GUIDELINES FOR ENERGY COST SAVINGS RESULTING FROM TRACKING AND MONITORING ELECTRICAL AND NATURAL GAS USAGE, COST, AND RATES

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ABSTRACT

This paper discusses how improved energy information in schools and hospitals from tracking and monitoring electrical and natural gas usage, cost, and optional rate structures, can reduce energy costs. Recommendations, methods, and guidelines for monitoring and tracking of utilities are provided. These recommendations, methods, and guidelines are the result of on-site work for schools and hospitals. Recently completed energy usage survey and observations of several hospitals in Texas are included.

Opportunties exist for schools, hospitals, and other buildings to achieve significant dollar savings by good utility management. Understanding utility rate structures is essential for minimizing energy costs. The authors' data is for Texas schools and hospitals, but the principles presented apply to other geographic areas.

INTRODUCTION

The opportunity for energy cost savings in Texas schools and hospitals is a resource which, if tapped on a statewide basis, can save millions of dollars. Resource management is a popular concept, however, many facilities in Texas do not include an ongoing detailed energy management program. Even fewer facilities accomplish comprehensive assessment or evaluation of energy consumption. Considering that energy costs represent significant dollars, that almost all projections indicate increasing energy costs, and that cost reduction strategies and errors can be identified by comprehensive tracking and monitoring, it is logical to conclude that energy utilities should be included in resource management of Texas schools, hospitals, and other commercial and industrial facilities.

An organized energy tracking and monitoring system (ETMS) is a basic requirement for successful energy management. An ETMS should be a management tool that would promote sufficient information in order to understand energy and cost performance, and to provide a database to effectively control and manage energy resources. An energy tracking and monitoring system consists of a manual or computer method of recording and comparing of energy usage data, (e.g. kwh, kw, mcf, etc.), energy performance (Btu/ft.^{2}, Btu/patient-day, Btu/pound product, etc.) energy costs performance (e.g. \$/ft.^{2}, \$/patient day, \$/LB. product, and etc.), rate structure options (electrical and natural gas), and other specialized data. The tracking system should be on a monthly basis. Results of the monthly data, comparisons to the same month for prior year, and annual summaries may be used to identify billing errors, sudden changes in performance, equipment problems, opportunities for savings, and possible alternate rate structure (e.g. time-of-day options, special riders, meter consolidation, transformers purchases, seasonal options, etc.). Energy consumption patterns can be identified. The ETMS also provides information for more accurate budget planning and forecasting. A major benefit of the ETMS is the basis for motivation to achieve cost reduction. For any energy cost reduction program to be successful, there must be accountability for its success. The ETMS provides a basis for specific performance measurement of the energy manager and for goal setting.

Typical examples of actual savings from monitoring and tracking of electrical energy include the following:

. $108,000 demand reading error at College Station I.S.D.,

. $38,000/year rate change savings at Gladewater High School,

. $9,000 year billing error at Elysian Fields I.S.D.,

. $6,730 billing error in billing accounting when changing rates at a McKinney I.S.D. School,

. $4,800 billing errors at Lampasas I.S.D.,

. $19,000 per year at one Tatum ISD school to eliminate minimum billing,

. more than $50,000/year savings at high schools in Lewisville by summer shut-down.

. A $91,000 per year savings in a hospital by integrating strategic use of existing emergency generators and a time-of-day off-peak electric utility rider.

Typical examples of natural gas savings identified from ETMS include the following:

. $2,200 refund for sales tax billing at Sonora High School

Proceedings of the Sixth Symposium on Improving Building Systems in Hot and Humid Climates, Dallas, TX, October 3-4, 1989

. $35,000 per year savings by contract negotiated gas rates at one central Texas hospital, and very excessive natural gas usage identified at several schools.

. Also, natural gas rate changes were identified which the Owner was not aware of until evaluating the ETMS data.

Energy tracking and monitoring should be required by the school board, school superintendent, administrator, or chief fiscal officer. The actual task can be assigned to the engineering, facilities maintenance and operation, or business office. All of the groups should review monthly reports and be alert for problems and opportunities. Our observation is that until top management becomes interested in the utility costs, serious action will not be undertaken on a consistent basis. In house personnel can be used for energy tracking. Specialized assistance may be required to resolve problems and implement strategies.

STARTING A TRACKING SYSTEM

The following are basic sequential steps in gathering and organizing data to establish an energy tracking system for buildings.

1. Locate the buildings. Obtain the address and specific building identification (e.g. street address, building name, building identification numbers, etc.). It is helpful to prepare a small scale layout of the building on 8 1/2 x 11 inch paper.

2. Physically locate all electric and natural gas meters and identify specific locations on the small scale drawings of the buildings. Record the meter number, meter type, utility company name, and meter multipliers.

3. Determine the area (ft.^{2}) of each building. Identify the area that each meter serves.

4. Obtain the utility account numbers for each meter. This information may be obtained from past utility billing receipts, or from the utility company. Record these account numbers by the meter numbers on the small scale drawings. This is one place to stop the data gathering and evaluate the data obtained. Verify that meters are actually installed for each account being billed. Each meter number should be correlated to a billing account number. At this step in the process, the authors have identified account billings at public schools and small manufacturing plants for meters that were non-existent and for meters that had been disconnected.

