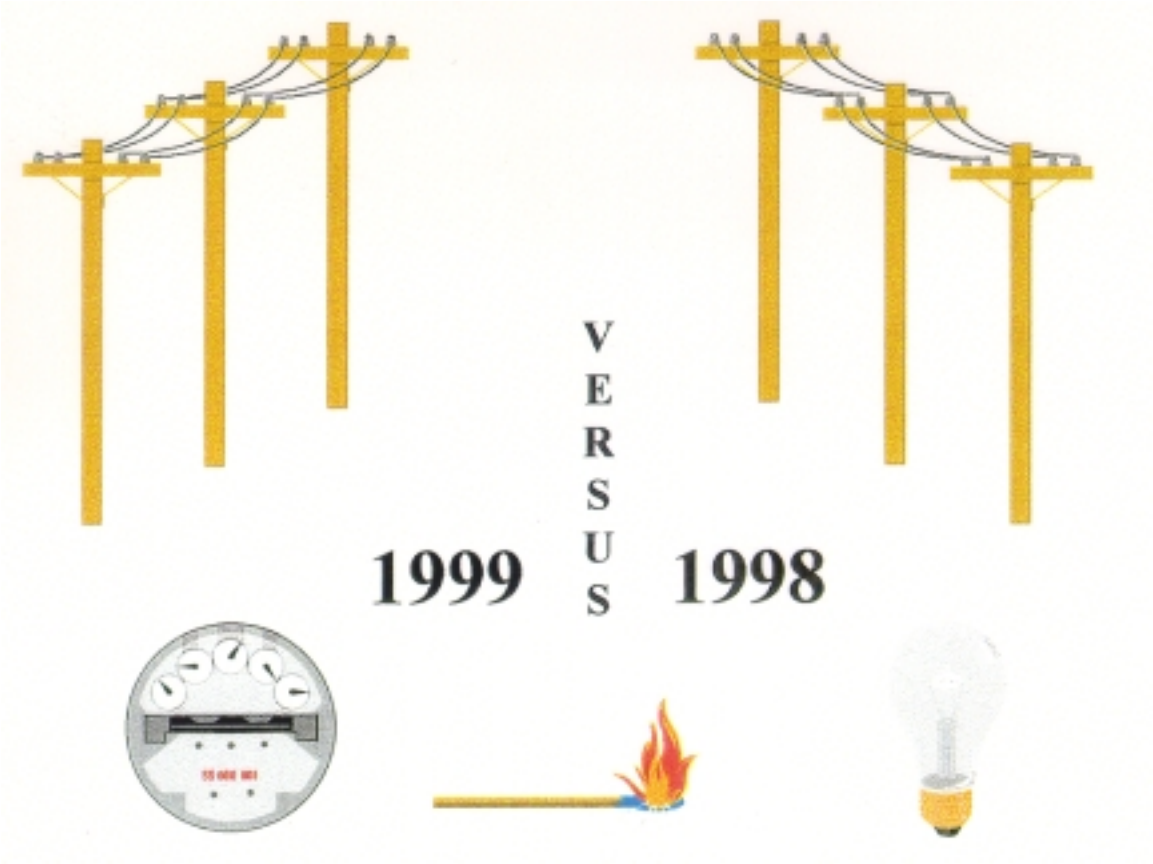
Energy Accounting Audit
for
Commercial Office Building



Apollo Office Building

Date of Report: November 9, 2000

Prepared by:
Henry Manczyk, C.P.E., C.E.M.

BUILDING ENERGY ACCOUNTING AUDIT

Henry Manczyk, C.P.E., C.E.M.

An important part of an overall energy accounting system is the ability to measure the usage and attendant cost of your resources.

An energy accounting audit will allow you to track monthly consumption and costs for each facility you manage, allowing you to generate detailed analyses. Depending on your needs, data can be retrieved showing differences between buildings or differences between certain time periods.

Your audit need not be sophisticated. Even a simple plan will allow you to:

- Track utility costs
- Account for current energy consumption and cost
- Identify areas where opportunities for savings may exist
- Justify capital investment decisions
- Identify and correct consumption problems
- Pinpoint billing errors

Additionally, one can identify relationships between energy use and factors such as occupancy and outdoor temperatures. Once patterns are established, potential problems such as equipment malfunctions can be identified and corrected.

Prior to commencing an energy audit, one must go through an information-gathering stage that would include the following:

- Assemble copies of all monthly utility bills.
- Characterize utility bills either by building or by meter, and organize them into 12-month blocks using the meter-read dates.
- Familiarize yourself with all meters and sub-meters. If several meters are used, it is helpful to clearly label them on a blueprint for each facility being monitored.
- Determine which facility or space is being served by each meter.
- Obtain historical energy data to establish a base year. If you don't have this information in your files, it can be obtained from your local utility company.
- Obtain degree-day data. This information may be obtained from your utility company, National Oceanic and Atmospheric Administration, or your local weather stations.

An important part of the overall energy auditing program is to be able to measure at what point you are and determining where you are going. It is vital to establish an energy accounting system at the beginning of the program.

Energy accounting is an integral part of energy management and conservation since it measures and accounts for energy consumption.

The building energy accounting audit provides a detailed weather-adjusted evaluation of the historical energy utility (electric, natural gas, oil, and steam) usage and costs for the facility that was audited. From this analysis, a utility accounting report is generated that can assist the building owner as follows:

a) The initial stages of project development;
b) The ongoing monitoring and verification of a specific facility's project savings; and,
c) Identifying facilities to target conservation project efforts supported by an energy audit and complete economic analysis.

Typically, energy for a facility is monitored on a BTU/square foot/year basis; the goal, of course, being to reduce this figure. However, if the BTU/square foot/year decreases from one year to the next, how can we be assured that it is through our energy conservation efforts? Maybe the weather was less severe, there were shorter operating hours, fewer employees, or a combination of these and other variables, which are truly responsible for the decrease in energy consumption.

Conversely, if BTU/square foot/year does increase, does that necessarily mean that your energy conservation efforts have failed? Maybe part of your operation has increased, such as longer hours of equipment operation, or the weather was more severe (higher degree days), or regular fuel cost escalation and other factors that should be considered as part of an overall evaluation.

All of the above factors may be responsible for the increased energy consumption and, in fact, energy use may have been even greater had it not been for conservation efforts.

The measurement of EUI (Energy Utilization Index) is the amount of energy consumed (measured in Thousands of British Thermal Units {MBTU's}), and divided by the gross conditioned area in square feet. This value, when used as a comparison between functionally similar structures, will show these structures with higher EUI's to be less efficient than those with lower EUI's.

The BEPS (Building Energy Performance Standards) is another way to benchmark and verify energy consumption in a specific facility. It is important to be aware of the varying factor degree days, which directly influences whether the EUI shall increase or decrease. A degree day, being the number of degrees under 65 per day, and cumulative for each year, certainly results in a tremendous impact on an EUI value.

Again, an energy audit is a most important tool in your energy management program. Remember, if energy cannot be measured, it cannot be controlled.

Building Energy Accounting Audit
1999 Vs 1998

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Apollo Office Building
Energy Accounting

Building Information

BUILDING: Apollo Office Building
BUILDING NO.: 1
LOCATION: 40 West Ave.
GROSS AREA: 167,212 Ft^2

ENERGY TYPE:	Electric
ENERGY UNIT:	KWH
SUPPLIER:	X
ACCOUNT #:	48367561
METER #:	52984758

ENERGY TYPE:	Steam
ENERGY UNIT:	M-Lbs
SUPPLIER:	Y
ACCOUNT #:	T15348
METER #:	JL-9

Audit Parameters

CURRENT YEAR:	1999
BASE YEAR:	1998
COMPARISON:	1999 vs 1998
# OF MONTHS:	12
PERIOD:	January - December

Apollo Office Building

Comparative Energy Usage

1999 vs 1998

	Non-Weather Related Energy				Weather Related Energy					
	Electric Consumption, KWH		Electric Costs		Steam Consumption, M-Lbs		Steam Costs		Degree Days	
	1998	1999	1998	1999	1998	1999	1998	1999	1998 D.D.	1999 D.D.
Jan	227,418	203,383	$22,421.60	$19,952.37	527.3	919.7	$4,603.33	$7,449.57	1,033	1,295
Feb	208,619	179,951	$20,776.34	$18,078.52	448.2	657.2	$3,912.79	$5,323.32	900	952
Mar	202,848	185,158	$20,306.09	$18,415.97	488.6	742.2	$4,265.48	$6,011.82	837	1056
Apr	227,492	186,749	$22,859.58	$18,937.53	213.1	215.5	$1,860.36	$1,745.55	507	585
May	220,125	178,854	$22,688.75	$19,208.25	26.5	20.2	$231.35	$163.62	114	194
Jun	222,917	202,773	$23,063.63	$21,504.25	0	0	$0.00	$0.00	114	57
Jul	245,599	226,457	$24,702.13	$23,127.21	0	0	$0.00	$0.00	4	2
Aug	219,681	213,470	$22,755.12	$19,629.41	0	0	$0.00	$0.00	11	25
Sep	210,197	196,599	$21,852.04	$18,061.44	0	0	$0.00	$0.00	115	93
Oct	183,938	172,914	$19,615.44	$16,242.93	139.9	212.9	$1,133.19	$1,728.75	425	431
Nov	163,117	160,089	$16,779.54	$15,386.82	461	426.5	$3,734.10	$3,463.18	686	584
Dec	165,758	164,589	$17,009.35	$14,978.76	457.1	483.3	$3,702.51	$3,924.40	929	1012
Total	2,497,709	2,270,986	$254,829.61	$223,523.46	2,762	3,678	$23,443.10	$29,810.20	5,675	6,286

