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Preliminary Study of O&M Opportunities at the University of Texas Medical Branch at Galveston

Submitted to the
Energy Management and Operations Department at UTMB Galveston
By the
Energy Systems Laboratory

Dr. Mingsheng Liu
Dr. Yeqiao Zhu
Dr. David Claridge
Dr. Jeff Haberl

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Executive Summary

At the request of the Energy Management and Operations Department at the University of Texas Medical Branch at Galveston, the Energy Systems Laboratory at the Texas A&M University performed the preliminary study of O&M Opportunities at the 49 buildings (over 3.5 million ft^2 floor area) and its central plant.

The central plant provides the chilled water and steam to all of these buildings. Constant air volume systems are used in 48 buildings while single duct variable air volume systems are used in the Medical Research Building, which was built in 1993.

Three major O&M opportunities were identified in the UTMB buildings and the central plant:

- Optimizing the outside air reset schedules of the air handling units;
- Controlling the steam pressure at 125 psi or lower; and
- Optimizing the chilled water and cooling tower water set points.

Summary of Potential Savings for each O&M Measure Based on the Measured Energy-Use Data from April 1, 1993 to March 30, 1994

Item		Consumption	Savings	% Savings	$ Savings	Note
Buildings	Steam (MMBtu)	301,274	132,260	44%	$598,000	Improved operation Optimized schedule
	Ch-water (MMBtu)	906,540	188,660	21%	$1,336,000	Improved operation Optimized schedule
Central Plant	Electricity (MkWh)	69,711	15,221	22%	$852,000	Increase chilled water temperature
	Gas (MCF)	437,563	32,051	7%	$83,000	Increase boiler efficiency
Total					$2,868,000	

Note: Gas price $2.57/MCF; Ch-water price $7.08/MMBtu ($0.085/ton-hour); Steam price $4.524/MMBtu; and Electricity price $0.056/kWh.

The simultaneous heating and cooling can be reduced substantially by optimizing the cold and hot deck set points. Over $1,934,000/yr in potential savings were identified in the 49 buildings by using the simplified engineering modeling method. A detailed analysis is required to determine the optimized operation schedules for each building before implementing this O&M measure.

The average boiler efficiency was 0.67 from April 1, 1993 to March 30, 1994. This relatively low efficiency was caused by setting the supply steam pressure at 145 psi from March to October. If the steam pressure is set at 125 psi year around, the boiler efficiency can be increased to 0.72. Consequently, more than 32,000 MCF of gas can be saved. Based on the current gas price of $2.57/MCF, this O&M measure will reduce the gas bill by $82,000/yr. It is suggested an engineering analysis be performed to determine the lowest steam pressure possible to maximize the boiler efficiency.

The annual average kW/ton may be reduced from 0.92 to 0.72 by increasing the chilled water supply temperature (from 40 °F to a range of 41°F -45°F) and decreasing the cooling tower supply water temperature (from a range of 70°F-88°F to a range of 65°F-86°F). Consequently, the electricity consumption at the central plant may be reduced by 15,222 MkWh/yr, or 22% of the measured electricity consumption from April 1, 1993 to March 30, 1994. The electricity bill could be reduced by $852,000/yr based on the average electricity cost of $0.056/kWh.

The sum of these potential savings is $2,868,000/yr. However, the total savings will be smaller than this if all three O&M measures are implemented because the reduction of chilled water and steam use in the buildings will decrease the savings at the central plant.

It is important to emphasize the preliminary nature of this study. Although boiler efficiency may be improved by simply reducing the steam pressure to 125 psi, implementation of the other savings measures requires more investigation and engineering analysis at the individual building level.

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1.0 Introduction

At the request of the Energy Management and Operations Department at the University of Texas Medical Branch (UTMB) at Galveston, the Energy Systems Laboratory of Texas A&M University performed a preliminary study of O&M Opportunities in the 49 buildings (over 3.5 million ft^2 floor area) at UTMB and its central plant.

The central plant provides the chilled water and steam to all of these buildings. Constant air volume systems are used in 48 buildings while single duct variable air volume systems are used in the Medical Research Building, which was built in 1993.

This preliminary study investigated the potential savings from

- Improving the outside air reset schedules;
- Improving the boiler efficiency; and
- Improving chiller operations.

This report summarizes the basic procedures, recommendations, and potential savings for the suggested O&M options.

2.0 Improved Hot and Cold Deck Operation Schedule Analysis

Constant air volume systems are used in 48 major UTMB buildings which have a total floor area of 3,354,000 ft^2 according to a survey performed by Central Plant on September 1994. These constant air volume systems use cold deck set points of 55°F or less and vary hot deck temperature from 100°F to 80°F according to outside air temperature.

These constant volume systems consumed 906,560 MMBtu ($6,418,000) of chilled water and 301,270 MMBtu ($1,363,000/yr) of steam from April 1, 1993 to March 30, 1994 according to Lone Star Energy Corporation's records. These buildings have an average thermal energy use index of 0.3385 MMBtu/ ft^2 yr, or $2.32/$ft^2$ yr. Improved hot and cold deck reset schedules can reduce the thermal energy consumption substantially by reducing reheat. The analysis procedures used and results are summarized below.

2.1 Method

The characteristic parameters were either collected or measured from a site visit to each building and air handling unit (AHU). Then, a simplified engineering model was developed for each building, sometimes for each AHU, to simulate building energy consumption under the Energy Management and Control System (EMCS) operating schedules as well as under improved hot and cold deck schedules. The differences between Lone Star's measured consumption and simulated consumption under current schedules are considered as potential maintenance savings since the requested set points are often not maintained due to a number of mechanical problems, such as unbalanced water loops and control valve problems, which were observed during the site visit. The differences between simulated energy consumption under the current and the improved schedules are considered to be the potential improved operating savings.

Table 1. Summary of Building and AHU Parameters Used in the Model Simulations

Bldg name	AC area sq ft	System type & numbers	Total CFM	O.A. frac.	Temperatures (measured & set points)							
					Pre-heat		Pre-cool		Hot		Cold	
					mea.	sp.	mea.	sp.	mea.	sp.	mea.	sp.
Ashbel Smith	46,508	scv-9	50,657	0.36	62.3	45					59	52
Gail Borden	59,924	dcvp-5,scv-3	71,750	0.28	76.2	45	48	56	85.2	#1	55~	53
Graves bldg	58,423	dcvp-2	94,309	0.16	66.4	52	66.9	58	89.8	#2	56.4	55
Child Center	191,476	dcvp-5,scv-1	222,360	0.29	73.5	45	61.7	57	89.9	#3	53.9	55
Old Children	19,280	scv-3	13,508	0.04	78.8*						53.7	52
John Sealy	312,392	dcv-1,scvp-4,scv-17	380,780	0.39	78.3/67,79.5*	45	57	57	89.2	#4	61.4	55
John Hospital	163,337	dcvp-7,scvp-6,scv-2	158,958	0.45	63.6	52	57.4	58	81.5	#3	55.4~	55
Administration	90,310	dcvp-2,scv-2	134,400	0.13			66.5	60	84.5	#3	66/55.6	55
Communica.	18,088	scv-4	15,309	0.28								55
Randall	206,560	dcvp-3,scv-5,fcu-13	161,440	0.26	72.6	53	68.4	58	86	#5	57.8~	55
Microbiology	35,856	scv-3	24,311	0.57	69.8	45					56.5	55
Mary Moody	55,133	dcvp-1	61,725	0.18	55.9	52	83.8	56	98	#6	54.8	55
Animal Resour.	26,677	dcvp-2	41,800	1.00	54^	52	46^	55	85^	#6	50.2^	55
Physical Plant	38,626	scv-2	32,406	0.26	65*						54/43.8	55
New Shine	215,855	fcu-20	17,400	0.00								55
Surgical Annex	7,768	scv-2	8,000	0.00							59	55
Brackenridge	13,874	scv-2	19,500	0.66	65.5*						54.3	55
Caly Hall	12,344	scv-2	11,155	0.09							55^	55
Bethel Hall	14,439	scv-2	11,155	0.09								55
Nolan Hall	17,010	Apt.unit-28	29,000	0.00								55
Visant Hall	14,275	Apt. unit-2	20,000	0.00								55
Morgan Hall	14,439	Apt.unit-2	12,000	0.00								55
League Hall	14,440	Apt.unit-2	21,800	0.00								55
Unit D	29,668	Apt.unit-3	24,720	0.00								55
Machine Room	1,878	scv-1	4,400	0.00								55
Administration	57,169	scv-11	82,011	0.05							54.6	55
William	98,219	scvp*-3,scvp-5,scv-1	132,490	0.22			63.6	60			67.3/55	55
Hospital Clinic	214,116	dcvp-4,scv-2	210,770	0.15	45	45	66	56	92	#7	54.5~	55
Allied Heath	148,880	dcvp-4,scv-3	197,373	0.17			67	60	88.7	#8	63.2/55	55
Medical Re.	280,614	scvp-10	60,900	1.00	67.1	52		60			55.7	55
Emergency	123,948	dcvp-4,scv-4	101,057	0.13			55	60	84.7	#9	53.8~	55
Phamacology	42,314	scvp-1,scv-3	43,705	0.33	66.3,73.2*	45		60			65/54.7	55
Maurice Ewing	44,242	dcvp-1,scv-2	49,507	0.63	69.2	45	73.7	60	88.2	#9	73.7/53	55
Parking	19,922	scvp*-2,scv-2	26,440	0.17	63.8	52	57.4	60			64/52.5	55

Note: 1. Control schedule for Thd:

No.#1: if Ta>85 then Thd=75 else Thd=min{90,90-0.38(Ta-45)}
No.#2: if Ta>95 then Thd=80 else Thd=min{100,80+0.33(95-Ta)}
No.#3: if Ta>95 then Thd=75 else Thd=min{95,75+0.33(95-Ta)}
No.#4: if Ta>94 then Thd=95 else Thd=min{102,95+0.16(94-Ta)}
No.#5: if Ta>90 then Thd=80 else Thd=min{93,80+0.25(90-Ta)}
No.#6: if Ta>80 then Thd=80 else Thd=min{100,80+0.5(80-Ta)}
No.#7: if Ta>80 then Thd=80 else Thd=min{95,80+0.375(80-Ta)}
No.#8: if Ta>80 then Thd=87 else Thd=min{102,87+0.375(80-Ta)}
No.#9: if Ta>80 then Thd=85 else Thd=min{100,85+0.375(80-Ta)}

2. "^ " site visit measured value
3. "~" Average temperature from part data measured
4. "*" Tph for mixed or return air of scv system.
5. "T/T" Tmax/Tmin.
6. scvp*: single duct constant valume with by-pass
7. scv: single duct constant valume
8. dcvp: dual duct constant volume with out side air pre-treatment unit
9. dcv: dual duct constant volume

The building floor areas were supplied by the Energy Management and Operations Department at the UTMB. The AHU information, such as types, schematic diagrams, outside air intakes and total flow rates, was collected from design drawings, air balance reports, and site measurements. The current hot and cold deck control schedules were obtained from UTMB's EMCS control programs. We also measured the cold and hot deck temperature for a number of AHUs. This information is presented in Appendix A and was used for the model simulations. This information is condensed in Table 1 for quick reference.

The improved hot and cold deck operation schedules were developed based on our experience with five UTMB buildings. This information is summarized in Table 2. In the model analysis, these optimized schedules were used for each building. Although these operating schedules can be used to determine the potential O&M savings for entire campus, they can not be regarded as the optimized operating schedules for specific buildings. The optimized operating schedules have to be developed for each building by a detailed engineering analysis.

Table 2: Summary of the Improved Hot and Cold Deck Operation Schedules

System	Deck	Schedule
Dual Duct	Cold	Min(60, 60-0.125(T_a-60))
	Hot	If T_a>80°F then off If T_a<80°F then Min(85, 85-0.25(T_a-60)
Pretreat	Preheat	If T_a<40°F then 40 If T_a>40°F then off
	Precool	If T_a<60°F then off If T_a>60°F then Min(57, 57-0.125(T_a-60))
Single Duct	Cold	Min(61, 61-0.09(T_a-58))

2.2 Results

Since the measured chilled water and steam use are not available for each individual building, the predicted total consumption of the 49 buildings is compared with the measured total central plant consumption data.

Figure 1 shows the Lone Star measured and model simulated chilled water and steam consumption versus the ambient temperature. Simulated values are shown for the current operating schedules and for the improved or "optimal" schedules. It was found that the measured chilled water and steam consumption agreed well with the simulated consumption under the current operating schedules although measured values were slightly higher than the model prediction. This difference is considered as the potential savings by improving maintenance. Both the chilled water and steam consumption are reduced substantially using the improved operation schedules. This reduction is considered as the potential savings from improved operation.

The annual potential savings are summarized in Table 3. Improved maintenance can reduce the annual chilled water and steam consumption by 53,000 MMBtu/yr and 32,670 MMBtu/yr, respectively, for a total of $523,000/yr. Improved operation can reduce chilled water and steam consumption by 135,660 MMBtu/yr and 99,590 MMBtu/yr, respectively, or $1,411,000/yr. The total potential savings are $1,934,000/yr, or 25% of the current annual cost of $7,781,000.

Table 3: Summary of Thermal Energy Consumption at 49 UTMB Buildings from April 1, 1993 to March 30, 1994

	Consumption MBtu/yr		Potential Savings		
	Ch-water	Steam	Ch-water	Steam	Total
Measured Consumption	906,540	301,270	MMBtu/yr	MMBtu/yr	$/yr
Improved maintenance	851,650	268,600	53,000	32,670	$523,000
Improved operation	717,880	169,000	135,657	99,590	$1,411,000
Total					$1,934,000

Note: Chilled water price is $7.08/MMBtu, steam price is $4.524/MMBtu

Table 4: Summary of the Potential Operation Savings for 39 Buildings Which Were Simulated

Name	Base Consumption(MMBtu/yr)			Base Costs	Savings	Percent
	Ch-water	Steam	Total	$/yr	$/yr	Saving(%)
Shriner's Burns Institute(new)	2,435	3	2,439	$17,253	$0	0%
Surgical Research Annex	1,121	3	1,125	$7,950	$0	0%
Nolan Hall	4,058	3	4,061	$28,744	$0	0%
Vinsant Hall	2,803	3	2,807	$19,859	$0	0%
Morgan Hall	1,682	3	1,685	$11,922	$0	0%
League Hall	3,049	3	3,052	$21,600	$0	0%
Unit D	3,460	3	3,464	$24,510	$0	0%
Dorm Machine Room	613	3	617	$4,354	$0	0%
Medical Research Building	40,012	408	40,420	$285,131	$0	0%
Parking Garage-10th&Market(west)	3,944	30	3,974	$28,059	$0	0%
Bethel Hall	2,178	342	2,520	$16,967	$3,673	22%
Caly Hall	2,156	500	2,656	$17,526	$4,996	28%
Microbiology	7,150	321	7,471	$52,074	$6,775	13%
Communications Building	3,452	593	4,045	$27,123	$8,797	32%
Emergency Room	19,376	1,489	20,865	$143,918	$9,407	7%
Mary Moody Northen Pavilion	12,015	1,744	13,760	$92,956	$11,851	13%
Administration Building	21,474	3,479	24,953	$167,775	$12,880	8%
Animal Resource Center	16,363	3,493	19,856	$131,652	$13,964	11%
Brackenridge Hall	6,082	1,539	7,621	$50,023	$15,227	30%
Physical Plant	7,066	2,545	9,611	$61,941	$20,869	34%
TDCJ Hospital(Randal)	35,996	2,932	38,927	$268,116	$21,706	8%
Graves Hospital	16,151	3,635	19,786	$130,794	$22,314	17%
Maurice Ewing Hall	15,148	2,395	17,543	$118,083	$24,973	21%
Pharmacology Building	10,253	2,214	12,467	$82,607	$25,040	30%
Gail Borden Building	16,255	2,722	18,977	$127,400	$25,440	20%
Old Children's Building	6,747	324	7,072	$49,235	$32,334	65%
Children's Hospital	47,050	6,553	53,603	$362,760	$32,888	9%
University Hospital Clinics	40,683	4,469	45,151	$308,253	$33,468	11%
School of Allied Health Scs&Nursing	36,095	6,999	43,093	$287,216	$39,365	14%
Administration Annex	15,803	6,371	22,174	$140,708	$41,253	29%
William C.Levin Hall	27,268	7,226	34,494	$225,748	$41,913	19%
Moody Library	16,043	10,336	26,379	$160,345	$44,006	27%
John W.McCullough Building	41,762	6,922	48,684	$326,990	$49,903	15%
Ashbel Smith Building(Old Red)	15,163	4,542	19,706	$127,902	$53,945	42%
John Sealy North	46,557	7,869	54,426	$365,223	$64,226	18%
Clinical Science Building	25,853	5,748	31,602	$209,043	$70,644	34%
Basic Science Building	67,068	19,887	86,955	$564,810	$152,139	27%
John Sealy Hospital	96,729	23,987	120,716	$793,359	$225,438	28%
John Sealy South	85,122	15,840	100,962	$674,724	$256,369	38%
Average	21,083	4,038	25,121	$167,536	$35,018	21%
Total	822,236	157,481	979,717	$6,533,875	$1,365,700	21%

Note: Steam consumption does not include the domestic hot water consumption.

Table 4 presents the potential operation savings for 39 buildings. The potential savings varies from $0 to $256,000/yr with an average of $35,000/yr, or 21% of the current steam and chilled water consumption. No potential savings were identified in 10 buildings where fan coil units or VAV systems and small systems are used.

The simulated building energy consumption under both the current and improved schedules and the potential savings are presented in Appendix B for each building.

3.0 Improved Boiler Efficiency Analysis

The Lone Star Energy central plant has two boilers which supply steam to UTMB buildings. These two boilers are each operated during alternative months according to Lone Star operators. These two boilers produced about 301,274 MMBtu steam with a total gas consumption of 437,563 MMCF from April 1, 1993 to March 30, 1994. The average boiler efficiency is about 0.67. It appears that the boiler efficiency can be improved. The analysis procedure and results are summarized below.

3.1 Method

First, we requested measured hourly data from the central plant including steam production, gas consumption, make up water, and steam pressure. Then, daily average values were produced based on the hourly data in order to simplify analysis. Finally, the daily average boiler efficiency was calculated according to the steam production and gas consumption as:

$$\eta = 0.971 \frac{E_{steam}}{MCF_{gas}}$$

where η is the boiler efficiency, E_{steam} is the boiler steam production (MMBtu/hr), and MCF_{gas} is the gas consumption (MCF/hr). Note that the impact of makeup water on the boiler efficiency is neglected and the gas was assumed to have a heat content of 1030 Btu/CF_{gas}.