5. The next step is to obtain the actual energy consumption and cost data for each meter or account. The easiest method is to call the utility company and request a computer printout of monthly consumption, demand (kw), and cost for the past twelve months. During our experience of data gathering for more than 250 different Texas public school districts, only two electric company offices have not been cooperative in providing this data for the schools involved. All natural gas companies readily provided the data. Most Texas utilities have this data readily available for the past twelve months. The billing receipts from the Customer's files also have the necessary information. The Customer's files will most likely be the data source if a two year history of consumption and cost are desired for the initial tracking set-up.

6. While gathering the utility consumption and cost data, rate schedules for each account should be identified. In most cases the rate schedule number is identified on the billing stub. Request that the utility company provide copies of each rate schedule. The utility representative should explain the rate schedule, and assist the customer in verifying the calculations for a typical month. All riders to the rate (e.g. fuel cost, etc.) should be requested.

7. The next step is to record the utility data. The data can be recorded on manual forms or entered into a computer. Examples of the forms for the manual systems are shown in Figures 1 and 2. Several computer programs are available for tracking and monitoring. Spread sheets for personal computers are also a very convenient method.

The format selected should provide a method of comparing consumption and cost on a monthly basis to the same month for the prior year or a selected base year. Many schools have selected the base year for consumption to be the year when they start an energy management program. This approach is beneficial because it readily shows the accumulated cost savings the program has generated. This is a good approach for program justification and management visibility. However, this method does not readily show operational problems or billing errors. Comparisons to the same month for the prior year must be made for good control and management. The reason for any significant changes observed in these monthly consumption and cost comparisons should be determined. Weather differences may result in changes which can be accounted for by tracking and adjusting for cooling degree days and heating degree days. Care should be used in adjusting for weather factors because some buildings with high internal loads and high insulating characteristics are not very sensitive to weather variations.

8. Key ratios should be calculated and compared on a monthly and annual basis. Selected ratios can identify unusually high consumption and cost. Ratios recommended for evaluating include the following:

- Dollars per kilowatt-hour ($/kwh)
- Dollars per thousand cubic feet of natural gas ($/mcf)
- Dollars per square feet of gross building area ($/ft.^{2})
- Energy consumption per square feet of gross building area (Btu/ft.^{2}). Include conditioned and non-conditioned area (ft.^{2}).

These ratios may be adjusted for weather variation (but the unadjusted data and ratios should be presented along with any adjusted data. The ratios are intended to be used for management purposes in understanding energy performance and cost. Adjustments to the actual data can be misleading when presenting the actual operating situation.

Additional specialized energy ratios may be used. Examples include:

- Dollars per patient-day
- Dollars per licensed hospital bed
- Dollars per enplanement (for airports)
- Dollars per pound of product produced

Specialized ratios for schools indicating summer usage of buildings are helpful. These include the following:

- Summer cost index (SCI)

SCI = (SUMMER ENERGY COST / ANNUAL ENERGY COST) X 100

- Summer energy index (SEI)

SEI = (SUMMER ENERGY USAGE / ANNUAL ENERGY USAGE) X 100

Comparisons of the above key ratios assist in identifying trends and in maintaining comparisons when building area changes. They are also beneficial in comparing one facility to another.

9. The next step in the tracking and monitoring process is to evaluate the data and ratios, make comparisons, review the results, assemble in formats for communicating with others, publish reports, and act on the results to control energy costs.

Recent performance ratio data calculated for a large Texas school district (54 campuses) indicated a definite potential for significant energy and cost savings. The initial investigations included calculating the annual cost performance ($/FT.^{2}-YR.) for each school. The energy cost performance range was as follows:

TYPE SCHOOL	$/ft.^{2}-yr.
HIGH SCHOOL	$0.63 TO $1.11
MIDDLE SCHOOL	$0.39 TO $1.01
ELEMENTARY SCHOOL	$0.41 TO $1.55

Almost identical (construction and school schedules) elementary schools were on the opposite ends of the cost range. Investigations identified operational differences causing the enormous operating cost differences.

INTERPRETING ENERGY USAGE DATA

The most important process of tracking any type of data is the reading and interpretation of the data. Neatly compiled utility bills are useless information without a proper understanding and interpretation. The gatherer of the information should be knowledgeable of the data, but the analyzer must understand the data and be able to apply the proper interpretation with regards to all factors involved (i.e. kw, kwh, mcf, fuel cost adjustments and utility rate schedules and riders).

The following two examples illustrate actual utility bills of two Texas schools and the benefits of an ETMS.

Example 1 is a 12 month utility history for a 280,000 square foot high school building without summer school.

MONTH	KW	KWH	$	MCF	$
JAN	748	262,650	12,904.81	1,694	8,469.15
FEB	759	271,200	13,268.27	1,111	5,341.08
MAR	937	185,550	9,006.01	82	398.55
APR	1,152	276,900	13,482.86	95	497.07
MAY	1,028	313,950	17,071.28	61	284.14
JUN	642	216,600	14,172.63	43	203.58
JUL	922	266,850	17,488.34	39	195.28
AUG	1,121	541,650	35,525.57	20	97.30
SEP	1,429	534,600	35,020.07	56	228.21
OCT	1,196	287,100	18,698.89	128	551.81
NOV	1,001	272,850	13,243.04	228	1,059.62
DEC	950	201,450	9,870.94	599	2,855.51
TOTAL	11,885	3,631,350	$209,752.71	4,156	$20,181.30

Key Ratios:

$ 0.058 / KWH
$ 4.860 / MCF
$ 0.82 / SQ.FT.- YR.
59,552 Btu / SQ.FT. - YR.

