

**MANAGEMENT SKILLS AND ATTITUDES OF
PRINCIPALS TOWARD ENERGY UTILIZATION**

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ABSTRACT

The purpose of this study was to compare several factors in the management skills of principals which affected energy utilization and, therefore, increased or decreased energy consumption in the school plant. This study provided districts with information to differentiate between management skills exhibited by school principals in meeting their energy utilization goals. This information could be used to design inservice programs on energy utilization for principals to define the role of administrators in energy conservation and to alert certification institutions of any facility management deficiencies in administrative training. This study provided baseline data for the energy management systems companies involved in districts' conservation efforts during the late 1980s to educate principals in energy conservation.

TEXT

This study investigated the managerial skills and attitudes of principals in predicting energy utilization/consumption on school campuses. The study focused on skills and attitudes of principals in relation to communication, incentives, district policy, energy training, staff involvement, student participation, support personnel, and availability of equipment information which pertained to energy utilization.

The review of literature strongly suggested the importance of managerial skills and attitudes as reflected in the routines of building managers (i.e., principals) in the efficient utilization of energy. Additionally, the literature emphasized the importance of training personnel responsible for energy utilization in efforts to reduce energy consumption. With the use of shared savings programs and other conservation efforts, principals have been targeted as significant factors in the utilization of energy on school campuses.

Principals responded to the Survey of Energy Management, an instrument designed by the researcher, who followed some general guidelines based on the recommendations for administrators in training manuals by state energy agencies, utility companies, and energy studies such as SEED. The survey was written in three parts: (1) a questionnaire regarding factors which influenced energy utilization during fall 1985, (2) an opinionnaire relating to attitudes and managerial skills which affected energy utilization, and (3) a subjective questionnaire for historical personal data. Part #1 allowed a yes,

no, or don't know response; Part #2 allowed a strongly agree, agree, no opinion, disagree, or strongly disagree response; Part #3 was answered subjectively. Space for comments regarding any statement was provided at the end of the survey. History information relating to the HVAC equipment, energy training, and length of building employment of the respondent was requested. Table 1 gives a summary of the items.

**Table 1
Summary of the Instrument Items**

	Part #1 items	Part #2 items
Incentives	1, 13	
District policy	2, 14	25, 26, 34, 35, 36
Energy training	4, 15	31, 42
Teacher involvement	8, 20	30, 40
Student involvement	9, 21	
Conservation efforts of personnel in high demand area		32
Availability of energy support personnel	11, 23	28, 38, 41
Support services	7, 12	
Comprehension level of operation manuals	16	33, 43
Communication between plant operator/custodian and the principal	3, 6, 10, 18, 22	
Energy management systems		27, 37

For the purpose of designing engineering-related training materials and user guidelines, the researcher reviewed only those items pertinent to the following instrument categories: energy training, conservation efforts of personnel in high

demand area, availability of energy support personnel, comprehension level of operation manuals, communication between plant operator/custodian and the principal, and energy management systems. Additional instrument items, such as "dropping oil and gas prices will reduce concern about energy," were valuable to the researcher in understanding predispositions.

The population for the study included 51 principals from the Houston Independent School District, Texas, during the 1985-86 academic year. Energy utilization rankings of the campuses were obtained from the district Energy Conservation Department to separate the principals into three energy utilization/consumption groups: low energy utilization, moderate energy utilization, and high energy utilization. These designations were based on energy performance ratings given to the schools in a mid-year 1985-86 analysis by the Energy Conservation Department. Five elementary school principals, eight middle school principals, and five high school principals were polled from each utilization grouping.

