilled Water Supply EMCS Thermistor	YES	52
Chilled Water Return EMCS Thermistor	YES	54
Hot Water Supply EMCS Thermistor	YES	148
Hot Water Return EMCS Thermistor	YES	146
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	?	
Thermometers Notes		
Flowmeters Notes CW HW	 Upstream OK, Downstream OK Not Found	OK
General Notes	Very Messy Piping and Metering (Crowded)	
Picture	# 22	

Building	CHEM - Austin Greaux Chemical Eng'g	Thermometer Reading (F)
Function	Classrooms, Labs, Offices	
Conditioned Area (ft^2)	7,172	
Mech. Room Condition	Steamy, Tight, Old	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	N/A
Chilled Water Return EMCS Thermistor	YES	52
Hot Water Supply EMCS Thermistor	YES	N/A
Hot Water Return EMCS Thermistor	YES	130
Chilled Water Flowmeter	DI on Supply	
Hot Water Flowmeter	DI on Supply	
Thermometers Notes	Thermometers not found on CW and HW Supply	
Flowmeters Notes CW HW	 Upstream OK, Downstream OK "U" 1' Upstream, Valve 1' Downstream	 OK Bad Location
General Notes	Bldg. Supplied with Steam, to generate HW with a Heat Exch.	
Picture	# 23	

Building	ECON - Home Economics	Thermometer Reading (F)
Function	Cooking, Sewing, Classrooms	
Conditioned Area (ft^2)	12,965	
Mech. Room Condition	Good	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	52
Chilled Water Return EMCS Thermistor	YES	N/A
Hot Water Supply EMCS Thermistor	YES	N/A
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	DI on AHU Supply Line	
Hot Water Flowmeter	In-line on Return	
Thermometers Notes	Thermometers not found on HW Supply and Return, and CW Return	
Flowmeters Notes CW HW	 Elbow 1' Upstream Upstream OK, Downstream OK	 Bad Location OK
General Notes		
Picture	# 24	

Building	COOP - COOP Extension Bldg.	Thermometer Reading (F)
Function	Offices	
Conditioned Area (ft^2)	13,899	
Mech. Room Condition	Clean (Chiller Outside)	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	48
Chilled Water Return EMCS Thermistor	YES	Broken
Hot Water Supply EMCS Thermistor	YES	170
Hot Water Return EMCS Thermistor	YES	124
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Return	
Thermometers Notes	Thermometer Broken on CW Return	
Flowmeters Notes CW HW	 Elbow 3' Upstream, Downstream OK Upstream OK, Downstream OK	 Bad Location OK
General Notes	Own Boiler and Chiller	
Picture	# 25	

Building	PHY - Physical Plant Administration	Thermometer Reading (F)
Function	Offices	
Conditioned Area (ft^2)	7,224	
Mech. Room Condition	Penthouse Style Room, Good	
Accessibility of Thermometers	High	
Accessibility of Flowmeters	High	
Chilled Water Supply EMCS Thermistor	YES	Broken
Chilled Water Return EMCS Thermistor	YES	52
Hot Water Supply EMCS Thermistor	YES	175
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Return	
Thermometers Notes	Hard to Read, Broken, N/A	
Flowmeters Notes		
CW	Upstream OK, Downstream OK	OK
HW	Upstream OK, Downstream OK	OK
General Notes		
Picture	NO	

Building	REC - Central Receiving - DPS	Thermometer Reading (F)
Function	Warehouse, Police Dept.	
Conditioned Area (ft^2)	17,006	
Mech. Room Condition	Good	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	52
Chilled Water Return EMCS Thermistor	YES	54
Hot Water Supply EMCS Thermistor	YES	143
Hot Water Return EMCS Thermistor	YES	134
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Return	
Thermometers Notes	All Thermistors and Thermometers are on AHU Supply and Return Lines	
Flowmeters Notes		
CW	Upstream OK, Downstream OK	OK
HW	Upstream OK, Downstream OK	OK
General Notes		
Picture	NO	

Building	HILL - Hilliard Hall	Thermometer Reading (F)
Function	Radio Station, Offices	
Conditioned Area (ft^2)	22,109	
Mech. Room Condition	Old, Roomy	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	63 (Wrong!)
Chilled Water Return EMCS Thermistor	YES	52
Hot Water Supply EMCS Thermistor	YES	106
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Return	
Thermometers Notes		
Flowmeters Notes		
CW	Upstream OK, Downstream OK	OK
HW	Upstream OK, Downstream OK	OK
General Notes		
Picture	NO	