Figure 2 shows the boiler efficiency and steam pressure in time series. It can be seen that the boiler efficiency varies from 0.55 to 0.75 and the steam pressure varies from 125 psi to 145 psi. When the steam pressure is approximately 125 psi, the boiler has efficiency values of 0.70. When the steam pressure is near 145 psi, the boiler efficiency drops to values generally in the range 0.60-0.66.

Figure 3 shows the steam production and steam pressure as time series. Very low steam production (about 32 MMBtu/hr) is observed in January 1994 and November and

December 1993, while the boilers have relatively high efficiency. Clearly, the boilers can run at high efficiency regardless of steam production if the steam pressure is at 125 psi.

Based on these observations, it is assumed that the boilers would have an average annual efficiency of 0.72 if operated at 125 psi, which is the measured average efficiency in January 1994. The gas consumption assuming 125 psi operation is then calculated as:

$$MCF_{gas} = 0.971 \frac{E_{steam}}{0.72}$$

3.2 Results

Table 4 presents the steam production, gas consumption and boiler efficiencies. The boilers produced 301,274 MMBtu/yr steam with a total gas consumption of 437,563 MCF/yr from April 1, 1993 to March 30, 1994. The annual average boiler efficiency was 0.67. If the boiler efficiency is increased to 0.72 by setting steam pressure to 125 psi, the boilers would drop to 405,512 MCF/yr with the same steam production of 301,274MMBtu/yr. Consequently, the annual potential gas savings are 32,051 MCF/yr, or 7% of the current annual consumption. If the gas price is $2.57/MCF, then the cost savings would be $82,000/yr.

Table 4: Summary of Boiler Efficiency Analysis

	Steam	Gas	Efficiency	Savings %
	MMBtu/yr	MCF/yr		
Current	301,274	437,563	0.67	
Improved	301,274	405,512	0.72	7

Figure 4 presents the current gas consumption and the predicted gas consumption for 125 psi operation.

4.0 Improved Chiller Operation Analysis

The Lone Star Energy central plant has 7 chillers with a total capacity of 19,400 Tons. The central plant produced about 906,540 MMBtu or 75,545,000 Ton-hr from April 1, 1993 to March 30, 1994. The central plant electricity consumption was about 69,711 Million kWh during the same period. Since no separated compressor electricity consumption data are available, the total electricity consumption data were used to investigate the chillers' efficiency. The analysis procedures and results are summarized below.

4.1 Method

The Energy Management and Operations Department at UTMB supplied the following hourly data: central plant electricity consumption, chilled water production, chilled water flow, chilled water supply and and return temperatures, cooling tower water flow, and cooling tower supply and return temperatures. The daily average data were produced using these hourly data.

The electricity consumption per ton-hr is calculated as the ratio of the central plant electricity consumption to the chilled water production. This parameter is then correlated with the average water temperatures at the condenser and evaporator by a linear regression. The average water temperature at the evaporator is taken as the average value of chilled water supply and return temperatures. The average water temperature at the condenser is taken as the average value of cooling tower supply and return temperatures.

After an improved cooling tower supply temperature schedule and an improved chilled water supply temperature schedule are developed, the average water temperatures at the condenser and evaporator are again determined. These temperature values are introduced into the regression formula obtained above to calculate the kW/ton under these improved schedules. The difference between the electricity consumption at this kW/ton

and measured kW/ton represents the potential savings from improved operation schedules.

4.2 Results

Figure 5 shows the measured kW/ton and average condenser water temperature as function of the evaporator water temperature. It shows that the kW/ton tended to decrease linearly with an increase of the average evaporator water temperature when the condenser water temperature is constant. When the condenser water temperature increases, the kW/ton increases. Both characteristics are consistent with normal chiller performance. Hence, the kW/ton was linearly regressed against the average evaporator water and condenser water temperatures. The regression formula determined is:

$$kW / ton = 1.27665 - 0.02356T_{evaporator} + 0.008481T_{condenser}$$

Figure 6 shows the measured chilled water supply temperature and the suggested schedules for supply temperature as a function of ambient temperature. The measured chilled water supply water temperature was about 39°F. The suggested chilled water temperature varies from 41°F to 45°F according to the ambient temperature. Consequently, the return water temperature may be kept at a constant value of 53°F under the new supply water temperature schedule. With this operating schedule, the average water temperature will increase from 2°F to 6°F compared with the current operating schedule.

Figure 7 shows the measured cooling tower supply water temperature and the suggested cooling tower supply water temperature schedule. The current cooling tower supply water temperature is about 8°F higher than the ambient wet bulb temperature when the ambient wet bulb temperature is higher than 70°F. The suggested water temperature is about 5°F higher than the wet bulb temperature when the wet bulb is higher than 65°F. The cooling tower supply water temperature cannot be lower than 65°F in order to maintain the minimum pressure difference across the expansion valves.

Use of the improved chilled water supply temperature and the improved cooling tower supply temperature will reduce the kW/ton substantially. Figure 8 presents the measured and predicted kW/ton using the improved operating schedule.

Table 5 summarizes the potential savings due to the improved chilled water supply and cooling tower supply water temperatures. The improved cooling tower and chilled water temperatures can reduce compressor electricity consumption by 15,221,000 kWh, or 22% of the current central plant electricity consumption. If the electricity price is $0.056/kWh, the annual potential electricity savings are $852,000/yr.

Table 5: Summary of Chiller Efficiency Analysis

	Electricity (MkWh)	kW/ton	Savings	
Current	69,711	0.92	Electricity	%
Improved	54,489	0.72	15,222	22

5.0 Conclusions

Three major O&M opportunities were identified in the UTMB buildings and the central plant:

- Improving the outside air reset schedules of AHUs;
- Controlling the steam pressure at 125 psi; and
- Improving the chilled water and cooling tower water temperature set points.

Table 6 summarizes the total potential O&M savings ($2,868,000/yr) and potential O&M savings for each O&M option.

Table 6: Summary of Potential Savings for each O&M Measure

Item		Consumption	Savings	Percent Savings	$ Savings	Notes
Buildings	Steam (MMBtu)	301,274	132,260	44%	$598,000	Improved operation Optimized schedule
	Ch-water (MMBtu)	906,540	188,660	21%	$1,336,000	Improved operation Optimized schedule
Central Plant	Electricity (MkWh)	69,711	15,221	22%	$852,000	Increase chilled water temperature
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Total					$2,868,000	

Note: Gas price $2.57/MCF; Ch-water price $7.08/MMBtu ($0.085/ton-hr); Steam price $4.524/MMBtu; and Electricity price $0.054/kWh.

The improved cold and hot deck temperature schedules can reduce re-heat significantly in most constant air volume systems while maintaining suitable room relative humidity levels. The total potential savings in 49 buildings are about $1,934,000/yr at the current energy prices ($7.08/MMBtu for chilled water, and $4.524/MMBtu for steam). Note that the improved hot and cold deck operation schedules were developed based on our experience with five UTMB buildings. Although these operating schedules can be used to determine the potential O&M savings for the entire campus, they cannot be regarded as the optimized operating schedules for specific

buildings. The optimized operating schedules have to be developed for each building by a detailed engineering analysis.

The average boiler efficiency was 0.67 from April 1, 1993 to March 30, 1994. This relatively low efficiency was caused by setting the supply steam pressure at 145 psi from March to October. If the steam pressure is set to 125 psi year around, the average boiler efficiency can be increased to 0.72. Consequently, more than 32,000 MCF gas can be saved. Based on the current gas price of $2.57/MCF, this O&M measure will reduce the gas bill by $82,000/yr.

The annual average kW/ton can be reduced from 0.92 to 0.72 if the suggested chilled water supply temperature and cooling tower supply water temperature schedules are used. The improved chilled water and cooling tower temperature schedules can potentially reduce the compressors' electricity consumption by 15,222 MkWh/yr, or 22% of the measured electricity consumption from April 1, 1993 to March 30, 1994. The electricity bill could be reduced by $852,000/yr.

It is important to emphasize the preliminary nature of this study. Although boiler efficiency may be improved by simple set-back the steam pressure to 125 psi, the other potential savings can only be achieved through specific and detailed investigations and necessary engineering work.

Fig. 1: Comparison of Consumption
(April 1-1993 to March 30-1994)

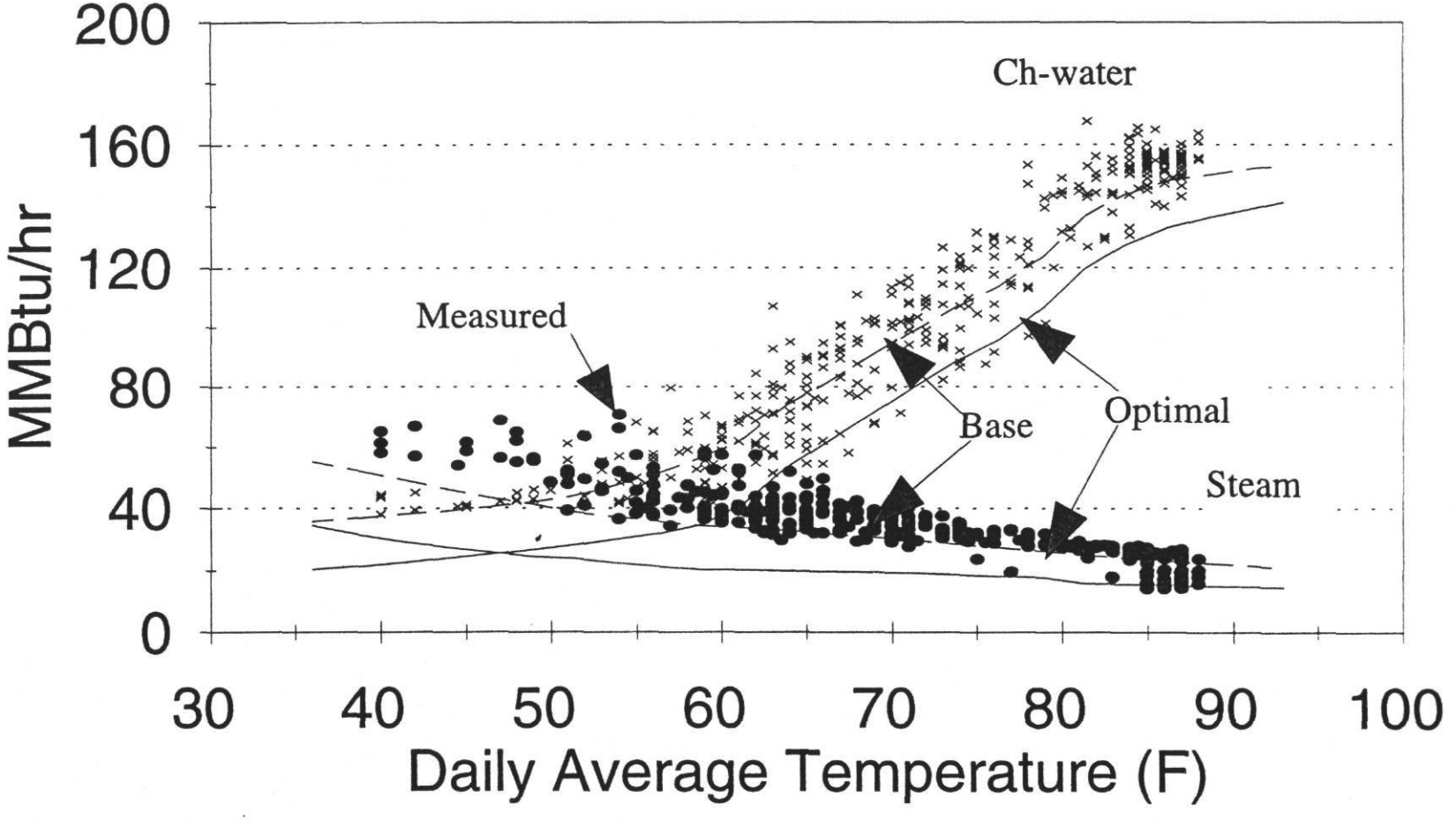


Fig. 2: Boiler Efficiency Time Series
(April 1-1993 to March 30-1994)

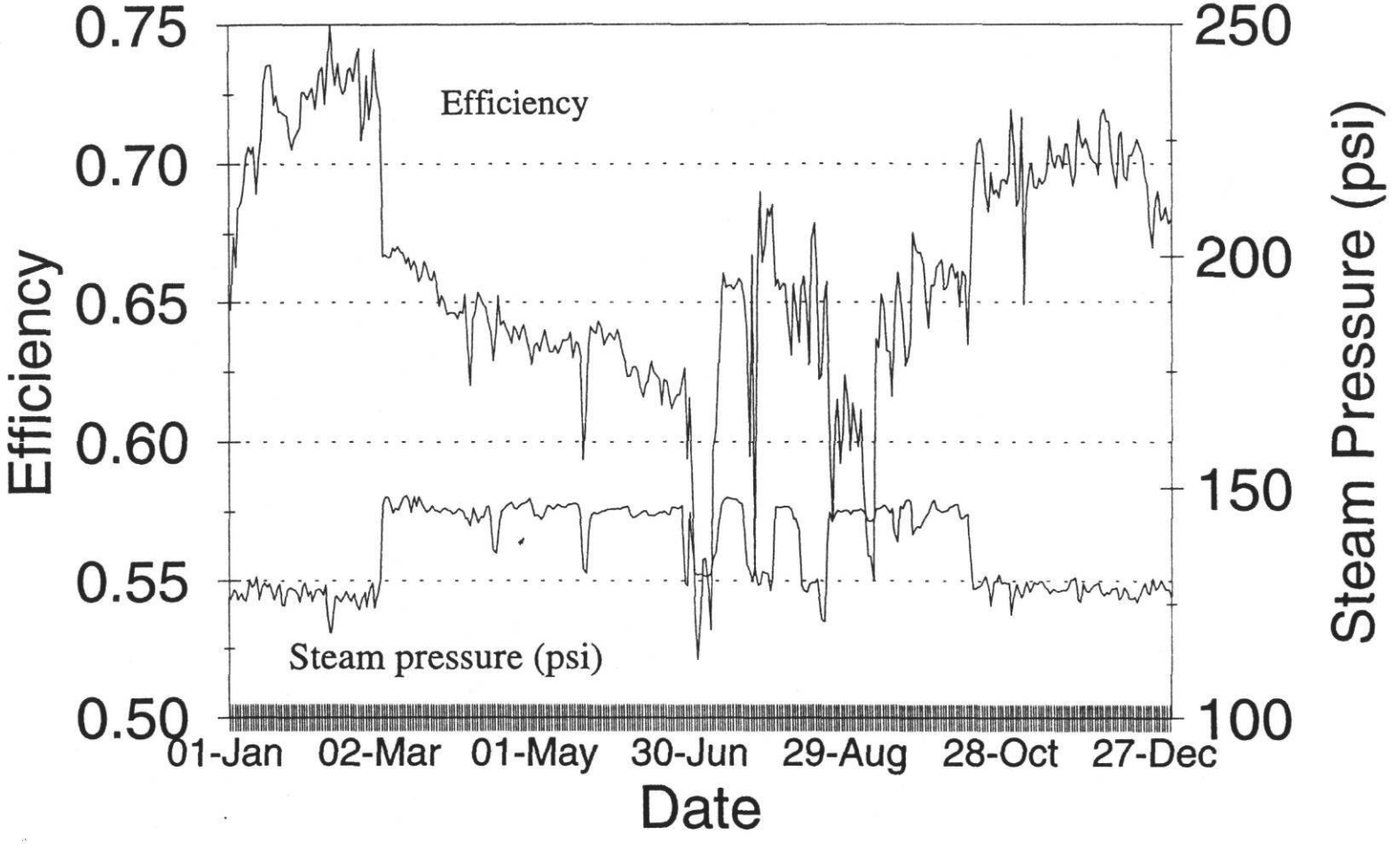


Fig. 3: Steam Consumption Time Series
(April 1-1993 to March 30-1994)

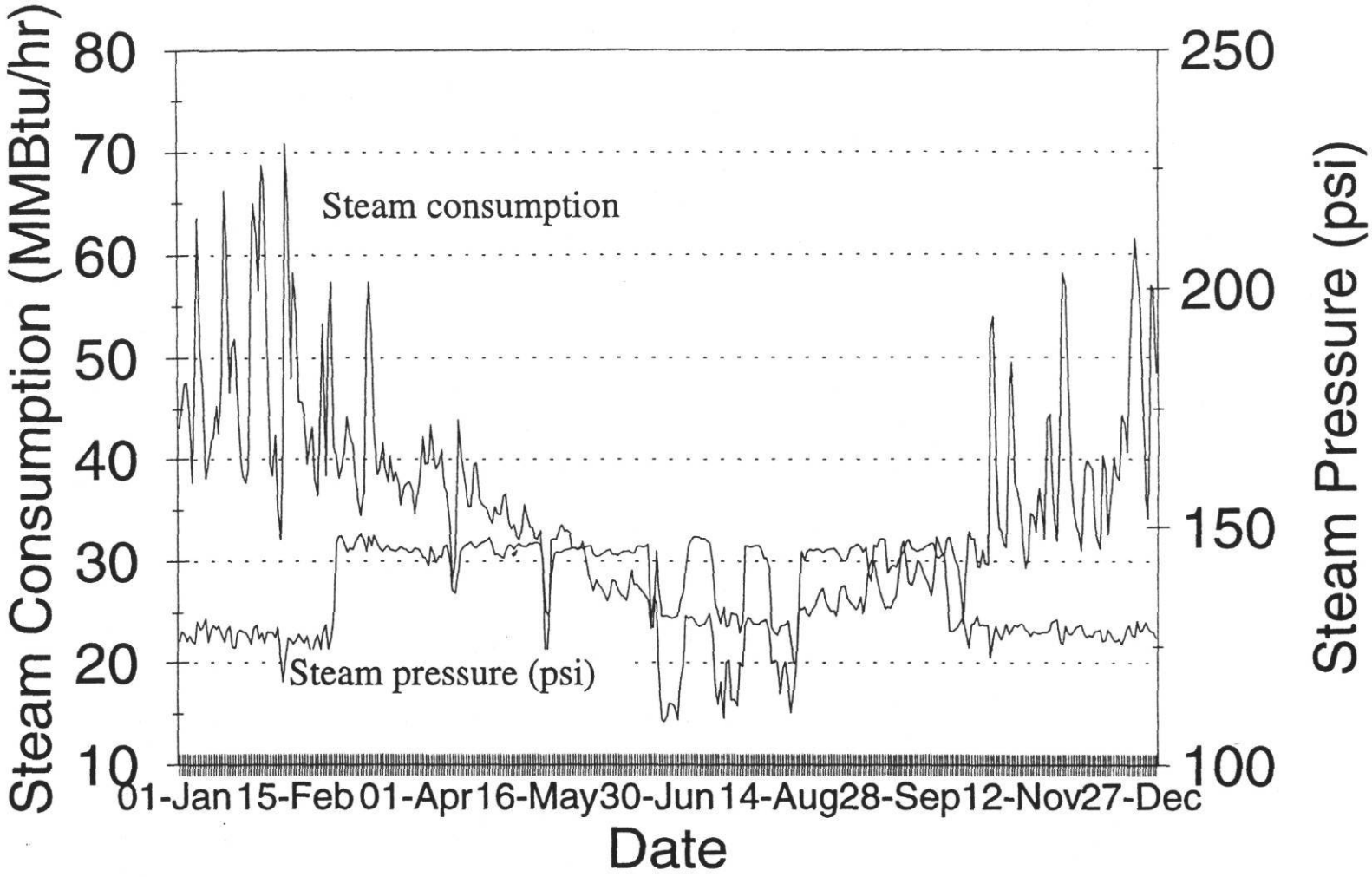


Fig. 4: Gas Consumption
(April 1-1993 to March 30-1994)

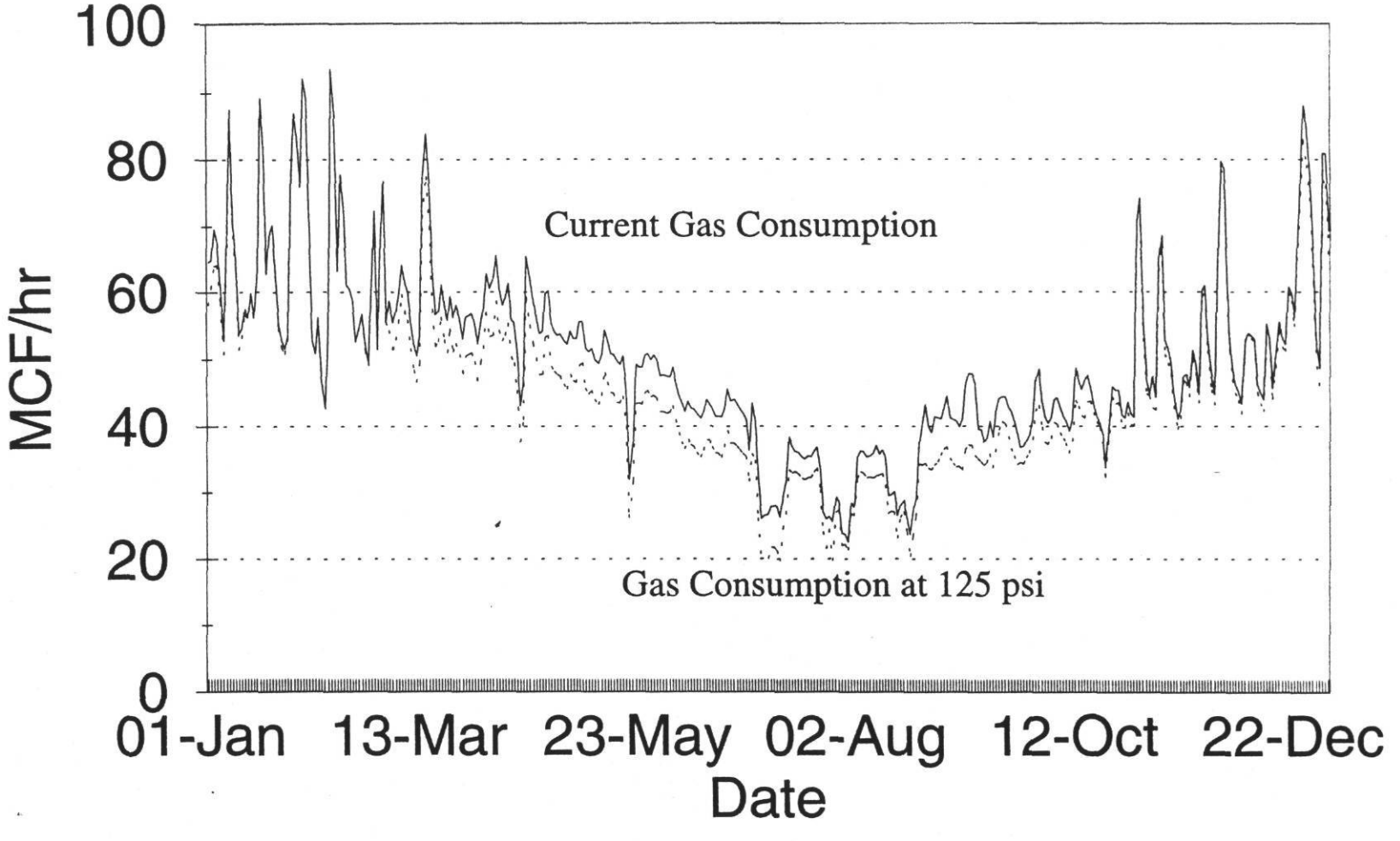


Fig. 5: Measured kW/ton

(April 1-1993 to March 30-1994)

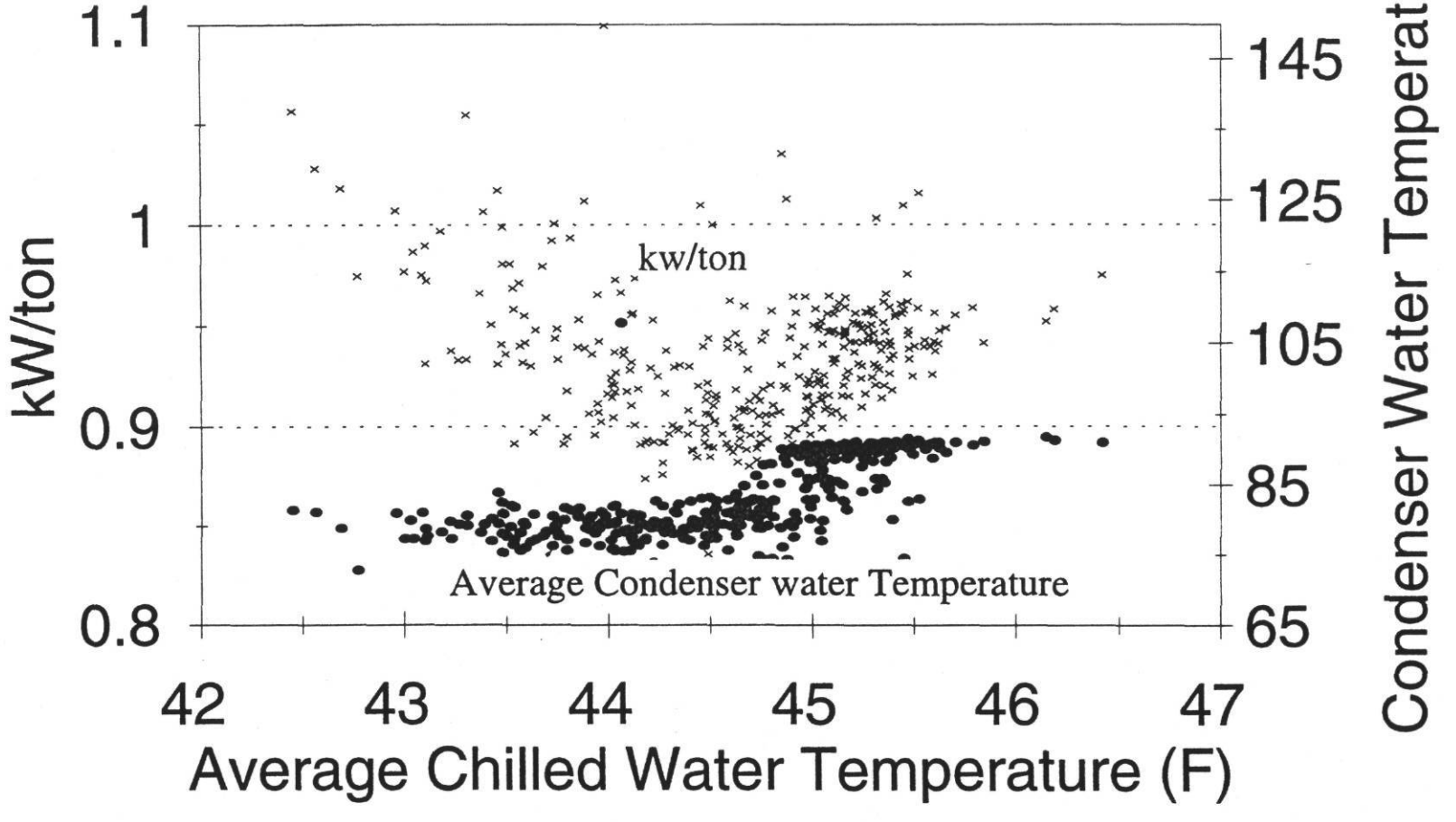


Fig. 6: Ch-water Supply Temperature
(April 1-1993 to March 30-1994)

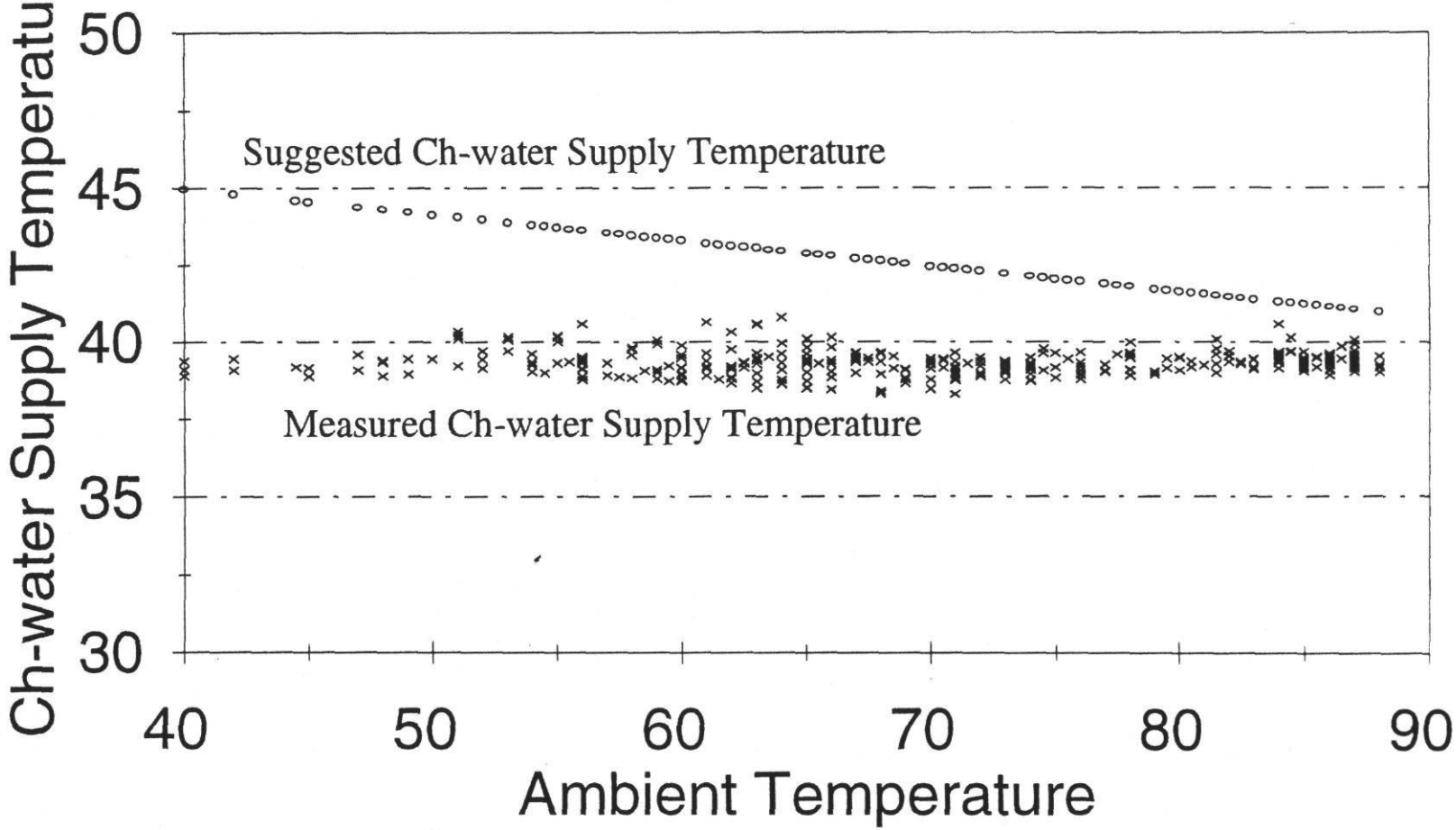


Fig. 7: Cooling Tower Temperature
(April 1-1993 to March 30-1994)

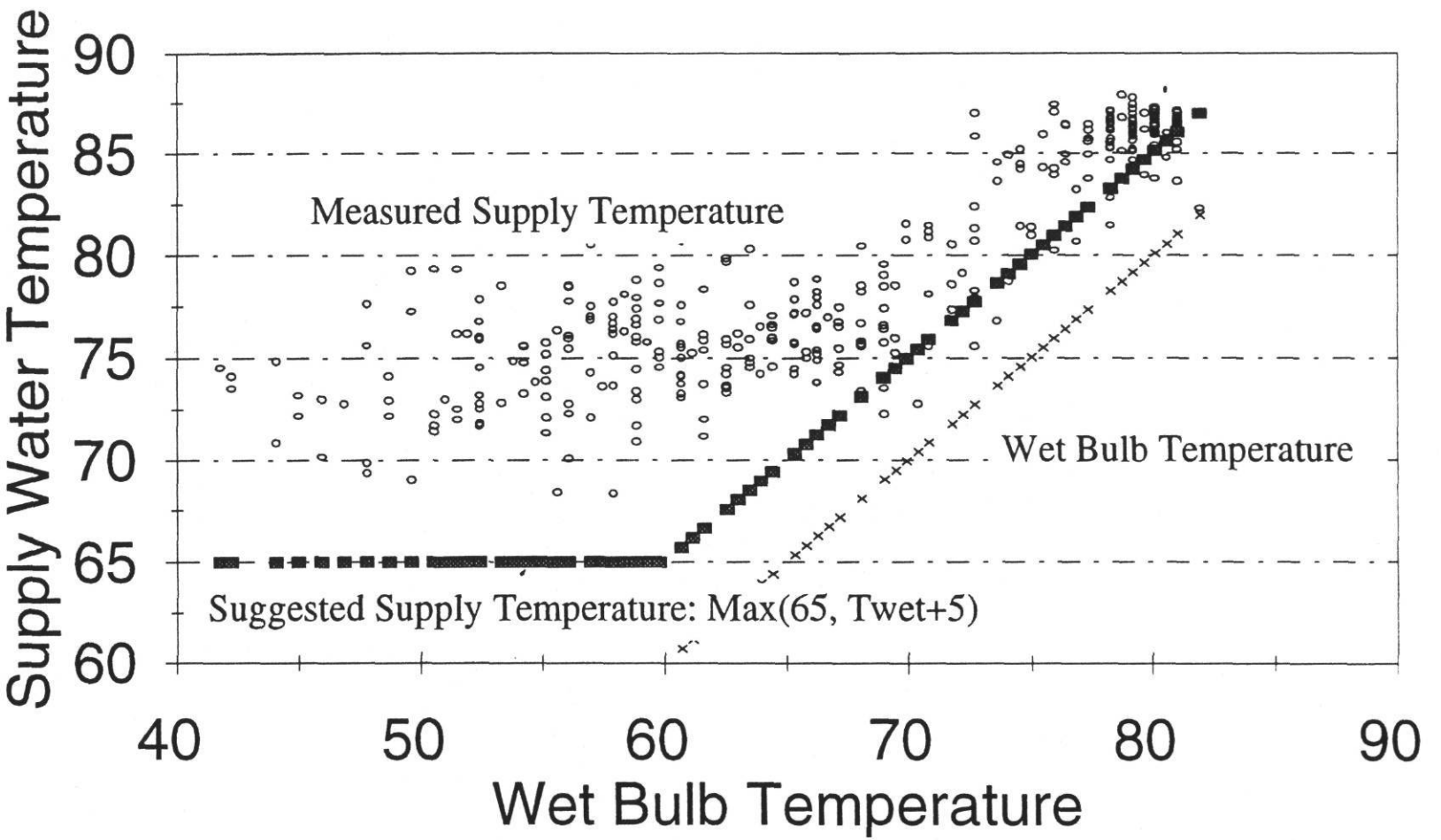
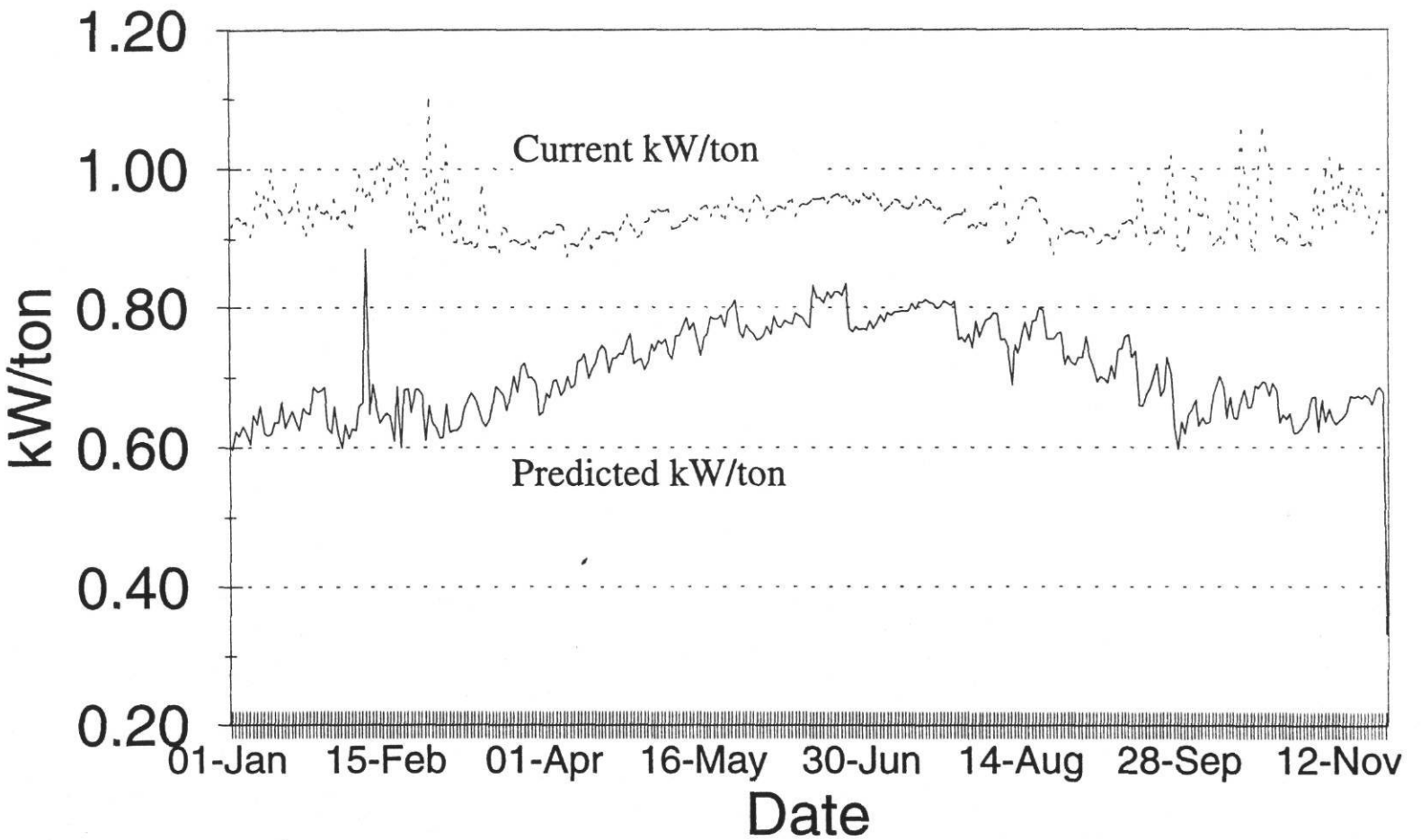


Fig. 8: Current and Predicted kW/ton

(April 1-1993 to March 30-1994)



Appendix A: Summary of Collected Parameters for Building and Air Handling Units

This appendix lists the basic parameters of the buildings and air handling units. These parameters include building name, gross area, system name and type, outside air intake (both minimum and maximum), return air flow rate, total air flow rate, preheat deck set point, pre-cold deck set point and measured values for some of the units, hot deck set point and measured value, and cold deck set point and measured values. the code "-99" means not applicable.

Appendix. AHUs data-base of buildings

Bldg name	Co	Gross sq ft	AC area sq ft	System type & name		Air volume				O.A. frac.	Temperature									
				name	type	OA1	OA2	RA	Total		Tph		T pc		Tph		Thd		Tcd	
											mea.	sp.	mea.	sp.	mea.	sp.	mea.	sp.	mea.	sp.
Ashbel Smith	1	49,138	46,508	278,286,287	scv	0	14,034	0	14,034		-99		-99		62.3	45	-99		59.1	52
				279~283	scv	0	4,370	29,944	34,314		-99		-99		-99		-99		55.1	52
				284	scv	0	0	2,309	2,309		-99		-99		-99		-99		62 8	52
				scv-9		0	18,404	32,253	50,657	0.36	62.3	45							59	52
Gail Borden	3	63,156	59,924	23~27	dcvp	14,970	0	48,180	63,150		76	45	48	56	-99		85.2	#1	55.3	50
				262	scv	0	5,000	0	5,000		-99		-99		76.3	45	-99		54.6	55
				259,183	scv	0	0	3,600	3,600		-99		-99		-99		-99			55
				dcvp-5,scv-3		14,970	5,000	51,780	71,750	0.28	76.2	45	48	56			85.2	#1	55~	53
Graves Bldg	4	59,000	58,423	dcvp-2	dcvp	15,000	0	81,309	94,309	0.16	66.4	52	66.9	58	-99		89.8	#2	56.4	55
Child Center	6	198,072	191,476	220~224	dcvp	63,100	0	157,540	220,640		-99		61.7	57	-99		89.9	#3	53.4	55
				230	scv	0	1,720	0	1,720		-99		-99		73.5	45	-99		54.4	55
				dcvp-5,scv-1		63,100	1,720	157,540	222,360	0.29	73.5	45	61.7	57			89.9	#3	53.9	55
Old Children	8	21,275	19,280	56	scv	0	0	5,292	5,292		-99		-99		78.8	-99	-99		55	52
				204~205	scv	0	516	7,700	8,216		-99		-99		-99		-99		52.3	52
				scv-3		0	516	12,992	13,508	0.04	78.8*								53.7	52
John Sealy	9	348,590	312,392	326,327,331~2	scvp	27,480	0	58,130	85,160		67	45	57	57	-99		-99		57	55
Hospital				75~79,69	scv	0	52,500	131,605	184,105		-99		-99		-99		-99		52.9	55
				72,73,342	scv	0	64,220	0	64,220		-99		-99		78.3	45	-99		66.3	55
				107,119,66,80~1,349	scv	0	0	17,900	17,900		-99		-99		-99		-99		63.5	55
				186	dcv	0	6,133	8,587	14,720		-99		-99		-99		89.2	#4	52 8	54
				329,333	scv	0	0	14,675	14,675		-99		-99		79.5	-99	-99		76	55
				dcv-1,scvp-4,scv-17		27,480	122,853	230,897	380,780	0.39	78.3/67,79.5*	45	57	57			89.2	#4	61.4	55

Bldg name	Co	Gross sq ft	AC area sq ft	System type & name		Air volume				O.A. frac.	Temperature									
				name	type	OA1	OA2	RA	Total		Tph		T pc		Tph		Thd		Tcd	
											mea.	sp.	mea.	sp.	mea.	sp.	mea.	sp.	mea.	sp.
John Hospital	11	167,588	163,337	87~89,93~96	dcvp	29,012	0	38,446	67,458		63.9	52	58.9	60	-99		81.5	#3	53.4	55
				98~9,101~2,104~5	scvp	37,348	0	46,687	84,035		63.2	52	55.9	56	-99		-99		57.7	55
				80	scv	0	2,800	0	2,800		-99		-99		-99		-99		55.2	55
				103	scv	0	1,935	2,730	4,665											55
				dcvp-7,scvp-6,scv-2		66,360	4,735	87,863	158,958	0.45	63.6	52	57.4	58			81.5	#3	55.4~	55
Administra-	12	96,260	90,310	109,110	dcvpe	17,100	0	112,300	129,400		-99		66.5	60	-99		84.5	#3	55.6	55
tion				310,311	scv	0	0	5,000	5,000		-99		-99		-99		-99		66	55
				dcvp-2,scv-2		17,100	0	117,300	134,400	0.13			66.5	60			84.5	#3	66/55.6	55
Communica.	13	18,278	18,088	113,114,115	scv	0	1,725	10,979	12,704		-99		-99		-99		-99			55
				71	scv	0	2,605	0	2,605		-99		-99		-99		-99			55
				scv-4		0	4,330	10,979	15,309	0.28										55
Randall	16	234,147	206,560	57,58,59	dcvpe	39,400	0	93,280	132,680		72.6	53	68.4	58	-99		86	#5	55 2	55
				49~52,55	scv	0	2,572	13,703	16,275		-99		-99		-99		-99		60.3	55
				30,33~38,40~45	fcu			12,485	12,485											55
				dcvp-3,scv-5,fcu-13		39,400	2,572	119,468	161,440	0.26	72.6	53	68.4	58			86	#5	57.8~	55
Microbiology	18	40,618	35,856	235,236	scv			10,349	10,349										54.7	55
				265	scv	0	13,962	0	13,962		-99		-99		69.8	45	-99		58.3	55
				scv-3		0	13,962	10,349	24,311	0.57	69.8	45							56.5	55
Mary Moody	19	67,374	55,133	dcvp-1	dcvpe	11,000	0	56,600	61,725	0.18	55.9	52	83.8	56	-99		98	#6	54.8	55
Animal Resource	20	40,000	26,677	dcvp-2	dcvp	41,800	0	0	41,800	1.00	54^	52	46^	55	-99		85^	#6	50.2^	55
Physical Plant	21	39,845	38,626	288	scv	0	8,330	22,000	30,330		-99		-99		65	-99	-99		54.1	55
				292	scv	0	0	2,076	2,076		-99		-99		-99		-99		43.8	55
				scv-2		0	8,330	24,076	32,406	0.26	65*								54/43.8	55

Bldg name	Co	Gross sq ft	AC area sq ft	System type & name		Air volume				O.A. frac.	Temperature									
				name	type	OA1	OA2	RA	Total		Tph		T pc		Tph		Thd		Tcd	
											mea.	sp.	mea.	sp.	mea.	sp.	mea.	sp.	mea.	sp.
New Shine	23		215,855	fcu-20	fcu			17,400	17,400	0.00										55
Surgical Annex	27	15,274	7,768	scv-2	scv			8,000	8,000	0.00									59	55
Brackenridge	30	14,065	13,874	scv-2	scv	0	12,815	7,185	19,500	0.66	-99		-99		65.5*	-99	-99		54.3	55
Caly Hall	31	14,497	12,344	scv-2	scv	0	1,005	10,510	11,155	0.09	-99		-99		-99		-99		55^	55
Bethel Hall	32	14,497	14,439	scv-2	scv	0	1,005	10,510	11,155	0.09	-99		-99		-99		-99			55
Nolan Hall	33	18,345	17,010	Apt.unit-28	Apt.un			29,000	29,000	0.00	-99		-99		-99		-99			55
Visant Hall	34	14,497	14,275	Apt. unit-2	Apt.un			20,000	20,000	0.00	-99		-99		-99		-99			55
Morgan Hall	35	14,497	14,439	Apt.unit-2	Apt.un			12,000	12,000	0.00	-99		-99		-99		-99			55
League Hall	36	14,497	14,440	Apt.unit-2	Apt.un			21,800	21,800	0.00	-99		-99		-99		-99			55
Unit D	37	31,510	29,668	Apt.unit-3	Apt.un			24,720	24,720	0.00	-99		-99		-99		-99			55
Machine Room	38	1,878	1,878	scv-1	scv			4,400	4,400	0.00					-					55
Administration	48	61,600	57,169	118,126~134	scv	0	4,092	75,415	79,507		-99		-99		-99		-99		56.4	55
Annex				185	scv			2,504	2,504										52.8	55
				scv-11		0	4,092	77,919	82,011	0.05									54.6	55
William	55	117,219	98,219	237,238	scvpe	7,095	0	40,870	47,965		-99		67.6	60	-99		-99		57.2	55
(Levin Hall)				242,243,269	scvpe*	9,060	0	28,750	37,810		-99		61.8	60	-99		-99		55	55
				264,266,267	scvpe	9,860	0	28,550	36,410		-99		61.4	60			-99		67.3	55
				270	scv	0	3,092	7,213	10,305		-99		-99		-99		-99			55
				scvp*-3,scvp-5,scv-1		26,015	3,092	105,383	132,490	0.22			63.6	60					67.3/55	55
Hospital Clinic	56	220,538	214,116	295~298	dcvpe	26,240	0	179,530	205,770			45	66	56	-99		92	#7	54.5	55
				303,304	scv	0	5,000	0	5,000		-99		-99		-99		-99			55
				dcvp-4,scv-2		26,240	5,000	179,530	210,770	0.15	45	45	66	56			92	#7	54.5~	55

Bldg name	Co	Gross sq ft	AC area sq ft	System type & name		Air volume				O.A. frac.	Temperature									
				name	type	OA1	OA2	RA	Total		Tph		T pc		Tph		Thd		Tcd	
											mea.	sp.	mea.	sp.	mea.	sp.	mea.	sp.	mea.	sp.
Allied Heath	57	149,717	148,880	312~315	dcvpe	33,843	0	151,914	185,757		-99		67	60	-99		88.7	#8	54.9	55
				316~318	scv	0	0	11,616	11,616		-99		-99		-99		-99		63.2	55
				dcvp-4,scv-3		33,843	0	163,530	197,373	0.17			67	60			88.7	#8	63.2/55	55
Medical Res.	59	287,749	280,614	scvp-10	scvp	0	60,900	0	60,900	1.00	-99			60	67.1	52	-99		55.7	55
Emergency	64	127,214	123,948	376~379	dcvpe	13,234	0	71,033	84,267		-99		55	60	-99		84.7	#9	53.8	55
				380~383	scv			16,790	16,790											55
				dcvp-4,scv-4		13,234	0	87,823	101,057	0.13			55	60			84.7	#9	53.8~	55
Phamacology	70	45,688	42,314	209,198	scv	0	9,410	24,500	33,900		-99		-99		73.2	-99	-99		55.6	55
				208	scv	0	0	4,865	4,865										65	55
				274	scvp	0	4,940	0	4,940		-99			60	66.3	45	-99		54.7	55
				scvp-1,scv-3		0	14,350	29,365	43,705	0.33	66.3,73.2*	45		60					65/54.7	55
Maurice Ewing	71	53,205	44,242	60	dcvpe	2,949	0	16,100	19,049		-99		73.7	60	-99		88.2	#9	53.2	55
Hall				61	scv	0	28,258	0	28,258		-99		-99		69.2	45	-99		54.1	55
				63	scv			2,200	2,200										73.7	55
				dcvp-1,scv-2		2,949	28,258	18,300	49,507	0.63	69.2	45	73.7	60			88.2	#9	73.7/53	55
Parking	98	17,369	19,922	324,325	scvp*	4,495	0	19,550	24,045		63.8	52	57.4	60	-99		-99		52.5	55
				321,322	scv			2,395	2,395										64	55
				scvp*-2,scv-2	*	4,495	0	21,945	26,440	0.17	63.8	52	57.4	60					64/52.5	55

I. Control schedule for Thd

No.#1: If Ta>85 then Thd=75 else Thd=min{90,90-0.38(Ta-45)}
No.#2: If Ta>95 then Thd=80 else Thd=min{100,80+0.33(95-Ta)}
No.#3: If Ta>95 then Thd=75 else Thd=min{95,75+0.33(95-Ta)}
No.#4: If Ta>94 then Thd=95 else Thd=min{102,95+0.16(94-Ta)}
No.#5: If Ta>90 then Thd=80 else Thd=min{93,80+0.25(90-Ta)}
No.#6: If Ta>80 then Thd=80 else Thd=min{100,80+0.5(80-Ta)}
No.#7: If Ta>80 then Thd=80 else Thd=min{95,80+0.375(80-Ta)}
No.#8: If Ta>80 then Thd=87 else Thd=min{102,87+0.375(80-Ta)}
No.#9: If Ta>80 then Thd=85 else Thd=min{100,85+0.375(80-Ta)}

II. Temperatures measured from EMCS with 65F of Ta
III. T^: Temperature from site measurement
IV. T~: average temperature from part data measured
V. scvp*: AHU system with by-pass
VI. T*: Tph for mix or return air of SCV
VII. T/T: Tmax/Tmin

Appendix B: Summary of Building Energy Consumption Under the Current and the Improved Hot and Cold Deck Reset Schedules

We simulated 39 buildings' energy consumption by using the simplified engineering models. However, we did not have enough information to simulate the other 10 buildings. The potential savings for these ten buildings were estimated by assuming that their average savings (per square foot) equal the average savings identified in the other 39 buildings. The results are summarized in Table B-1.

Table B-1. Summary of Potential O & M Savings for All Buildings

Item	Number of Bldg	Conditioned Floor Area		Base Consumption (MMBtu/yr)			Base Costs ($/yr)			Savings	
		sq ft	%	Ch-water	Steam	Total	Ch-water	Steam	Total	$/yr	%
Simulated	39	3,437,782	96%	822,236	157,481	979,717	$5,821,000	$712,000	$6,533,000	$1,366,000	21%
Area Corrected	10	130,860	4%	31,299	5,994	37,293	$221,000	$27,000	$248,000	$56,900	21%
Total Bldgs	49	3,568,642	100%	853,535	163,475	1,017,010	$6,042,000	$739,000	$6,781,000	$1,422,900	21%

Note: 1. Energy consumption were simulated using a simplified engineering model
2. Energy prices are $7.08/MMBtu for ch-water and $4.524/MMBtu for steam
3. Steam consumption does not include domestic hot water

The annual energy consumption of each building was simulated using the Galveston bin temperature data for 39 buildings. The simulation results are summarized in a separate table for each building. The potential savings and basic building information are also summarized in the Table.

Table 1.Summary of Simulated Ch-water & Steam Consumption in the Ashbel Smith Building(Old Red) - bldg code 1

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.82	0.95	36	42	0.44	0.35	19	15
39	0.83	0.88	67	71	0.45	0.28	37	23
41	0.84	0.82	88	86	0.47	0.25	49	26
44	0.85	0.76	143	129	0.48	0.23	80	39
46	0.86	0.72	146	123	0.49	0.21	83	36
49	0.86	0.74	205	177	0.50	0.21	118	50
51	0.91	0.68	214	161	0.51	0.18	119	42
54	0.95	0.66	336	233	0.52	0.16	182	56
56	1.01	0.64	306	195	0.53	0.14	160	43
59	1.12	0.62	481	266	0.56	0.13	238	55
61	1.21	0.60	585	290	0.61	0.12	296	59
64	1.38	0.58	735	309	0.72	0.12	385	63
66	1.51	0.56	855	319	0.85	0.11	482	64
69	1.64	0.54	987	326	0.98	0.11	592	64
71	1.76	0.52	870	256	1.11	0.10	546	48
74	1.89	0.49	857	222	1.23	0.08	560	38
76	1.99	0.46	703	163	1.34	0.07	474	24
79	2.14	0.43	949	191	1.49	0.05	660	23
81	2.34	0.40	1,655	285	1.67	0.04	1,181	28
84	2.44	0.38	2,161	336	1.77	0.03	1,570	22
86	2.50	0.35	1,139	159	1.85	0.01	841	5
89	2.52	0.32	1,019	130	1.89	0.00	767	0
91	2.53	0.30	554	65	1.94	0.00	425	0
93	2.54	0.27	71	8	1.98	0.00	55	0
Total			15,163	4,542			9,920	823
Total/F			0.33	0.10			0.21	0.02

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
5,243	3,719	8,963	45%	$37,120	$16,825	$53,945	42%

Note: 1. Building type: Offices/Classrooms
2. Conditioned floor area(F): 46,508 sq ft
3. Total CFM: 50,657
4. O.A. fraction: 0.36

Table 2.Summary of Simulated Ch-water & Steam Consumption in the Gail Borden Building - bldg code 3

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.87	0.93	38	41	0.44	0.45	19	20
39	0.88	0.84	71	68	0.44	0.37	36	30
41	0.88	0.77	92	80	0.46	0.32	49	33
44	0.89	0.70	150	118	0.50	0.29	84	50
46	0.91	0.64	155	109	0.54	0.27	92	46
49	0.94	0.59	223	141	0.59	0.24	140	58
51	0.97	0.55	229	130	0.64	0.22	151	52
54	1.02	0.50	360	178	0.70	0.20	245	70
56	1.08	0.46	327	139	0.75	0.18	227	54
59	1.15	0.41	494	176	0.81	0.16	345	68
61	1.26	0.40	610	195	0.90	0.16	435	75
64	1.47	0.37	781	199	1.10	0.15	585	80
66	1.60	0.35	908	197	1.24	0.15	703	83
69	1.74	0.32	1,048	191	1.41	0.14	847	85
71	1.87	0.29	925	143	1.57	0.13	777	66
74	2.01	0.25	913	115	1.75	0.12	792	56
76	2.13	0.22	752	78	1.90	0.11	669	39
79	2.30	0.19	1,018	83	2.10	0.10	929	45
81	2.52	0.16	1,781	110	2.28	0.02	1,609	11
84	2.63	0.13	2,330	114	2.42	0.01	2,145	12
86	2.72	0.11	1,238	52	2.53	0.01	1,153	5
89	2.77	0.11	1,120	43	2.59	0.01	1,050	4
91	2.81	0.10	615	21	2.64	0.01	579	2
93	2.84	0.09	79	3	2.69	0.01	75	0
Total			16,255	2,722			13,737	1,041
Total/F			0.27	0.05			0.23	0.02

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
2,519	1,681	4,200	22%	$17,835	$7,605	$25,440	20%

Note:
1. Building type: Offices/Classrooms
2. Conditioned floor area(F): 59,924 sq ft
3. Total CFM: 71,750
4. O.A. fraction: 0.28

Table 3.Summary of Simulated Ch-water & Steam Consumption in the Graves Hospital - bldg code 4

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	1.41	1.02	62	45	0.87	0.48	38	21
39	1.40	0.94	114	76	0.88	0.42	71	34
41	1.40	0.88	146	92	0.90	0.39	95	41
44	1.39	0.82	235	139	0.93	0.37	158	62
46	1.38	0.75	236	129	0.97	0.34	166	59
49	1.37	0.69	327	164	1.00	0.32	238	76
51	1.36	0.62	320	147	1.03	0.30	244	71
54	1.37	0.59	485	208	1.07	0.28	377	99
56	1.39	0.55	423	168	1.10	0.26	335	79
59	1.41	0.52	604	221	1.14	0.24	487	104
61	1.44	0.49	695	239	1.21	0.24	583	115
64	1.57	0.47	834	250	1.36	0.23	725	123
66	1.65	0.44	937	252	1.47	0.23	834	128
69	1.74	0.42	1,048	252	1.58	0.22	952	130
71	1.83	0.39	902	194	1.69	0.21	834	102
74	1.92	0.36	870	165	1.80	0.19	818	87
76	1.99	0.33	704	118	1.90	0.18	671	63
79	2.10	0.30	931	134	2.03	0.16	899	73
81	2.25	0.28	1,586	195	2.05	0.00	1,445	0
84	2.32	0.25	2,054	224	2.15	0.00	1,903	0
86	2.37	0.22	1,078	102	2.23	0.00	1,015	0
89	2.39	0.20	966	80	2.28	0.00	922	0
91	2.40	0.17	526	38	2.32	0.00	508	0
93	2.41	0.15	68	4	2.36	0.00	66	0
Total			16,151	3,635			14,384	1,468
Total/F			0.28	0.06			0.25	0.03

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
1,767	2,167	3,934	20%	$12,510	$9,804	$22,314	17%

Note: 1. Building type: Offices
2. Conditioned floor area(F): 58,423 sq ft
3. Total CFM: 94,309
4. O.A. fraction: 0.16

Table 4.Summary of Simulated Ch-water & Steam Consumption in the Children's Hospital - bldg code 6

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	1.88	2.11	83	93	1.03	1.24	45	55
39	2.02	1.96	164	159	1.20	1.12	97	90
41	2.14	1.83	225	192	1.35	1.02	142	107
44	2.26	1.71	381	289	1.49	0.93	252	157
46	2.39	1.57	408	269	1.66	0.84	284	143
49	2.51	1.45	597	345	1.82	0.75	433	179
51	2.62	1.34	619	316	1.97	0.68	465	159
54	2.75	1.22	969	430	2.14	0.60	754	211
56	2.87	1.10	872	334	2.30	0.53	699	161
59	3.00	0.98	1,287	421	2.48	0.46	1,062	196
61	3.30	0.95	1,591	459	2.81	0.45	1,356	219
64	3.99	0.89	2,122	471	3.58	0.44	1,903	235
66	4.44	0.82	2,521	467	4.11	0.43	2,333	243
69	4.93	0.76	2,966	456	4.68	0.41	2,816	249
71	5.38	0.69	2,658	342	5.20	0.39	2,571	194
74	5.86	0.61	2,660	278	5.76	0.36	2,615	163
76	6.27	0.54	2,214	189	6.24	0.33	2,204	116
79	6.85	0.46	3,032	205	6.89	0.30	3,051	131
81	7.60	0.40	5,368	280	7.45	0.00	5,258	0
84	7.97	0.34	7,072	301	7.90	0.00	7,005	0
86	8.24	0.28	3,758	126	8.25	0.00	3,764	0
89	8.37	0.22	3,389	89	8.46	0.00	3,427	0
91	8.47	0.17	1,854	38	8.63	0.00	1,890	0
93	8.55	0.13	239	4	8.77	0.00	245	0
Total			47,050	6,553			44,670	3,007
Total/F			0.25	0.03			0.23	0.02

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
2,380	3,545	5,925	11%	$16,850	$16,038	$32,888	9%

Note: 1. Building type: Childrens Hospital
2. Conditioned floor area(F): 191,476 sq ft
3. Total CFM: 222,360
4. O.A. fraction: 0.29

Table 5.Summary of Simulated Ch-water & Steam Consumption in the Clinical Science Building - bldg code 7

Ambient Temper-ature	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
(°F)	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.00	1.81	0	79	0.00	1.24	0	54
39	0.03	1.66	2	135	0.00	1.10	0	89
41	0.07	1.54	8	162	0.00	0.98	0	103
44	0.15	1.43	25	242	0.00	0.87	0	147
46	0.20	1.30	34	222	0.00	0.74	0	126
49	0.35	1.18	83	280	0.00	0.62	0	147
51	0.70	1.05	164	248	0.00	0.50	0	118
54	1.01	0.91	355	322	0.00	0.38	0	135
56	1.28	0.81	389	247	0.00	0.30	0	92
59	1.60	0.74	687	318	0.21	0.26	88	112
61	1.84	0.73	888	350	0.52	0.27	250	130
64	2.26	0.69	1,202	365	1.04	0.26	552	138
66	2.53	0.65	1,439	368	1.40	0.25	793	142
69	2.83	0.61	1,705	367	1.78	0.24	1,074	144
71	3.11	0.57	1,535	282	2.14	0.23	1,058	114
74	3.39	0.53	1,539	242	2.51	0.22	1,140	101
76	3.63	0.50	1,280	175	2.83	0.22	1,000	76
79	3.97	0.46	1,758	203	3.27	0.21	1,447	93
81	4.45	0.44	3,142	309	3.67	0.00	2,594	0
84	4.69	0.43	4,162	380	3.96	0.00	3,511	0
86	4.87	0.42	2,219	190	4.18	0.00	1,904	0
89	4.94	0.41	2,002	165	4.29	0.00	1,737	0
91	5.00	0.40	1,095	87	4.38	0.00	959	0
93	5.04	0.39	141	11	4.45	0.00	125	0
Total			25,853	5,748			18,232	2,061
Total/F			0.21	0.05			0.15	0.02

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
7,622	3,687	11,309	36%	$53,964	$16,680	$70,644	34%

Note: 1. Building type: Labs/Classrooms
2. Conditioned floor area(F): 124,214 sq ft
3. Total CFM: 126,000
4. O.A. fraction: 0.45

Table 6.Summary of Simulated Ch-water & Steam Consumption in the Old Children's Building - bldg code 8

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.25	0.28	11	12	0.21	0.01	9	1
39	0.25	0.22	20	18	0.21	0.01	17	1
41	0.25	0.18	26	18	0.21	0.00	22	0
44	0.25	0.13	42	22	0.21	0.00	35	0
46	0.25	0.10	43	18	0.22	0.00	37	0
49	0.25	0.11	60	26	0.22	0.01	53	3
51	0.28	0.09	65	21	0.23	0.00	54	0
54	0.33	0.08	118	28	0.23	0.00	82	0
56	0.38	0.07	115	22	0.24	0.00	72	0
59	0.44	0.06	190	27	0.24	0.00	105	0
61	0.49	0.06	237	27	0.25	0.00	120	0
64	0.60	0.05	320	26	0.26	0.00	136	0
66	0.66	0.04	377	23	0.26	0.00	148	0
69	0.73	0.03	440	20	0.27	0.00	160	0
71	0.79	0.02	391	12	0.27	0.00	134	0
74	0.85	0.01	386	5	0.28	0.00	127	0
76	0.90	0.00	316	0	0.29	0.00	102	0
79	0.99	0.00	438	0	0.30	0.00	132	0
81	1.12	0.00	791	0	0.31	0.00	215	0
84	1.17	0.00	1,040	0	0.31	0.00	277	0
86	1.20	0.00	546	0	0.32	0.00	146	0
89	1.19	0.00	483	0	0.33	0.00	133	0
91	1.18	0.00	259	0	0.34	0.00	74	0
93	1.17	0.00	33	0	0.34	0.00	10	0
Total			6,747	324			2,399	5
Total/F			0.35	0.02			0.12	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
4,349	319	4,668	66%	$30,791	$1,443	$32,234	65%

Note: 1. Building type: Labs/Offices
2. Conditioned floor area(F): 19,280 sq ft
3. Total CFM: 13,508
4. O.A. fraction: 0.04

Table 7.Summary of Simulated Ch-water & Steam Consumption in the John Sealy Hospital - bldg code 9

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	3.96	5.45	174	240	1.89	2.57	83	113
39	4.14	4.99	335	404	2.07	2.13	168	173
41	4.28	4.60	450	483	2.27	1.90	239	200
44	4.42	4.25	746	718	2.49	1.80	420	304
46	4.62	3.98	790	680	2.74	1.68	468	286
49	4.84	3.85	1,151	917	2.97	1.56	707	372
51	5.04	3.74	1,190	881	3.19	1.45	752	343
54	5.39	3.61	1,902	1,274	3.41	1.34	1,203	474
56	5.78	3.49	1,756	1,060	3.63	1.23	1,104	374
59	6.25	3.36	2,680	1,441	3.96	1.15	1,699	491
61	6.87	3.24	3,318	1,565	4.47	1.12	2,157	540
64	8.02	3.12	4,268	1,660	5.42	1.09	2,881	580
66	8.91	3.01	5,059	1,707	6.31	1.06	3,585	604
69	10.02	2.88	6,033	1,736	7.27	1.03	4,377	622
71	11.03	2.75	5,449	1,356	8.17	0.98	4,038	486
74	12.07	2.57	5,478	1,165	9.12	0.90	4,139	407
76	12.94	2.39	4,569	843	9.95	0.81	3,513	287
79	14.19	2.21	6,284	980	11.19	0.73	4,959	322
81	15.86	2.04	11,195	1,442	13.07	0.65	9,229	455
84	16.63	1.89	14,752	1,680	14.03	0.58	12,444	511
86	17.15	1.72	7,819	784	14.75	0.49	6,727	225
89	17.33	1.55	7,019	627	15.13	0.41	6,129	166
91	17.45	1.40	3,821	306	15.42	0.34	3,378	74
93	17.53	1.26	491	35	15.65	0.27	438	8
Total			96,729	23,987			74,837	8,416
Total/F			0.31	0.08			0.24	0.03

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
21,892	15,571	37,463	31%	$154,995	$70,443	$225,438	28%

Note:
1. Building type: Labs/Offices
2. Conditioned floor area(F): 312,392 sq ft
3. Total CFM: 380,780
4. O.A. fraction: 0.39

Table 8.Summary of Simulated Ch-water & Steam Consumption in the John W.McCullough Building - bldg code 11

Ambient Temper-ature	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
(°F)	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	1.80	2.85	79	126	0.16	1.16	7	51
39	1.80	2.56	146	207	0.16	0.87	13	71
41	1.80	2.30	189	242	0.26	0.72	27	76
44	1.81	2.07	306	350	0.42	0.65	70	110
46	1.82	1.80	312	308	0.61	0.57	104	98
49	1.83	1.55	436	370	0.78	0.50	186	120
51	1.79	1.27	423	300	0.96	0.44	227	104
54	1.97	1.19	694	421	1.15	0.38	406	133
56	2.13	1.11	649	338	1.34	0.31	406	95
59	2.31	1.03	991	441	1.54	0.26	661	111
61	2.58	0.97	1,247	467	1.88	0.24	906	117
64	3.24	0.91	1,722	482	2.67	0.23	1,421	121
66	3.73	0.85	2,120	484	3.21	0.21	1,826	119
69	4.27	0.79	2,568	478	3.82	0.19	2,301	116
71	4.76	0.73	2,349	361	4.38	0.17	2,164	82
74	5.26	0.65	2,388	294	4.96	0.12	2,251	55
76	5.69	0.57	2,009	200	5.46	0.08	1,927	27
79	6.30	0.49	2,790	216	6.15	0.05	2,724	22
81	7.11	0.41	5,017	291	7.01	0.00	4,952	0
84	7.49	0.35	6,644	309	7.49	0.00	6,639	0
86	7.76	0.27	3,536	124	7.86	0.00	3,582	0
89	7.86	0.20	3,185	82	8.06	0.00	3,265	0
91	7.94	0.14	1,739	30	8.23	0.00	1,801	0
93	8.00	0.09	224	2	8.36	0.00	234	0
Total			41,762	6,922			38,098	1,627
Total/F			0.26	0.04			0.23	0.01

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
3,665	5,295	8,959	18%	$25,948	$23,955	$49,903	15%

Note: 1. Building type: Labs/Classrooms
2. Conditioned floor area(F): 163,337 sq ft
3. Total CFM: 158,958
4. O.A. fraction: 0.45

Table 9.Summary of Simulated Ch-water & Steam Consumption in the Administration Building - bldg code 12

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	1.74	1.05	76	46	1.26	0.58	55	25
39	1.76	0.99	143	80	1.31	0.54	106	44
41	1.79	0.93	188	98	1.36	0.51	142	53
44	1.81	0.88	306	149	1.40	0.48	236	80
46	1.83	0.83	313	141	1.45	0.44	248	76
49	1.86	0.77	441	184	1.49	0.41	356	98
51	1.87	0.72	442	170	1.54	0.39	363	91
54	1.89	0.67	669	236	1.58	0.36	559	127
56	1.91	0.62	582	187	1.63	0.33	496	101
59	1.93	0.56	830	241	1.68	0.31	720	131
61	1.96	0.52	947	250	1.77	0.30	856	145
64	2.07	0.48	1,102	256	1.98	0.29	1,053	155
66	2.18	0.44	1,238	252	2.12	0.28	1,205	160
69	2.30	0.41	1,383	245	2.27	0.27	1,369	163
71	2.41	0.37	1,190	182	2.42	0.26	1,194	126
74	2.53	0.33	1,148	148	2.57	0.24	1,166	108
76	2.63	0.28	929	100	2.70	0.22	954	77
79	2.78	0.24	1,231	107	2.88	0.20	1,275	88
81	2.97	0.20	2,098	143	2.92	0.00	2,062	0
84	3.07	0.17	2,720	150	3.05	0.00	2,709	0
86	3.13	0.13	1,429	60	3.17	0.00	1,443	0
89	3.17	0.10	1,282	38	3.24	0.00	1,311	0
91	3.19	0.06	698	14	3.30	0.00	722	0
93	3.21	0.04	90	1	3.35	0.00	94	0
Total			21,474	3,479			20,696	1,848
Total/F			0.24	0.04			0.23	0.02

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
777	1,631	2,408	10%	$5,501	$7,379	$12,880	8%

Note: 1. Building type: Offices
2. Conditioned floor area(F): 90,310 sq ft
3. Total CFM: 134,400
4. O.A.fraction: 0.13

Table 10.Summary of Simulated Ch-water & Steam Consumption in the Communications Building - bldg code 13

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.18	0.17	8	8	0.08	0.07	3	3
39	0.20	0.16	16	13	0.09	0.06	8	5
41	0.21	0.16	22	16	0.11	0.05	11	5
44	0.22	0.15	37	25	0.12	0.05	20	8
46	0.23	0.14	40	24	0.13	0.04	22	7
49	0.24	0.13	58	32	0.14	0.03	34	8
51	0.25	0.13	60	30	0.15	0.03	36	6
54	0.26	0.12	93	42	0.16	0.02	58	7
56	0.27	0.11	83	34	0.17	0.01	53	4
59	0.29	0.11	122	45	0.19	0.01	80	3
61	0.30	0.10	142	47	0.20	0.00	97	2
64	0.31	0.09	162	48	0.22	0.00	114	1
66	0.32	0.09	183	48	0.23	0.00	131	0
69	0.35	0.08	213	47	0.25	0.00	149	0
71	0.38	0.07	189	34	0.27	0.00	131	0
74	0.41	0.06	187	27	0.29	0.00	130	0
76	0.44	0.05	154	17	0.31	0.00	108	0
79	0.47	0.04	209	16	0.34	0.00	151	0
81	0.52	0.03	367	19	0.40	0.00	285	0
84	0.54	0.02	481	16	0.44	0.00	391	0
86	0.56	0.01	254	3	0.47	0.00	215	0
89	0.56	0.00	228	0	0.49	0.00	200	0
91	0.58	0.00	126	0	0.51	0.00	112	0
93	0.59	0.00	16	0	0.53	0.00	15	0
Total			3,452	593			2,552	57
Total/F			0.19	0.03			0.14	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
900	536	1,436	36%	$6,372	$2,425	$8,797	32%

Note: 1. Building type:
2. Conditioned floor area(F): 18,088 sq ft
3. Total CFM: 15,309
4. O.A. fraction: 0.28

Table 11.Summary of Simulated Ch-water & Steam Consumption in the TDCJ Hospital (Randal) - bldg code 16

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	2.20	1.79	97	79	1.14	0.74	50	33
39	2.22	1.60	180	129	1.17	0.55	94	44
41	2.24	1.43	235	150	1.24	0.43	130	45
44	2.25	1.27	380	215	1.35	0.37	228	62
46	2.27	1.09	388	186	1.48	0.30	252	51
49	2.28	0.92	543	220	1.60	0.24	380	57
51	2.30	0.77	542	181	1.72	0.19	405	44
54	2.34	0.63	827	223	1.84	0.13	651	47
56	2.45	0.56	744	170	1.97	0.08	599	26
59	2.56	0.49	1,098	210	2.12	0.05	908	19
61	2.69	0.45	1,298	217	2.33	0.03	1,127	13
64	3.13	0.40	1,663	214	2.84	0.02	1,508	9
66	3.42	0.36	1,944	204	3.18	0.01	1,809	5
69	3.75	0.32	2,255	190	3.56	0.00	2,143	0
71	4.05	0.27	2,000	131	3.91	0.00	1,933	0
74	4.37	0.21	1,985	93	4.29	0.00	1,949	0
76	4.66	0.15	1,645	52	4.63	0.00	1,635	0
79	5.06	0.09	2,242	40	5.07	0.00	2,244	0
81	5.58	0.04	3,937	28	5.71	0.00	4,028	0
84	5.84	0.00	5,179	0	6.02	0.00	5,335	0
86	6.05	0.00	2,761	0	6.28	0.00	2,862	0
89	6.18	0.00	2,502	0	6.45	0.00	2,611	0
91	6.28	0.00	1,374	0	6.59	0.00	1,443	0
93	6.36	0.00	178	0	6.71	0.00	188	0
Total			35,996	2,932			34,513	454
Total/F			0.17	0.01			0.17	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
1,483	2,477	3,959	10%	$10,500	$11,206	$21,706	8%

Note: 1. Building type: Prison Hospital
2. Conditioned floor area(F): 206,560 sq ft
3. Total CFM: 161,440
4. O.A. fraction: 0.26

Table 12.Summary of Simulated Ch-water & Steam Consumption in the Microbiology - bldg code 18

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.17	0.28	7	12	0.17	0.10	7	5
39	0.17	0.22	13	18	0.17	0.05	13	4
41	0.17	0.18	17	18	0.17	0.02	17	3
44	0.17	0.13	28	22	0.17	0.02	28	3
46	0.17	0.10	28	18	0.17	0.01	28	2
49	0.17	0.10	39	23	0.17	0.00	39	0
51	0.17	0.09	39	21	0.17	0.00	40	0
54	0.20	0.08	69	28	0.18	0.00	63	0
56	0.23	0.07	71	22	0.19	0.00	57	0
59	0.29	0.06	124	27	0.21	0.00	90	0
61	0.37	0.06	180	27	0.25	0.00	122	0
64	0.52	0.05	278	26	0.35	0.00	187	0
66	0.62	0.04	353	23	0.46	0.00	263	0
69	0.73	0.03	438	20	0.58	0.00	351	0
71	0.82	0.02	407	12	0.69	0.00	343	0
74	0.92	0.01	418	5	0.81	0.00	368	0
76	1.01	0.00	355	0	0.91	0.00	322	0
79	1.14	0.00	503	0	1.05	0.00	464	0
81	1.31	0.00	921	0	1.22	0.00	864	0
84	1.39	0.00	1,231	0	1.31	0.00	1,164	0
86	1.45	0.00	661	0	1.38	0.00	629	0
89	1.48	0.00	599	0	1.41	0.00	572	0
91	1.50	0.00	329	0	1.44	0.00	315	0
93	1.52	0.00	43	0	1.46	0.00	41	0
Total			7,150	321			6,388	16
Total/F			0.20	0.01			0.18	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
762	305	1,066	14%	$5,395	$1,380	$6,775	13%

Note:
1. Building type: Labs
2. Conditioned floor area(F): 35,856 sq ft
3. Total CFM: 24,311
4. O.A. fraction: 0.57

Table 13.Summary of Simulated Ch-water & Steam Consumption in the Mary Moody Northen Pavilion - bldg code 19

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.92	0.68	40	30	0.54	0.30	24	13
39	0.92	0.63	75	51	0.55	0.25	44	20
41	0.92	0.58	97	60	0.57	0.22	60	23
44	0.92	0.53	155	89	0.60	0.20	101	34
46	0.91	0.47	156	80	0.63	0.19	107	32
49	0.91	0.41	216	99	0.66	0.17	157	40
51	0.90	0.36	212	84	0.69	0.15	163	36
54	0.92	0.33	323	116	0.72	0.14	255	48
56	0.93	0.30	284	91	0.75	0.12	229	36
59	0.95	0.27	408	116	0.79	0.11	338	45
61	1.02	0.26	492	124	0.85	0.10	410	49
64	1.13	0.24	602	126	0.98	0.10	523	52
66	1.20	0.22	683	123	1.08	0.09	612	53
69	1.28	0.20	772	117	1.18	0.09	710	54
71	1.36	0.17	670	85	1.27	0.08	629	41
74	1.44	0.15	652	67	1.38	0.07	625	34
76	1.51	0.12	532	44	1.47	0.07	517	23
79	1.60	0.10	711	44	1.58	0.06	701	26
81	1.74	0.09	1,228	61	1.68	0.00	1,187	0
84	1.81	0.08	1,607	69	1.77	0.00	1,566	0
86	1.87	0.07	853	31	1.84	0.00	838	0
89	1.90	0.06	771	24	1.88	0.00	763	0
91	1.93	0.05	423	11	1.92	0.00	421	0
93	1.95	0.05	55	1	1.96	0.00	55	0
Total			12,015	1,744			11,035	659
Total/F			0.22	0.03			0.20	0.01

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
980	1,086	2,066	15%	$6,938	$4,913	$11,851	13%

Note: 1. Building type: Psychiatric Hospital
2. Conditioned floor area(F): 55,133 sq ft
3. Total CFM: 61,725
4. O.A. fraction: 0.18

Table 14.Summary of Simulated Ch-water & Steam Consumption in the Animal Resource Center - bldg code 20

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.00	1.34	0	59	0.00	0.77	0	34
39	0.00	1.19	0	96	0.00	0.61	0	49
41	0.00	1.05	0	110	0.00	0.52	0	54
44	0.00	0.93	0	157	0.00	0.47	0	80
46	0.00	0.79	0	135	0.00	0.42	0	72
49	0.00	0.66	1	157	0.00	0.38	0	90
51	0.00	0.51	0	121	0.00	0.34	0	79
54	0.06	0.47	22	166	0.00	0.30	0	104
56	0.14	0.42	44	129	0.00	0.26	0	79
59	0.26	0.38	113	161	0.07	0.22	31	95
61	0.58	0.42	278	201	0.28	0.24	135	114
64	1.03	0.40	546	214	0.77	0.24	409	128
66	1.32	0.39	749	222	1.10	0.24	622	138
69	1.64	0.38	985	228	1.45	0.25	872	148
71	1.92	0.37	950	180	1.77	0.25	873	122
74	2.22	0.35	1,007	158	2.10	0.24	952	111
76	2.47	0.33	870	116	2.38	0.24	841	85
79	2.82	0.31	1,249	138	2.77	0.24	1,227	106
81	3.29	0.30	2,325	209	3.27	0.00	2,305	0
84	3.52	0.28	3,118	251	3.51	0.00	3,116	0
86	3.66	0.27	1,671	122	3.69	0.00	1,683	0
89	3.72	0.25	1,507	103	3.78	0.00	1,529	0
91	3.76	0.24	822	53	3.84	0.00	840	0
93	3.78	0.23	106	6	3.88	0.00	109	0
Total			16,363	3,493			15,544	1,688
Total/F			0.61	0.13			0.58	0.06

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
819	1,805	2,624	13%	$5,799	$8,166	$13,964	11%

Note: 1. Building type: Animal rooms
2. Conditioned floor area(F): 26,677 sq ft
3. Total CFM: 41,800
4. O.A. fraction: 1

Table 15.Summary of Simulated Ch-water & Steam Consumption in the Physical Plant - bldg code 21

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.41	0.42	18	18	0.20	0.21	9	9
39	0.43	0.41	35	33	0.23	0.20	18	16
41	0.46	0.40	48	42	0.25	0.19	26	20
44	0.48	0.39	80	66	0.27	0.19	46	32
46	0.50	0.38	85	65	0.30	0.18	51	30
49	0.52	0.37	124	89	0.32	0.17	76	40
51	0.54	0.36	127	86	0.34	0.16	80	38
54	0.56	0.35	198	125	0.36	0.16	127	55
56	0.58	0.35	177	105	0.38	0.15	116	45
59	0.60	0.34	258	144	0.41	0.14	175	60
61	0.62	0.33	300	158	0.43	0.14	210	68
64	0.64	0.32	340	170	0.46	0.14	245	74
66	0.67	0.31	379	177	0.49	0.14	277	80
69	0.73	0.30	438	182	0.52	0.14	310	84
71	0.78	0.29	387	144	0.54	0.14	267	68
74	0.84	0.28	381	127	0.57	0.13	258	60
76	0.89	0.27	313	94	0.60	0.13	210	45
79	0.96	0.25	424	113	0.64	0.12	282	54
81	1.05	0.24	740	171	0.75	0.12	528	83
84	1.09	0.23	967	205	0.81	0.11	717	101
86	1.12	0.22	509	99	0.86	0.11	390	50
89	1.13	0.21	456	83	0.88	0.11	358	43
91	1.13	0.20	248	43	0.91	0.10	198	22
93	1.14	0.19	32	5	0.92	0.10	26	3
Total			7,066	2,545			4,999	1,181
Total/F			0.18	0.07			0.13	0.03

Potential O & M Savings							
Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
2,067	1,364	3,430	36%	$14,698	$6,171	$20,869	34%

Note: 1. Building type: Offices/Shops
2. Conditioned floor area(F): 38,626 sq ft
3. Total CFM: 32,406
4. O.A. fraction: 0.26

Table 16.Summary of Simulated Ch-water & Steam Consumption in the Shriner's Burns Institute (new) - bldg code 23

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.28	0.00	12	0	0.28	0.00	12	0
39	0.28	0.00	23	0	0.28	0.00	23	0
41	0.28	0.00	29	0	0.28	0.00	29	0
44	0.28	0.00	47	0	0.28	0.00	47	0
46	0.28	0.00	48	0	0.28	0.00	48	0
49	0.28	0.01	66	3	0.28	0.01	66	3
51	0.28	0.00	66	0	0.28	0.00	66	0
54	0.28	0.00	98	0	0.28	0.00	98	0
56	0.28	0.00	85	0	0.28	0.00	85	0
59	0.28	0.00	119	0	0.28	0.00	119	0
61	0.28	0.00	134	0	0.28	0.00	134	0
64	0.28	0.00	148	0	0.28	0.00	148	0
66	0.28	0.00	158	0	0.28	0.00	158	0
69	0.28	0.00	167	0	0.28	0.00	167	0
71	0.28	0.00	137	0	0.28	0.00	137	0
74	0.28	0.00	126	0	0.28	0.00	126	0
76	0.28	0.00	98	0	0.28	0.00	98	0
79	0.28	0.00	123	0	0.28	0.00	123	0
81	0.28	0.00	196	0	0.28	0.00	196	0
84	0.28	0.00	247	0	0.28	0.00	247	0
86	0.28	0.00	127	0	0.28	0.00	127	0
89	0.28	0.00	113	0	0.28	0.00	113	0
91	0.28	0.00	61	0	0.28	0.00	61	0
93	0.28	0.00	8	0	0.28	0.00	8	0
Total			2,435	3			2,435	3
Total/F			0.01	0.00			0.01	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type:
2. Conditioned floor area(F): 215,855 sq ft
3. Total CFM: 17,400
4. O.A. fraction: 0.00

Table 17.Summary of Simulated Ch-water & Steam Consumption in the Moody Library - bldg code 24

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	1.55	1.54	68	68	1.08	1.08	47	47
39	1.56	1.51	126	123	1.09	1.05	88	85
41	1.57	1.49	165	156	1.10	1.03	115	108
44	1.57	1.47	266	248	1.10	1.00	186	169
46	1.58	1.44	271	246	1.11	0.98	190	167
49	1.60	1.42	381	337	1.12	0.95	267	226
51	1.63	1.39	384	328	1.13	0.93	267	219
54	1.65	1.37	583	482	1.15	0.90	405	318
56	1.67	1.34	508	408	1.17	0.88	355	267
59	1.70	1.32	729	564	1.20	0.85	513	365
61	1.72	1.29	832	624	1.22	0.83	588	399
64	1.76	1.27	938	674	1.26	0.80	669	427
66	1.79	1.24	1,017	706	1.29	0.78	730	442
69	1.82	1.22	1,095	733	1.31	0.75	791	453
71	1.85	1.19	911	590	1.34	0.73	662	360
74	1.87	1.16	850	526	1.37	0.69	621	315
76	1.90	1.12	669	394	1.41	0.67	499	238
79	1.93	1.08	855	477	1.49	0.67	661	298
81	1.98	1.04	1,395	732	1.58	0.67	1,115	474
84	2.00	1.00	1,771	890	1.64	0.67	1,453	596
86	2.01	0.96	917	439	1.70	0.67	773	306
89	2.01	0.92	816	374	1.74	0.67	705	271
91	2.02	0.89	442	194	1.78	0.67	390	147
93	2.02	0.86	56	24	1.82	0.67	51	19
Total			16,043	10,336			12,140	6,716
Total/F			0.25	0.16			0.19	0.10

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
3,903	3,619	7,522	29%	$27,633	$16,372	$44,006	27%

Note: 1. Building type: Library
2. Conditioned floor area(F): 65,455 sq ft
3. Total CFM: 73,000
4. O.A. fraction: 0.04

Table 18.Summary of Simulated Ch-water & Steam Consumption
in the Surgical Research Annex - bldg code 27

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.13	0.00	6	0	0.13	0.00	6	0
39	0.13	0.00	10	0	0.13	0.00	10	0
41	0.13	0.00	13	0	0.13	0.00	13	0
44	0.13	0.00	22	0	0.13	0.00	22	0
46	0.13	0.00	22	0	0.13	0.00	22	0
49	0.13	0.01	30	3	0.13	0.01	30	3
51	0.13	0.00	30	0	0.13	0.00	30	0
54	0.13	0.00	45	0	0.13	0.00	45	0
56	0.13	0.00	39	0	0.13	0.00	39	0
59	0.13	0.00	55	0	0.13	0.00	55	0
61	0.13	0.00	62	0	0.13	0.00	62	0
64	0.13	0.00	68	0	0.13	0.00	68	0
66	0.13	0.00	73	0	0.13	0.00	73	0
69	0.13	0.00	77	0	0.13	0.00	77	0
71	0.13	0.00	63	0	0.13	0.00	63	0
74	0.13	0.00	58	0	0.13	0.00	58	0
76	0.13	0.00	45	0	0.13	0.00	45	0
79	0.13	0.00	57	0	0.13	0.00	57	0
81	0.13	0.00	90	0	0.13	0.00	90	0
84	0.13	0.00	114	0	0.13	0.00	114	0
86	0.13	0.00	58	0	0.13	0.00	58	0
89	0.13	0.00	52	0	0.13	0.00	52	0
91	0.13	0.00	28	0	0.13	0.00	28	0
93	0.13	0.00	4	0	0.13	0.00	4	0
Total			1,121	3			1,121	3
Total/F			0.14	0.00			0.14	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type: Animal Labs
2. Conditioned floor area(F): 7,768 sq ft
3. Total CFM: 8,000
4. O.A. fraction: 0.00

Table 19.Summary of Simulated Ch-water & Steam Consumption in the Brackenridge Hall - bldg code 30

Ambient Temper-ature	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
(°F)	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.00	0.26	0	12	0.00	0.13	0	6
39	0.00	0.26	0	21	0.00	0.12	0	10
41	0.01	0.25	1	26	0.00	0.12	0	12
44	0.04	0.24	7	41	0.00	0.11	0	19
46	0.08	0.24	13	41	0.00	0.11	0	18
49	0.11	0.23	27	55	0.00	0.10	0	24
51	0.15	0.23	35	53	0.02	0.10	4	23
54	0.18	0.22	64	78	0.05	0.09	19	32
56	0.22	0.21	66	65	0.09	0.09	27	26
59	0.25	0.21	108	89	0.13	0.08	54	35
61	0.30	0.20	145	97	0.16	0.08	79	39
64	0.44	0.20	234	104	0.20	0.08	107	43
66	0.53	0.19	300	108	0.25	0.08	144	45
69	0.63	0.18	376	111	0.36	0.08	219	48
71	0.71	0.18	352	87	0.47	0.08	230	38
74	0.80	0.17	364	76	0.57	0.07	258	33
76	0.88	0.16	310	56	0.66	0.07	232	25
79	0.99	0.15	436	66	0.78	0.07	345	29
81	1.13	0.14	797	100	0.94	0.06	662	44
84	1.20	0.14	1,061	120	1.01	0.06	899	53
86	1.24	0.13	565	57	1.07	0.06	489	26
89	1.26	0.12	509	47	1.10	0.05	445	21
91	1.27	0.11	277	24	1.12	0.05	245	11
93	1.27	0.10	36	3	1.14	0.05	32	1
Total			6,082	1,539			4,491	662
Total/F			0.44	0.11			0.32	0.05

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
1,591	876	2,467	32%	$11,264	$3,963	$15,227	30%

Note: 1. Building type:
2. Conditioned floor area(F): 13,874 sq ft
3. Total CFM: 19,500
4. O.A. fraction: 0.66

Table 20.Summary of Simulated Ch-water & Steam Consumption in the Caly Hall - bldg code 31

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.23	0.13	10	6	0.15	0.05	7	2
39	0.23	0.12	18	10	0.15	0.05	12	4
41	0.23	0.12	24	12	0.15	0.04	16	5
44	0.23	0.11	39	19	0.16	0.04	26	6
46	0.23	0.11	40	18	0.16	0.03	27	6
49	0.24	0.10	56	25	0.16	0.03	38	7
51	0.24	0.10	56	23	0.16	0.03	38	6
54	0.24	0.09	84	33	0.16	0.02	58	7
56	0.24	0.09	73	27	0.17	0.02	50	5
59	0.24	0.08	103	36	0.17	0.01	73	5
61	0.24	0.08	117	38	0.17	0.01	84	5
64	0.24	0.07	129	39	0.18	0.01	95	4
66	0.24	0.07	139	39	0.18	0.01	103	3
69	0.25	0.06	148	39	0.19	0.00	112	2
71	0.25	0.06	122	29	0.19	0.00	94	0
74	0.25	0.05	113	23	0.20	0.00	90	0
76	0.25	0.04	88	16	0.21	0.00	73	0
79	0.25	0.04	111	16	0.22	0.00	95	0
81	0.25	0.03	178	20	0.22	0.00	157	0
84	0.25	0.02	224	20	0.23	0.00	205	0
86	0.26	0.02	116	7	0.24	0.00	109	0
89	0.26	0.01	104	4	0.25	0.00	100	0
91	0.26	0.00	57	0	0.26	0.00	56	0
93	0.26	0.00	7	0	0.26	0.00	7	0
Total			2,156	500			1,727	67
Total/F			0.17	0.04			0.14	0.01

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
429	433	862	32%	$3,037	$1,959	$4,996	28%

Note:
1. Building type: Labs/Offices
2. Conditioned floor area(F): 12,344 sq ft
3. Total CFM: 11,155
4. O.A. fraction: 0.09

Table 21.Summary of Simulated Ch-water & Steam Consumption in the Bethel Hall - bldg code 32

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.23	0.12	9.90	5.19	0.15	0.04	7	2
39	0.23	0.11	18	9	0.15	0.04	12	3
41	0.23	0.11	24	11	0.15	0.03	16	3
44	0.23	0.10	39	17	0.16	0.03	26	4
46	0.23	0.10	40	16	0.16	0.02	27	3
49	0.24	0.09	56	21	0.16	0.02	38	4
51	0.24	0.08	56	20	0.16	0.01	38	2
54	0.24	0.08	84	28	0.16	0.00	58	1
56	0.24	0.07	73	22	0.17	0.00	51	0
59	0.24	0.07	103	29	0.17	0.00	75	0
61	0.24	0.06	117	29	0.18	0.00	87	0
64	0.24	0.06	129	30	0.19	0.00	100	0
66	0.24	0.05	139	28	0.20	0.00	111	0
69	0.25	0.05	148	27	0.20	0.00	121	0
71	0.25	0.04	122	19	0.21	0.00	103	0
74	0.25	0.03	113	14	0.22	0.00	99	0
76	0.25	0.02	88	7	0.23	0.00	81	0
79	0.25	0.01	111	6	0.24	0.00	106	0
81	0.25	0.01	178	4	0.25	0.00	175	0
84	0.26	0.00	227	0	0.26	0.00	227	0
86	0.27	0.00	121	0	0.27	0.00	121	0
89	0.28	0.00	111	0	0.28	0.00	112	0
91	0.28	0.00	62	0	0.29	0.00	62	0
93	0.29	0.00	8	0	0.29	0.00	8	0
Total			2,178	342			1,862	23
Total/F			0.15	0.02			0.13	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
315	319	634	25%	$2,230	$1,443	$3,673	22%

Note: 1. Building type: Dormitory
2. Conditioned floor area(F): 14,439 sq ft
3. Total CFM: 11,155
4. O.A. fraction: 0.09

Table 22.Summary of Simulated Ch-water & Steam Consumption in the Nolan Hall - bldg code 33

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.46	0.00	20	0	0.46	0.00	20	0
39	0.46	0.00	38	0	0.46	0.00	38	0
41	0.46	0.00	49	0	0.46	0.00	49	0
44	0.46	0.00	78	0	0.46	0.00	78	0
46	0.46	0.00	79	0	0.46	0.00	79	0
49	0.46	0.01	110	3	0.46	0.01	110	3
51	0.46	0.00	109	0	0.46	0.00	109	0
54	0.46	0.00	163	0	0.46	0.00	163	0
56	0.46	0.00	141	0	0.46	0.00	141	0
59	0.46	0.00	199	0	0.46	0.00	199	0
61	0.46	0.00	224	0	0.46	0.00	224	0
64	0.46	0.00	246	0	0.46	0.00	246	0
66	0.46	0.00	263	0	0.46	0.00	263	0
69	0.46	0.00	279	0	0.46	0.00	279	0
71	0.46	0.00	229	0	0.46	0.00	229	0
74	0.46	0.00	210	0	0.46	0.00	210	0
76	0.46	0.00	163	0	0.46	0.00	163	0
79	0.46	0.00	205	0	0.46	0.00	205	0
81	0.46	0.00	327	0	0.46	0.00	327	0
84	0.46	0.00	412	0	0.46	0.00	412	0
86	0.46	0.00	212	0	0.46	0.00	212	0
89	0.46	0.00	188	0	0.46	0.00	188	0
91	0.46	0.00	102	0	0.46	0.00	102	0
93	0.46	0.00	13	0	0.46	0.00	13	0
Total			4,058	3			4,058	3
Total/F			0.24	0.00			0.24	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type:
2. Conditioned floor area(F): 17,010 sq ft
3. Total CFM: 29,000
4. O.A. fraction: 0.00

Table 23.Summary of Simulated Ch-water & Steam Consumption in the Vinsant Hall - bldg code 34

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.32	0.00	14	0	0.32	0.00	14	0
39	0.32	0.00	26	0	0.32	0.00	26	0
41	0.32	0.00	34	0	0.32	0.00	34	0
44	0.32	0.00	54	0	0.32	0.00	54	0
46	0.32	0.00	55	0	0.32	0.00	55	0
49	0.32	0.01	76	3	0.32	0.01	76	3
51	0.32	0.00	76	0	0.32	0.00	76	0
54	0.32	0.00	113	0	0.32	0.00	113	0
56	0.32	0.00	97	0	0.32	0.00	97	0
59	0.32	0.00	137	0	0.32	0.00	137	0
61	0.32	0.00	155	0	0.32	0.00	155	0
64	0.32	0.00	170	0	0.32	0.00	170	0
66	0.32	0.00	182	0	0.32	0.00	182	0
69	0.32	0.00	193	0	0.32	0.00	193	0
71	0.32	0.00	158	0	0.32	0.00	158	0
74	0.32	0.00	145	0	0.32	0.00	145	0
76	0.32	0.00	113	0	0.32	0.00	113	0
79	0.32	0.00	142	0	0.32	0.00	142	0
81	0.32	0.00	226	0	0.32	0.00	226	0
84	0.32	0.00	284	0	0.32	0.00	284	0
86	0.32	0.00	146	0	0.32	0.00	146	0
89	0.32	0.00	130	0	0.32	0.00	130	0
91	0.32	0.00	70	0	0.32	0.00	70	0
93	0.32	0.00	9	0	0.32	0.00	9	0
Total			2,803	3			2,803	3
Total/F			0.20	0.00			0.20	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type: Labs/Offices
2. Conditioned floor area(F): 14,275 sq ft
3. Total CFM: 20,000
4. O.A. fraction: 0.00

Table 24.Summary of Simulated Ch-water & Steam Consumption in the Morgan Hall - bldg code 35

Ambient Temper-ature	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
(°F)	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.19	0.00	8	0	0.19	0.00	8	0
39	0.19	0.00	16	0	0.19	0.00	16	0
41	0.19	0.00	20	0	0.19	0.00	20	0
44	0.19	0.00	32	0	0.19	0.00	32	0
46	0.19	0.00	33	0	0.19	0.00	33	0
49	0.19	0.01	46	3	0.19	0.01	46	3
51	0.19	0.00	45	0	0.19	0.00	45	0
54	0.19	0.00	68	0	0.19	0.00	68	0
56	0.19	0.00	58	0	0.19	0.00	58	0
59	0.19	0.00	82	0	0.19	0.00	82	0
61	0.19	0.00	93	0	0.19	0.00	93	0
64	0.19	0.00	102	0	0.19	0.00	102	0
66	0.19	0.00	109	0	0.19	0.00	109	0
69	0.19	0.00	116	0	0.19	0.00	116	0
71	0.19	0.00	95	0	0.19	0.00	95	0
74	0.19	0.00	87	0	0.19	0.00	87	0
76	0.19	0.00	68	0	0.19	0.00	68	0
79	0.19	0.00	85	0	0.19	0.00	85	0
81	0.19	0.00	136	0	0.19	0.00	136	0
84	0.19	0.00	170	0	0.19	0.00	170	0
86	0.19	0.00	88	0	0.19	0.00	88	0
89	0.19	0.00	78	0	0.19	0.00	78	0
91	0.19	0.00	42	0	0.19	0.00	42	0
93	0.19	0.00	5	0	0.19	0.00	5	0
Total			1,682	3			1,682	3
Total/F			0.12	0.00			0.12	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type: Dormitory
2. Conditioned floor area(F): 14,439 sq ft
3. Total CFM: 12,000
4. O.A. fraction: 0.00

Table 25.Summary of Simulated Ch-water & Steam Consumption in the League Hall - bldg code 36

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.35	0.00	15	0	0.35	0.00	15	0
39	0.35	0.00	28	0	0.35	0.00	28	0
41	0.35	0.00	37	0	0.35	0.00	37	0
44	0.35	0.00	59	0	0.35	0.00	59	0
46	0.35	0.00	60	0	0.35	0.00	60	0
49	0.35	0.01	83	3	0.35	0.01	83	3
51	0.35	0.00	82	0	0.35	0.00	82	0
54	0.35	0.00	123	0	0.35	0.00	123	0
56	0.35	0.00	106	0	0.35	0.00	106	0
59	0.35	0.00	149	0	0.35	0.00	149	0
61	0.35	0.00	168	0	0.35	0.00	168	0
64	0.35	0.00	185	0	0.35	0.00	185	0
66	0.35	0.00	198	0	0.35	0.00	198	0
69	0.35	0.00	209	0	0.35	0.00	209	0
71	0.35	0.00	172	0	0.35	0.00	172	0
74	0.35	0.00	158	0	0.35	0.00	158	0
76	0.35	0.00	123	0	0.35	0.00	123	0
79	0.35	0.00	154	0	0.35	0.00	154	0
81	0.35	0.00	246	0	0.35	0.00	246	0
84	0.35	0.00	309	0	0.35	0.00	309	0
86	0.35	0.00	159	0	0.35	0.00	159	0
89	0.35	0.00	141	0	0.35	0.00	141	0
91	0.35	0.00	76	0	0.35	0.00	76	0
93	0.35	0.00	10	0	0.35	0.00	10	0
Total			3,049	3			3,049	3
Total/F			0.21	0.00			0.21	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type: Labs/Offices
2. Conditioned floor area(F): 14,440 sq ft
3. Total CFM: 21,800
4. O.A. fraction: 0.00

Table 26.Summary of Simulated Ch-water & Steam Consumption in the Unit D - bldg code 37

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.40	0.00	17	0	0.40	0.00	17	0
39	0.40	0.00	32	0	0.40	0.00	32	0
41	0.40	0.00	41	0	0.40	0.00	41	0
44	0.40	0.00	67	0	0.40	0.00	67	0
46	0.40	0.00	68	0	0.40	0.00	68	0
49	0.40	0.01	94	3	0.40	0.01	94	3
51	0.40	0.00	93	0	0.40	0.00	93	0
54	0.40	0.00	139	0	0.40	0.00	139	0
56	0.40	0.00	120	0	0.40	0.00	120	0
59	0.40	0.00	169	0	0.40	0.00	169	0
61	0.40	0.00	191	0	0.40	0.00	191	0
64	0.40	0.00	210	0	0.40	0.00	210	0
66	0.40	0.00	224	0	0.40	0.00	224	0
69	0.40	0.00	238	0	0.40	0.00	238	0
71	0.40	0.00	195	0	0.40	0.00	195	0
74	0.40	0.00	179	0	0.40	0.00	179	0
76	0.40	0.00	139	0	0.40	0.00	139	0
79	0.40	0.00	175	0	0.40	0.00	175	0
81	0.40	0.00	279	0	0.40	0.00	279	0
84	0.40	0.00	350	0	0.40	0.00	350	0
86	0.40	0.00	180	0	0.40	0.00	180	0
89	0.40	0.00	160	0	0.40	0.00	160	0
91	0.40	0.00	87	0	0.40	0.00	87	0
93	0.40	0.00	11	0	0.40	0.00	11	0
Total			3,460	3			3,460	3
Total/F			0.12	0.00			0.12	0.00

Potential O & M Savings							
Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type: Clinic
2. Conditioned floor area(F): 29,668 sq ft
3. Total CFM: 24,720
4. O.A. fraction: 0.00

Table 27.Summary of Simulated Ch-water & Steam Consumption in the Dorm Machine Room - bldg code 38

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.07	0.00	3	0	0.07	0.00	3	0
39	0.07	0.00	6	0	0.07	0.00	6	0
41	0.07	0.00	7	0	0.07	0.00	7	0
44	0.07	0.00	12	0	0.07	0.00	12	0
46	0.07	0.00	12	0	0.07	0.00	12	0
49	0.07	0.01	17	3	0.07	0.01	17	3
51	0.07	0.00	17	0	0.07	0.00	17	0
54	0.07	0.00	25	0	0.07	0.00	25	0
56	0.07	0.00	21	0	0.07	0.00	21	0
59	0.07	0.00	30	0	0.07	0.00	30	0
61	0.07	0.00	34	0	0.07	0.00	34	0
64	0.07	0.00	37	0	0.07	0.00	37	0
66	0.07	0.00	40	0	0.07	0.00	40	0
69	0.07	0.00	42	0	0.07	0.00	42	0
71	0.07	0.00	35	0	0.07	0.00	35	0
74	0.07	0.00	32	0	0.07	0.00	32	0
76	0.07	0.00	25	0	0.07	0.00	25	0
79	0.07	0.00	31	0	0.07	0.00	31	0
81	0.07	0.00	49	0	0.07	0.00	49	0
84	0.07	0.00	62	0	0.07	0.00	62	0
86	0.07	0.00	32	0	0.07	0.00	32	0
89	0.07	0.00	28	0	0.07	0.00	28	0
91	0.07	0.00	16	0	0.07	0.00	16	0
93	0.07	0.00	2	0	0.07	0.00	2	0
Total			613	3			613	3
Total/F			0.33	0.00			0.33	0.00

Potential O & M Savings							
Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type: Equipment Rm.
2. Conditioned floor area(F): 1,878 sq ft
3. Total CFM: 4,400
4. O.A. fraction: 0.00

Table 28.Summary of Simulated Ch-water & Steam Consumption in the Administration Annex - bldg code 48

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	1.77	1.08	78	48	1.23	0.54	54	24
39	1.78	1.05	144	85	1.24	0.51	100	41
41	1.78	1.03	187	108	1.24	0.49	131	51
44	1.79	1.00	302	170	1.25	0.47	211	79
46	1.79	0.98	306	167	1.26	0.45	215	76
49	1.79	0.95	427	227	1.26	0.42	301	101
51	1.80	0.93	424	219	1.27	0.40	299	95
54	1.80	0.90	634	319	1.27	0.38	449	134
56	1.80	0.88	547	267	1.28	0.36	389	109
59	1.80	0.85	772	366	1.29	0.34	553	147
61	1.80	0.83	870	401	1.31	0.34	634	164
64	1.80	0.81	959	429	1.34	0.34	710	180
66	1.80	0.78	1,024	445	1.36	0.34	771	190
69	1.80	0.76	1,086	458	1.38	0.33	831	200
71	1.81	0.73	892	362	1.40	0.33	693	161
74	1.81	0.70	820	316	1.43	0.31	647	141
76	1.81	0.66	638	234	1.45	0.30	511	105
79	1.81	0.63	801	277	1.47	0.28	652	125
81	1.81	0.59	1,276	419	1.49	0.27	1,052	190
84	1.81	0.56	1,605	499	1.51	0.26	1,338	228
86	1.81	0.53	826	241	1.53	0.24	699	110
89	1.82	0.49	735	200	1.56	0.23	630	92
91	1.82	0.46	399	101	1.58	0.22	345	47
93	1.82	0.44	51	12	1.60	0.20	45	6
Total			15,803	6,371			12,260	2,797
Total/F			0.28	0.11			0.21	0.05

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
3,543	3,574	7,117	32%	$25,084	$16,169	$41,253	29%

Note: 1. Building type: Offices
2. Conditioned floor area(F): 57,169 sq ft
3. Total CFM: 82,011
4. O.A. fraction: 0.05

Table 29.Summary of Simulated Ch-water & Steam Consumption in the Basic Science Building - bldg code 54

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.00	2.90	0	128	0.00	1.60	0	70
39	0.00	2.80	0	227	0.00	1.60	0	130
41	0.00	2.80	0	294	0.00	1.50	0	158
44	0.00	2.80	0	473	0.00	1.50	0	254
46	0.00	2.70	0	462	0.00	1.40	0	239
49	0.00	2.70	0	643	0.00	1.40	0	333
51	0.00	2.60	0	614	0.00	1.40	0	330
54	0.90	2.60	318	918	0.00	1.30	0	459
56	1.80	2.50	547	760	0.00	1.30	0	395
59	2.90	2.50	1,244	1,073	0.00	1.20	0	515
61	3.70	2.50	1,787	1,208	1.00	1.20	483	580
64	5.10	2.40	2,713	1,277	2.70	1.20	1,436	638
66	6.00	2.40	3,408	1,363	3.70	1.20	2,102	682
69	7.10	2.30	4,274	1,385	4.80	1.20	2,890	722
71	8.00	2.30	3,952	1,136	5.80	1.20	2,865	593
74	9.00	2.20	4,086	999	6.90	1.20	3,133	545
76	9.80	2.20	3,459	777	7.80	1.20	2,753	424
79	11.00	2.10	4,873	930	9.10	1.20	4,031	532
81	12.60	2.00	8,896	1,412	10.80	1.10	7,625	777
84	13.40	2.00	11,886	1,774	11.70	1.10	10,378	976
86	13.90	1.90	6,338	866	12.30	1.10	5,609	502
89	14.20	1.80	5,751	729	12.60	1.00	5,103	405
91	14.30	1.80	3,132	394	12.80	1.00	2,803	219
93	14.40	1.70	403	48	13.00	1.00	364	28
Total			67,068	19,887			51,575	10,504
Total/F			0.59	0.17			0.45	0.09

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
15,493	9,383	24,876	29%	$109,690	$42,449	$152,139	27%

Note: 1. Building type: Labs/Classrooms
2. Conditioned floor area(F): 114,443 sq ft
3. Total CFM: 220,000
4. O.A. fraction: 0.75

Table 30.Summary of Simulated Ch-water & Steam Consumption in the William C.Levin Hall - bldg code 55

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	1.44	1.27	63	56	0.79	0.62	35	27
39	1.54	1.23	125	100	0.90	0.59	73	48
41	1.63	1.20	171	126	0.99	0.56	104	59
44	1.71	1.17	288	198	1.07	0.53	180	90
46	1.80	1.14	307	194	1.16	0.50	199	86
49	1.88	1.11	448	263	1.25	0.48	298	113
51	1.96	1.08	463	254	1.33	0.45	314	106
54	2.04	1.05	720	369	1.42	0.42	500	149
56	2.12	1.02	644	309	1.50	0.39	456	120
59	2.20	0.98	945	422	1.59	0.37	684	160
61	2.28	0.96	1,100	461	1.74	0.37	840	179
64	2.48	0.93	1,317	492	2.07	0.37	1,100	195
66	2.67	0.90	1,519	509	2.29	0.36	1,303	205
69	2.90	0.87	1,743	521	2.54	0.36	1,527	215
71	3.10	0.83	1,531	412	2.76	0.35	1,364	171
74	3.31	0.79	1,503	358	3.00	0.33	1,361	149
76	3.49	0.74	1,233	262	3.20	0.31	1,131	109
79	3.74	0.70	1,658	310	3.49	0.29	1,547	128
81	4.08	0.66	2,878	463	3.86	0.27	2,727	192
84	4.24	0.62	3,756	549	4.05	0.26	3,596	226
86	4.35	0.58	1,982	262	4.20	0.24	1,917	108
89	4.39	0.53	1,780	215	4.29	0.22	1,736	88
91	4.43	0.49	969	108	4.35	0.20	953	44
93	4.45	0.46	125	13	4.41	0.18	123	5
Total			27,268	7,226			24,067	2,972
Total/F			0.28	0.07			0.25	0.03

Potential O & M Savings							
Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
3,201	4,255	7,456	22%	$22,663	$19,250	$41,913	19%

Note: 1. Building type: Auditoriums
2. Conditioned floor area(F): 98,219 sq ft
3. Total CFM: 132,490
4. O.A. fraction: 0.22

Table 31.Summary of Simulated Ch-water & Steam Consumption in the University Hospital Clinics- bldg code 56