ANALYSIS OF DATA

ENERGY TRAINING

For the purpose of this study, Questionnaire Item #4 addressed the principal's training: "Have you received energy conservation training as support for your current responsibilities?" Table 2 indicates that 30 (58.8%) of the respondents had not received training in energy management as support for current responsibilities. A breakdown of the groups showed the following analysis of administrators receiving training in energy management: high energy utilization, 3 (17.6%); low energy utilization, 9 (52.9%); moderate energy utilization, 7 (41.2%). The data indicated that the administrators in the low energy utilization group had more training than did administrators in the high and moderate energy utilization groups. An analysis of the data showed that 30 (58.8%) of the principals responded no to the question. Three principals failed to respond to Questionnaire Item #4. An interview of administrators revealed the following information: (a) formal training - none; (b) informal training - high energy utilization, 3 (17.6%); low energy utilization, 8 (47.1%); moderate energy utilization, 6 (35.2%). A breakdown of the groups showed the following analysis of administrators receiving informal training in energy management: high energy utilization, 3 (17.6%); low energy utilization, 8 (47.1%); moderate energy utilization, 6 (35.2%). Recommendation - Training of management will enhance cost avoidance potential.

Questionnaire Item #15 stated, "Has district-provided training about energy conservation met the needs on your campus?" Table 2 presents the data. A breakdown of the groups showed the following analysis of administrators believing that district-provided training about energy conservation met their campus' needs: high energy utilization, 4 (23.5%); low energy utilization, 7 (41.2%); moderate energy utilization, 4 (23.5%). Nearly two thirds (11, 64.7%) of the respondents who believed training met the campus needs were in the low and moderate energy utilization groups. Seven (41.2%) of the respondents in the high

energy utilization group did not believe the training met campus needs. Recommendation - Training should be specific to the requirements of the site.

Table 2
Energy Training Analysis
(n = 17 in each energy utilization category)

	Yes		No		Total	
	n	%	n	%	n	%
Principals with Previous Energy Conservation Training						
High	3	17.6	13	76.5	16	94.1
Low	9	52.9	8	47.1	17	100.0
Moderate	7	41.2	9	52.9	16	94.1
Total	19	37.3	30	58.8	49	96.1
Training Has Met Campus Needs						
High	4	23.5	7	41.2	11	64.7
Low	7	41.2	8	47.1	15	88.2
Moderate	4	23.5	8	47.1	12	70.6
Total	15	29.4	23	45.1	38	74.5

Note. On this and all succeeding tables, the totals might not equal 17 (100.0%), because (1) of rounding and (2) some respondents might not have indicated yes or no responses.

Opinionnaire Item #31 stated, "Training efforts should be improved/updated." Table 3 presents the data. Training improvement and updating was endorsed by 70.6 percent of the respondents from the high energy utilization group and by 88.2 percent of the respondents from the low energy utilization group. Approximately one fourth (23.5%) of the high energy utilization group had no opinion concerning this item. Recommendation - When training updates are perceived favorably by management, training should be implemented.

Table 3
Training Should Be Improved
(n = 17 in each energy utilization category)

	SA	A	NO	D	SD	Total
High	23.5	47.1	23.5	--	--	94.1
Low	35.3	52.9	11.8	--	--	100.0
Moderate	47.1	23.5	17.6	11.8	--	100.0

Note. On this and succeeding tables of this specific type, numbers are expressed in percentages and the following key applies: SA, strongly agree; A, agree; NO, no opinion; D, disagree; SD, strongly disagree.

Opinionnaire Item #42 stated, "Computer, kitchen, and shop personnel need energy training." Table 4 presents the data. Training for computer, kitchen, and shop personnel was endorsed by 64.7 percent of the respondents from the high and low energy utilization groups. Of the low energy utilization group, 35.3 percent had no opinion concerning this item. In the high energy utilization group, 35.3 percent expressed no opinion or disagreed with the statement. Recommendation - Training for auxiliary personnel is perceived to be important; training should include auxiliary personnel.

CONSERVATION EFFORTS OF PERSONNEL IN HIGH DEMAND AREA

Opinionnaire Item #32 stated, "Cafeteria and shop personnel are energy conscious." Data regarding these areas are presented in Table 4. Only in the high energy utilization group did the no opinion and disagree response percentages approach the strongly agree and agree response percentages. For both the low and moderate energy utilization groups, 58.8 percent of the group responses were affirmative. Recommendation - Management should be informed of the cost avoidance measures required by all employees.