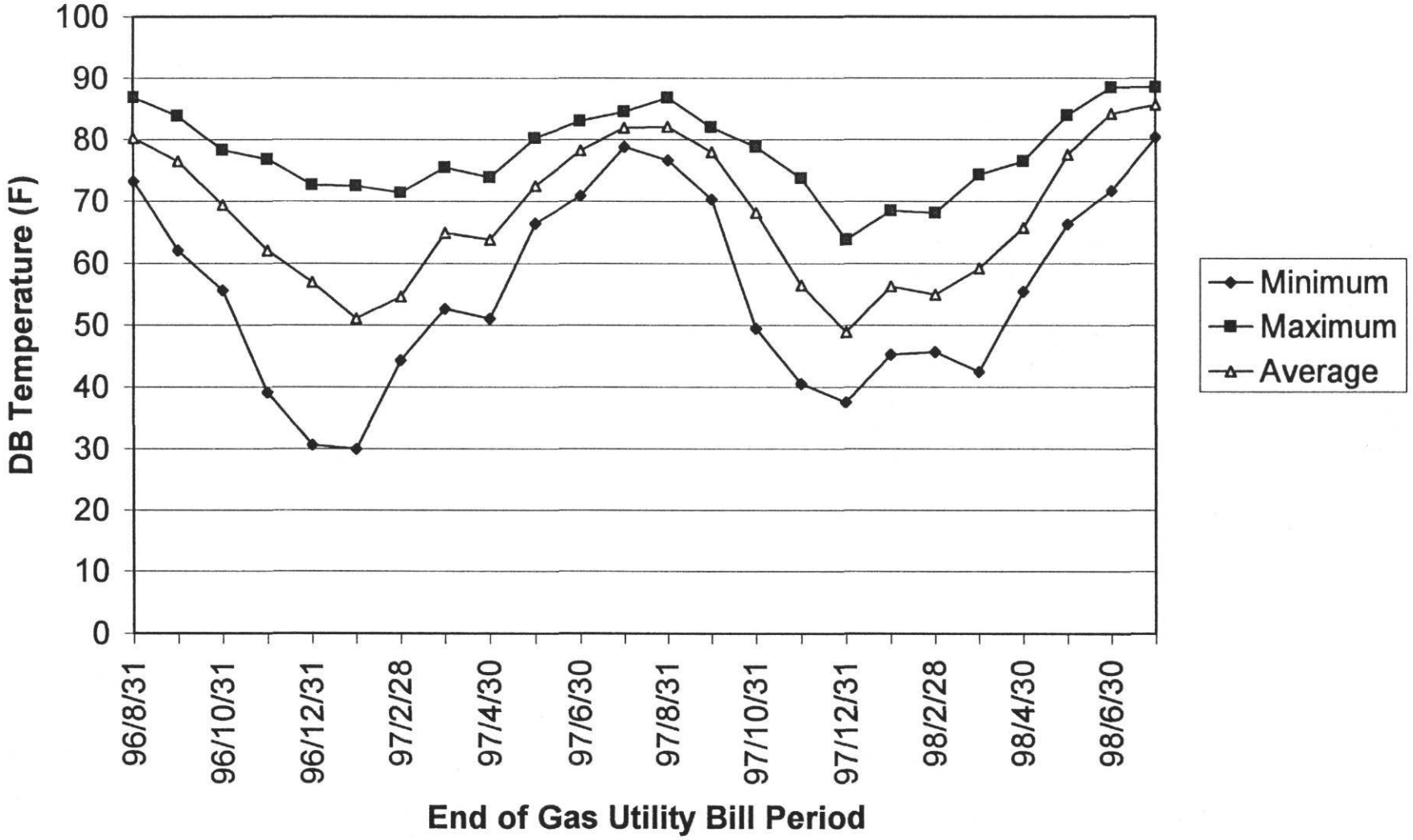
Building	NG - New Gym	Thermometer Reading (F)
Function	Gymnasium	
Conditioned Area (ft^2)	26,846	
Mech. Room Condition	Clean, Roomy	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	Not Sure
Chilled Water Return EMCS Thermistor	YES	Not Sure
Hot Water Supply EMCS Thermistor	YES	139
Hot Water Return EMCS Thermistor	YES	N/A
Chilled Water Flowmeter	Rosemont Orifice- Plate - ΔP	
Hot Water Flowmeter	In-Flow on Condensate Return	
Thermometers Notes	Thermometers Problems (CW Supply and Return Readings, and HW Return N/A)	
Flowmeters Notes		
CW	Upstream OK, Downstream OK	OK
HW	Upstream OK, Downstream OK	OK
General Notes	Bldg. Supplied with Steam, to generate HW with a Heat Exch.	
Picture	NO	

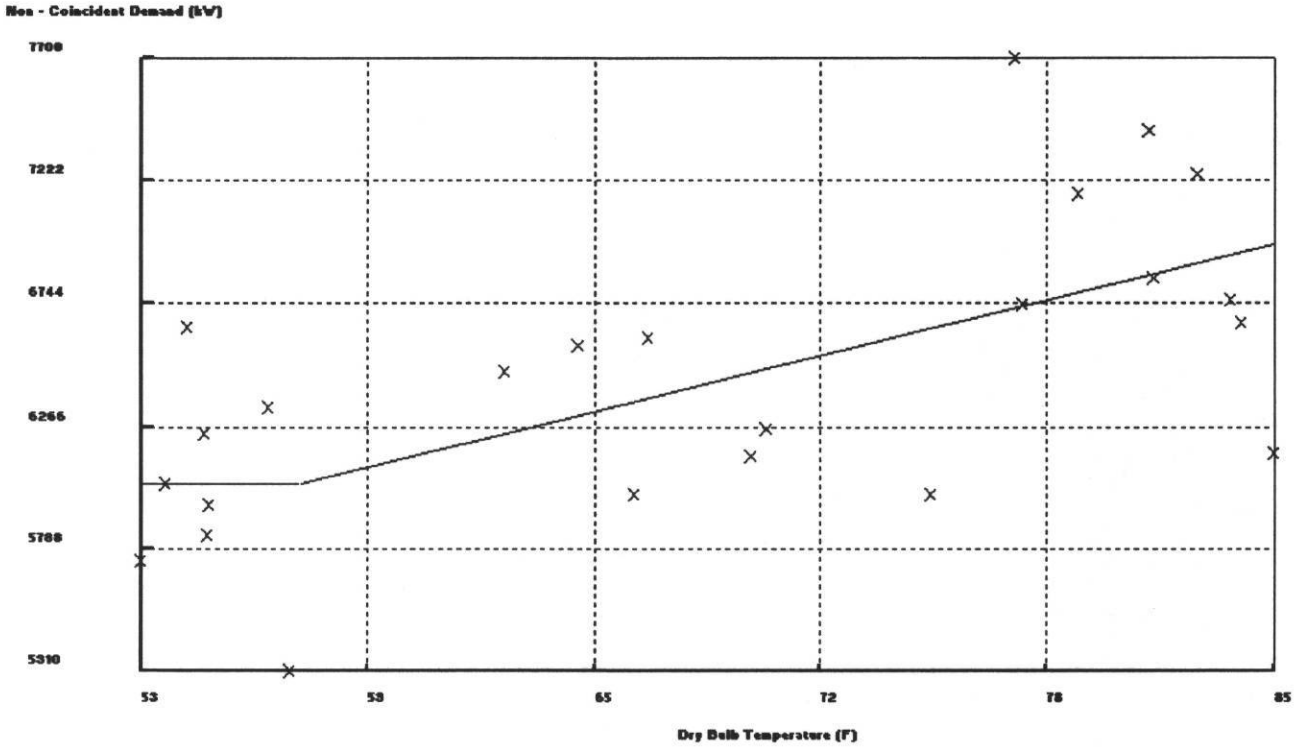
Building	OWEN - Owens Franklin Health Center	Thermometer Reading (F)
Function	Health Center (X-Ray), Offices	
Conditioned Area (ft^2)	21,395	
Mech. Room Condition	Negative Pressure, Roomy, Dirty	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	N/A
Chilled Water Return EMCS Thermistor	YES	58
Hot Water Supply EMCS Thermistor	YES	N/A
Hot Water Return EMCS Thermistor	YES	125
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI on Supply	
Thermometers Notes	Thermometers not found on CW and HW Supply	
Flowmeters Notes		
CW	Upstream OK, Downstream OK	OK
HW	Upstream OK, Downstream OK	OK
General Notes	2 Mech. Rooms (1 HW, 1CW) Steam to HW Conversion	
Picture	NO	