Apollo Office Building
Energy Usage Summary
1999 vs 1998

1998

Month	Electric KWH	Electric Cost	Steam M-Lbs	Steam Energy Cost	Steam and Demand Total Energy Cost	Steam and Electric Total Energy Costs
Jan	227,418	$22,421.60	527.3	$4,603.33	$7,181.33	$29,602.93
Feb	208,619	$20,776.34	448.2	$3,912.79	$6,490.79	$27,267.13
Mar	202,848	$20,306.09	488.6	$4,265.48	$6,843.48	$27,149.57
Apr	227,492	$22,859.58	213.1	$1,860.36	$4,438.36	$27,297.94
May	220,125	$22,688.75	26.5	$231.35	$2,809.35	$25,498.10
June	222,917	$23,063.63	0	$0.00	$2,578.00	$25,641.63
July	245,599	$24,702.13	0	$0.00	$2,578.00	$27,280.13
Aug	219,681	$22,755.12	0	$0.00	$2,578.00	$25,333.12
Sep	210,197	$21,852.04	0	$0.00	$1,310.00	$23,162.04
Oct	183,938	$19,615.44	139.9	$1,133.19	$2,443.19	$22,058.63
Nov	163,117	$16,779.54	461	$3,734.10	$5,044.10	$21,823.64
Dec	165,758	$17,009.35	457.1	$3,702.51	$5,012.51	$22,021.86
TOTAL:	2,497,709	$254,829.61	2,761.70	$23,443.10	$49,307.10	$304,136.71

1999

Month	Electric KWH	Electric Cost	Steam M-Lbs	Steam Energy Cost	Steam and Demand Total Energy Cost	Steam and Electric Total Energy Costs
Jan	203,383	$19,952.37	919.7	$7,449.57	$8,759.57	$28,711.94
Feb	179,951	$18,078.52	657.2	$5,323.32	$12.00	$18,090.52
Mar	185,158	$18,415.97	742.2	$6,011.82	$7,321.82	$25,737.79
Apr	186,749	$18,937.53	215.5	$1,745.55	$3,055.55	$21,993.08
May	178,854	$19,208.25	20.2	$163.62	$1,473.62	$20,681.87
June	202,773	$21,504.25	0	$0.00	$1,310.00	$22,814.25
July	226,457	$23,127.21	0	$0.00	$1,310.00	$24,437.21
Aug	213,470	$19,629.41	0	$0.00	$1,310.00	$20,939.41
Sep	196,599	$18,061.44	0	$0.00	$1,727.00	$19,788.44
Oct	172,914	$16,242.93	212.9	$1,728.75	$3,455.75	$19,698.68
Nov	160,089	$15,386.82	426.5	$3,463.18	$5,190.18	$20,577.00
Dec	164,589	$14,978.76	483.3	$3,924.40	$5,651.40	$20,630.16
TOTAL:	2,270,986	$223,523.46	3,677.50	$29,810.20	$40,576.88	$264,100.35

Apollo Office Building

MONTH	ELECTRIC CONSUMPTION	COST	STEAM CONSUMPTION	COST	DEGREE DAYS
Jan- 98	227,418.00	$22,421.60	527.30	$4,271.13	1,033
Jan- 99	203,383.00	$19,952.37	919.70	$7,449.57	1,295
Feb- 98	208,619.00	$20,776.34	448.20	$3,630.42	900
Feb- 99	179,951.00	$18,078.52	657.20	$5,323.32	952
Mar- 98	202,848.00	$20,306.09	488.60	$3,957.66	837
Mar- 99	185,158.00	$18,415.97	742.20	$6,011.82	1,056
Apr- 98	227,492.00	$22,859.58	213.10	$1,726.11	507
Apr- 99	186,749.00	$18,937.53	215.50	$1,745.55	585
May- 98	220,125.00	$22,688.75	26.50	$214.65	114
May- 99	178,854.00	$19,208.25	20.20	$163.62	194
Jun- 98	222,917.00	$23,063.63	0.00	$0.00	114
Jun- 99	202,773.00	$21,504.25	0.00	$0.00	57
Jul- 98	245,599.00	$24,702.13	0.00	$0.00	4
Jul- 99	226,457.00	$23,127.21	0.00	$0.00	2
Aug- 98	219,681.00	$22,755.12	0.00	$0.00	11
Aug- 99	213,470.00	$19,629.41	0.00	$0.00	25
Sep- 98	210,197.00	$21,852.04	0.00	$0.00	115
Sep- 99	196,599.00	$18,061.44	0.00	$0.00	93
Oct- 98	183,938.00	$19,615.44	139.90	$1,133.19	425
Oct- 99	172,914.00	$16,242.93	212.90	$1,724.49	431
Nov- 98	163,117.00	$16,779.54	461.00	$3,734.10	686
Nov- 99	160,089.00	$15,386.82	426.50	$3,454.65	584
Dec- 98	165,758.00	$17,009.35	457.10	$3,702.51	929
Dec- 99	164,589.00	$14,978.76	483.30	$3,914.73	1,012
TOTAL 98	2,497,709.00	$254,829.61	2,761.70	$22,369.77	5,675
TOTAL 99	2,270,986.00	$223,523.46	3,677.50	$29,787.75	6,286

CURRENT SQUARE FOOTAGE: 167,212

MMBTU	Electric	Steam
1998	8,523	3,284
1999	7,749	4,373

BTU/(SF*DD)	
1998	12.44
1999	11.53

REDUCTION 7.31%

BTU/SF	
1998	70,606
1999	72,492

REDUCTION (2.67%)

COST/SF	
1998	1.66
1999	1.51

Total Cost Avoidance:
$17,305.84

Steam Cost Avoidance:

CURRENT [$/UNIT]*(*BASE* [CONS/DD]-*CURRENT* [CONS/DD])* *CURRENT* [DD] = Cost Avoidance

8.10 0.49 0.59 6,286 ($5,009.53)

Electric Cost Avoidance:

CURRENT [$/KWH] * (*BASE* CONS - *CURRENT* CONS) = Cost Avoidance

0.098426 2,497,709 2,270,986 $22,315.38

Apollo Office Building

MONTH	ELECTRIC CONSUMPTION	COST	STEAM CONSUMPTION	COST	DEGREE DAYS
Jan- 87	315,218.00	$22,681.60	861.00	$6,974.10	1,223
Jan- 99	203,383.00	$19,952.37	919.70	$7,449.57	1,295
Feb- 87	295,181.00	$21,732.38	945.50	$7,658.55	1,153
Feb- 99	179,951.00	$18,078.52	657.20	$5,323.32	952
Mar- 87	301,336.00	$20,502.85	577.50	$4,677.75	858
Mar- 99	185,158.00	$18,415.97	742.20	$6,011.82	1,056
Apr- 87	293,368.00	$17,854.20	236.40	$1,914.84	454
Apr- 99	186,749.00	$18,937.53	215.50	$1,745.55	585
May- 87	295,532.00	$18,607.15	67.50	$546.75	234
May- 99	178,854.00	$19,208.25	20.20	$163.62	194
Jun- 87	315,342.00	$23,077.63	69.10	$559.71	39
Jun- 99	202,773.00	$21,504.25	0.00	$0.00	57
Jul- 87	365,532.00	$30,557.59	60.20	$487.62	7
Jul- 99	226,457.00	$23,127.21	0.00	$0.00	2
Aug- 87	361,236.00	$32,034.78	40.10	$324.81	50
Aug- 99	213,470.00	$19,629.41	0.00	$0.00	25
			12.00		
Sep- 87	336,537.00	$30,314.40	40.10	$324.81	139
Sep- 99	196,599.00	$18,061.44	0.00	$0.00	93
Oct- 87	288,328.00	$21,697.39	134.40	$1,088.64	547
Oct- 99	172,914.00	$16,242.93	212.90	$1,724.49	431
Nov- 87	291,872.00	$18,179.10	273.30	$2,213.73	722
Nov- 99	160,089.00	$15,386.82	426.50	$3,454.65	584
Dec- 87	300,049.00	$19,790.21	319.40	$2,587.14	997
Dec- 99	164,589.00	$14,978.76	483.30	$3,914.73	1,012
TOTAL 87	3,759,531.00	$277,029.28	3,624.50	$29,358.45	6,423
TOTAL 99	2,270,986.00	$223,523.46	3,677.50	$29,787.75	6,286

CURRENT SQUARE FOOTAGE: 167,212

MMBTU	Electric	Steam
1987	12,828	4,310
1999	7,749	4,373

BTU/(SF*DD)

1987	15.96
1999	11.53

REDUCTION 27.73%

BTU/SF

1987	102,490
1999	72,492

REDUCTION 29.27%

COST/SF

1987	1.83
1999	1.51

Total Cost Avoidance: $145,455.63

Steam Cost Avoidance:

CURRENT [$/UNIT]*(*BASE* [CONS/DD]-*CURRENT* [CONS/DD])* *CURRENT* [DD] = Cost Avoidance

8.10 0.56 0.59 6,286 ($1,055.50)

Electric Cost Avoidance:

CURRENT [$/KWH] * (*BASE* CONS - *CURRENT* CONS) = Cost Avoidance

0.098426 3,759,531 2,270,986 $146,511.13

COST AVOIDANCE/SAVINGS
1999 vs 1998

Building Number:

Building Name: Apollo Office Building **Gross Area:** 167,212 Ft^2

HEATING: WEATHER RELATED

	COST / CONSUMPTION	[CONSUMPTION / DEGREE DAYS	-	CONSUMPTION / DEGREE DAYS]	DEGREE DAYS	= $
STEAM:	$29,787.75 / 3,677.50	[2,761.70 / 5,675	-	3,677.50 / 6,286]	6,286	= $ (5,009.53)
GAS:	$0.00 / 0.00	[0.00 / 0	-	0.00 / 0]	0	= $ 0.00
OIL:	0 / 0	[0 / 0	-	0 / 0]	0	= $ 0.00

ELECTRICAL: NON-WEATHER RELATED

	COST / CONSUMPTION	[CONSUMPTION	-	CONSUMPTION]	= $
ELECTRICAL:	$223,523.46 / 2,270,986.00	[2,497,709.00	-	2,270,986.00]	= $ 22,315.38

HEATING:

	1998	1999
MMBTUS x 1000 / SQ. FT. =	70.61	72.49
MMBTUS x 10^6 / SQ. FT. x D.D. =	12.44	11.53
COST / SQ. FT. =	1.66	1.51
DEGREE DAYS =	5,675	6,286

TOTAL COST AVOIDANCE = $ 17,305.84

no sign is a savings

minus sign is a loss

ENERGY UTILIZATION INDEX

January - December

BUILDING: Apollo Office Building **SQUARE FEET:** 167,212

YEAR: 1999 DEGREE DAYS: 6,286

2,270,986.00	KWH x 3,413 =	7.75E+09	BTU'S	COST:	$223,523.46
3,677.50	M-LBS x 1,189,000 =	4.37E+09	BTU'S	COST:	$29,787.75
0.00	THERMS x 100,000 =	0.00E+00	BTU'S	COST:	$0.00
0.00	GALS x 138700 =	0.00E+00	BTU'S	COST:	$0.00
	TOTAL =	1.21E+10	BTU'S	COST:	$253,311.21