Table 4
Personnel Training
(n = 17 in each energy utilization category)

	SA	A	NO	D	SD	Total
Other Personnel Need Training						
High	17.6	47.1	23.5	11.8	--	100.0
Low	17.6	47.1	35.3	--	--	100.0
Moderate	17.6	58.8	--	11.8	5.9	94.1
Personnel Are Energy Conscious						
High	17.6	35.3	23.5	23.5	--	99.9
Low	11.8	47.1	17.6	17.6	--	94.1
Moderate	5.9	52.9	17.6	17.6	5.9	99.9

AVAILABILITY OF ENERGY SUPPORT PERSONNEL

Questionnaire Item #11 stated, "Central office personnel are available for energy conservation consultation." Table 5 presents the data. A breakdown of the groups showed the following analysis of administrators believing that central office personnel were available for energy conservation consultation: high energy utilization, 12 (70.6%); low energy utilization, 10 (58.8%); moderate energy utilization, 12 (70.6%). Note that there were only 36 (70.6%) principals who responded to this item. Recommendation - All management personnel should be acquainted with the energy consultant for their facility.

Questionnaire Item #23 stated, "I have consulted with central office energy personnel to improve energy efficiency." Table 5 presents the data. A breakdown of the groups showed the following analysis of administrators consulting with central office energy personnel to improve energy efficiency: high energy utilization, 9 (52.9%); low energy utilization, 10 (58.8%); moderate energy utilization, 7 (41.2%). Recommendation - Two-way communication between management and consultant must be ongoing.

Table 5
Personnel Availability
(n = 17 in each energy utilization category)

	Yes		No		Total	
	n	%	n	%	n	%
Personnel Are Available						
High	12	70.6	1	5.9	13	76.5
Low	10	58.8	1	5.9	11	64.7
Moderate	12	70.6	0	--	12	70.6
Total	34	66.7	2	3.9	36	70.6
Personal Contacts Improve Efficiency						
High	9	52.9	8	47.1	17	100.0
Low	10	58.8	7	41.2	17	100.0
Moderate	7	41.2	9	52.9	16	94.1
Total	26	51.0	24	47.1	50	98.1

Opinionnaire Item #28 stated, "Sufficient energy support personnel are available for my needs." Table 6 presents the data. Of the high energy utilization group, 58.8 percent were satisfied with the availability of energy support personnel, whereas only 41.2 percent of the respondents from the low energy utilization group stated their agreement. Approximately 30 percent of both the moderate and low energy utilization groups disagreed with this item. Recommendation - Information regarding support services will lessen the opportunity to excuse poor results; investigate the type of support personnel available.

Table 6
Sufficient Personnel Are Available
(n = 17 in each energy utilization category)

	SA	A	NO	D	SD	Total
High	--	58.8	17.6	23.5	--	99.9
Low	5.9	35.3	29.4	29.4	--	100.0
Moderate	17.6	35.3	11.8	17.6	11.8	94.1

Opinionnaire Item #38 stated, "Additional personnel trained in energy conservation are needed." Table 7 presents the data. Of the respondents in the high energy utilization group, 58.9 percent favored additional personnel trained in energy conservation, whereas only 29.4 percent of the respondents in the low energy utilization group favored additional personnel. An unusually high percentage (41.2%) in the low energy utilization group offered no opinion to this item. Recommendation - Inhouse training of available personnel should be evaluated before considering additional personnel.

Opinionnaire Item #41 stated, "Plant operators have the resources to fully implement conservation measures." Table 7 presents the data. Of both the high and low energy utilization groups, 35.3 percent denied the availability of sufficient resources. Approximately 50 percent of both groups were satisfied with resource availability. Recommendation - Clarification of the availability of energy support resources should be given by management with this information provided to the plant operator.

Table 7
Resource Availability
(n = 17 in each energy utilization category)

	SA	A	NO	D	SD	Total
Additional Personnel Are Needed						
High	11.8	47.1	17.6	17.6	5.9	100.0
Low	5.9	23.5	41.2	23.5	5.9	100.0
Moderate	5.9	52.9	17.6	17.6	5.9	99.9
Operators Have Sufficient Resources						
High	11.8	41.2	11.8	29.4	5.9	100.0
Low	17.6	23.5	23.5	23.5	11.8	99.9
Moderate	5.9	29.4	5.9	35.3	23.5	100.0

SUPPORT SERVICES

Questionnaire Item #7 stated, "Energy-related supplies (such as light bulbs with low wattage) are delivered as requested." The data are presented in Table 8. Only 38 principals responded either yes or no to this statement; 33 (64.7%) indicated that energy-related supplies were delivered as requested. Only 38 (74.5%) of the 51 (100.0%) principals responded to this item. Recommendation - An inventory of energy resource items should be available for management, with clarification of their importance to the program.