Building	OLD - Old Education Building	Thermometer Reading (F)
Function	Classrooms, Offices	
Conditioned Area (ft^2)	10,850	
Mech. Room Condition	Clean	
Accessibility of Thermometers	OK	
Accessibility of Flowmeters	OK	
Chilled Water Supply EMCS Thermistor	YES	54
Chilled Water Return EMCS Thermistor	YES	Broken
Hot Water Supply EMCS Thermistor	YES	130
Hot Water Return EMCS Thermistor	YES	Broken
Chilled Water Flowmeter	DI on Return	
Hot Water Flowmeter	DI	
Thermometers Notes	Thermometers on CW and HW Return are Broken	
Flowmeters Notes		
CW	Upstream OK, Downstream OK	OK
HW	Upstream OK, Downstream OK	OK
General Notes	Steam to HW Conversion	
Picture	NO	

Deliverables 3 & 5

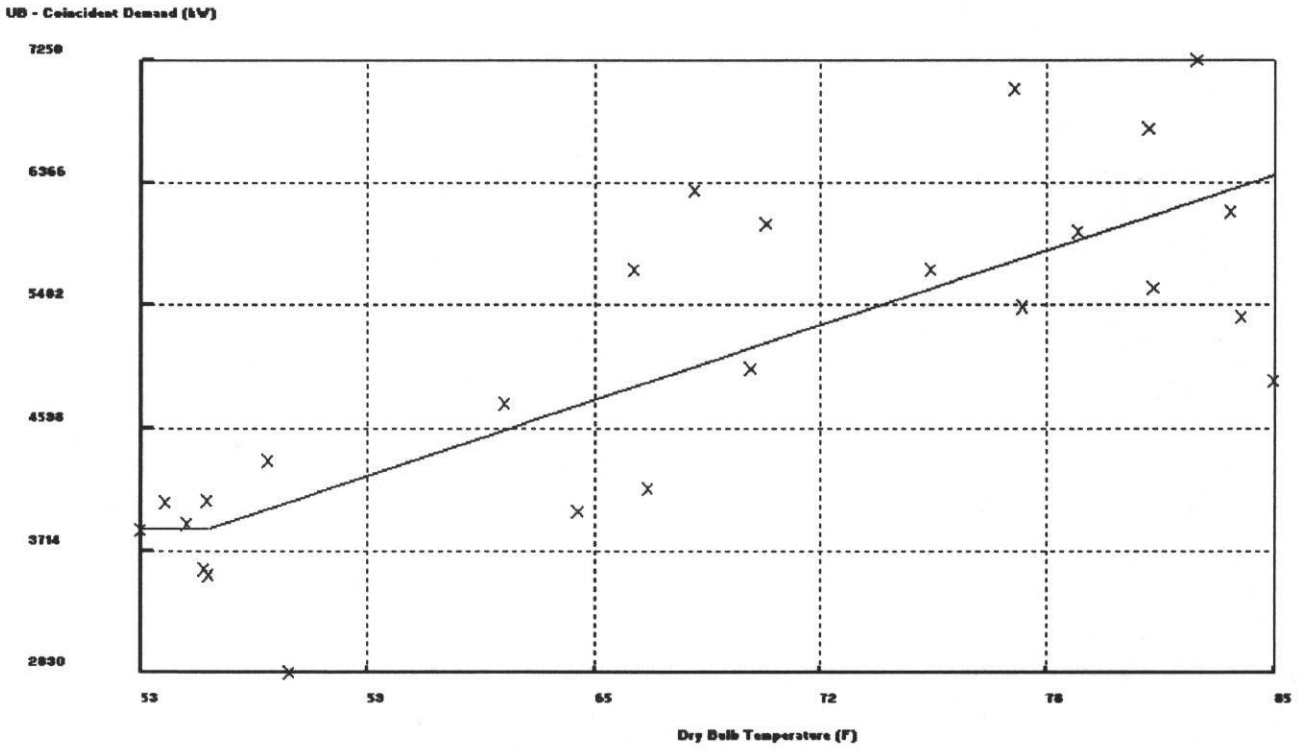
Figure 9.b. Dry Bulb Temperature from IAH - NWS