BTU / Ft^2 - D.D. = 1.15E+07

YEAR: 1998 DEGREE DAYS: 5,675

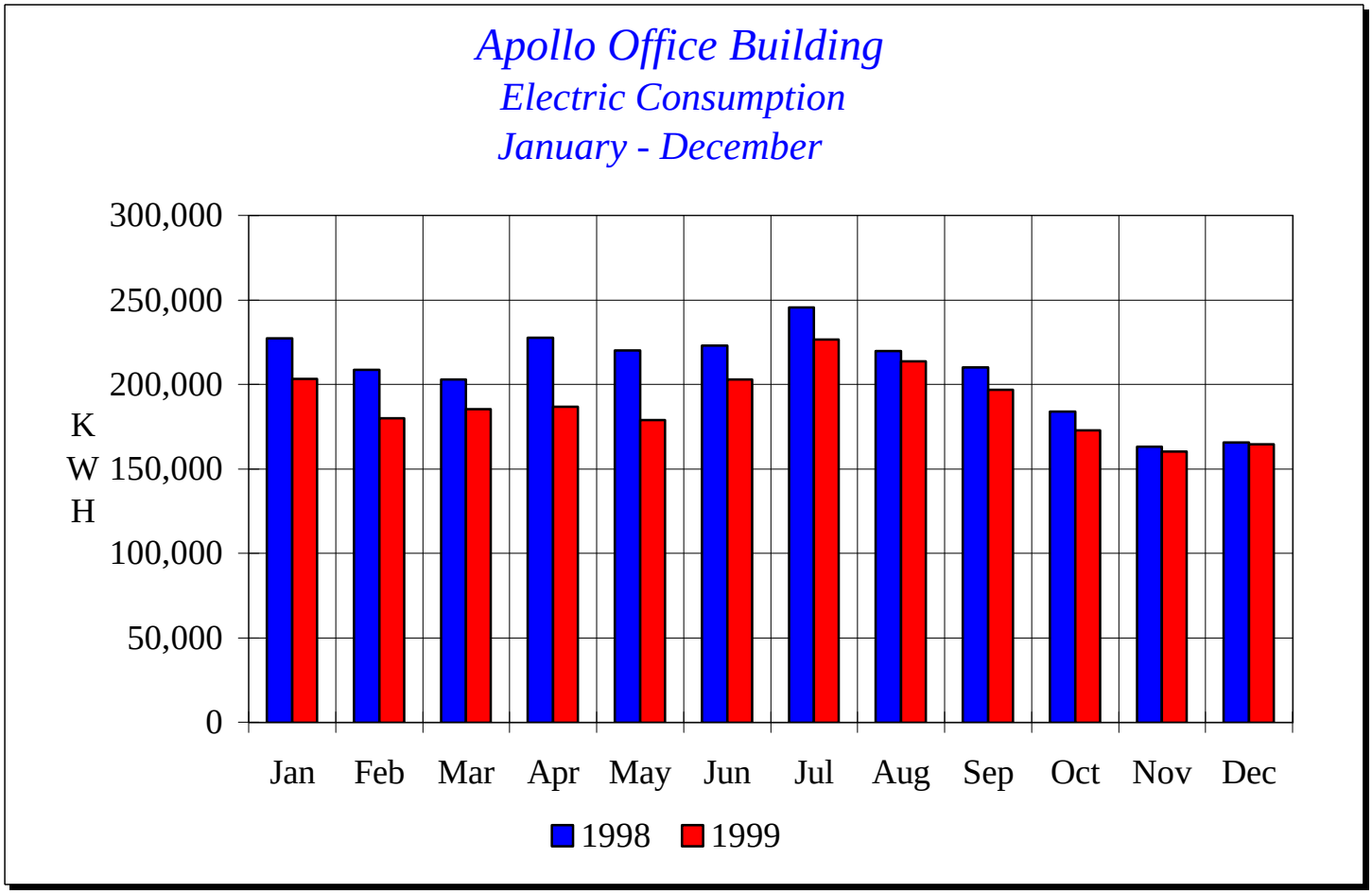
2,497,709	KWH x 3,413 =	8.52E+09	BTU'S	COST:	$254,829.61
2,761.70	M-LBS x 1,189,000 =	3.28E+09	BTU'S	COST:	$22,369.77
0.00	THERMS x 100,000 =	0.00E+00	BTU'S	COST:	$0.00
0.00	GALS x 138,700 =	0.00E+00	BTU'S	COST:	$0.00
	TOTAL =	1.18E+10	BTU'S	COST:	$277,199.38

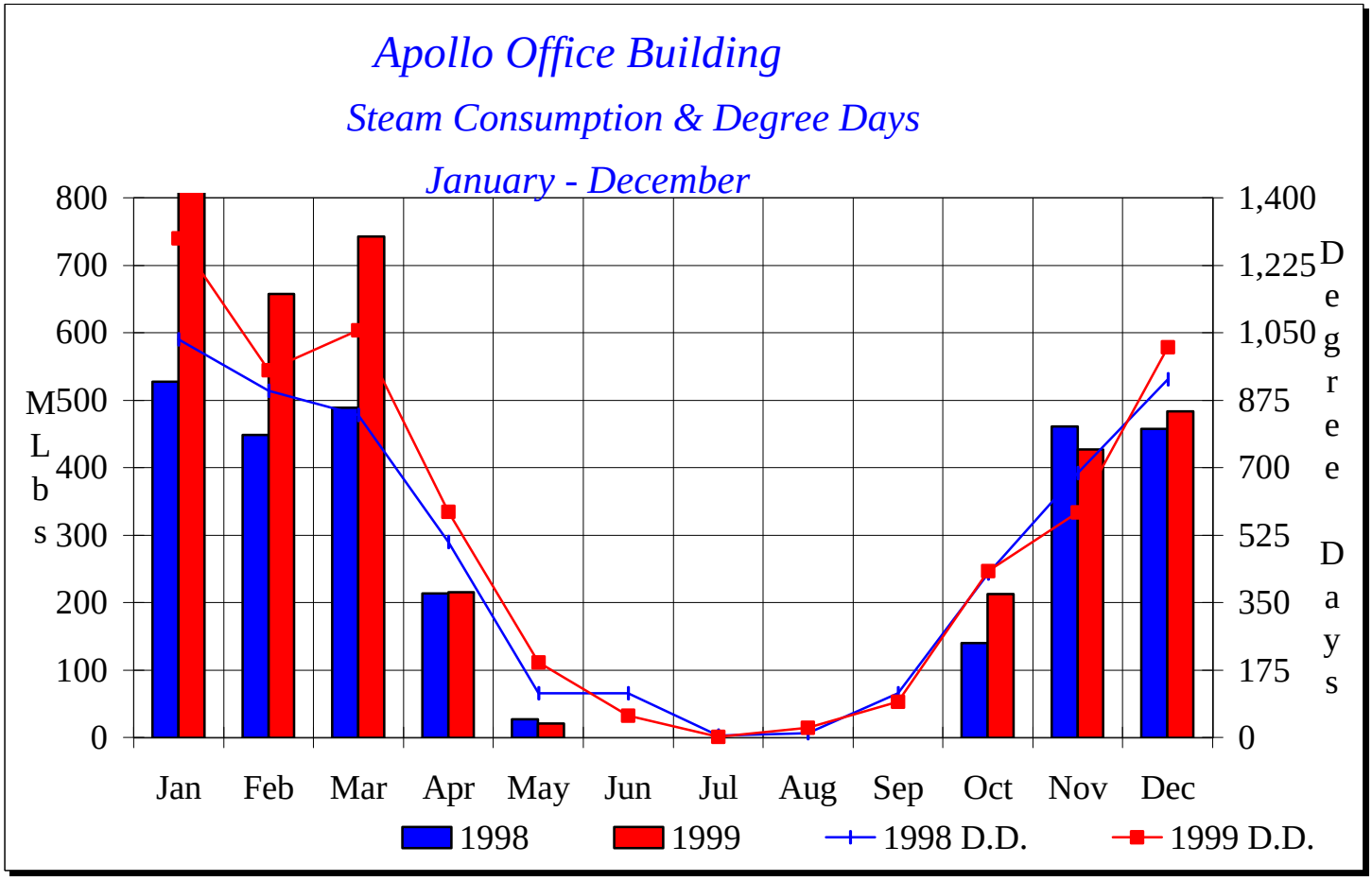
BTU / Ft^2 - D.D. = 1.24E+07

YEAR: 1987 DEGREE DAYS: 6,423

3,759,531.00	KWH x 3,413 =	1.28E+10	BTU'S	COST:	$277,029.28
3,624.50	M-LBS x 1,189,000 =	4.31E+09	BTU'S	COST:	$29,358.45
0.00	THERMS x 100,000 =	0.00E+00	BTU'S	COST:	$0.00
0.00	GALS x 100,000 =	0.00E+00	BTU'S	COST:	$0.00
	TOTAL =	1.71E+10	BTU'S	COST:	$306,387.73

BTU / Ft^2 - D.D. = 1.60E+07


Apollo Office Building
Electric Consumption
January - December
300,000
250,000
200,000
150,000
100,000
50,000
0
K
W
H
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1998
1999