Questionnaire Item #12 stated, "The central maintenance department responds in a timely manner." Table 8 presents the data. A breakdown of the groups showed the following analysis of administrators believing that the maintenance department responded in a timely manner: high energy utilization, 14 (82.4%); low energy utilization, 16 (94.2%);

moderate energy utilization, 13 (76.5%). Recommendation - Management should understand the importance of shutdowns on equipment and all steps necessary to restart an energy management system.

COMPREHENSION LEVEL OF OPERATION MANUALS

Questionnaire Item #16 addressed this hypothesis, and data are shown in Table 8. The item stated, "Equipment manuals are easily understood." A breakdown of the groups showed the following analysis of administrators believing the equipment manuals were easily understood: high energy utilization, 9 (52.9%); low energy utilization, 7 (41.2%); moderate energy utilization, 6 (35.3%). These percentages are somewhat higher than the number of respondents affirming the adequacy of information necessary to maintain equipment, which was discussed earlier. Thirty-four (66.6%) of the principals responded to this item. Recommendation - Operation and training materials must be adjusted to meet the work and educational background of the user; understanding of learning style is essential for the trainer.

Table 8
Resource Efficiency
(n = 17 in each energy utilization category)

	Yes		No		Total	
	n	%	n	%	n	%
Supplies Are Delivered						
High	10	58.8	3	17.6	13	76.5
Low	13	76.5	1	5.9	14	82.4
Moderate	10	58.8	1	5.9	11	64.7
Total	33	64.7	5	9.8	38	74.5
Maintenance Responds in a Timely Manner						
High	14	82.4	2	11.8	16	94.2
Low	16	94.2	0	--	16	94.2
Moderate	13	76.5	3	17.6	16	94.1
Total	43	84.3	5	9.8	48	94.1
Manuals Are Understood						
High	9	52.9	4	23.5	13	86.4
Low	7	41.2	3	17.6	10	58.8
Moderate	6	35.3	5	29.4	11	64.7
Total	22	43.1	12	23.5	34	66.6

Opinionnaire Item #33 stated, "Written maintenance guidelines/schedules are easy to understand." Table 9 presents the data. Less than half of all

groups concurred with the opinions that guidelines and schedules were easy to understand. Over one fourth of each group had no opinion. Three principals failed to respond to this item. Recommendation - Standardization of checklists (maintenance procedures) throughout a plant ensure understanding; technical jargon should be eliminated whenever possible.

Opinionnaire Item #43 stated, "Written instructions and measures for personnel can be read and followed." Table 9 presents the data. Nine (52.9%) of the low energy utilization group and 12 (70.6%) of the high energy utilization group agreed with this statement. Five (29.4%) of the high energy utilization group and 6 (35.3%) of the low energy utilization group had no opinion. Recommendation - Instructions to management may be understood, but efforts to communicate instructions to the plant operator should be investigated.

Table 9
Clarity

(n = 17 in each energy utilization category)

	SA	A	NO	D	SD	Total
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Guidelines Are Understandable

High	5.9	41.2	47.1	5.9	--	100.0
Low	5.9	35.3	29.4	17.6	5.9	94.1
Moderate	11.8	29.4	29.4	11.8	5.9	88.3

Instructions Can Be Followed

High	11.8	58.8	29.4	--	--	100.0
Low	11.8	41.2	35.3	11.8	--	100.0
Moderate	5.9	47.1	17.6	11.8	5.9	88.3

COMMUNICATION BETWEEN PLANT OPERATOR/CUSTODIAN AND THE PRINCIPAL

Questionnaire Item #3 stated, "Do you have adequate information available to maintain your equipment?" As shown in Table 10, availability of information which was adequate to maintain the equipment was confirmed by 24 (47.1%) of the respondents. Forty-one (80.4%) of the 51 principals responded to this item. Recommendation - Maintenance information is essential for a successful program; specific information regarding the cataloging of information should be discussed.