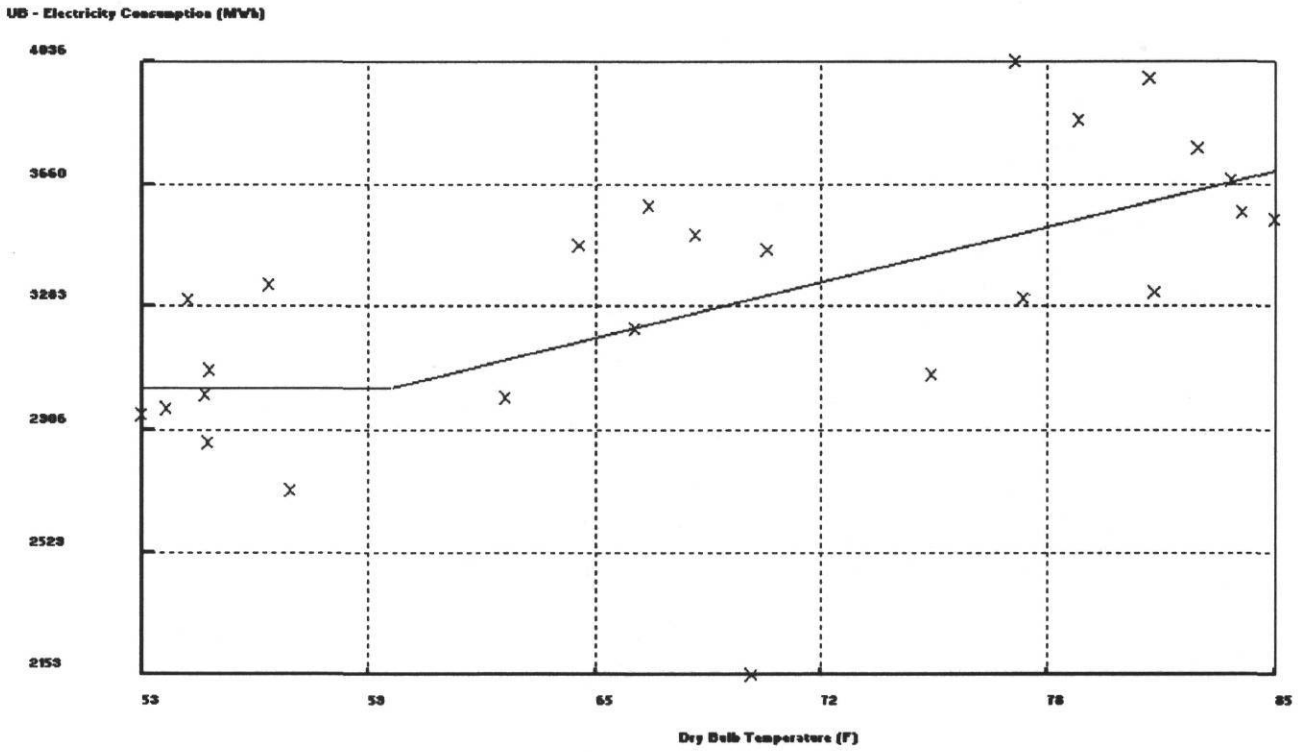
Model: 3P-CP (C). Non - Coincident Demand (kW) vs. Dry Bulb Temperature (F)
Ycp = 6040.4165 (139.9861) LS = 0.0000 (0.0000) RS = 33.5065 (8.6071) Xcp = 57.0632
N = 24 N1 = 8 N2 = 16 R2 = 0.41 adjR2 = 0.38 RMSE = 445.70 CV-RMSE = 6.9% p = 0.46
DW = 1.00 (p>0)

Utility Bills Non-Coincident Electricity Demand Baseline Model (7/25/96 - 8/25/98).



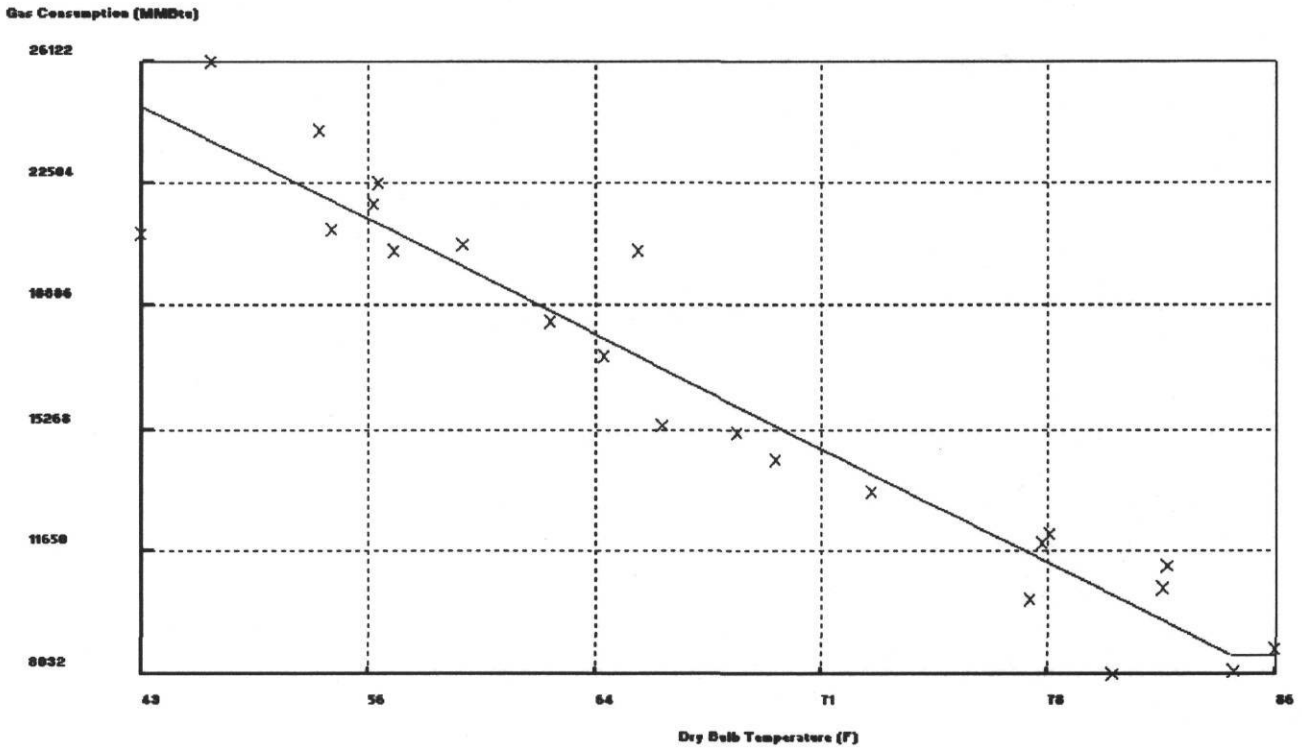
Model: 3P-CP (C). UB - Coincident Demand (kW) vs. Dry Bulb Temperature (F)
Ycp = 3877.9130 (240.9498) LS = 0.0000 (0.0000) RS = 83.4783 (13.3097) Xcp = 54.4728
N = 25 N1 = 6 N2 = 19 R2 = 0.63 adjR2 = 0.62 RMSE = 744.14 CV-RMSE = 14.7% p = 0.20
DW = 1.56 (i%)

Utility Bills Coincident Electricity Demand Baseline Model (7/25/96 - 8/25/98).



Model: 3P-CP (C). UB - Electricity Consumption (MWh) vs. Dry Bulb Temperature (F)
Ycp = 3031.1222 (104.6574) LS = 0.0000 (0.0000) RS = 26.6912 (7.4045) Xcp = 59.6536
N = 25 N1 = 8 N2 = 17 R2 = 0.36 adjR2 = 0.33 RMSE = 347.98 CV-RMSE = 10.5% p = 0.14
DW = 1.67 (i%)

Utility Bills Electricity Consumption Baseline Model (7/25/96 - 8/25/98).