SCI = 29.4%
SUI = 21.6%

The excessive summer usage for this building is clear, as a result the district which operates this building has reduced the summer usage by approximately $30,000 upon the implementation of the district's ETMS.

Example 2 is a 12 month utility history for a 46,763 square foot primary school building.

MONTH	KW	KWH	$	$/KWH	MCF	$
JAN	315	24,600	3,274.00	0.133	75.9	380.00
FEB	309	23,700	3,255.00	0.137	206.4	1,032.00
MAR	339	14,100	3,104.00	0.220	61.8	267.00
APR	135	17,400	3,183.00	0.183	46.8	241.00
MAY	135	13,200	3,082.00	0.233	20.8	114.00
JUN	120	9,000	2,993.00	0.333	13.4	77.00
JUL	111	6,600	2,932.00	0.444	11.4	67.00
AUG	240	28,200	3,479.00	0.123	12.4	72.00
SEP	228	33,000	3,514.00	0.106	15.5	87.00
OCT	195	23,400	3,297.00	0.141	40.6	205.00
NOV	309	24,600	3,324.00	0.135	43.0	217.00
DEC	300	32,400	3,435.00	0.106	103.1	500.00
TOTAL	1,885	250,200	$38,872.00	0.155	641.1	3,080.00

Key Ratios:

$0.155 / KWH
$ 4.800 / MCF
$ 0.90 / SQ.FT.- YR.
32,382 Btu / SQ.FT. - YR.

SCI = 22/9%
SUI = 12.4%

The analyzer of the above information should have easily detected the excessive $/kwh value for any one of the 12 months. This building had been in use for 18 months before an ETMS was in place. The results of the investigations of the $/kwh value discovered that the school was minimum billing every month. This was due to the initial electrical contract the district signed for electric service. This particular electric utility bills minimum dollar amounts were based on previous demand levels and contract values. The district which operates this building is saving approximately $19,000 a year upon the implementation of the district's ETMS. NOTE: The school district was not legally entitled to a refund on this account. All rate structures, riders, contracts, and other account information is the responsibility of the customer.

USING COMPUTERS TO TRACK ENERGY USAGE & COST

Several Texas school districts and hospitals have successfully used personal computers to track and monitor energy consumption and costs. These school districts include Midland, Lampasas, Katy, Marshall, Coppell, and Calallen. Medium size school districts and large districts will save significant time by utilizing a computerized system. Our observations determined that school districts with more than 20 combined electrical and gas accounts require a computer in order to effectively provide adequate information in a timely manner. A computer tracking system simplifies and makes comparisons, key ratios, and reports for large districts possible. The computerized system is a more effective management tool.

There is a wide variation in available software. Some of the purchased programs are complex to use. A user friendly and menu driven package can be less time consuming and easier than using spreadsheets. A key factor in selecting software is to select a system that will be a management tool. We have observed some programs to have so many variable inputs and adjustments to the basic data that the actual consumption and cost could not be readily identified. Most companies will provide no-cost demonstration disks for evaluation. The best check is to talk to another user. The other factor in selecting software is to identify the support available and cost of any support.

The essential basic inputs for a computer energy tracking system for buildings include the following:

- Energy consumption
- Peak electrical demand (kw)
- Cost of energy
- Meter or account numbers
- Gross area of facility (conditioned and non-conditioned)
- Monthly heating degree days
- Monthly cooling degree days.

The essential basic outputs for a computer tracking system for buildings include the following:

- Consumption (mcf, kw-hr.)
- Peak electrical demand (kw)
- Dollars spent for fuel and total energy
- Comparisons of consumption and cost to same month for prior year (actual values and percentage)
- Key ratios ($/kwh,, $/mcf, Btu/ft.^{2}, etc.)

An example of a school utility program is provided to illustrate the convenience and benefits of using a computer. The menu driven program provides key ratios by account and utility, monthly comparisons to prior year, monthly percent cost and consumption variations, total report per site (for more than one meter), and total reports for an entire school district. Typical formats are shown in Tables 1, 2, 3, 4, 5, 6, 7, 8, and 9. The first application of this system identified 69.3% increases in cost for the March comparison of a school (Table 7). The reason was a billing error.

RATE STRUCTURE EVALUATIONS

Each electric utility company and each natural gas company have their own rate structures. The natural gas rate structures vary for each city. Each utility has many different rate structures for different types of customers. In the southern part of Texas, for example one electric utility company has at least three different basic rate structures for school customers. There are several riders available for these rate structures. Energy cost management must include an understanding of the specific rate structures available for each building.

Unfortunately, electric rate structures are complex and difficult for the customers to understand. Our experience during on-site energy evaluations of more than 290 different school districts is that many of the utility customer representatives have difficulty in manually verifying a billing calculation on the first try because of the complex rates with riders, numerous minimum billing options, numerous minimum on-peak demand options, and block rate adjustments. Few school personnel understand their electric rate structures.

SCHOOL ENERGY USAGE AND PATTERNS

There is a wide variation of energy performance and energy cost performance in Texas public schools. The utility data organized from these schools have assisted in identifying characteristics of efficient schools as well as usage that need changing to make schools more energy efficient. Our observations are that most schools do not have an effective tracking and monitoring program.