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	3.02	1.72	133	76	2.16	0.83	95	37
39	3.04	1.58	246	128	2.19	0.69	177	56
41	3.04	1.44	320	151	2.25	0.61	236	64
44	3.04	1.30	514	220	2.33	0.55	393	94
46	3.07	1.17	525	200	2.42	0.49	414	84
49	3.12	1.08	743	257	2.51	0.44	598	105
51	3.17	1.00	748	235	2.60	0.39	613	93
54	3.23	0.91	1,141	321	2.69	0.34	949	121
56	3.30	0.82	1,003	250	2.78	0.30	845	90
59	3.37	0.74	1,447	316	2.88	0.25	1,237	108
61	3.57	0.69	1,725	335	3.06	0.23	1,476	113
64	3.91	0.63	2,078	335	3.43	0.22	1,826	116
66	4.13	0.57	2,344	323	3.72	0.21	2,110	116
69	4.37	0.51	2,630	306	4.02	0.19	2,418	114
71	4.60	0.45	2,272	220	4.30	0.17	2,126	83
74	4.86	0.37	2,205	169	4.62	0.14	2,097	64
76	5.08	0.30	1,795	107	4.90	0.11	1,730	40
79	5.39	0.24	2,388	107	5.26	0.09	2,330	39
81	5.80	0.20	4,095	140	5.64	0.00	3,980	0
84	6.03	0.17	5,346	151	5.91	0.00	5,238	0
86	6.21	0.14	2,834	62	6.14	0.00	2,799	0
89	6.33	0.11	2,564	43	6.30	0.00	2,551	0
91	6.43	0.08	1,408	17	6.44	0.00	1,409	0
93	6.51	0.05	182	1	6.55	0.00	183	0
Total			40,683	4,469			37,830	1,536
Total/F			0.19	0.02			0.18	0.01

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
2,853	2,933	5,786	13%	$20,199	$13,269	$33,468	11%

Note: 1. Building type:

2. Conditioned floor area(F): 214,116 sq ft

3. Total CFM: 210,770

4. O.A. fraction: 0.15

Table 32.Summary of Simulated Ch-water & Steam Consumption in the School of Allied Health Scs & Nursing - bldg code 57

Ambient Temper-ature	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
(°F)	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	2.46	1.72	108	76	1.63	0.89	72	39
39	2.55	1.64	207	133	1.72	0.82	140	66
41	2.62	1.57	275	165	1.81	0.76	190	80
44	2.68	1.50	453	253	1.89	0.71	319	120
46	2.75	1.41	470	241	1.99	0.65	339	111
49	2.81	1.33	668	317	2.07	0.60	494	142
51	2.86	1.26	676	296	2.16	0.55	510	130
54	2.92	1.18	1,032	416	2.25	0.50	794	177
56	2.98	1.10	907	335	2.34	0.46	711	139
59	3.04	1.02	1,305	438	2.44	0.41	1,045	177
61	3.11	0.96	1,503	464	2.62	0.41	1,264	196
64	3.35	0.91	1,780	483	3.03	0.39	1,610	210
66	3.57	0.86	2,029	487	3.31	0.38	1,878	216
69	3.82	0.81	2,300	485	3.61	0.37	2,172	221
71	4.05	0.75	2,001	371	3.89	0.35	1,921	172
74	4.30	0.69	1,950	311	4.19	0.32	1,901	146
76	4.51	0.62	1,591	220	4.45	0.30	1,571	104
79	4.80	0.56	2,127	249	4.79	0.27	2,124	120
81	5.20	0.52	3,674	364	4.99	0.00	3,522	0
84	5.41	0.49	4,800	430	5.24	0.00	4,647	0
86	5.57	0.45	2,539	204	5.44	0.00	2,482	0
89	5.65	0.41	2,288	167	5.57	0.00	2,257	0
91	5.71	0.38	1,251	83	5.68	0.00	1,243	0
93	5.76	0.35	161	10	5.77	0.00	161	0
Total			36,095	6,999			33,367	2,567
Total/F			0.24	0.05			0.22	0.02

Potential O & M Savings							
Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
2,728	4,432	7,160	17%	$19,314	$20,050	$39,365	14%

Note: 1. Building type: Classrooms/Labs
2. Conditioned floor area(F): 148,880 sq ft
3. Total CFM: 197,373
4. O.A. fraction: 0.17

Table 33.Summary of Simulated Ch-water & Steam Consumption in the Medical Research Building - bldg code 59

Ambient Temper-ature	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
(°F)	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.36	1.11	16	49	0.77	0.28	34	12
39	0.47	0.90	38	73	0.89	0.08	72	6
41	0.57	0.73	60	76	0.98	0.00	103	0
44	0.66	0.57	112	96	1.07	0.00	181	0
46	0.77	0.38	132	65	1.17	0.00	201	0
49	0.87	0.21	207	50	1.27	0.00	302	0
51	0.96	0.00	226	0	1.36	0.00	321	0
54	1.18	0.00	417	0	1.46	0.00	514	0
56	1.45	0.00	439	0	1.55	0.00	471	0
59	1.79	0.00	768	0	1.72	0.00	737	0
61	2.24	0.00	1,084	0	2.12	0.00	1,024	0
64	3.00	0.00	1,595	0	2.91	0.00	1,548	0
66	3.52	0.00	1,998	0	3.46	0.00	1,967	0
69	4.08	0.00	2,453	0	4.06	0.00	2,441	0
71	4.61	0.00	2,277	0	4.62	0.00	2,283	0
74	5.19	0.00	2,357	0	5.24	0.00	2,379	0
76	5.71	0.00	2,016	0	5.79	0.00	2,044	0
79	6.38	0.00	2,825	0	6.49	0.00	2,875	0
81	7.22	0.00	5,094	0	7.36	0.00	5,195	0
84	7.67	0.00	6,800	0	7.84	0.00	6,950	0
86	8.03	0.00	3,663	0	8.23	0.00	3,754	0
89	8.26	0.00	3,345	0	8.49	0.00	3,437	0
91	8.44	0.00	1,849	0	8.70	0.00	1,905	0
93	8.60	0.00	241	0	8.87	0.00	248	0
Total			40,012	408			40,984	18
Total/F			0.14	0.00			0.15	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type:
2. Conditioned floor area(F): 280,614 sq ft
3. Total CFM: 60,900
4. O.A. fraction: 1

Table 34.Summary of Simulated Ch-water & Steam Consumption in the Emergency Room - bldg code 64

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	1.42	0.61	62	27	1.07	0.26	47	12
39	1.46	0.57	118	46	1.12	0.23	91	19
41	1.50	0.53	157	56	1.16	0.20	122	21
44	1.53	0.50	258	84	1.20	0.18	203	30
46	1.56	0.45	267	78	1.25	0.15	214	25
49	1.59	0.42	379	99	1.30	0.12	309	30
51	1.62	0.38	383	90	1.35	0.10	317	24
54	1.66	0.34	585	121	1.39	0.08	491	28
56	1.69	0.31	514	94	1.44	0.06	438	18
59	1.73	0.28	740	118	1.49	0.04	640	17
61	1.76	0.25	852	119	1.57	0.03	758	14
64	1.86	0.22	992	118	1.75	0.03	928	13
66	1.96	0.20	1,115	112	1.87	0.02	1,062	11
69	2.07	0.17	1,247	104	2.00	0.02	1,205	9
71	2.18	0.15	1,074	73	2.13	0.01	1,052	4
74	2.29	0.12	1,040	53	2.27	0.00	1,031	0
76	2.39	0.09	845	30	2.40	0.00	846	0
79	2.53	0.06	1,121	26	2.56	0.00	1,133	0
81	2.71	0.04	1,910	26	2.78	0.00	1,964	0
84	2.80	0.02	2,484	16	2.90	0.00	2,573	0
86	2.88	0.00	1,313	0	3.01	0.00	1,371	0
89	2.93	0.00	1,186	0	3.08	0.00	1,247	0
91	2.97	0.00	650	0	3.14	0.00	689	0
93	3.00	0.00	84	0	3.20	0.00	90	0
Total			19,376	1,489			18,823	276
Total/F			0.16	0.01			0.15	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
553	1,214	1,767	8%	$3,915	$5,492	$9,407	7%

Note: 1. Building type:
2. Conditioned floor area(F): 123,948 sq ft
3. Total CFM: 101,057
4. O.A. fraction: 0.13

Table 35.Summary of Simulated Ch-water & Steam Consumption in the Pharmacology Building - bldg code 70

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.49	0.53	22	23	0.26	0.23	11	10
39	0.52	0.49	42	40	0.29	0.20	24	16
41	0.55	0.46	57	48	0.32	0.18	33	19
44	0.57	0.44	96	74	0.34	0.17	58	28
46	0.60	0.41	102	70	0.37	0.15	63	26
49	0.62	0.39	147	94	0.39	0.14	94	32
51	0.64	0.38	152	90	0.42	0.12	98	29
54	0.68	0.36	238	128	0.44	0.11	156	38
56	0.71	0.35	216	106	0.47	0.09	142	29
59	0.76	0.33	324	143	0.50	0.08	215	36
61	0.81	0.32	389	154	0.56	0.08	269	38
64	0.88	0.30	468	162	0.65	0.07	343	39
66	0.95	0.29	539	164	0.71	0.07	406	40
69	1.06	0.27	636	165	0.79	0.06	473	39
71	1.15	0.26	570	127	0.85	0.06	421	28
74	1.25	0.23	568	106	0.92	0.05	419	20
76	1.34	0.21	471	74	0.99	0.03	349	11
79	1.45	0.19	644	83	1.08	0.02	480	8
81	1.61	0.17	1,139	116	1.27	0.01	897	5
84	1.69	0.15	1,496	130	1.37	0.00	1,214	0
86	1.74	0.12	791	57	1.46	0.00	664	0
89	1.75	0.10	709	41	1.51	0.00	612	0
91	1.76	0.08	386	18	1.55	0.00	340	0
93	1.77	0.06	50	2	1.59	0.00	44	0
Total			10,253	2,214			7,823	492
Total/F			0.24	0.05			0.18	0.01

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
2,430	1,723	4,153	33%	$17,204	$7,836	$25,040	30%

Note: 1. Building type: Labs/Offices
2. Conditioned floor area(F): 42,314 sq ft
3. Total CFM: 43,705
4. O.A. fraction: 0.33

Table 36.Summary of Simulated Ch-water & Steam Consumption in the Maurice Ewing Hall - bldg code 71

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.29	0.81	13	35	0.20	0.37	9	16
39	0.29	0.69	24	56	0.21	0.26	17	21
41	0.30	0.59	32	62	0.22	0.21	23	22
44	0.31	0.50	52	85	0.23	0.19	39	33
46	0.31	0.44	53	75	0.24	0.18	41	30
49	0.32	0.42	76	100	0.25	0.16	59	39
51	0.32	0.40	76	95	0.26	0.15	61	35
54	0.39	0.38	137	136	0.27	0.13	94	47
56	0.47	0.37	143	111	0.28	0.12	84	37
59	0.59	0.35	253	148	0.32	0.11	136	46
61	0.76	0.33	369	159	0.42	0.11	201	51
64	1.09	0.32	580	168	0.64	0.10	343	54
66	1.31	0.30	744	170	0.89	0.10	504	55
69	1.55	0.28	931	171	1.15	0.09	692	56
71	1.76	0.27	870	131	1.39	0.09	686	42
74	1.98	0.24	900	110	1.64	0.08	743	35
76	2.17	0.22	766	78	1.85	0.07	653	23
79	2.44	0.20	1,080	89	2.14	0.06	948	24
81	2.80	0.18	1,973	127	2.51	0.03	1,770	21
84	2.96	0.16	2,628	145	2.70	0.02	2,391	20
86	3.08	0.15	1,404	66	2.83	0.02	1,292	7
89	3.12	0.13	1,265	51	2.90	0.01	1,175	3
91	3.15	0.11	691	24	2.95	0.00	646	0
93	3.17	0.09	89	3	3.00	0.00	84	0
Total			15,148	2,395			12,693	717
Total/F			0.34	0.05			0.29	0.02

Potential O & M Savings							
Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
2,455	1,678	4,133	24%	$17,381	$7,591	$24,973	21%

Note:
1. Building type: Labs/Offices
2. Conditioned floor area(F): 44,242 sq ft
3. Total CFM: 49,507
4. O.A. fraction: 0.63

Table 37.Summary of Simulated Ch-water & Steam Consumption in the John Sealy South - bldg code 90

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	1.75	4.08	77	180	0.00	3.05	0	134
39	2.12	3.81	172	308	0.00	2.50	0	202
41	2.37	3.58	248	376	0.00	2.03	0	213
44	2.64	3.38	446	571	0.00	1.59	0	269
46	2.92	3.15	500	538	0.00	1.08	0	185
49	3.31	2.94	787	700	0.00	0.61	0	145
51	3.91	2.75	923	649	0.14	1.02	32	241
54	4.49	2.56	1,586	903	0.52	0.71	183	251
56	4.99	2.35	1,517	715	0.91	0.44	275	132
59	5.62	2.12	2,413	910	1.50	0.20	644	85
61	6.74	2.22	3,253	1,071	2.73	0.32	1,320	156
64	7.86	2.09	4,181	1,112	4.02	0.24	2,141	126
66	8.62	1.97	4,893	1,118	4.91	0.17	2,791	94
69	9.44	1.84	5,685	1,110	5.90	0.10	3,549	61
71	10.21	1.73	5,043	853	6.87	0.19	3,393	93
74	10.98	1.62	4,986	735	7.77	0.11	3,525	50
76	11.64	1.52	4,110	537	8.49	0.00	2,995	0
79	12.57	1.43	5,570	631	9.61	0.00	4,259	0
81	13.58	1.11	9,587	780	11.09	0.00	7,830	0
84	14.23	1.07	12,624	946	11.85	0.00	10,508	0
86	14.72	1.02	6,712	466	12.43	0.00	5,666	0
89	14.97	0.98	6,061	397	12.73	0.00	5,156	0
91	15.15	0.94	3,318	206	12.97	0.00	2,840	0
93	15.30	0.91	428	25	13.16	0.00	368	0
Total			85,122	15,840			57,475	2,437
Total/F			0.23	0.04			0.15	0.01

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
27,646	13,403	41,049	41%	$195,734	$60,635	$256,369	38%

Note: 1. Building type: Hospital Rooms
2. Conditioned floor area(F): 372,669 sq ft
3. Total CFM: 302,000
4. O.A. fraction: 0.30

Table 38.Summary of Simulated Ch-water & Steam Consumption in the John Sealy North - bldg code 91

Ambient Temper-ature	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
(°F)	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.48	2.53	21	111	0.00	2.16	0	95
39	0.52	2.27	42	184	0.00	1.90	0	154
41	0.54	2.04	57	215	0.00	1.69	0	177
44	0.57	1.83	96	310	0.00	1.49	0	251
46	0.60	1.59	102	272	0.00	1.25	0	214
49	0.63	1.37	149	325	0.00	1.04	0	247
51	0.66	1.15	156	271	0.00	0.84	0	198
54	0.75	0.99	266	348	0.00	0.64	0	227
56	1.10	0.95	333	288	0.10	0.54	29	165
59	1.78	0.91	762	390	0.44	0.53	190	228
61	2.31	0.90	1,117	435	1.04	0.53	500	256
64	3.33	0.88	1,773	469	2.13	0.53	1,135	282
66	4.00	0.86	2,274	489	2.88	0.53	1,635	302
69	4.74	0.84	2,854	506	3.69	0.53	2,222	321
71	5.42	0.82	2,676	406	4.44	0.53	2,193	264
74	6.12	0.80	2,780	362	5.22	0.53	2,370	242
76	6.73	0.77	2,376	273	5.90	0.53	2,084	187
79	7.60	0.75	3,365	332	6.84	0.53	3,030	234
81	8.76	0.73	6,184	514	8.04	0.50	5,679	350
84	9.32	0.71	8,267	628	8.67	0.50	7,687	440
86	9.72	0.69	4,430	313	9.13	0.50	4,164	226
89	9.88	0.66	4,003	269	9.37	0.50	3,794	201
91	10.00	0.65	2,190	141	9.55	0.50	2,091	109
93	10.09	0.63	283	18	9.69	0.50	271	14
Total			46,557	7,869			39,074	5,383
Total/F			0.88	0.15			0.74	0.10

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
7,483	2,486	9,969	18%	$52,980	$11,247	$64,226	18%

Note: 1. Building type: Surgery/Treatment
2. Conditioned floor area(F): 52,997 sq ft
3. Total CFM: 114,000
4. O.A. fraction: 0.19

Table 39.Summary of Simulated Ch-water & Steam Consumption in the Parking Garage - 10th & Market(west) - bldg code 98

Ambient Temper-ature (°F)	Base Consumption				Optimized Consumption			
	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam	Ch-water	Steam
	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr	MMBtu/hr	MMBtu/hr	MMBtu/yr	MMBtu/yr
36	0.19	0.08	8	4	0.12	0.02	5	1
39	0.19	0.07	16	5	0.13	0.01	11	0
41	0.20	0.05	21	6	0.15	0.00	15	0
44	0.21	0.04	35	7	0.16	0.00	28	0
46	0.21	0.03	36	5	0.18	0.00	31	0
49	0.22	0.02	52	4	0.20	0.00	48	0
51	0.22	0.00	52	0	0.22	0.00	52	0
54	0.24	0.00	84	0	0.24	0.00	84	0
56	0.26	0.00	78	0	0.26	0.00	78	0
59	0.27	0.00	118	0	0.27	0.00	118	0
61	0.29	0.00	141	0	0.30	0.00	144	0
64	0.33	0.00	176	0	0.36	0.00	189	0
66	0.37	0.00	208	0	0.39	0.00	224	0
69	0.41	0.00	244	0	0.44	0.00	262	0
71	0.44	0.00	219	0	0.48	0.00	235	0
74	0.49	0.00	220	0	0.52	0.00	236	0
76	0.52	0.00	184	0	0.56	0.00	197	0
79	0.57	0.00	252	0	0.61	0.00	268	0
81	0.63	0.00	443	0	0.67	0.00	471	0
84	0.66	0.00	585	0	0.70	0.00	621	0
86	0.69	0.00	312	0	0.73	0.00	332	0
89	0.70	0.00	284	0	0.74	0.00	301	0
91	0.71	0.00	156	0	0.76	0.00	166	0
93	0.72	0.00	20	0	0.77	0.00	22	0
Total			3,944	30			4,137	1
Total/F			0.20	0.00			0.21	0.00

Potential O & M Savings

Energy (MMBtu/yr)				Costs ($/yr)			
Ch-water	Steam	Total	Total (%)	Ch-water	Steam	Total	Total (%)
0	0	0	0%	$0	$0	$0	0%

Note: 1. Building type:
2. Conditioned floor area(F): 19,922 sq ft
3. Total CFM: 26,440
4. O.A. fraction: 0.17