Model: 3P-CP (H). Gas Consumption (MMBtu) vs. Dry Bulb Temperature (F)
Ycp = 8557.9549 (596.2299) LS = -460.4978 (29.6564) RS = 0.0000 (0.0000) Xcp = 84.1196
N = 23 N1 = 21 N2 = 2 R2 = 0.92 adjR2 = 0.92 RMSE = 1601.62 CV-RMSE = 9.9% p = 0.12
DW = 1.67 (i%)

Utility Bills Gas Consumption Baseline Model (7/31/96 -7/31/98).

Deliverable 4

Appendix A

San Bernard Electric Cooperative LP-8 Rate Schedule

Effective November, 1998

SAN BERNARD ELECTRIC COOPERATIVE, INC. Tariff for Electric Service	Section III	Sheet No. 39
	Revision	Page

SECTION TITLE: RATE SCHEDULES APPLICABILITY: ALL AREAS SERVED	PUC STAMP

409 Schedule LP-8 Large Power Service Revised

A. Availability

Available to industrial and large commercial consumers whose demands exceed 2,000 kilowatts for all uses, subject to the established rules and regulations of the Cooperative.

B. Type of Service

Three-phase, 60 Hertz, at available voltages. Frequency and voltage shall be subject to reasonable variation.

C. Monthly Rate

Each billing period the Customer shall be obligated to pay the following charges:

Rate Code 18 -

1. Customer Charge: $4,400.00 per meter

This charge is an availability charge for providing electric distribution service. In no event shall the Customer Charge be less than $4,400.00 or the amount specified in any contract with the Customer. The Customer Charge does not include any energy; and

2. NCP Demand Charge: $2.75 per kW of NCP Billing Demand

The NCP billing demand shall be the maximum kilowatt demand established by the consumer for any consecutive sixty (60) minute period during the month for which the bill is rendered, as indicated or recorded by a demand meter and adjusted for power factor as provided herein, but in no event less than fifty percent (50%) of the highest demand established in the preceding eleven (11) months; and

3. Energy Charge: $0.008568 per kWh; and

SAN BERNARD ELECTRIC COOPERATIVE, INC. Tariff for Electric Service	Section III	Sheet No. 40
	Revision	Page
SECTION TITLE: RATE SCHEDULES APPLICABILITY: ALL AREAS SERVED	PUC STAMP	

4. Power Cost

The cost of power to serve the Customer including but not limited to capacity, delivery, energy, and fuel charges for the billing period plus adjustments applied to the current monthly billing to account for differences in actual purchased electricity costs billed in previous periods. The power cost will be calculated using the billing units defined in the same manner as defined in the applicable Wholesale rate to the Cooperative including any ratchet provisions in the wholesale rate. The Customer's billing units for power cost may be adjusted for line losses, as determined by the Cooperative, to calculate the Customer's power cost at the wholesale supplier's metering point to the Cooperative.

D. Billing Adjustments

All bills shall be subject to applicable billing adjustments as provided in this tariff.

E. Power Factor Adjustment

The consumer agrees to maintain unity power factor as nearly as practicable. NCP demand charges may be adjusted to correct for average power factors less than ninety percent (90%). The demand shall be taken at 90% of the highest kVA demand recorded during the period.

F. Minimum Monthly Charges

The minimum charge shall be the highest one of the following charges plus any power cost charges and tax:

1. The Customer Charge plus the NCP Demand Charge.
2. The minimum monthly charge specified in the contract.

SAN BERNARD ELECTRIC COOPERATIVE, INC. Tariff for Electric Service	Section III	Sheet No. 41
	Revision	Page

SECTION TITLE: RATE SCHEDULES APPLICABILITY: ALL AREAS SERVED	PUC STAMP

G. Delivery Point

Unless otherwise specified in the service contract, the delivery point shall be the point of attachment to the Cooperative's primary substation facilities. All wiring, pole lines, and other equipment (except metering equipment) on the load side of the delivery point shall be owned and maintained by the consumer.

H. Demand and Power Factor Metering

If the rate schedule provides for measurement of demand or power factor, the Cooperative shall have the right to make such measurements by test at any time, or install meters permanently in order to determine the demand and power factor values to be used for billing.

I. Terms of Payment

All bills are due and payable monthly within sixteen (16) days after bills have been issued by the Cooperative. After this date a one-time late payment penalty of five percent (5%) of the outstanding balance will be added to the amount due.

SAN BERNARD ELECTRIC COOPERATIVE, INC. Tariff for Electric Service	Section III	Sheet No. 47
	Revision	Page

SECTION TITLE: RATE SCHEDULES APPLICABILITY: ALL AREAS SERVED	PUC STAMP

E. Conditions of Service

1. Security lighting equipment shall be owned, maintained, and operated by the Cooperative.
2. Faulty or failed lighting equipment will be repaired by Cooperative within a reasonable period during regular working hours only.
3. The Cooperative will provide non-standard fixtures in standard wattages (100 watt and 250 watt) for high pressure sodium lighting at the above monthly rates where there is no risk due to engineering or safety considerations and the consumer will pay the difference between standard and non-standard fixture cost.

F. Terms of Payment

All bills are due and payable monthly within sixteen (16) days after the bills have been issued by the Cooperative.

Appendix B

San Bernard Electric Cooperative LP-8 Rate Schedule

Effective Prior to November, 1998

SAN BERNARD ELECTRIC COOPERATIVE, INC.

SECTION:	Section No. III
RATE SCHEDULES	Sheet No. 39
	Effective Date_____
	Revision No. 1
APPLICABILITY:	Page_____ of _____

409 Schedule LP-8 - Large Power Service Prairie View A&M

Availability

Available to industrial and large commercial consumers whose demands exceed 2,000 kilowatts for all users, subject to the established rules and regulations of the Cooperative.

Type of Service

Three-phase, 60 hertz, at available voltages. Frequency and voltage shall be subject to reasonable variation.

Monthly Rate

Customer Charge:	$4,480.00 per month
NCP Demand Charge:	$2.75 per kW of Billing Demand per month
LCRA Demand Charge:	$4.46 per kW of Billing Demand
Energy Charge:	$0.034645 per kWh for all kWh

Billing Adjustments

All bills shall be subject to applicable billing adjustments as provided in this tariff.