Apollo Office Building
Steam Consumption & Degree Days
January - December
800
700
600
500
400
300
200
100
0
M
L
b
s
1,400
1,225
1,050
875
700
525
350
175
0
D
e
g
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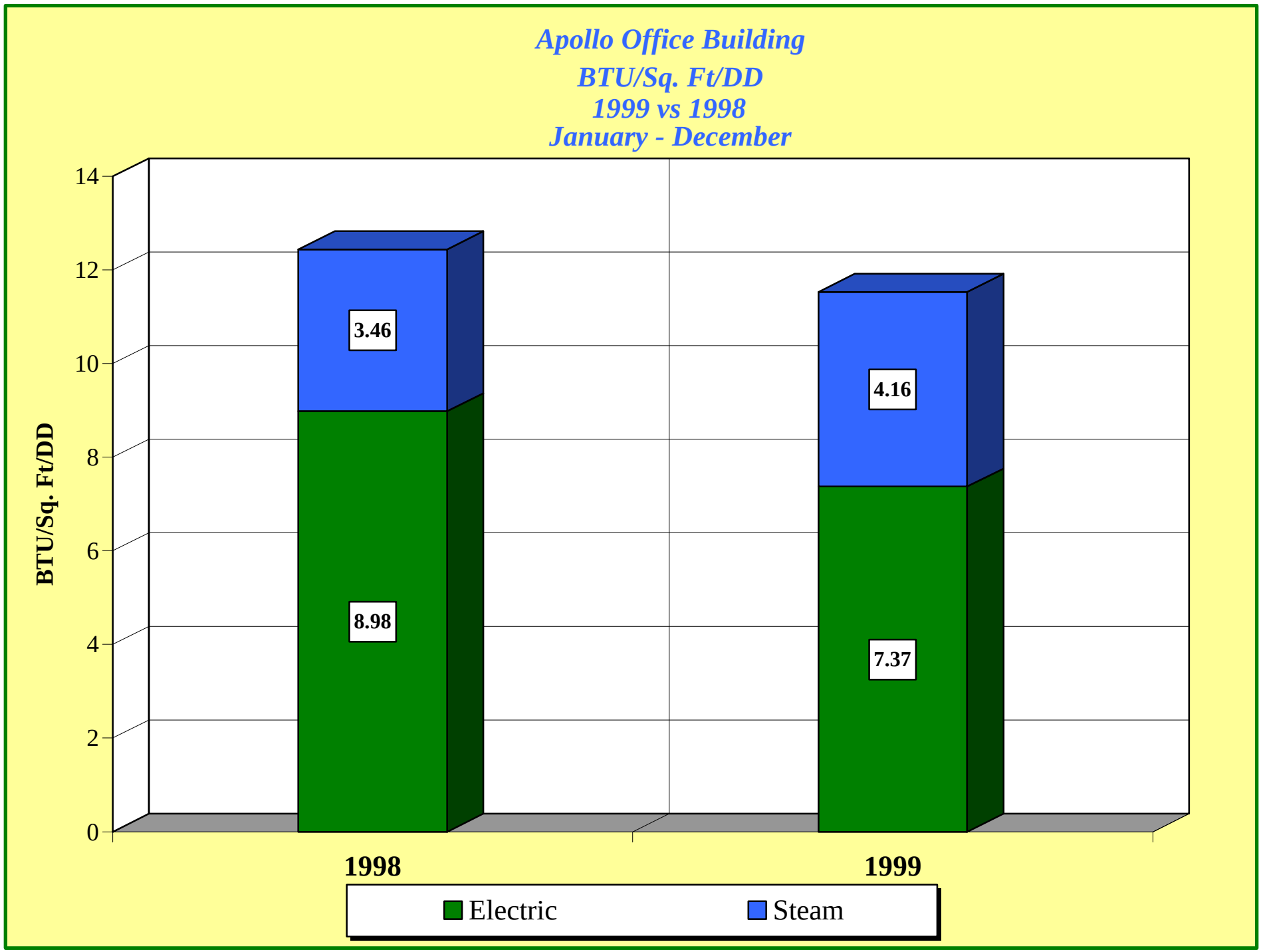
e
e
D
a
y
s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1998
1999
1998 D.D.
1999 D.D.

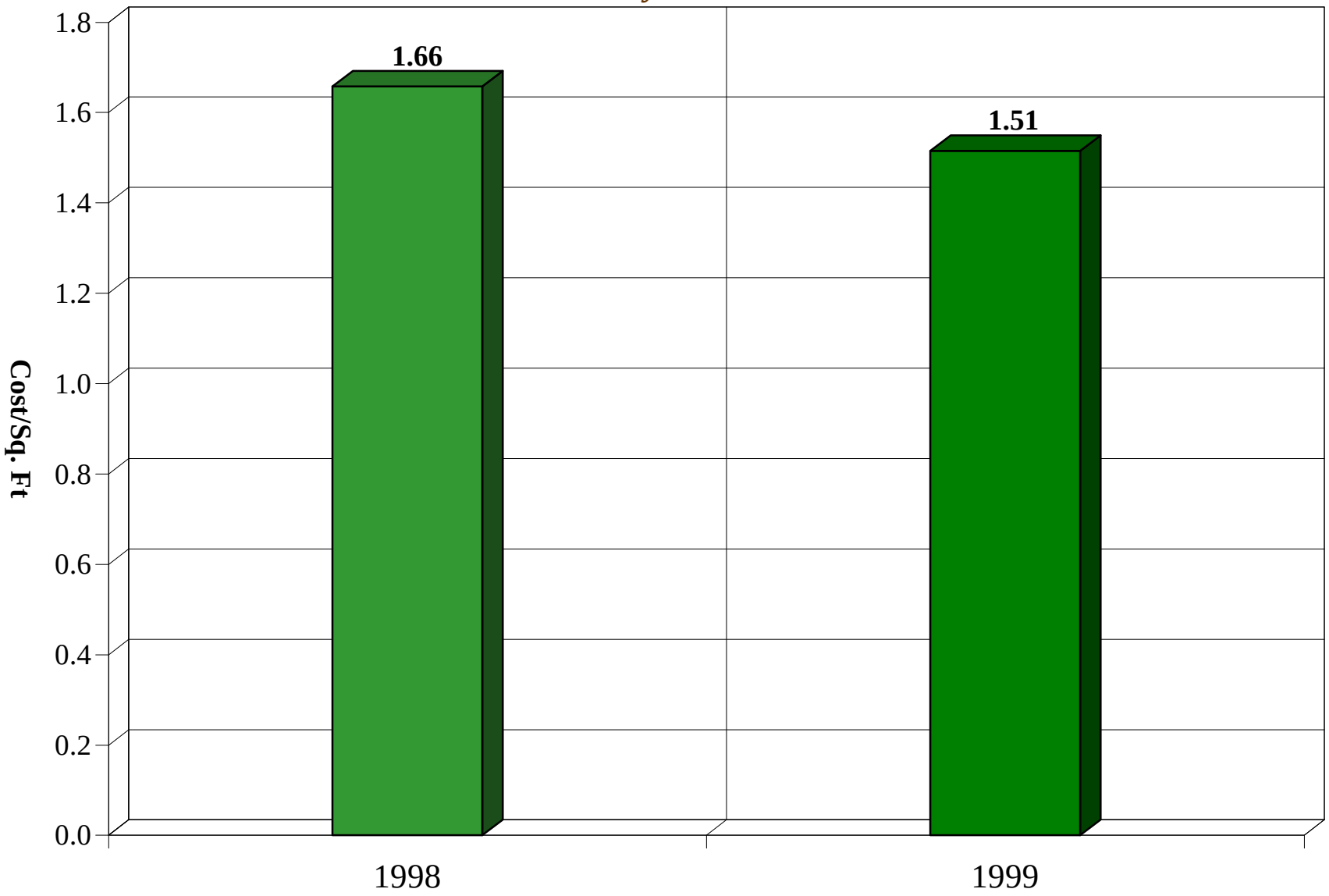

Apollo Office Building
BTU/Sq. Ft/DD
1999 vs 1998
January - December
BTU/Sq. Ft/DD
14
12
10
8
6
4
2
0
3.46
8.98
4.16
7.37
1998
1999
Electric
Steam

Apollo Office Building

Cost per/Sq. Ft

1999 vs 1998

January - December



Electrical Usage

Apollo Office Building

SHOULDER PEAK

	1998		1999	
	Consumption KWH	Demand KW	Consumption KWH	Demand KW
Jan	112,096	556.80	98,983	0.00
Feb	105,192	524.40	93,154	0.00
Mar	120,375	514.80	108,559	0.00
Apr	142,585	586.80	118,197	0.00
May	144,026	0.00	119,593	0.00
Jun	102,687	0.00	92,850	0.00
Jul	82,833	0.00	76,083	0.00
Aug	75,710	0.00	75,962	0.00
Sep	72,633	0.00	68,368	0.00
Oct	93,181	0.00	86,007	0.00
Nov	105,808	0.00	102,656	0.00
Dec	94,648	0.00	96,311	0.00
TOTAL	1,251,774	2,182.80	1,136,723	0.00

PEAK

	1998		1999	
	Consumption KWH	Demand KW	Consumption KWH	Demand KW
Jan	25,307	556.80	21,941	502.80
Feb	23,827	524.40	20,086	472.80
Mar	7,776	514.80	7,723	470.40
Apr	0	586.80	0	505.20
May	0	608.40	0	568.80
Jun	45,296	620.40	40,616	624.00
Jul	75,308	633.60	67,936	631.20
Aug	69,521	621.60	67,433	592.80
Sep	66,694	601.20	62,608	546.00
Oct	23,035	583.20	23,833	522.00
Nov	0	458.40	0	514.80
Dec	11,401	464.40	9,918	448.80
TOTAL	348,165	6,774.00	322,094	6,399.60

OFF-PEAK

	1998		1999	
	Consumption KWH	Demand KW	Consumption KWH	Demand KW
Jan	90,015	398.40	82,459	405.60
Feb	79,600	406.80	66,711	339.60
Mar	74,697	384.00	68,876	362.40
Apr	84,907	373.20	68,552	316.80
May	76,099	391.20	59,261	369.60
Jun	74,934	372.00	69,307	409.20
Jul	87,458	438.00	82,438	453.60
Aug	74,450	439.20	70,075	387.60
Sep	70,870	404.40	65,623	368.40
Oct	67,722	345.60	63,074	298.80
Nov	57,309	268.80	57,433	289.20
Dec	59,709	291.60	58,360	283.20
TOTAL	897,770	4,513.20	812,169	4,284.00