HOSPITAL ENERGY SURVEY

A survey of hospital energy consumption and cost was conducted by the authors and completed in 1989. The purpose of the survey was to identify Texas hospitals with high operating cost and low energy efficiency, to evaluate their tracking systems, and to identify potential for energy savings. The survey was also beneficial for the individual participants because it allowed them to compare their performance with other hospitals. Most of the hospitals provided only annual consumption and cost totals rather than the monthly data requested for one year.

Survey data is presented in Tables 9 and 10 and Figures 3 through 8. The cost and performance data includes twelve months. The hospitals are ranked in Table 9 by annual energy cost per square foot. All data in this survey is for the basic hospitals except Hospital M which includes office buildings because of utility metering situations. Observations of the data include the following:

. There are wide variations in energy cost performance ($/ft.^{2}-yr.) and energy performance (Btu/ft.^{2}-yr.) in Texas hospitals.

. Most hospitals have a relatively low electrical energy average unit cost. Figure 7 ranks the hospitals according to average unit electrical cost ($/kw-hr.), except for two hospitals, the average unit cost is about $0.045/kw-hr.

. Natural gas unit costs varied from $2.88 to $4.99/mcf. Only one hospital paid less than $3.00/mcf.

. The hospital (N) with the lowest unit natural gas cost ($2.88) has a negotiated natural gas contract.

. The hospitals with the lowest energy operating cost performance ($/ft.^{2}-yr.) did not have the lowest unit energy costs. See Figure 8.

. Table 10 shows the potential annual dollar savings from negotiated natural gas contracts for each of the hospitals. These data assume present consumption and that the natural gas costs were negotiated to $3.00/mcf.

. There were wide variations in natural gas unit costs for hospitals being served by one specific natural gas company. Unit costs ranged from $3.24 to $4.26 per mcf. This variation is because each city has different natural gas rates even though they may be served by the same natural gas utility.

. Only two of the hospitals have a tracking system and they were on the lower operating cost ($/ft.^{2}-yr.) end of the range that responded to this survey.

. There is potential for reduction of energy usage and energy cost for most hospitals responding to the survey.

. A tracking and monitoring system is justified for hospitals.

RECOMMENDATIONS

The following are recommendations concerning tracking and monitoring systems and policy regarding rate structures.

1. All Texas public schools should be required to track energy consumption and cost before receiving any state funds for operations or facilities.

2. Electric rate structures in Texas should be simplified.

3. Eliminate any rate schedule that imposes a risk for a customer who is attempting to reduce their electrical demand in conjunction with time-of-day billings (e.g. TU Electric's Rider S for peak shaving projects).

ACKNOWLEDGMENTS

The large school data base was obtained during the authors' design work and energy audit work. Most of the school energy audit work as conducted under contract to the Governor's Office of Budget & Planning - State of Texas. Dr. Mel Roberts was the state's program officer.

REFERENCES

1. McClure, James D., Estes, James M., Estes, Mike C., "Guidelines for Energy Efficient Schools", Fifth Annual Symposium Improving Building Energy Efficiency in Hot and Humid Climates, September 1988.

High School
CAMPUS: Primary-High School

ELECTRICITY ANALYSIS

MONTH	ACCOUNT NO	KWH	COST	COST/KWH	COST/SQFT	SITE BTU/SQFT	SOURCE BTU/SQFT
Apr	0502140000	37600	3055.20	.081	.042	1767.	6006.
May	0502140000	42600	3382.70	.079	.047	2002.	6804.
Jun	0502140000	37600	2990.20	.080	.041	1767.	6006.
Jul	0502140000	24400	1729.40	.071	.024	1147.	3897.
Aug	0502140000	36400	2711.40	.074	.037	1711.	5814.
Sep	0502140000	44600	3547.10	.080	.049	2096.	7124.
Oct	0502140000	52400	3847.40	.073	.053	2463.	8370.
Nov	0502140000	48600	3434.38	.071	.047	2284.	7763.
Dec	0502140000	35800	2880.14	.080	.040	1682.	5718.
Jan	0536550000	42000	3268.60	.078	.045	1974.	6709.
Feb	0536550000	57800	4108.74	.071	.057	2716.	9232.
Mar	0536550000	40000	3302.00	.083	.045	1880.	6389.
YEAR TOTALS:		499800	38257.26	.077	.527	23489.	79833.