Determination of NCP Billing Demand

The billing demand shall be the maximum kilowatt demand established by the consumer for any consecutive sixty (60) minute period during the month for which the bill is rendered, as indicated or recorded by a demand meter and adjusted for power factor as provided herein, but in no event less than fifty percent (50%) | T

PUBLIC UTILITY COMMISSION OF TEXAS
APPROVED
JAN 27 '92 DOCKET 10549
CONTROL # 10861
TARIFF CLERK

SECTION: RATE SCHEDULES	Section No. III Sheet No. 40 Effective Date Revision No. Page ____ of ____
APPLICABILITY:	

of the highest demand established in the preceding eleven (11) months.

Determination of LCRA CP Billing Demand

The billing demand shall be defined in the same manner in which the billing demand is defined in the applicable wholesale rate including all adjustments specified in the applicable rates and subject to the same power factor correction as defined in the applicable wholesale rate.

Power Factor Adjustment

The consumer agrees to maintain unity power factor as nearly as practicable. NCP demand charges may be adjusted to correct for average power factors lower than ninety percent (90%). The demand shall be taken at 90% of the highest kVA demand recorded during that period.

Minimum Monthly Charges

The minimum monthly charge shall be the highest one of the following charges plus any power cost adjustment charge and tax:

1. The Customer Charge plus the Demand Charge.
2. The minimum monthly charge specified in the contract.

Delivery Point

Unless otherwise specified in the service contract, the delivery point shall be the point of attachment

SECTION: RATE SCHEDULES	Section No. III Sheet No. 41 Effective Date Revision No. Page ____ of ____
APPLICABILITY:	

primary substation facilities. All wiring, pole lines, and other equipment (except metering equipment) on the load side of the delivery point shall be owned and maintained by the consumer.

Demand and Power Factor Metering

If the rate schedule provides for measurement of demand or power factor, the Cooperative shall have the right to make such measurements by test at any time, or install meters permanently in order to determine the demand and power factor values to be used for billing.

Terms of Payment

All bills are due and payable monthly within sixteen (16) days after bills have been issued by the Cooperative. After this date a one-time late payment penalty of five percent (5%) of the outstanding balance will be added to the amount due.

Appendix C

Houston Light & Power LOS(A) and SEI rate schedules

HOUSTON LIGHTING & POWER COMPANY
HL&P 79

LARGE OVERHEAD SERVICE (A)-LOS-A

AVAILABILITY

From 138,000 volt, three-phase, 60 hertz alternating current, overhead lines which have been made available for this service.

APPLICATION

To all electric service supplied at one location and measured through one meter when the Customer owns, operates and maintains all facilities (except metering equipment) necessary to receive three-phase, 60 hertz alternating current service at 138,000 volts or higher.

Energy cannot be resold or shared. If Customer has electric generating capacity installed and desires standby service, additional contract arrangements will be required.

MONTHLY BILL

To determine the amount of the monthly bill to be paid a calculation shall be made each month under (1) and (2) below, subject in each case to the applicable adjustments stated under (3) below, and the Customer shall pay the higher of the two amounts thus determined:

(1) Rate

(a)	Facilities Charge	$2.634 per month.
(b)	Demand Charge	
	Primary Kva Charge	$14.220 which includes 2.000 Primary Kva, plus
		$7.11 per Kva for all additional Primary Kva
	Secondary Kva Charge	$2.20 per Kva for all Secondary Kva.
(c)	Energy Charge	$.004874 per Kwh for the first 295 Kwh per Primary Kva, plus

$.011071 per Kwh for the next 289 Kwh per Primary Kva, plus

$.005250 per Kwh for all additional Kwh.

(d) Fuel Charge — Amount determined in accordance with Rider FC.

(2) Minimum Bill

The Primary Kva charge applicable to the current month plus the monthly Facilities Charge.

(3) Adjustments

(a) Plus an amount determined in accordance with Rider PCRF.

(b) In the event that Customer's Monthly Bill is based upon a period of less than 27 days or more than 33 days, the Kva prices, facilities charge and the Kwh per Kva quantities expressed in item "(1) Rate" above, shall be adjusted by multiplying by a ratio determined by dividing the actual number of days by 30 days.

(c) Company has 69,000 volt service available in certain areas which it intends to replace with 138,000 volt service. If Customer takes service at 69,000 volts and has not provided the capability in Customer's substation to receive 138,000 volt service or higher, the Primary Kva charge and Secondary Kva charge shall be increased by adding $0.10 per Kva to all such Kva charges.

(d) For service within the incorporated limits of a municipality which imposes a municipal franchise fee upon the revenues received by Company within that municipality, except on municipal accounts within municipalities which have signed an appropriate Franchise Agreement, added to and separately stated on each customer's bill will be an amount equal to the municipal franchise fee adjusted for the revenue related effect of said fee plus the associated revenue related costs of (i) the state gross receipts tax, (ii) the Public Utility Commission assessment, (iii) uncollectible accounts and (iv) factoring expense.

DEFINITION OF ON-PEAK HOURS AND OFF-PEAK HOURS

Company's On-Peak hours, for the purposes of this rate schedule, are designated as of the date hereof as being from 8 a.m. to 10 p.m. each

HOUSTON LIGHTING & POWER COMPANY
HL&P 79

Monday through Friday starting on May 15 and continuing through October 15 each year. Labor Day and Independence Day (July 4) shall not be considered On-Peak. If July 4 occurs on Sunday then the following Monday shall not be considered On-Peak. The Company's On-Peak hours may be changed from time to time and Customer will be notified 12 months prior to such change becoming effective.

Company's Off-Peak hours, for the purposes of this rate schedule, are all hours of the year not designated as On-Peak hours.

DEFINITION OF ON-PEAK KVA, ANNUAL ON-PEAK KVA AND OFF-PEAK KVA

The terms "On-Peak Kva," "Annual On-Peak Kva" and "Off-Peak Kva" shall be defined as follows:

(1) On-Peak Kva is the average Kva supplied during the four fifteen minute periods of maximum use during the On-Peak hours of the billing month.