Apollo Office Building
Energy Accounting
1999 vs 1998
January - December

Electric Peak Demand Summary

Apollo Office Building

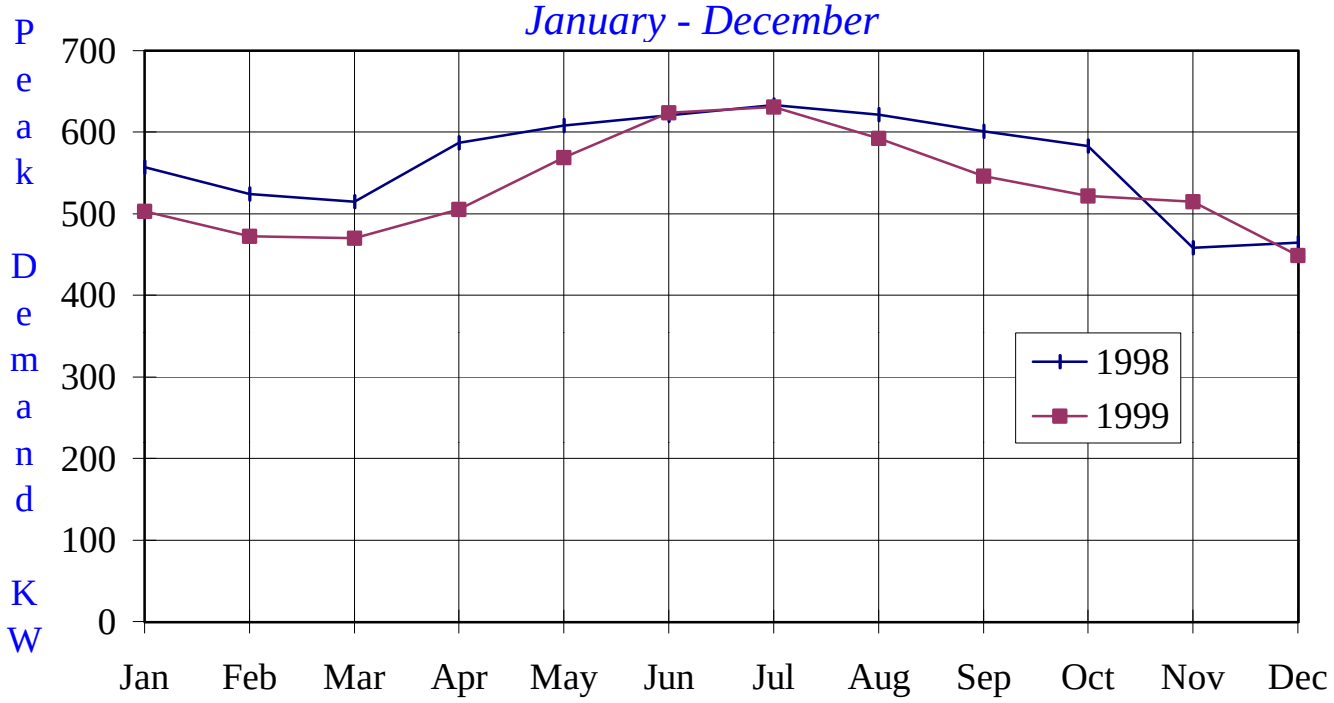
	Peak Demand KW	
Month	1998	1999
Jan	556.80	502.80
Feb	524.40	472.80
Mar	514.80	470.40
Apr	586.80	505.20
May	608.40	568.80
Jun	620.40	624.00
Jul	633.60	631.20
Aug	621.60	592.80
Sep	601.20	546.00
Oct	583.20	522.00
Nov	458.40	514.80
Dec	464.40	448.80
Average	564.50	533.30

Apollo Office Building

Electrical Peak Demand

1999 vs 1998

January - December

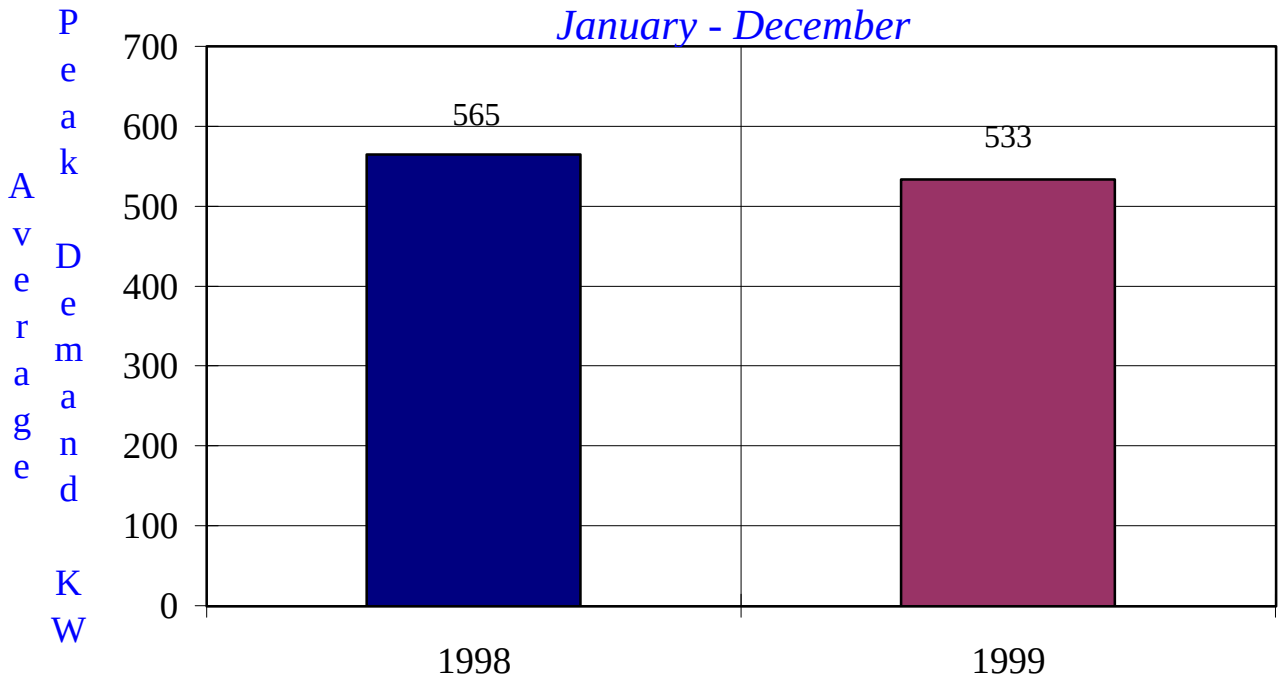


Apollo Office Building

Average Electrical Peak Demand

1999 vs 1998

January - December



Apollo Office Building
Energy Accounting

Apollo Office Building

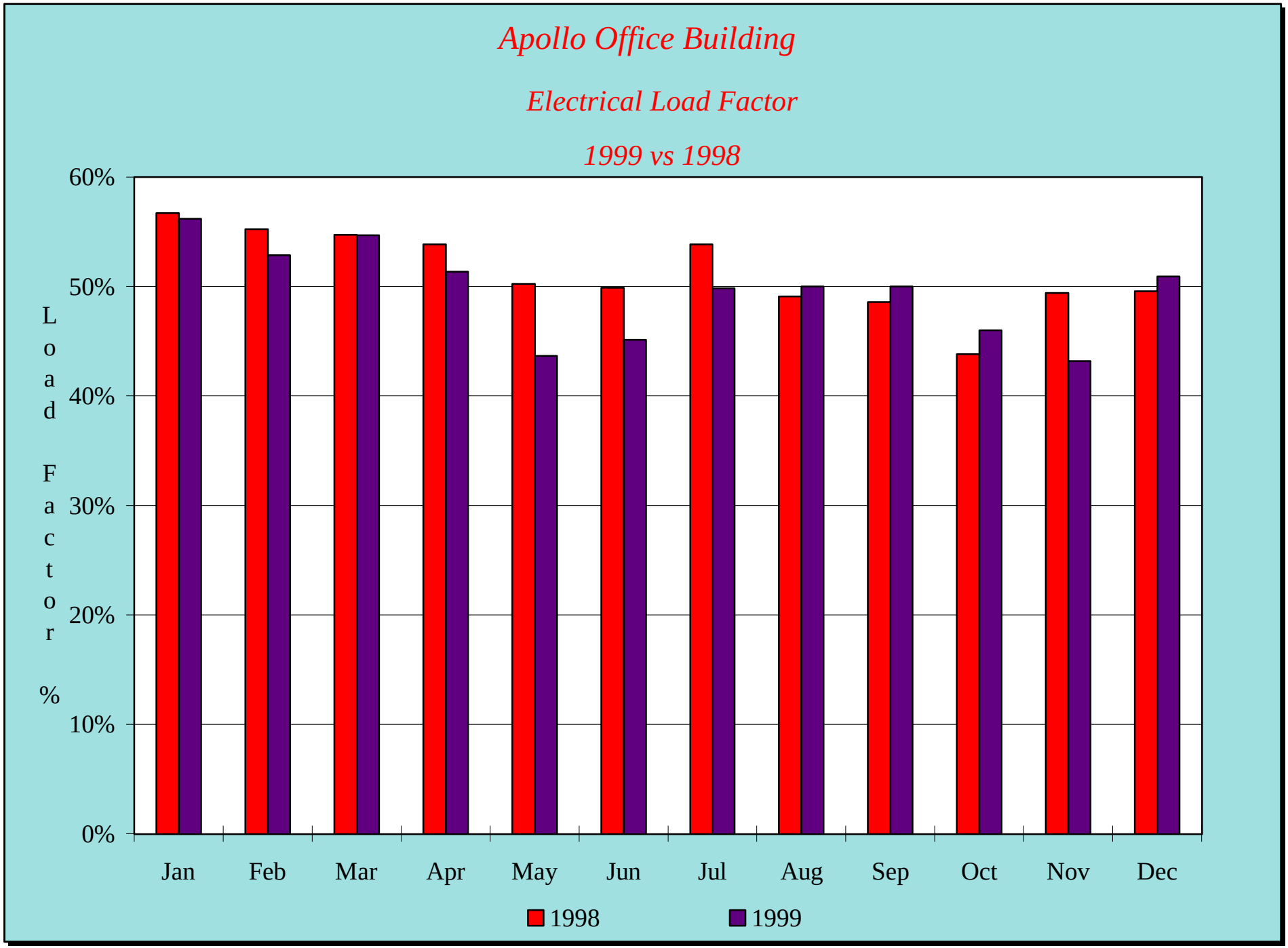
Electrical Usage & Load Factor

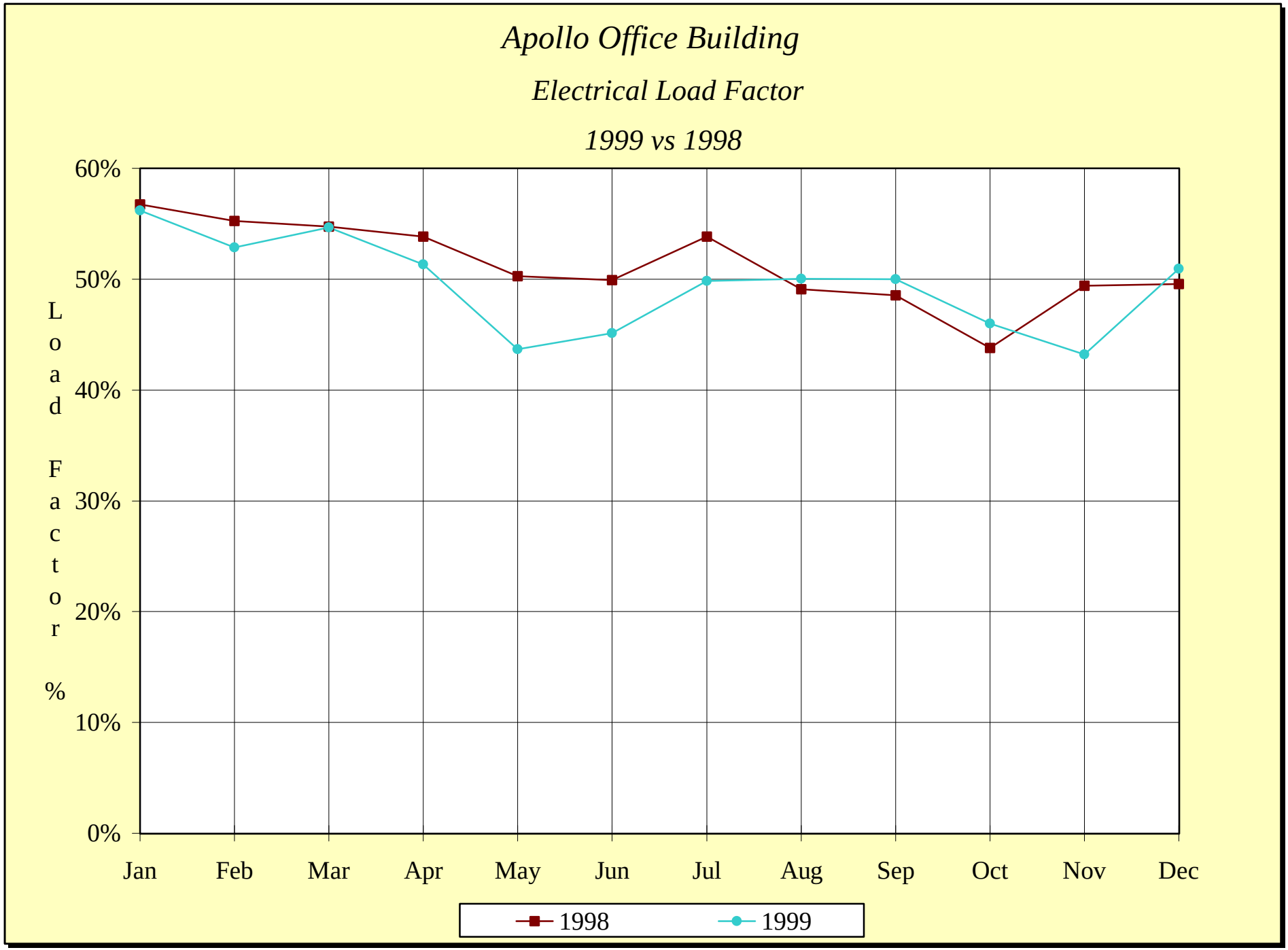
1998

	Total KWH	Maximum Demand KW	Load Factor, %
Jan	227,418	556.80	56.73%
Feb	208,619	524.40	55.25%
Mar	202,848	514.80	54.73%
Apr	227,492	586.80	53.84%
May	220,125	608.40	50.25%
Jun	222,917	620.40	49.90%
Jul	245,599	633.60	53.84%
Aug	219,681	621.60	49.09%
Sep	210,197	601.20	48.56%
Oct	183,938	583.20	43.80%
Nov	163,117	458.40	49.42%
Dec	165,758	464.40	49.57%
TOTAL	2,497,709	6,774.00	51.21%

1999

	Total KWH	Maximum Demand KW	Load Factor, %
Jan	203,383	502.80	56.18%
Feb	179,951	472.80	52.86%
Mar	185,158	470.40	54.67%
Apr	186,749	505.20	51.34%
May	178,854	568.80	43.67%
Jun	202,773	624.00	45.13%
Jul	226,457	631.20	49.83%
Aug	213,470	592.80	50.01%
Sep	196,599	546.00	50.01%
Oct	172,914	522.00	46.01%
Nov	160,089	514.80	43.19%
Dec	164,589	448.80	50.93%
TOTAL	2,270,986	6,399.60	49.29%


Apollo Office Building
Electrical Load Factor
1999 vs 1998
60%
50%
40%
30%
20%
10%
0%
Load Factor %
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1998
1999


Apollo Office Building
Electrical Load Factor
1999 vs 1998
60%
50%
40%
30%
20%
10%
0%
Load Factor %
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1998
1999

Apollo Office Building
Energy Accounting

Apollo Office Building

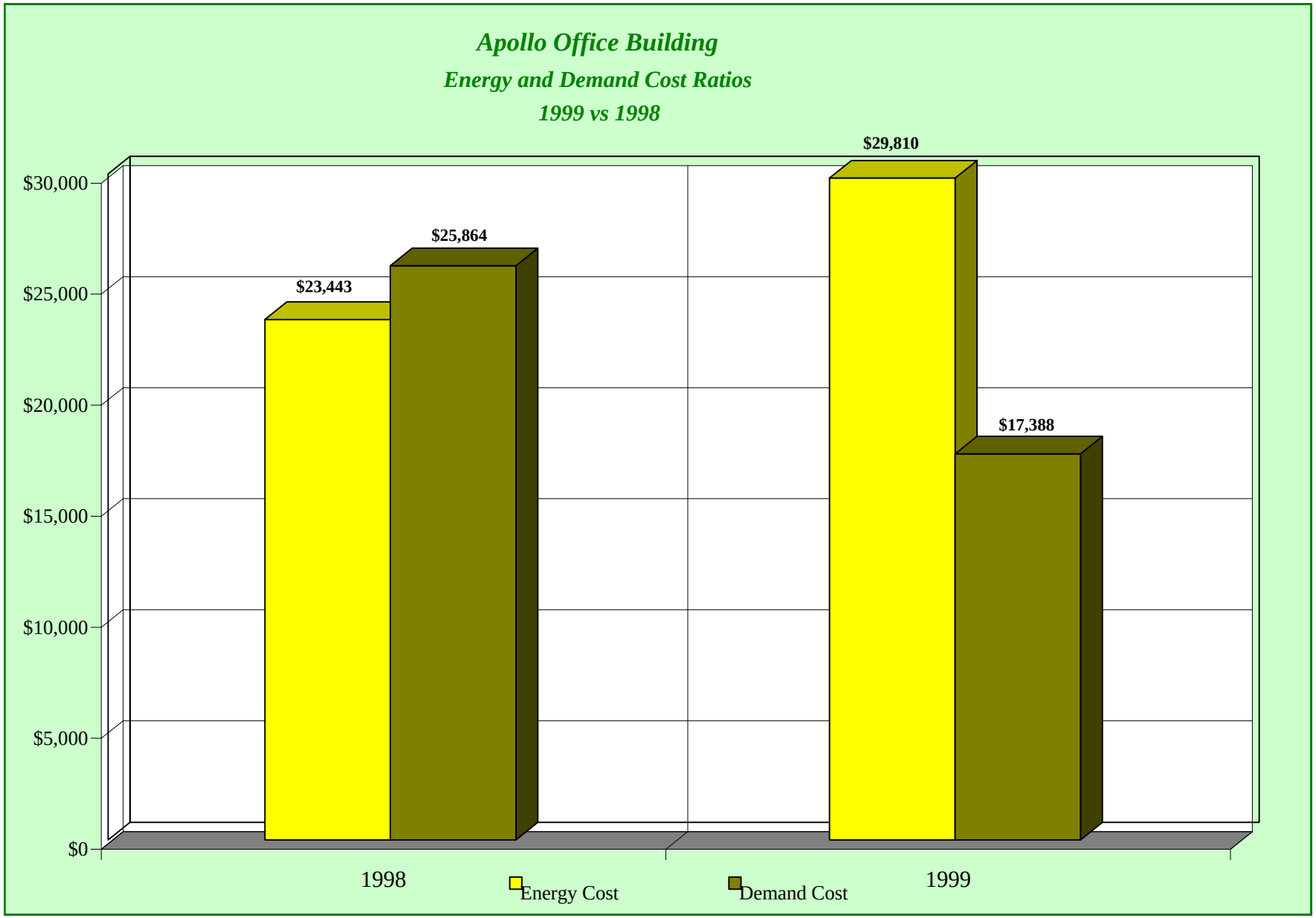
Steam Usage Data & Demand

1998

	Consumption M-Lbs	Rate ($/unit)	Steam Cost ($)	Demand Cost ($)	Total Energy Costs ($)
Jan	527.3	$8.73	$4,603.33	$2,578.00	$7,181.33
Feb	448.2	$8.73	$3,912.79	$2,578.00	$6,490.79
Mar	488.6	$8.73	$4,265.48	$2,578.00	$6,843.48
Apr	213.1	$8.73	$1,860.36	$2,578.00	$4,438.36
May	26.5	$8.73	$231.35	$2,578.00	$2,809.35
Jun	0	$8.73	$0.00	$2,578.00	$2,578.00
Jul	0	$8.73	$0.00	$2,578.00	$2,578.00
Aug	0	$8.73	$0.00	$2,578.00	$2,578.00
Sep	0	$8.10	$0.00	$1,310.00	$1,310.00
Oct	139.9	$8.10	$1,133.19	$1,310.00	$2,443.19
Nov	461	$8.10	$3,734.10	$1,310.00	$5,044.10
Dec	457.1	$8.10	$3,702.51	$1,310.00	$5,012.51
TOTAL	2761.7	$8.49	$23,443.10	$25,864.00	$49,307.10

1999

	Consumption M-Lbs	Rate ($)	Steam Cost ($)	Demand Cost ($)	Total Energy Costs ($)
Jan	919.7	$8.10	$7,449.57	$1,310.00	$8,759.57
Feb	657.2	$8.10	$5,323.32	$1,310.00	$6,633.32
Mar	742.2	$8.10	$6,011.82	$1,310.00	$7,321.82
Apr	215.5	$8.10	$1,745.55	$1,310.00	$3,055.55
May	20.2	$8.10	$163.62	$1,310.00	$1,473.62
Jun	0	$8.10	$0.00	$1,310.00	$1,310.00
Jul	0	$8.10	$0.00	$1,310.00	$1,310.00
Aug	0	$8.10	$0.00	$1,310.00	$1,310.00
Sep	0	$8.10	$0.00	$1,727.00	$1,727.00
Oct	212.9	$8.12	$1,728.75	$1,727.00	$3,455.75
Nov	426.5	$8.12	$3,463.18	$1,727.00	$5,190.18
Dec	483.3	$8.12	$3,924.40	$1,727.00	$5,651.40
TOTAL	3677.5	$8.11	$29,810.20	$17,388.00	$47,198.20


Apollo Office Building
Energy and Demand Cost Ratios
1999 vs 1998
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
$23,443
$25,864
$29,810
$17,388
1998
1999
Energy Cost
Demand Cost

APPENDIX A – TECHNICAL INFORMATION

BUILDING ENERGY CONSUMPTION CHARACTERISTICS

On a national basis, the systems in buildings which will consume the most energy are, in descending order:

1. Heating and Ventilating
2. Lighting
3. Cooling and Ventilating
4. Domestic Hot Water

The amount of energy consumed in a given building depends upon climate, building construction, use and type of operation, control and efficiency of the mechanical and electrical equipment.