ELECTRICAL COST AND PERFORMANCE
FOR AN ELEMENTARY SCHOOL

TABLE 1

High School
CAMPUS: Primary-High School

ELECTRICITY COMPARISON TO PREVIOUS YEAR

MONTH	CURRENT YEAR/PREVIOUS YEAR KWH	COST	COST/KWH	VARIATION KWH	COST	%COST	%KWH
Apr	37600	3055.20	.081				
	42400	2636.40	.062	-4800	418.80	13.7	-12.8
May	42600	3382.70	.079				
	44200	2822.00	.064	-1600	560.70	16.6	-3.8
Jun	37600	2990.20	.080				
	37800	1955.20	.052	-200	1035.00	34.6	-.5
Jul	24400	1729.40	.071				
	31400	2177.60	.069	-7000	-448.20	-25.9	-28.7
Aug	36400	2711.40	.074				
	31400	2177.60	.069	5000	533.80	19.7	13.7
Sep	44600	3547.10	.080				
	62600	3741.00	.060	-18000	-193.90	-5.5	-40.4
Oct	52400	3847.40	.073				
	46200	3156.00	.068	6200	691.40	18.0	11.8
Nov	48600	3434.38	.071				
	45000	3040.00	.068	3600	394.38	11.5	7.4
Dec	35800	2880.14	.080				
	34000	2913.00	.086	1800	-32.86	-1.1	5.0
Jan	42000	3268.60	.078				
	43600	3474.20	.080	-1600	-205.60	-6.3	-3.8
Feb	57800	4108.74	.071				
	58000	3991.00	.069	-200	117.74	2.9	-.3
Mar	40000	3302.00	.083				
	41800	3221.10	.077	-1800	80.90	2.5	-4.5
TOTAL:	499800	38257.26	.077				
	518400	35305.10	.068	-18600	2952.16	7.7	-3.7

ELECTRICAL CONSUMPTION AND COST COMPARED
TO PREVIOUS YEAR FOR AN ELEMENTARY SCHOOL

TABLE 2

Primary School
CAMPUS: Primary-High School

NATURAL GAS ANALYSIS

MONTH	ACCOUNT NO	MCF	COST	COST/MCF	COST/SQFT	BTU/SQFT
Apr	212505127901	26.0	137.62	5.293	.007	1427.
May	212505127901	12.1	61.57	5.088	.003	664.
Jun	212505127901	1.5	12.57	8.380	.001	82.
Jul	212505127901	1.4	12.14	8.671	.001	77.
Aug	212505127901	1.1	10.95	9.955	.001	60.
Sep	212505127901	5.5	31.52	5.731	.002	302.
Oct	212505127901	9.0	46.26	5.140	.002	494.
Nov	212505127901	27.2	141.04	5.185	.008	1493.
Dec	212505127901	58.0	294.66	5.080	.016	3183.
Jan	212505127901	77.7	393.21	5.061	.021	4264.
Feb	212505127901	118.0	617.33	5.232	.033	6475.
Mar	212505127901	51.7	284.51	5.503	.015	2837.
YEAR TOTALS:		389	2043.38	5.250	.109	21357.

NATURAL GAS COST AND PERFORMANCE
FOR AN ELEMENTARY SCHOOL

TABLE 3

Primary School
CAMPUS: Primary-High School

NATURAL GAS COMPARISON TO PREVIOUS YEAR

MONTH	CURRENT YEAR/PREVIOUS YEAR MCF	COST	COST/MCF	VARIATION MCF	COST	%COST	%MCF
Apr	26	137.62	5.293				
	59	264.05	4.468	-33	-126.43	-91.9	-127.3
May	12	61.57	5.088				
	8	48.70	5.939	4	12.87	20.9	32.2
Jun	2	12.57	8.380				
	1	8.28	16.560	1	4.29	34.1	66.7
Jul	1	12.14	8.671				
	0	6.54	65.400	1	5.60	46.1	92.9
Aug	1	10.95	9.955				
	0	6.08	.000	1	4.87	44.5	100.0
Sep	6	31.52	5.731				
	6	27.55	4.833	-0	3.97	12.6	-3.6
Oct	9	46.26	5.140				
	12	54.01	4.577	-3	-7.75	-16.8	-31.1
Nov	27	141.04	5.185				
	41	191.81	4.644	-14	-50.77	-36.0	-51.8
Dec	58	294.66	5.080				
	67	314.97	4.694	-9	-20.31	-6.9	-15.7
Jan	78	393.21	5.061				
	132	639.10	4.856	-54	-245.89	-62.5	-69.4
Feb	118	617.33	5.232				
	108	503.58	4.684	11	113.75	18.4	8.9
Mar	52	284.51	5.503				
	62	290.77	4.690	-10	-6.26	-2.2	-19.9
TOTAL:	389	2043.38	5.250				
	495	2355.44	4.759	-106	-312.06	-15.3	-27.2

NATURAL GAS CONSUMPTION AND COST TO PREVIOUS
YEAR FOR AN ELEMENTARY SCHOOL

TABLE 4

West Oaks Elementary

CAMPUS: West Oaks Elementary

TOTAL ENERGY COST

MONTH	ELEC($)	NAT. GAS($)	COST/ SQ FT	SITE BTU /SQ FT	COMPARISON %COST	%BTU
Apr	2,666.72	63.08	.047	1,828.	12.4	-17.8
May	3,506.54	25.54	.061	2,373.	26.7	11.0
Jun	3,074.07	9.36	.053	1,967.	52.0	28.5
Jul	842.46	10.76	.015	1,194.	-61.3	-1.9
Aug	2,662.90	7.11	.046	1,678.	48.5	27.6
Sep	3,697.78	5.68	.064	2,660.	11.0	-13.7
Oct	3,768.00	12.08	.065	2,792.	61.5	15.4
Nov	3,715.12	51.21	.065	2,746.	19.9	4.0
Dec	2,188.91	96.65	.039	1,810.	1.9	.2
Jan	1,880.66	133.07	.035	1,766.	-13.3	-18.5
Feb	2,711.71	46.23	.048	2,333.	11.0	-5.1
Mar	1,089.76	113.86	.021	1,736.	-96.5	-7.5
TOTAL:	31,804.63	574.63	.559	24,886.	18.7	2.2