(2) Annual On-Peak Kva is the highest On-Peak Kva established in the 12 months ending with and including the current billing month, but not less than the minimum Annual On-Peak Kva amount specified in Customer's Agreement with Company for electric service.

(3) Off-Peak Kva is the average Kva supplied during the four fifteen minute periods of maximum use during the Off-Peak hours of the billing month.

DETERMINATION OF PRIMARY KVA AND SECONDARY KVA TO BE USED IN CALCULATING THE MONTHLY BILL

The Primary Kva and the Secondary Kva to be used in calculating the Monthly Bill shall be determined in accordance with the following provisions:

(1) If the Off-Peak Kva is equal to or less than the On-Peak Kva, then the highest of the following will be billed as Primary Kva:

(a) The On-Peak Kva;
(b) 90% of Annual On-Peak Kva; or
(c) 2,000 Kva.

(2) If the Off-Peak Kva is greater than the On-Peak Kva but equal to or less than the Annual On-Peak Kva, then the highest of the following will be billed as Primary Kva:

(a) The Off-Peak Kva;
(b) 90% of the Annual On-Peak Kva; or
(c) 2,000 Kva.

(3) If the Off-Peak Kva is greater than the Annual On-Peak Kva, then the Annual On-Peak Kva will be billed as Primary Kva and the excess of the Off-Peak Kva over the Annual On-Peak Kva will be billed as Secondary Kva except, as limited herein. The amount of Off-Peak Kva billed as Secondary Kva shall be limited to the maximum amount of Secondary Kva specified in Customer's Agreement with Company for electric service with all additional Kva billed as Primary Kva. Secondary Kva will not be made available to Customer if additional investment would be required to serve the Off-Peak load. If Customer contracts for Secondary Kva, but in a period of twelve billing months does not use in one or more months at least 50% of the contracted amount, such contracted Secondary Kva will be reduced to the maximum amount actually used during said period of twelve billing months. In case of such reduction, Customer will be given written notice of the amount of Secondary Kva still available and the effective date of the reduction.

(4) The above provision number (3) is not applicable to (a) new customers taking service for the first time during the period starting on October 16 and continuing through May 14 or (b) existing customers contracting for additional Secondary Kva during such period. Under such circumstances, unless the Annual On-Peak Kva has been determined by mutual written agreement, the Off-Peak Kva will be billed as Primary Kva until the following May 15.

PAYMENT

Bills are due when rendered. A bill for electric service is delinquent if payment is not received by the Past Due Date shown on the Electric Service Bill. The Past Due Date will not be less than sixteen (16) days from the date the bill is mailed to Customer.

If the total amount due is not received on or before the Past Due Date, a one time late payment charge will be assessed. The charge will be equal to a percentage of the total amount due exclusive of sales tax for each day, up to a maximum of fourteen (14) days, after the Past Due Date that payment is received. The percentage will be the daily non-compounded equivalent to the prime interest rate effective at Texas Commerce Bank, National Association, Houston, Texas on the meter read date, plus two percentage points, or, if the meter read date falls on a holiday or weekend, the preceding business day. If the total amount due is not received on or before the fourteenth (14th) day after the Past Due Date, the late payment charge to be assessed will become 5% of the total bill exclusive of sales tax.

In no case will the late payment charge exceed 5% of the total bill exclusive of sales tax.

HOUSTON LIGHTING & POWER COMPANY
HL&P 79

METERING

The Company may install remote metering equipment to obtain information with which to determine the amount of the monthly bill. Customer may, at any time, install metering instruments to check the service supplied under this schedule.

The Company may at its option measure service on the low voltage side of the Customer's transformers in which event the Kva and Kwh recorded by the Company's metering instruments will be adjusted to compensate for transformer losses on the basis of data furnished by the manufacturer of the Customer's transformers. When the manufacturer is unable to supply the necessary data the adjustment will be based on tests conducted by the Company on the Customer's transformers.

CONTRACT PERIOD

For customers first receiving service hereunder, the initial term of contract shall be five (5) years. For customers previously receiving service under Rate Schedules MGS, LGS, LOS-A, or LOS-B, and for whom no additional facilities are required, such prior electric service shall be counted towards the five year initial term. A credit for past service is given under this section if the switching customer fully compensates the Company for the cost of any additional facilities required.

NOTICE

Electric Service furnished under this rate schedule is subject to the Company's Terms and Conditions for the Sale of Electric Service, Sheet No. E1.

HOUSTON LIGHTING & POWER COMPANY
HL&P 7634

SUPPLEMENTAL AGREEMENT FOR STATE OWNED EDUCATIONAL INSTITUTIONS

That certain "Application and Agreement for Electric Service", Rate Schedule _____, entered into by and between _____, herein called "Customer", and Houston Lighting & Power Company, herein called "Company", which is to begin not later than _____, 19 ___ (hereinafter called the "Agreement"), is hereby supplemented and amended as follows:

1. Service provided herein is available only when taken in conjunction with service received at one point of delivery under Rate Schedule LGS.

2. Customer verifies that it is a state owned educational institution who takes Electrical Service billed under Rate Schedule LGS and such service is taken at distribution voltage, where Primary KVA is consistently above 5,000 KVA, as measured by taking the annual average primary KVA over the prior twelve month period.

3. The monthly bill shall be the sum of calculations made under (1) below or the calculations made under (2) below, whichever is higher, plus the applicable adjustments stated under (3) below.

   (1) Rate

(a)	Facilities Charge	Per Rate Schedule LOS-A
(b)	Demand Charge	
	Primary Kva Charge	Per Rate Schedule LOS-A plus $1.80 per primary KVA
	Secondary Kva Charge	Per Rate Schedule LOS-A
(c)	Energy Charge	Per Rate Schedule LOS-A
(d)	Fuel Charge	Amount determined in accordance with Rider FC.

(2) Minimum Bill

The Primary Kva Charge applicable to the current month plus the monthly Facilities Charge.

(3) Adjustments

(a) Plus an amount determined in accordance with Rider PCRF for the LGS Rate Schedule

(b) For service within the incorporated limits of a municipality which imposes a municipal franchise fee upon the revenues received by Company within that municipality, added to and separately stated on each Customer's bill will be an amount equal to the municipal franchise fee adjusted for the revenue related effect of said fee plus the associated revenue related costs of (i) the state gross receipts tax, (ii) the Public Utility Commission assessment, (iii) uncollectible accounts and (iv) factoring expense.