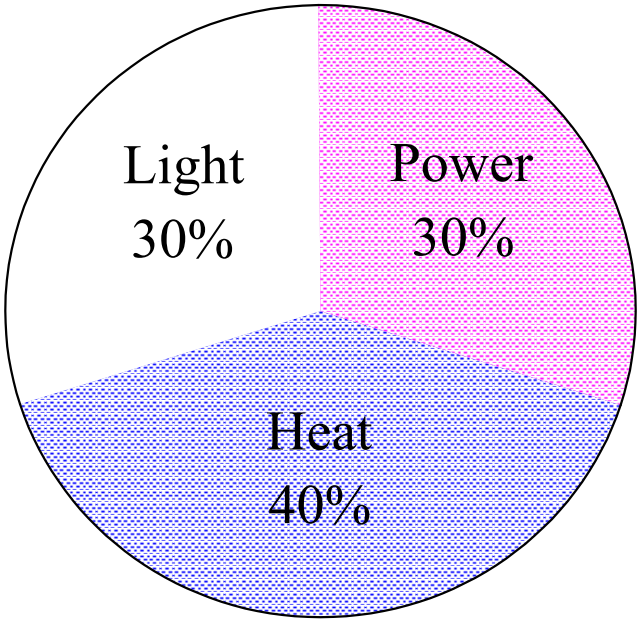
Climate conditions generally are considered to be the most important of all conditions affecting energy consumption.

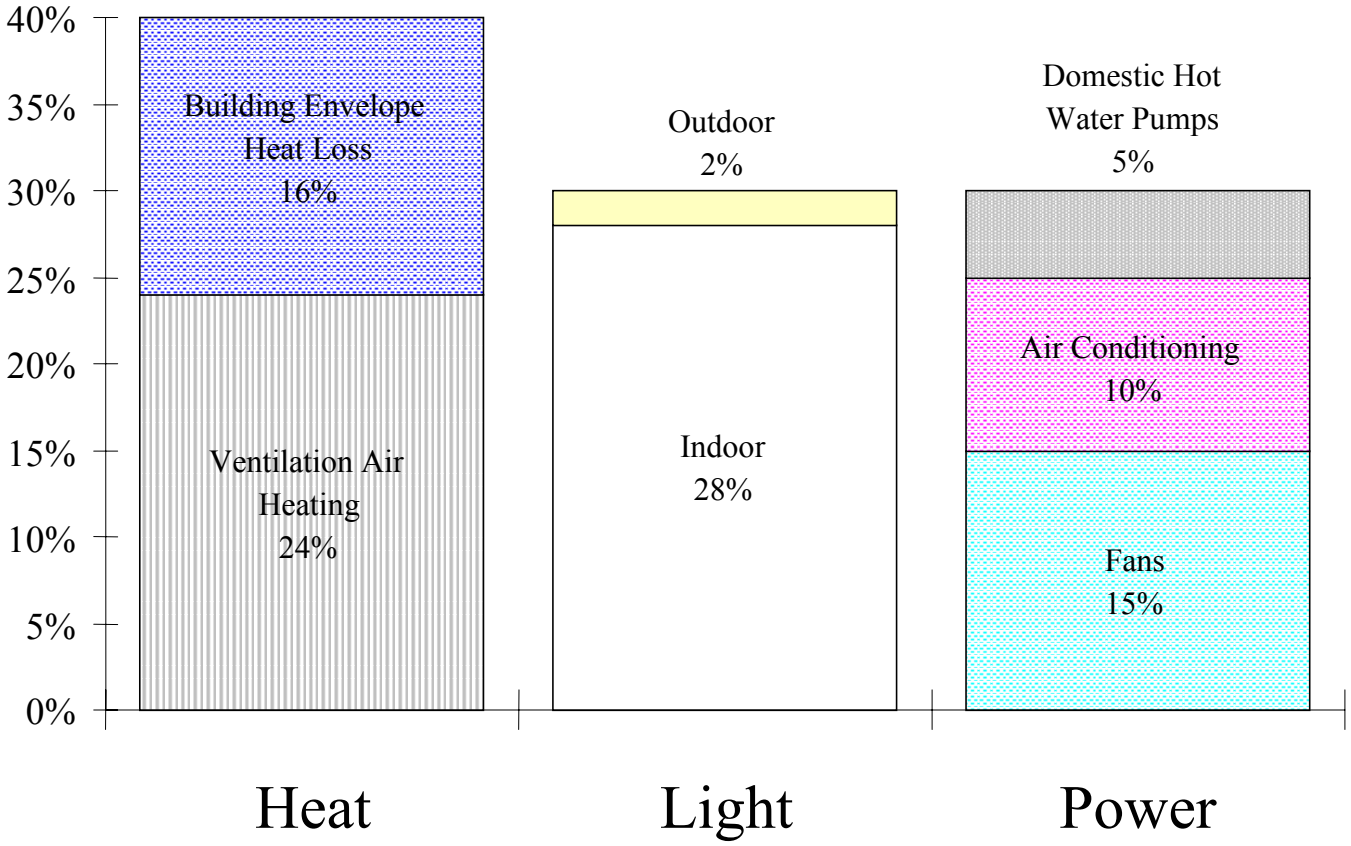
BUILDING LOADS

Energy consumption can be divided between two types of loads: Weather-Dependent Load and Base-Load. The weather-dependent load is self descriptive. It includes the heating, ventilating and air conditioning loads.

Base-Load consists of systems that are not affected by weather or, if they are, just slightly. For example, the lighting load is affected very little by weather, unless you are somehow relying on natural daylight. Elevator load is not affected by weather, except to the extent that it may receive less use when fewer people come in due to extremely inclement conditions.

TYPICAL COMMERCIAL BUILDING ENERGY USAGE





Henry Manczyk, Apollo Office Building

DEGREE DAYS DEFINITION

Outdoor air temperature is a major climatic variable affecting energy use. The temperature is usually discussed in terms of "degree days' - heating degree days and cooling degree days. The number of heating degree days in a regular 24-hour day is determined as the difference between 65 ^{o}F and the average of the high and low temperature for a specific day in question. For example, if the low temperature on a particular day is 35 ^{o}F, and the high is 55 ^{o}F, this day would have 20 heating degree days derived as follows:

High Temperature: 55 ^{o}F

Low Temperature: 35 ^{o}F

Average of High and Low $\frac{55 + 35}{2} = 45\ ^{o}F$

Heating Degree Days = 65 ^{o}F - Average of high and low temperature = 65 ^{o}F - 45 ^{o}F = 20 degree days for that specific day.

Adding all degree days each day represents a total degree day per year. Rochester's rated heating degree days per year is 6719.

Cooling degree days are determined in a similar manner, except that 65 ^{o}F is subtracted from the average.

BTU DEFINITION

Btu is short for British Thermal Unit, which is the amount of heat needed to raise one pound of water 1 ^{o}F. It is also equivalent to the energy produced by one kitchen match.

Heating Degree Day Conversions
English < == >Metric

Degree Day Definition

Outdoor air temperature is a major climatic variable affecting energy use. The temperature is usually discussed in terms of "degree days" – heating degree days and cooling degree days. The number of degree days in a regular 24 hour period is determined by the difference between 65°F (18.3°C) and the average of the high and low temperatures for a specific day in questions.

Adding all degree days each day represents the total degree days per year.

Cooling degree days are determined in a similar manner, except that 65°F (18.3°C) is subtracted from the average.

English (°F)

$$\text{Heating Degree Days} = 65°F - \frac{\text{High temperature (°F)} - \text{Low Temperature (°F)}}{2}$$

Metric (°C)

$$\text{Heating Degree Days} = 18.3°C - \frac{\text{High temperature (°C)} - \text{Low Temperature(°C)}}{2}$$

Conversion Factors

1 English Degree Day = 0.5556 Metric Degree Day
1 Metric Degree Day = 1.8 English Degree Days

Example

In Poland, there are 3725 heating degree days on average per year. To determine what the degree day equivalent would be in the United States:

English Degree Days = 1.8 x 3725 Metric Degree Days = 6705 degree days

or

Metric Degree Days = 0.5556 x 6705 English Degree Days = 3725 degree days

Heating Degree Day Conversions

English < == >Metric

The purpose of this worksheet is to allow the user to determine what the english or metric daily heating degree day equivalents would be for known daily high and low temperatures for a given region. The user has the option of entering the high and low temperatures in english or metric units.

NOTE: Enter Appropriate Values in Shaded Regions!

If English Known, Enter 0 **0**
If Metric Known, Enter 1

Enter appropriate Fahrenheit Values:

High Temperature	**55**	**deg F**
Low Temperature	**35**	**deg F**

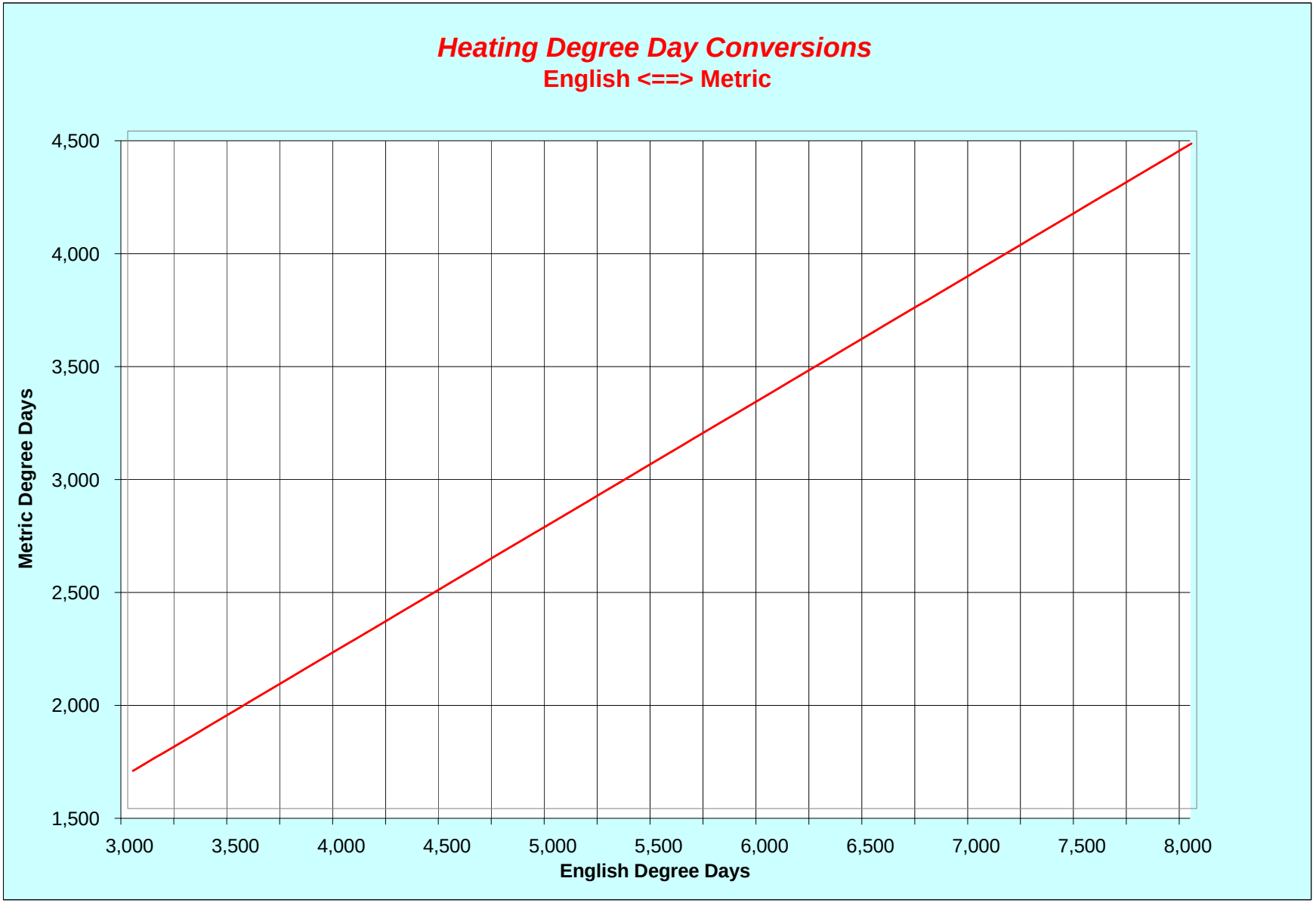
English (°F)	Metric (°C)
High Temperature 55.00 °F **Low Temperature 35.00 °F**	**High Temperature 12.78 °F** **Low Temperature 1.67 °F**
Average of High and Low 45°F	**Average of High and Low 7.22°F**
Heating Degree Days = 20	**Heating Degree Days = 11.11**

1 English Degree Day = 0.5556 Metric Degree Day
1 Metric Degree Day = 1.8 English Degree Days

Heating Degree Day Conversions

English <==> Metric

English Degree Days	Metric Degree Days
3,000	1,667
3,050	1,694
3,100	1,722
3,150	1,750
3,200	1,778
3,250	1,806
3,300	1,833
3,350	1,861
3,400	1,889
3,450	1,917
3,500	1,944
3,550	1,972
3,600	2,000
3,650	2,028
3,700	2,056
3,750	2,083
3,800	2,111
3,850	2,139
3,900	2,167
3,950	2,194
4,000	2,222
4,050	2,250
4,100	2,278
4,150	2,306
4,200	2,333
4,250	2,361
4,300	2,389
4,350	2,417
4,400	2,444
4,450	2,472
4,500	2,500
4,550	2,528
4,600	2,556
4,650	2,583
4,700	2,611
4,750	2,639
4,800	2,667
4,850	2,694
4,900	2,722
4,950	2,750
5,000	2,778
5,050	2,806
5,100	2,833
5,150	2,861
5,200	2,889
5,250	2,917
5,300	2,944
5,350	2,972
5,400	3,000
5,450	3,028
5,500	3,056
5,550	3,083
5,600	3,111
5,650	3,139
5,700	3,167
5,750	3,194
5,800	3,222
5,850	3,250
5,900	3,278
5,950	3,306
6,000	3,333
6,050	3,361
6,100	3,389
6,150	3,417
6,200	3,444
6,250	3,472
6,300	3,500
6,350	3,528
6,400	3,556
6,450	3,583
6,500	3,611
6,550	3,639
6,600	3,667
6,650	3,694
6,700	3,722
6,750	3,750
6,800	3,778
6,850	3,806
6,900	3,833
6,950	3,861
7,000	3,889
7,050	3,917
7,100	3,944
7,150	3,972
7,200	4,000
7,250	4,028
7,300	4,056
7,350	4,083
7,400	4,111
7,450	4,139
7,500	4,167
7,550	4,194
7,600	4,222
7,650	4,250
7,700	4,278
7,750	4,306
7,800	4,333
7,850	4,361
7,900	4,389
7,950	4,417
8,000	4,444


Heating Degree Day Conversions
English <==> Metric
Metric Degree Days
4,500
4,000
3,500
3,000
2,500
2,000
1,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
English Degree Days

DEGREE DAYS ACCUMULATION - UP TO DATE

1999 SEASON

12-Month Period

6,286 Degree Days Heating

1998 SEASON

12-Month Period

5,675 Degree Days Heating

ENERGY UTILIZATION INDEX COMPUTATION

TO COMPUTE THE ENERGY UTILIZATION INDEX (EUI), THE FOLLOWING IS DONE:

Total Electricity Used in KWH x 3.413	=	_____ BTUs
Total Gas Used in Therms x 100,000	=	_____ BTUs
Total #2 Oil Used in Gallons x 138,700	=	_____ BTUs
Total #6 Oil Used in Gallons x 146,000	=	_____ BTUs
Total Steam Used in Lbs x 1,189	=	_____ BTUs
Total Coal Used in Short Tons x 26 x 10^6	=	_____ BTUs
Total BTUs	=	_____ BTUs
Total Degree Days	=	_____
Gross Conditioned Area	=	_____ Square Feet

$$EUI = \frac{BTUs}{\text{Gross Conditioned Area x Degree Days}}$$

Therefore, EUI = _____ BTUs/Sq.Ft./D.D.

Energy Cost Avoidance

Equation Related With Heating

$$C.A.=\left[\left(\text{Base Year Consumption}\right)\left(\frac{\text{Current Year Cost}}{\text{Current Year Consumption}}\right)\left(\frac{\text{Current Year DD}}{\text{Base Year DD}}\right)\right]-\left(\text{Current Cost}\right)$$

C.A. = Cost Avoidance in $
Bb = Base year consumption
Cc = Current year cost
Bc = Current year consumption
Ddc = Current year degree days
Ddb = Base year degree days

$$C.A. = \left[\left(Bb\right)\left(\frac{Cc}{Bc}\right)\left(\frac{DDc}{DDb}\right)\right] - \left(Cc\right)$$

Equation Non-Weather Related

$$C.A.=\left[\left(\text{Base Year Consumption}\right)\left(\frac{\text{Current Year Cost}}{\text{Current Year Consumption}}\right)\right]-\left(\text{Current Cost}\right)$$

$$C.A. = \left[\left(Bb\right)\left(\frac{Cc}{Bc}\right)\right] - \left(Cc\right)$$

DEFINITIONS AND FORMULAS

1 KWH	= 3,413 BTUs
1 Therm	= 100,000 BTUs
1 Lb. of Steam at 100 psi	= 1,189 BTUs
1 BTU	= Amount of Heat Needed to Raise 1 Pound of Water 1 ^{o}F
1 M-Lb	= 1,000 Lbs of Steam
D.D.	= Degree Days (See Attached Explanation)

FORMULA

1. $$BTU / Sq.Ft / D.D. = \frac{Total\ BTUs}{Sq.Ft \times D.D.}$$

2. $$BTU / Sq.Ft = \frac{Total\ BTUs}{Sq.Ft}$$

3. $$\%\ in\ Dollar = \frac{Dollar\ Savings}{(Total\ Present\ Cost + Dollar\ Savings)} \times 100$$

Example: $$\%\ in\ Dollar\ Savings = \frac{200}{(1{,}000 + 200)} = 16.6\%$$

BTU/Sq.Ft. - Energy Consumed For a Given Area
BTU/Sq.Ft./D.D. = Energy Consumed For a Given Area at a Given Weather Condition

COST AVOIDANCE/SAVINGS

Building Number: _____

Building Name: _____ **Gross Area:** _____ **Ft^2**

ELECTRICAL: NON-WEATHER RELATED

	$\frac{\text{Cost}}{\text{Consumption}}$	[Consumption - Consumption] = $ _____
ELECTRICAL	_____	[-] = $ _____
Other	_____	[-] = $ _____

HEATING: WEATHER RELATED

	$\frac{\text{Cost}}{\text{Consumption}}$	$\left[\frac{\text{Consumption}}{\text{Degree Days}} - \frac{\text{Consumption}}{\text{Degree Days}}\right]$ Degree Days = $ _____
GAS	_____	[_____ - _____] Degree Days = $ _____
OIL	_____	[_____ - _____] Degree Days = $ _____
Other	_____	[_____ - _____] Degree Days = $ _____

HEATING:

MMBTUS x 1000 / SQ. FT. =		
MMBTUS x 10^6 / SQ. FT. x D.D. =		
COST / SQ. FT. =		
DEGREE DAYS		

TOTAL COST AVOIDANCE = $ _____

No sign is a savings

Minus sign is a loss