ELECTRICITY AND NATURAL GAS COST AND PERFORMANCE FOR AN ELEMENTARY SCHOOL

TABLE 5

TOTAL ENERGY COST

MONTH	ELEC($)	NAT. GAS($)	COST/ SQ FT	SITE BTU /SQ FT	COMPARISON %COST	%BTU
Apr	9,317.82	1,200.91	.048	2,697.	-3.0	-38.5
May	11,405.69	618.42	.055	2,594.	16.1	.2
Jun	10,478.83	197.99	.049	1,981.	42.6	1.9
Jul	4,753.98	142.04	.022	1,210.	-24.1	-20.8
Aug	7,600.22	154.46	.035	1,518.	21.8	3.9
Sep	12,650.26	310.90	.059	2,693.	6.2	-19.1
Oct	13,599.46	413.31	.064	3,036.	32.2	11.6
Nov	12,281.02	1,166.20	.061	3,448.	8.9	-20.3
Dec	9,010.74	2,789.86	.054	4,124.	6.4	4.5
Jan	9,015.83	3,452.67	.057	4,839.	-15.4	-36.5
Feb	11,419.41	5,446.84	.077	7,163.	18.3	24.9
Mar	8,349.21	2,634.16	.050	3,942.	-4.4	1.0
TOTAL:	119,882.47	18,527.76	.629	39,247.	10.6	-4.6

TOTAL ENERGY COST AND PERFORMANCE FOR A SMALL SCHOOL DISTRICT

TABLE 6

MAIN

CAMPUS:

ELECTRICITY COMPARISON TO PREVIOUS YEAR

MONTH	CURRENT YEAR/PREVIOUS YEAR KWH	COST	COST/KWH	VARIATION KWH	COST	%COST	%KWH
Jan	19080 19440	1021.05 1026.56	.054 .053	-360	-5.51	-.5	-1.9
Feb	20520 20160	1088.79 1064.03	.053 .053	360	24.76	2.3	1.8
Mar	57240 16560	2859.66 876.70	* .050 .053	40680	1982.96	69.3	71.1
Apr	0 24840	.00 1307.55	.000 .053	-24840	-1307.55	.0	.0
May	0 35920	.00 1801.80	.000 .070	-25920	-1801.80	.0	.0
Jun	0 17640	.00 1240.49	.000 .070	-17640	-1240.49	.0	.0
Jul	0 8280	.00 620.30	.000 .075	-8280	-620.30	.0	.0
Aug	0 11520	.00 856.48	.000 .074	-11520	-856.48	.0	.0
Sep	0 32760	.00 2407.06	.000 .073	-32760	-2407.06	.0	.0
Oct	0 25920	.00 1801.67	.000 .070	-25920	-1801.67	.0	.0
Nov	0 25200	.00 1325.00	.000 .053	-25200	-1325.00	.0	.0
Dec	0 19440	.00 1033.15	.000 .053	-19440	-1033.15	.0	.0
TOTALS	96840 247680	4969.50 15360.79	.051 .062	-150840	-10391.29	-209.1	-155.8

* METER READING ERROR (APPROXIMATELY $ 2,000)

BILLING ERROR FOUND BY COMPARISON TO PREVIOUS YEAR

TABLE 7

CALALLEN INDEPENDENT SCHOOL DISTRICT
ELECTRICAL CONSUMPTION
AS OF FEBRUARY 28, 1989

	Budgeted Consump.(KWH)	Actual Consump.	Difference	Budgeted Cost	Actual Cost	Difference
Central Office	46,260	48,420	2,160	$3,770.19	$3,524.48	($245.71)
High School	1,524,173	1,520,091	(4,082)	100,287.70	90,653.58	(9,634.12)
Middle School	798,064	643,392	(154,672)	49,719.40	44,275.10	(5,444.30)
Annaville Elementary	297,064	276,480	(21,280)	22,719.09	20,046.29	(2,672.80)
Magee Elementary	325,740	320,988	(4,752)	24,530.21	23,101.77	(1,428.44)
East Elementary	246,240	270,432	24,192	18,812.74	18,780.05	(32.69)
Wood River Elementary	173,376	167,904	(5,472)	13,766.06	12,659.60	(1,106.46)
Maintenance	129,642	131,120	1,478	11,252.92	11,084.87	(168.05)
Transportation	15,300	16,760	1,460	1,198.01	1,285.60	87.59
Central Kitchen	98,080	118,320	20,240	8,199.49	9,426.79	1,227.30
District Totals	3,654,635	3,513,907	(140,728)	254,255.81	234,838.13	(19,417.68)

TABLE 8

HOSPITAL ENERGY SURVEY DATA

NO.	SQ.FT.	KWH	KWH($)	ELECT. $/SQ.FT.	MCF	MCF($)	GAS $/SQ.FT.
M	721,003	21,046,500	$892,020	$1.24	72,989	$278,114	$0.39
K	234,500	7,551,065	$328,616	$1.40	21,932	$88,238	$0.38
F	370,000	12,591,600	$536,704	$1.45	42,065	$136,332	$0.37
N	485,913	18,643,800	$799,001	$1.64	48,103	$138,360	$0.28
B	304,393	9,800,520	$432,128	$1.42	48,781	$207,980	$0.68
E	510,204	21,008,800	$809,953	$1.59	75,623	$306,665	$0.60
I	300,979	11,341,600	$538,803	$1.79	34,011	$133,284	$0.44
J	781,457	30,294,200	$1,453,256	$1.86	109,551	$363,347	$0.46
H	514,410	21,877,294	$929,785	$1.81	71,514	$284,267	$0.55
A	401,000	12,228,000	$674,890	$1.68	89,997	$277,482	$0.69
L	153,181	6,401,600	$298,057	$1.95	24,117	$89,633	$0.59
D	250,917	11,210,000	$633,713	$2.53	17,524	$56,938	$0.23
C	346,253	14,513,000	$683,495	$1.97	64,803	$316,517	$0.91
G	171,000	8,198,550	$366,767	$2.14	37,196	$143,503	$0.84