4. Definition of on-peak hours and off-peak hours will be in accordance with Rate Schedule LOS-A.

5. The definition of on-peak kva, annual on-peak kva and off-peak KVA will be in accordance with Rate Schedule LOS-A.

6. Determination of primary kva and secondary kva to be used in calculating the bill will be in accordance with Rate Schedule LOS-A.

7. Payment terms will be in accordance with Rate Schedule LOS-A.

8. The contract period will be in accordance with Rate Schedule LGS.

9. Except as expressly supplemented and amended by paragraphs 1. through 8 above, the Agreement is not otherwise affected.

HOUSTON LIGHTING & POWER COMPANY
HL&P 7634

10. This Supplemental Agreement is not binding upon either party unless and until it has been duly executed in writing by both parties.

HOUSTON LIGHTING & POWER COMPANY

By _____
Vice-President

Attest _____
Secretary

Date _____

_____
Customer

By _____

_____
(Name printed or types)

Title _____

Attest _____
Secretary

Date _____

Deliverable 6

SBSA0495

Sbisa Dining Hall

Texas A&M University

137,913 square feet

Site Contact	ESL Metering Contact
Mr. Charles Darnell, Jr.	Jeff Haberl
Physical Plant Administration	053B WERC
Texas A&M University	Texas A&M University
(409) 845-5318	College Station, TX 77843-3123
Gene Stewart	(409) 845-9213
(409) 845-5511	

Summary of Energy Consumption

	Measured Use	% hours reported	Unit Cost	Estimated Cost
Electricity	243634 kWh	100	$0.02788	$6793
Peak 60 Minute Demand	612 kW	100	-	-
Chilled Water	1210.5 MMBtu	100	$4.670	$5653
Hot Water	553.7 MMBtu	100	$4.750	$2630

Peak 60 minute demand was recorded at 1300 Monday 03/23/98.
There were 744 hours in this month.

Comments

MSC00454

Memorial Student Center

Texas A&M University

368,935 square feet

Site Contact	ESL Metering Contact
Mr. Charles Darnell, Jr.	Jeff Haberl
Physical Plant Administration	053B WERC
Texas A&M University	Texas A&M University
(409) 845-5318	College Station, TX 77843-3123
Gene Stewart	(409) 845-9213
(409) 845-5511	

Summary of Energy Consumption

	Measured Use	% hours reported	Unit Cost	Estimated Cost
Electricity	*614907 kWh	100	$0.02788	$17144
Peak 60 Minute Demand	1053 kW	100	-	-
Chilled Water	3089.5 MMBtu	100	$4.670	$14428
Hot Water	1756.2 MMBtu	100	$4.750	$8342

Peak 60 minute demand was recorded at 1100 Thursday 03/26/98.
There were 744 hours in this month.

Comments

HECC0435

Harrington Tower

Texas A&M University

130,844 square feet

Site Contact	ESL Metering Contact
Mr. Charles Darnell, Jr.	Jeff Haberl
Physical Plant Administration	053B WERC
Texas A&M University	Texas A&M University
(409) 845-5318	College Station, TX 77843-3123
Gene Stewart	(409) 845-9213
(409) 845-5511	

Summary of Energy Consumption

	Measured Use	% hours reported	Unit Cost	Estimated Cost
Electricity	113143 kWh	100	$0.02788	$3154
Peak 60 Minute Demand	254 kW	100	-	-
Chilled Water	274.1 MMBtu	100	$4.670	$1280
Hot Water	44.9 MMBtu	100	$4.750	$213

Peak 60 minute demand was recorded at 1200 Wednesday 03/25/98.
There were 744 hours in this month.

Comments

TEAG0445

Teague

Texas A&M University

63,515 square feet

Site Contact	ESL Metering Contact
Mr. Charles Darnell, Jr.	Jeff Haberl
Physical Plant Administration	053B WERC
Texas A&M University	Texas A&M University
(409) 845-5318	College Station, TX 77843-3123
Gene Stewart	(409) 845-9213
(409) 845-5511	

Summary of Energy Consumption

	Measured Use	% hours reported	Unit Cost	Estimated Cost
Electricity	127348 kWh	100	$0.02788	$3550
Peak 60 Minute Demand	279 kW	100	-	-
Chilled Water	515.3 MMBtu	100	$4.670	$2406
Hot Water	305.0 MMBtu	100	$4.750	$1449

Peak 60 minute demand was recorded at 1100 Wednesday 03/11/98.
There were 744 hours in this month.

Comments

LIBR0468

Evans Library (Old)

Texas A&M University
812,289 square feet

Site Contact	ESL Metering Contact
Mr. Charles Darnell, Jr.	Jeff Haberl
Physical Plant Administration	053B WERC
Texas A&M University	Texas A&M University
(409) 845-5318	College Station, TX 77843-3123
Gene Stewart	(409) 845-9213
(409) 845-5511	

Summary of Energy Consumption

	Measured Use	% hours reported	Unit Cost	Estimated Cost
Electricity	848602 kWh	100	$0.02788	$23659
Peak 60 Minute Demand	1409 kW	100	-	-
Chilled Water	3568.6 MMBtu	100	$4.670	$16665
Hot Water	213.2 MMBtu	100	$4.750	$1013

Peak 60 minute demand was recorded at 1500 Wednesday 03/25/98.
There were 744 hours in this month.

Comments

ZACH0518

Zachry Engineering Center

Texas A&M University

324,400 square feet

Site Contact	ESL Metering Contact
Mr. Charles Darnell, Jr.	Jeff Haberl
Physical Plant Administration	053B WERC
Texas A&M University	Texas A&M University
(409) 845-5318	College Station, TX 77843-3123
Gene Stewart	(409) 845-9213
(409) 845-5511	

Summary of Energy Consumption

	Measured Use	% hours reported	Unit Cost	Estimated Cost
Electricity	560275 kWh	100	$0.02788	$15620
Peak 60 Minute Demand	1114 kW	100	-	-
Chilled Water	801.6 MMBtu	100	$4.670	$3743
Hot Water	240.8 MMBtu	94	$4.750	$1144

Peak 60 minute demand was recorded at 1500 Monday 03/30/98.
There were 744 hours in this month.

Comments