Questionnaire Item #6 stated, "At my campus, the principal and plant operator have regular, scheduled meetings." Of the low energy utilization group, an overwhelming majority (15, 88.2%) replied that the principal and plant operator had regular, scheduled meetings. The high (14, 82.4%) and moderate (15, 88.2%) energy utilization groups offered similar responses. These data are presented in Table 10. Recommendation - An assessment of management's communication skills may be necessary.

Table 10
Communication
(n = 17 in each energy utilization category)

	Yes		No		Total	
	n	%	n	%	n	%

Availability of Equipment Maintenance Information

High	9	52.9	5	29.4	14	82.3
Low	8	47.1	4	29.4	13	76.5
Moderate	7	41.2	7	41.2	14	82.4
Total	24	47.1	17	33.3	41	80.4

Regularity of Meetings Between Principal and Plant Operator

High	14	82.4	3	17.6	17	100.0
Low	15	88.2	2	11.8	17	100.0
Moderate	15	88.2	2	11.8	17	100.0
Total	44	86.3	7	13.7	51	100.0

Questionnaire Item #10 stated, "My campus uses a standard maintenance checklist." From the data presented in Table 11, it was determined that approximately two thirds of all the campuses used checklists (34, 66.7%). The low energy utilization group indicated a significantly lower percentage (9, 52.9%) of principals using standard maintenance checklists than did the high energy utilization group (13, 76.5%). Recommendation - Standard maintenance checklists should be reviewed for content and comprehension.

Table 11
Use of Standard Maintenance Checklists
(n = 17 in each energy utilization category)

	Yes		No		Total	
	n	%	n	%	n	%
High	13	76.5	2	11.8	15	88.3
Low	9	52.9	5	29.4	14	82.3
Moderate	12	70.6	3	17.6	15	88.2
Total	34	66.7	10	19.6	44	86.3

Questionnaire Item #18 stated, "Plant operator reports are reviewed regularly." In general, responses to this item continued the trend of principals in the high energy utilization group exhibiting a commitment to communication efforts. Table 12 shows that only one of the principals in the high energy utilization group responded no, compared to none in the low energy utilization

group. Three (17.6%) of the principals in the low energy group and 4 (24.5%) of the principals in the moderate energy utilization group did not respond yes or no to this item; yes or no responses were given by 44 (86.3%) of the principals. Recommendation - Plant operator reports should be reviewed for content and comprehension to improve design.

Questionnaire Item #22 was, "Written records of HVAC (heating/ventilation/air conditioning) system maintenance checks are kept." Table 12 reports the data. A breakdown of the groups showed the following analysis of administrators keeping written records: high energy utilization, 10 (58.8%); low energy utilization, 11 (64.7%); moderate energy utilization, 9 (52.9%). This item was acknowledged by 35 (68.7%) of the principals. Recommendation - Procedures regarding the written records of HVAC systems should be explored.

Table 12
Record-Keeping
(n = 17 in each energy utilization category)

	Yes		No		Total	
	n	%	n	%	n	%
Plant Operator Reports Are Reviewed Regularly						
High	16	94.1	1	5.9	17	100.0
Low	14	82.4	0	--	14	82.4
Moderate	11	64.7	2	11.8	13	76.5
Total	41	80.4	3	5.9	44	86.3
Written Records Are Kept						
High	10	58.8	2	11.8	12	70.6
Low	11	64.7	2	11.8	13	76.5
Moderate	9	52.9	1	5.9	10	58.8
Total	30	58.8	5	9.8	35	68.6

A brief summary of the data pertinent to communication indicated there was evidence of communication efforts with the plant operator by all groups. Adequate maintenance information was acknowledged by less than half (24, 47.1%) of the respondents. Checklists were reviewed by 41 (80.4%) of the respondents, but only 30 (58.8%) indicated that written records of the HVAC systems were kept. The quality of information gathered and exchanged during the principal/plant operator regular meetings may require additional study. Principals in the high energy utilization group exhibited similar communication traits as did principals in the low energy utilization group. It was the quality of these communication exchanges which may reveal any differences in managing energy utilization.