NO.	TOTAL $/SQ.FT	BTU/SQ.FT	$/KWH	$/MCF
M	$1.62	203,897	$0.0424	$3.81
K	$1.78	206,233	$0.0435	$4.02
F	$1.82	233,249	$0.0426	$3.24
N	$1.93	232,917	$0.0429	$2.88
B	$2.10	274,952	$0.0441	$4.26
E	$2.19	293,206	$0.0386	$4.06
I	$2.23	245,001	$0.0475	$3.92
J	$2.32	276,703	$0.0480	$3.32
H	$2.36	288,343	$0.0425	$3.97
A	$2.37	335,240	$0.0552	$3.08
L	$2.53	304,797	$0.0466	$3.72
D	$2.75	224,415	$0.0565	$3.25
C	$2.89	335,824	$0.0471	$4.88
G	$2.98	387,681	$0.0447	$3.86

TABLE. 9

TABLE 10

POTENTIAL NATURAL GAS SAVINGS
FROM NEGOTIATED CONTRACTS

NO.	MCF	MCF($)	$/MCF	SAVINGS ($)
N	48,103	$138,360	$2.88	$0.00
A	89,997	$277,482	$3.08	$7,491.00
F	42,065	$136,332	$3.24	$10,136.94
D	17,524	$56,938	$3.25	$4,366.20
J	109,551	$363,347	$3.32	$34,694.00
L	24,117	$89,633	$3.72	$17,282.00
M	72,989	$278,114	$3.81	$59,147.00
G	37,196	$143,503	$3.86	$31,915.00
I	34,011	$133,284	$3.92	$31,251.00
H	71,514	$284,267	$3.97	$69,725.00
K	21,932	$88,238	$4.02	$22,442.00
E	75,623	$306,665	$4.06	$79,796.00
B	48,781	$207,980	$4.26	$61,637.00
C	64,803	$316,517	$4.88	$122,108.00

EXAMPLE ENERGY TRACKING FORM FOR MANUAL METHOD

ENERGY TRACKING REPORT 19__ - 19__

SCHOOL NAME: BUILDING AREA ____________
ELECTRIC METER NO(S).:
GAS METER NO(S).:

DATE	KWH	KW	$	MCF	$	TOTAL $	KWH CHG.	MCF CHG.	$ CHG.
SEPT. 19__									
OCT. 19__									
NOV. 19__									
DEC. 19__									
JAN. 19__									
FEB. 19__									
MAR. 19__									
APR. 19__									
MAY. 19__									
JUNE 19__									
JULY 19__									
AUG. 19__									
TOTAL									

ANNUAL $ SAVINGS = $ ____________
ANNUAL OPERATING COST = $ ________/SQ. FT.

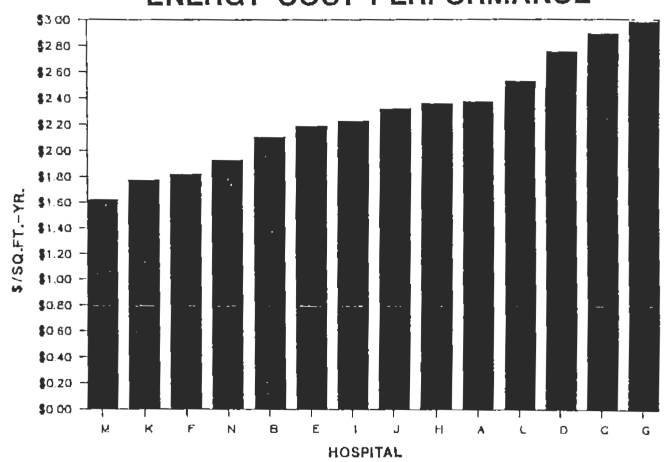
FIGURE 1

BUILDING ______________ SCHOOL YEAR ____________

MONTH	ELECTRICAL			NATURAL GAS		TOTAL
	KWH	KW	COST $	MCF	COST $	
September						
October						
November						
December						
January						
February						
March						
April						
May						
June						
July						
August						
TOTAL ANNUAL COST						
AVG. RATE	$/KWH =			$/MCF =		

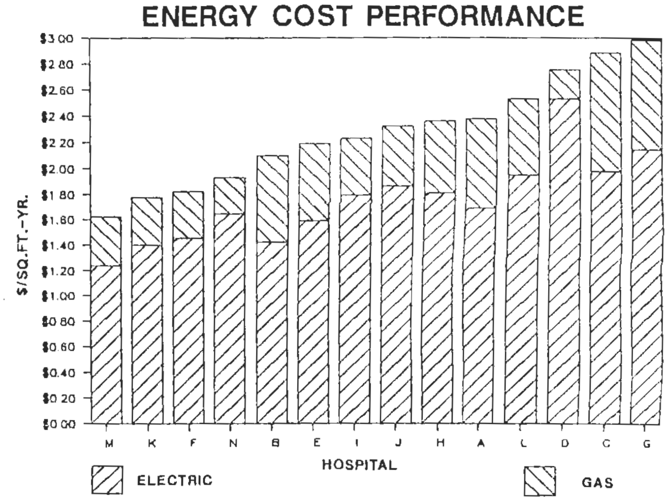
ENERGY USE AND COST
EXAMPLE TRACKING FORM
FIGURE 2