ENERGY MANAGEMENT SYSTEMS

Opinionnaire Item #27 stated, "Energy management systems (EMS) or HVAC needs to be controlled by the

campus." Principals in the high energy utilization group favored campus control of EMS or HVAC systems by 41.2 percent, compared to principals in the low energy utilization group (29.4%). The principals in the low energy utilization group opposed campus control by 35.3 percent, compared to principals in the high energy utilization group (17.7%). These data are presented in Table 13. Recommendation - The placement of controls should be discussed with management with full disclosure of all positive and negative factors.

Opinionnaire Item #37 stated, "Off-campus centrally-controlled EMS or HVAC is preferred." Approval of off-campus control of EMS or HVAC was given by 11.8 percent of the high energy utilization group, with 5.9 percent of the low and moderate energy utilization groups accepting off-campus control. The respondents from the low energy utilization group showed a higher percentage (41.2%) of apathy regarding controls of the systems, as opposed to respondents from the high energy utilization group (23.5%). The moderate energy utilization group was significantly opposed to off-campus control (82.4%). The high energy utilization group indicated a 64.7 percent opposition, with the low energy utilization group opposing off-campus control (42.9%). These data are shown in Table 13. Recommendation - Opposition to change should be addressed prior to equipment installations.

Table 13
Energy Utilization
(n = 17 in each energy utilization category)

	SA	A	NO	D	SD	Total
EMS Should Be Campus Controlled						
High	5.9	35.3	41.2	5.9	11.8	100.0
Low	--	29.4	35.3	23.5	11.8	100.0
Moderate	--	47.1	35.3	11.8	5.9	100.0
EMS Should Be Off-Campus Controlled						
High	--	11.8	23.5	29.4	35.3	100.0
Low	--	5.9	41.2	35.3	17.6	100.0
Moderate	5.9	--	11.8	47.1	35.3	100.0

As a brief summary of EMS opinionnaire items, respondents from the high energy utilization group expressed a strong desire (41.2%) to maintain control of their systems (Item #27), a position which was supported by increased opposition (64.7%) to off-campus control (Item #37). Respondents from the low energy utilization group continued this trend, with 29.4 percent favoring campus controlled systems and 52.9 percent rejecting off-campus controlled systems. Although 53.0 percent of the moderate energy utilization group had no opinion or rejected the need for EMS or HVAC systems being campus controlled, they firmly rejected (83.4%) any off-campus

controlled system. These statements are particularly important to HISD, as the Board of Education has recently endorsed total involvement of all campuses to the EMS systems plan. At the time of this study, no energy management systems with off-campus controls were employed by the district. Recommendation - Any off-site control system should be installed after educating the attitudes of site managers as to the advantages.

Questionnaire Item #2, which related to the success of energy management systems, stated, "Are recommended thermostat settings appropriate for your building?" Respondents of the high and low energy utilization groups were equally divided (8, 47.1%) as to the appropriateness of thermostat settings. Twenty (39.2%) of the 49 (96.1%) respondents rejected the appropriateness of thermostat settings, with 2 (3.9%) respondents not responding to this item.

Questionnaire Item #14, which also related to the success of energy management systems, stated, "Staff complaints make thermostat setting changes necessary." In the high and low energy utilization groups, 23 (67.6%) respondents believed that complaints necessitated changes in thermostat settings. A breakdown of the groups showed the following analysis of administrators believing complaints necessitated changes in thermostat settings: high

energy utilization, 13 (76.5%); low energy utilization, 10 (58.8%); moderate energy utilization, 10 (58.8%).

FINDINGS

A summary of the results of the statistical analysis of all instrument items is presented below.

1. Training backgrounds of managers influenced cost avoidance savings.
2. Appropriate training of personnel was supported by management.
3. Placement of controls was a key issue which must be addressed.
4. Principals perceived themselves to be communicators.
5. Energy support training for job responsibilities was supported by principals.
6. Principals seemed indifferent to the availability of energy conservation department personnel for consulting purposes.
7. Principals indicated that manuals and equipment information were not always available or written on the comprehension levels of the employees using them.
8. Record-keeping lacked standardization.