ENERGY COST PERFORMANCE

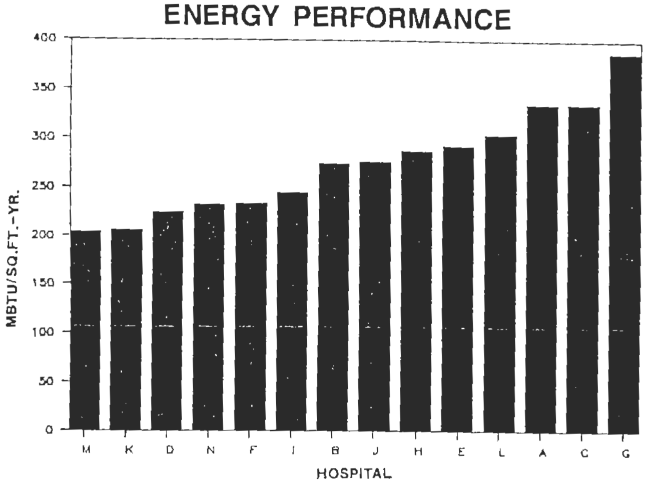


HOSPITAL COST PERFORMANCE
FIGURE 3:

ENERGY COST PERFORMANCE

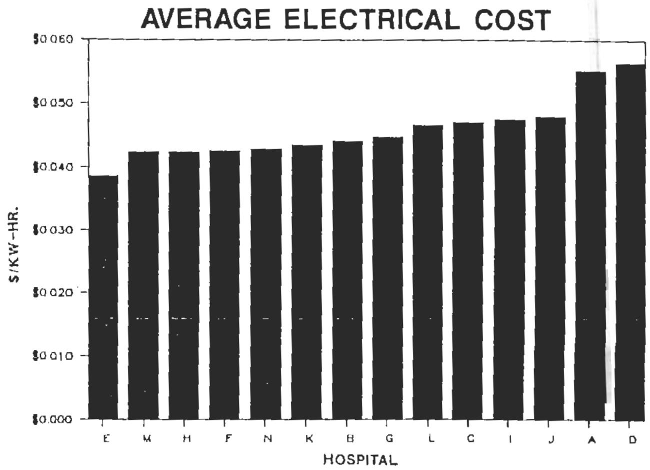


HOSPITAL COST PERFORMANCE
FIGURE 4:



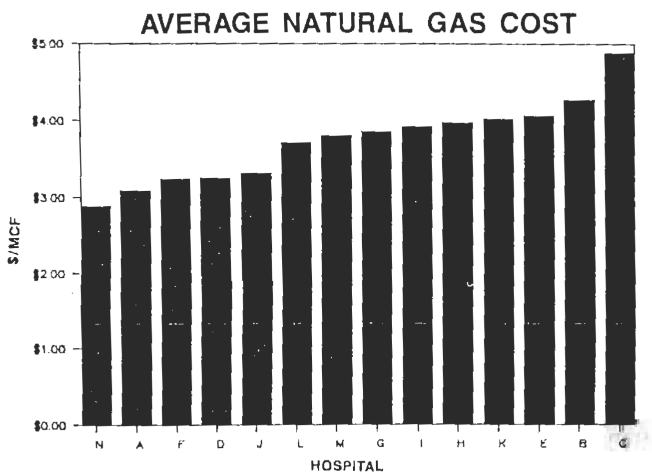
HOSPITAL ENERGY PERFORMANCE

FIGURE 5:



HOSPITAL AVERAGE ELECTRICAL COST

FIGURE 7:



HOSPITAL AVERAGE NATURAL GAS COST

FIGURE 6:

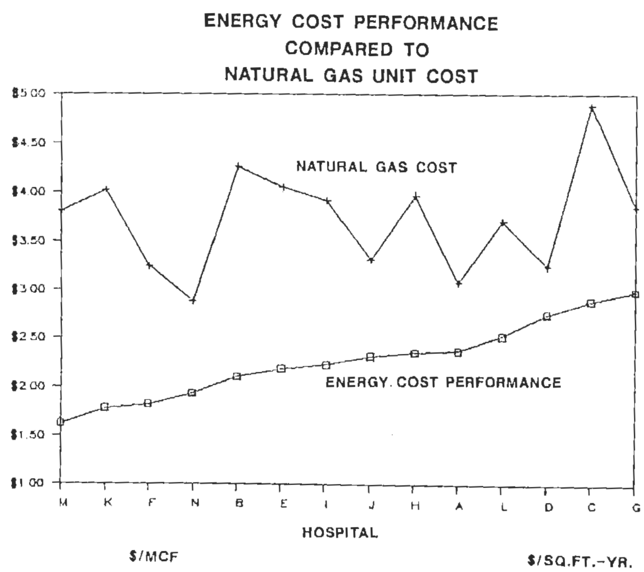


FIGURE 8: