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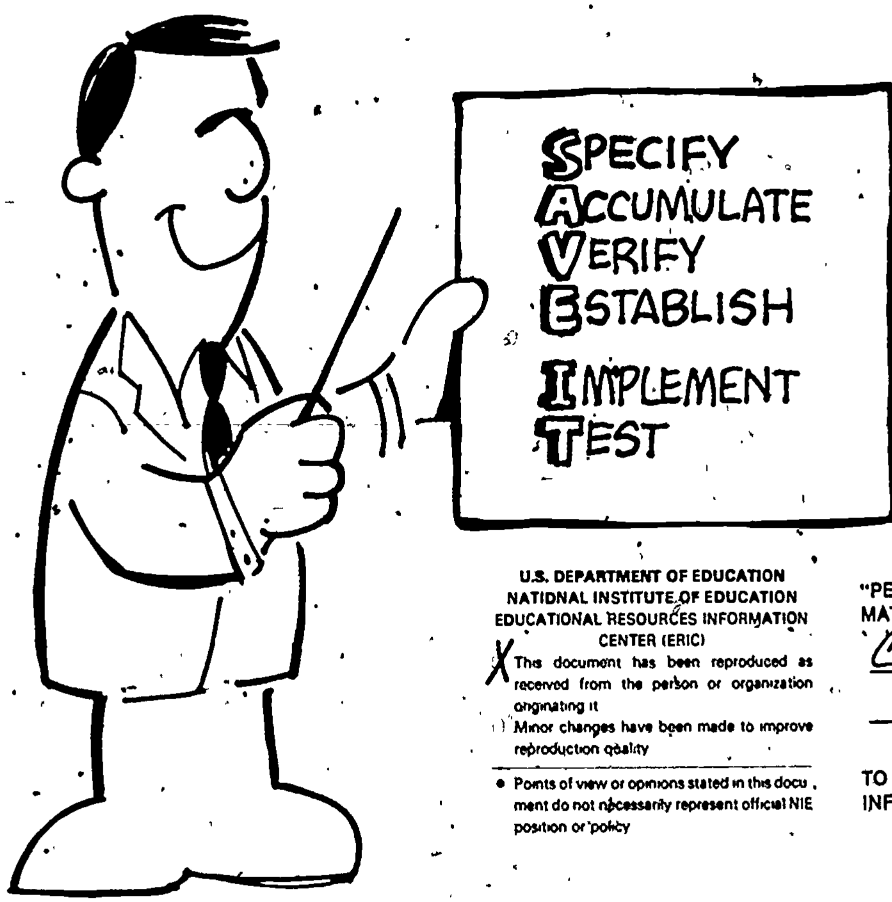
ABSTRACT

To assist Florida school administrators in establishing comprehensive energy management programs in their school districts, this handbook presents a systematic, integrated approach. The first chapter outlines the steps that school districts must take to initiate an energy management program, including establishing a committee and a coordinator for the district. Chapter 2 identifies procedures for collecting energy-use data at each school. Chapter 3 shows how the characteristics of the major energy-using systems and of operations practices affect energy consumption. Chapter 4 discusses the manpower and financial resources available to schools and shows how a plan can be formulated to use these resources effectively to identify and implement the best measures. Chapter 5 identifies strategies for the integration of energy issues into the existing curriculum. Chapter 6 addresses energy emergency contingency planning by providing guidelines for designing plans to deal with possible moderate and serious energy emergencies. Eight appendices contain checklists, forms, references, an index, a list of energy contact-persons in Florida, and a glossary. (Author/MLF)

FLORIDA ENERGY MANAGEMENT HANDBOOK

FOR SCHOOL ADMINISTRATORS



SAVE IT, FLORIDA.

FLORIDA ENERGY MANAGEMENT HANDBOOK
FOR SCHOOL ADMINISTRATORS

PREPARED BY:

The Governor's Energy Office

Tallahassee, Florida

IN CONJUNCTION WITH:

The Department of Education

and

Coloney Productions

1981

STATE OF FLORIDA
Office of the Governor
THE CAPITOL
TALLAHASSEE 32301

BOB GRAHAM
GOVERNOR

Dear School Administrator:

Recognizing that the rising cost of energy is having a detrimental effect on school district budgets, we are pleased to enclose the Florida Energy Management Handbook for School Administrators. Designed to help reduce the fiscal impacts of high energy costs, the Handbook provides a step-by-step guide for refining existing efforts or establishing a new, comprehensive program of energy management.

A comprehensive program will allow school districts to reduce energy consumption and realize substantial dollar savings. This Handbook and the technical assistance available through the Governor's Energy Office should assist you in your efforts.

We urge you to put into effect the conservation actions suggested in the Handbook. By doing this and actively participating in the technical assistance services available from the Governor's Energy Office, you can increase energy efficiency in your district's schools.

The Handbook is a cooperative effort of the Governor's Energy Office, the Florida Department of Education, and many school administrators around the State. We would like to express our appreciation to those school administrators who helped develop this useful, comprehensive guide that directly addresses the energy programs of Florida's schools.

Best wishes for success in reducing energy consumption in your district.

Sincerely,

Bob Graham
Governor

Ralph D. Turlington
Commissioner of Education

BG/RT/ipb

Enclosure

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INTRODUCTION

Florida's school administrators agree that their budgets are tight and getting tighter. The rapidly rising cost of energy is a major contributor to school budget problems. In fact, rising energy costs, coupled with higher costs for all school operating expenses, are forcing school boards and school administrators to make difficult decisions on which activities or programs to curtail.

In order to pay escalating energy bills, school boards and administrators have three major options:

1. To increase revenues through higher taxes (assuming the maximum millage rate has not been reached);

2. To reduce the amount of money spent for other needs, such as supplemental instructional materials, special programs, and salaries; or

3. To increase energy efficiency through energy management.

Clearly, the most acceptable option is to increase energy efficiency, thus reducing the impact of energy costs on the school district's budget. While efforts to improve energy efficiency may not eliminate the need to consider other options, they will allow the school district to reduce the impact of the most inflationary portion of its operating expenses. In so doing, the district will ensure that the other options are addressed only when absolutely necessary. There are many actions school administrators can take to promote energy efficiency. To be effective, however, these actions must be considered within a comprehensive framework.

The Florida Energy Management Handbook for School Administrators is intended to assist school administrators in establishing comprehensive energy management programs in their school districts. The handbook presents a systematic, integrated approach to energy management. The commitment and cooperation of everyone involved, from the school board and district administrators to teachers, students, and parents, is required. Only through implementation of a comprehensive program will school districts realize the reduction in energy consumption needed to overcome fiscal problems resulting from rising energy costs.

Some school districts have recognized the need to reduce energy consumption and have taken action. Many districts have adjusted thermostat settings and lowered lighting levels. But even though these actions have resulted in some savings, much greater savings could be realized as the result of a comprehensive energy management program.

If efforts to achieve energy efficiency are to be successful, they must consider the many factors that affect energy consumption in school facilities. Unless these factors are known and understood, conservation efforts may show results far short of expectations. Five major factors influence the level of energy use in school facilities. Two of these, climate and the mandated educational programs and activities that must be conducted in the facility, cannot be modified significantly. However, substantial increases in energy efficiency can be made by addressing the other three factors:

1. Building components and features, including floors, ceilings, walls, roof, windows, and landscaping. Many school buildings were designed and constructed with initial costs and space needs as the primary design criteria. This has resulted in the creation of a large inventory of school buildings that, by today's standards, are not energy-efficient;

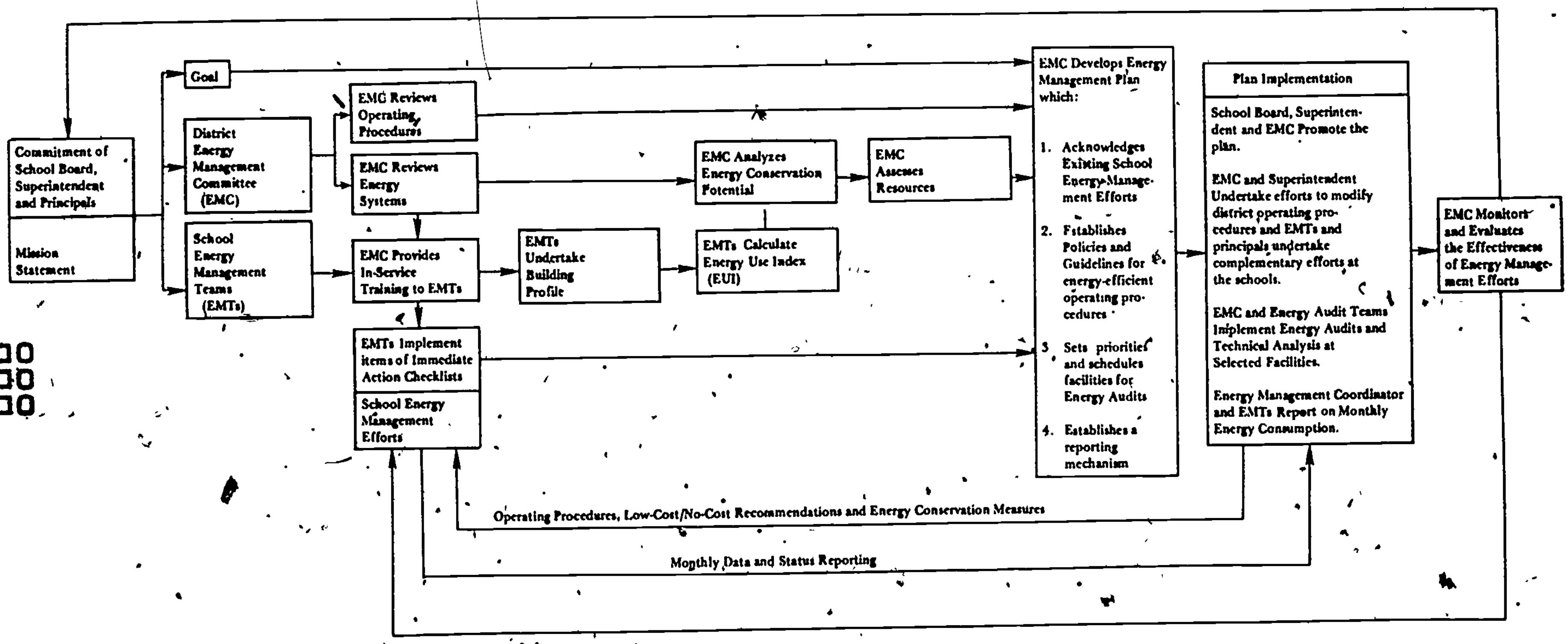
2. Energy-using systems and equipment, such as heating, cooling, lighting, ventilation, and transportation; and

3. Occupant habits and facility utilization, including the way maintenance personnel, operating and management personnel, teachers, students and others use the facilities, as well as the hours of operation.

All five factors are interrelated and must be addressed together for energy conservation and efficiency measures to be effective. The National Electrical Contractors Association's Handbook, *Total Energy Management* (1976) notes: "Effective energy management requires that the entire pattern of energy consumption be analyzed so that changes made will be integrated into the system in full light of the interrelationship which exists and the various effects which will occur." This handbook discusses all of these factors as part of a comprehensive, integrated energy management program.

The following flowchart depicts the process presented in this handbook that was designed to help school districts identify and address the many facets of energy management.

The Energy Management Process



As detailed in Chapter I, initiating a comprehensive, integrated energy management program requires the commitment of the major decision makers in the school district. The school board, the superintendent and top administrators must initiate their energy management program through establishment of an Energy Management Committee, headed by an Energy Management Coordinator for the district. This committee's first responsibility should be to expeditiously review the material presented in this Handbook and other available resources in order to develop a Mission Statement for the consideration of the school board. Acceptance of this mission and its subsequent promotion by the school board will formalize the district's commitment to energy efficiency. The mission statement will provide the overall goal and direction for the efforts of the Energy Management Committee. Utilizing the mission statement, the committee must set specific objectives and develop a plan of action. Energy Management Teams should be established at each school by the superintendent and school principals to assist the district Energy Management Committee in implementing the district's plan. These initial steps formalize and refine the district's commitment and establish the basic organizational structure for energy management.

The district Energy Management Committee, assisted by the school Energy Management Teams, must first determine where and how energy is being consumed in each of the district's facilities. Chapter II identifies procedures for collecting energy-use data at each school. The information gathered by the school Energy Management Teams on the Building Profile Form (Appendix A), will provide the information needed by the Energy Management Committee to target specific facilities for more detailed analysis. While the Energy Management Teams are gathering data, they can use the Immediate Action Checklists (Appendix B) to initiate many low-cost/no-cost conservation actions.

Chapter III identifies how the characteristics of the major energy-using systems and operations practices affect energy consumption. An understanding of the operation of energy-using systems can be used to determine strategies for reducing consumption. The information in Chapter III parallels the information in the Energy Audit Form (Appendix C) that is used in completing the detailed energy consumption analysis discussed in Chapter IV.

The Energy Management Committee must develop a plan for implementing the conservation measures that have been identified. But first, the available manpower and financial resources must be identified. Chapter IV discusses the resources available to schools. It shows how a plan can be formulated to effectively use those resources to identify and implement the most effective measures.

Energy education is an important part of any energy management program. Increased awareness of the energy issue and greater knowledge of the individual's role in reducing energy consumption is needed to secure the cooperation of administrators, teachers, students, and others required for effective energy management. Chapter V identifies strategies for the integration of energy issues into existing curricula.

In addition to ongoing energy conservation and efficiency efforts, school administrators must also be prepared to deal with possible energy supply shortages and the accompanying drastic price increases. Chapter VI addresses energy emergency contingency planning by providing guidelines for designing plans to deal with moderate and serious energy emergencies, should they occur.

Estimates have shown that the average school district can expect its energy costs per pupil per year to triple by 1985. Perhaps what hurts school districts most is that, unlike the private sector, they cannot routinely pass on higher costs by raising prices for the services or products they provide. With undercurrents of a nationwide tax revolt developing, the prospects for obtaining more funds to pay higher fuel costs are not bright. Reducing the effects of higher fuel costs on the district's budget through the development and implementation of a comprehensive energy management program appears to be the only fiscally-sound alternative.

The school district that confronts the energy situation with a well thought-out program will be years and dollars ahead.

CHAPTER I
ORGANIZING FOR ACTION

CHAPTER I

ORGANIZING FOR ACTION

When school administrators begin to deal with the energy problems of their district, their first consideration should be the level of effort and resources they can commit to the development of an effective program. In dealing with energy problems, the amount of time and effort spent is directly related to the benefits gained. The commitment that the school board, superintendent, school principals and top administrators place on their energy management efforts will determine the degree to which they will be able to solve the budgetary problems of rising fuel costs. To be effective, the district's energy management program must be an organized, comprehensive effort that is designed to produce results. A comprehensive effort will require the participation and commitment of personnel from every functional area of the school system and the leadership of its top administrators.

A. DISTRICT-WIDE COMMITMENT

A comprehensive energy management program requires the commitment and cooperation of the school board and top administrators, combined with the active participation of personnel at all levels. Although the board will not be involved in the day-to-day activities of energy management, its support is necessary to sustain the effort. The board's commitment must be clearly stated as a matter of policy. The best way to do this is for the school board to adopt the mission statement as an official resolution.

Establishment of a district-wide commitment begins when school administrators realize they can and must do something to reduce energy consumption and address rising energy costs. The appointment of an energy management committee for the school district is one important way that this realization is translated into action.

B. ENERGY MANAGEMENT COMMITTEE

The Energy Management Committee is the single most important group involved in the energy management program. The committee will direct the activities of the energy management program for the entire district. To be most effective, it should be made up of a cross-section of school district personnel that can supply the leadership and expertise necessary to develop and implement the program. The committee should be chaired by the district's Energy Management Coordinator, and must have direct access to, and the full support of, the district's top adminstrators and decision makers. The size and composition of the Energy Management Committee will vary from district to district. Ideally, it should include seven to fifteen members who can work together to produce results. The Energy Management Coordinator should serve as the head of this group. (School districts that have not already done so, should appoint an individual to serve as Energy Management Coordinator.) The Committee member should be selected to represent a diversity of expertise and should include:

- The Energy Management Coordinator--This person will be the district's and the committee's energy leader. This individual should represent a balance between energy expert and administrator, possess strong leadership qualities and, ideally, should fill the position fulltime.

- A Board Member--A member of the board represents its interests and commitment and is invaluable for setting parameters.

- A Principal Representative--A school principal knowledgeable in the concepts of staff development and in-service training can effectively involve staff and the community in assessing and implementing change.

- A Teacher Representative--Participation of the instructional staff is essential. This member should be able to gauge general teacher feelings, represent their interests, and have some knowledge of energy curriculum and issues.

- A Financial Administrator--A district administrator with insight into district-level planning can provide the fiscal guidance needed by the committee.

A Lay Person–A person from the community can lend pertinent expertise and provide an outsider's viewpoint. A recognized community leader should be sought to fill this position.

A Maintenance Representative– An individual knowledgeable about the district's energy operations, particularly HVAC systems, will provide the needed expertise.

A Public Relations Person--Reporting school efforts to the public can be of substantial assistance in gaining support for the program.

A Utility Representative--An expert from the local utility company can provide information about cost and supply of utility service.

An Architect/Engineer--An outside energy expert is a must for estimating costs and future design development.

A Student Representative--A recognized student leader who knows the student point of view and can identify the roles students can play in the energy program should be included.

Others, as needed, may be appointed.

While the Energy Management Committee will be responsible for directing all phases of the comprehensive energy management process, its first task will be to become familiar with the energy problems by reviewing this handbook and other related references and to develop a Mission Statement and goals for school board adoption.

C. MISSION STATEMENT - GOAL

To direct the energy management efforts of the district, the school board must adopt a formal Mission Statement. The school board should charge the Energy Management Committee with the responsibility for reviewing this handbook and other pertinent literature to develop a Mission Statement for the district's energy conservation program. Once adopted, this statement will direct the nature and scope of the program, and will serve as a refinement and formalization of the school board's commitment.

The goal set by the Mission Statement will vary from district to district, because some districts will have already undertaken energy-savings activities. Different opportunities will exist in different districts. The district's conservation goal should be presented in the form of a percentage reduction of energy consumption. The Mission Statement should be presented and formalized in the form of an official school board resolution, such as:

Be It Hereby Resolved That

Whereas the cost of basic energy fuels keeps increasing, and

Whereas the Board of Education bears a responsibility to provide for the efficient use of tax dollars, and

Whereas a basic need exists to make all citizens more aware of energy options, and

Whereas public education can provide leadership in examining life styles and developing a realistic energy ethic.

Now therefore, the Board of Education of ______ County hereby makes a commitment to reduce energy consumption by ______ percent in its facilities and directs the superintendent to establish the appropriate organization to develop and implement a district-wide energy management program to meet this goal.

Of course, the goal should be realistic. If the goal is too high, the Energy Management Committee and teams will become frustrated trying to accomplish the impossible. If it is too low, mediocre efforts could result.

After the Mission Statement has been formally adopted, a plan of action can be developed. A schedule of specific action steps should be developed by considering the answers to questions such as: When can we start? How long will it take to implement the measures we have identified? and What are the steps necessary to accomplish our goal ? The answers to these questions will depend on the size of the district, the extent of its needs and the resources available.

When these questions have been answered, a specific plan should be published by the district board. This plan should be presented, as a sign of the district's commitment, to personnel participating in the program and as a message to other district personnel and the general public that the school board is serious about energy conservation.

D. ENERGY MANAGEMENT TEAMS

The Energy Management Team is the individual school facility's counterpart to the Energy Management Committee and acts as an operational extension of the committee. Its responsibilities include all on-site data collection and the supervision of the effort to implement conservation measures in the school. The Energy Management Team reports to the district committee and is responsible for carrying out the district's energy management program in the schools.

Energy Management Teams should be established by the superintendent and the principal in each of the district's schools. The membership should be drawn from among the following:

The Principal, who is ultimately responsible for energy management as the school's top administrator.

Teachers, who control classroom use of energy and promote energy awareness through energy education.

Operational/Maintenance Personnel, who operate and maintain the major energy-using systems.

Coaches, who control the scheduling of many extracurricular activities.

Students, who are a major energy use factor and who influence the success of the conservation efforts.

Parents and Outside Experts, who provide community support for the program.

E. IN-SERVICE TRAINING

The Energy Management Team members will require some training in order to accomplish their assigned tasks. Training sessions should be conducted by the Energy Management Coordinator or another "energy expert" to give the team members a basic understanding of their responsibilities. Detailed instructions on the use of the Building Profile Form (Appendix A) and the Immediate Action Checklists (Appendix B) should be provided.

CHAPTER II
SURVEYING THE SITUATION/ TAKING IMMEDIATE ACTION

CHAPTER II

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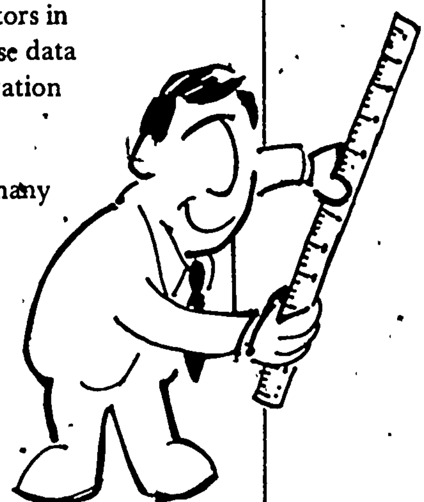
Knowing and understanding the energy consumption profile and the identification of the energy-using systems of each school facility are key factors in successfully operating any energy conservation plan. Without energy use data on which to base decisions, actions, and evaluations, an energy conservation program does not have a firm base.



The collection and recording of consumption data is important for many reasons. It:

- Provides the quantitative basis for the program;
- Points out possible areas of waste;
- Indicates the greatest energy-saving potentials;
- Provides comparisons;
- Prevents utility overcharges; and
- Creates an awareness of energy use and costs.

Measuring, compiling, and using energy consumption data for each school and for the entire school district is an essential element of every district energy management program. The importance of this can not be over emphasized, for without accurate and uniform data, there is no basis for assessing potential conservation actions and no way to evaluate performance of the conservation steps taken.

The building profile information covered in this section will assist you in establishing a solid base of information and data on which to develop your energy management program. The Building Profile Form (Appendix A) includes information about the use and structure of each facility, its rate of energy consumption and its Energy Use Index (EUI). This information can be used to complete the NECPA Preliminary Energy Audit Form discussed in Chapter IV.

While the Energy Management Teams are collecting data, the Immediate Action Checklists (Appendix B) should be distributed to each of the specific groups for which they were designed. The implementation of the items on these checklists will produce immediate energy savings while a comprehensive, district-wide plan is developed.

A. INVENTORY AND DESCRIPTION

Establishing an inventory and description of the school facilities is the initial step in forming the building profile. The Building Profile Form (in Appendix A) provides for a summary of building description and energy information. These forms can be copied, and one used for each school facility. The information needed can be supplied by the principal or the person most familiar with the building and its energy consumption.

Many factors related to the design and use of a facility affect its energy requirements. It is essential that the building and all of its energy-using systems, including HVAC, lighting, and others are properly inventoried. A comprehensive inventory and analysis of the building's energy use will permit the identification and evaluation of various energy conservation measures.

B. ENERGY USE DATA

The first step after the facility inventory has been conducted and the energy-using systems have been identified, is to collect actual energy use data for each type of energy used. The measurements and quantities of fuel types used at a facility can be obtained from a variety of sources. Some measurements can be determined from past utility bills, some from the internal records of the bookkeeping department, and still others can be gathered on site. Because 12 months of data is needed for analysis purposes, the data for the months of the current year should be combined with data from the remaining months of the previous year to create a 12-month data base.

There are various methods for obtaining, measuring, recording and using energy consumption data. You will be shown how to measure the various fuel types, how to record the data on the necessary forms, how to put the data in a common measuring form, and how to analyze what the data means.

1. Measuring Energy Consumption

Measuring energy consumption should begin with an examination of past records. If no special records of energy usage were kept, the utility bills may have to be located among other routine entries. If you are unable to obtain the proper information from your own records, the local utility should be able to supply the needed data.

To establish an accurate data base, the analysis should go back at least one year (or longer if accurate records are available). The location of electric, gas, oil, and other meters should be noted, and all suppliers should be identified. After the initial data collection has taken place, gathering and reporting energy consumption data can be done on a routine basis. When data is not readily available from past utility bills or when more accurate monitoring of energy consumption is required, it will be necessary to read the meters.

a. Measuring Electricity

Electric use is measured in two ways: the measure of consumption is the kilowatt hour (KWH); the measure of demand, which is the level rather than the rate of consumption, is the kilowatt (KW).

Some utilities simply bill on the number of kilowatt hours consumed. Others determine the rate by measuring both demand and consumption. If a facility is subject to demand billing, both factors, demand and consumption, must be considered.

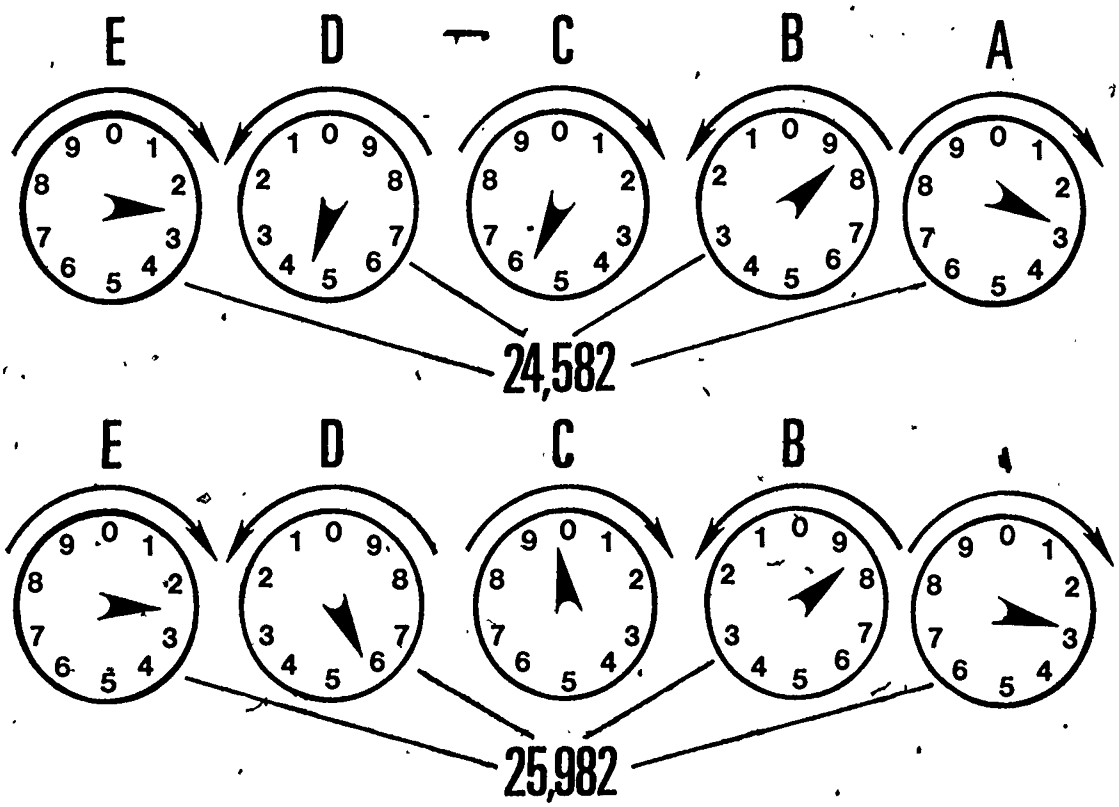
(1) Measuring Consumption

There are three types of electric meters in general use: the four-dial type, the five-dial type, and the cyclometer, which is a digital type. Four-dial and five-dial meters are read in the same manner. Four-dial meters record up to 10,000 kilowatt hours and five-dial meters record up to 100,000 kilowatt hours. Cyclometers are digital and read left to right.

Reading electric meters to determine energy consumption is not difficult, and if some basic meter reading procedures are followed, accurate readings will be obtained. To read the meter:

- Stand directly in front of the meter and start with the right hand dial (Dial A in Figure 2-1);
- Record the lower of the two numbers when the pointer is between numbers. When the pointer is directly on a number, look at the dial to the right - if its pointer has not passed zero, the correct reading of the first dial is the next lower number. (If the pointer has passed zero, the correct reading is the next higher number.);
- Continue reading from right to left.

Figure 2-1. How To Read Your Electric Meter.



The difference between the two readings is the usage for the period is 1400 KWH.

(2) Measuring Demand

In demand billing, measurement is based on the highest level of energy used (expressed in kilowatts) over a given period of time.

- Generation and transmission equipment loads vary in a direct relationship to the demand placed on them. The utilities are willing to supply greater amounts of electricity, but they charge more for the same number of KWH when high peak loads occur because of the cost of providing the additional capacity to accommodate the peak loads. Therefore, many electric utilities have adopted the practice of demand billing, which provides funding for the capital equipment and maintenance required to meet the higher demands.

- When demand billing is in effect, both the total consumption in KWH and the peak demand will determine the cost for billing purposes. For example, if a building consumes 7,200 KWH over a 30-day period, the average consumption is 10 KW per hour. However, if that same building reached a peak of 100 KW during the established demand, the demand factor is 100 KW. The bill for that month will be heavily influenced by the peak demand. Assuming that the utility charges a rate of $.03495 per KWH and imposes a demand charge of $5.50 per KW, the charges for gross consumption would be $252 (7,200 KWH x .03495) plus $550 for the 100 KW peak demand. The 100 KW peak demand, even though it only occurred during one hour of the month, had a drastic influence on the utility bill. Different utilities may establish separate policies on demand billing, and each school district should check with the utility servicing it for current rules and rates. A separate set of instruments records the peak demand, and meters record kilowatts instead of kilowatt hours.

If your facility is subject to demand billing, you can reduce the demand charges if you can determine when peak usage occurs. By rescheduling activities and staggering the start-up of electrical equipment, peak demand will be reduced and demand charges will be lowered.

Demand charges can increase utility bills dramatically. High demand charges can be avoided by load scheduling. If a load profile can be developed, the daily patterns and demand peaks can be identified. Some utilities relate load to time of day when determining demand rates. These utilities can provide data that will show a load profile which can be used in establishing a load schedule.

Developing a schedule for load shedding will not only help avoid high demand charges, it will also eliminate the unnecessary use of equipment. It can be accomplished through sophisticated automated systems,or manually. Manual scheduling is limited, but even a simple procedure, such as staggering equipment start-up times , can reduce demand charges.

b. Measuring Natural Gas Consumption

Natural (or manufactured) gas consumption is usually measured by volume. The standard units are MCF (thousand cubic feet) and CCF (hundred cubic feet). Some utilities measure consumption in therms, a unit equal to 100,000 BTU or approximately 97CF. If bottled gas is used, consumption is usually determined from delivery records.

Reading a gas meter is similar to reading an electric meter, except that the units are measured in cubic feet volume. To read a gas meter correctly, use the following procedure:

- Stand directly in front of the meter and start with the right hand dial.
- Record the lower of the two numbers if the pointer is between numbers. When the pointer is directly on a number, look at the dial to the right. If its pointer has not passed zero, the correct reading for the first dial is the next lower number.
- *Add two zeros* to the reading you just obtained to reach the correct total.

c. Measuring Fuel Oil Consumption

Fuel oil consumption can be measured from delivery records. If oil meters have been installed on the burners, the exact consumption rates can be determined if the readings are recorded. The records of oil deliveries will give an accurate indication of annual consumption, but if meter readings are available, monthly usage can be determined. Using monthly consumption figures will result in a more accurate picture of fuel oil consumption and will allow you to immediately evaluate the success of your fuel oil conservation efforts.

2. Recording Energy Consumption

Once the fuel sources are identified and accurate quantities and costs have been determined, the consumption figures need to be recorded in a logical and usable manner. Included in the Building Profile Form (Appendix A) you will find a Data Summary Sheet. One of these should be filled out for each school facility. The amount and cost of each fuel used is listed by month and then totaled for the year to supply annual energy use figures.

Recording and putting together the paperwork at this stage is a hard and arduous task, but without this solid base of energy use information, future management efforts could be misdirected. Remember, accurate and well-maintained data is a key to an effective energy program.

3. Analyzing the Data

Once the energy-use sources are quantified and compiled by fuel type on the Data Sheet, they need to be converted into common measuring equivalents. By arriving at a common measurement of all energy used in a facility, the total energy picture of a facility can be observed.

The common thread of conversion is the British Thermal Unit, the BTU. The BTU is:

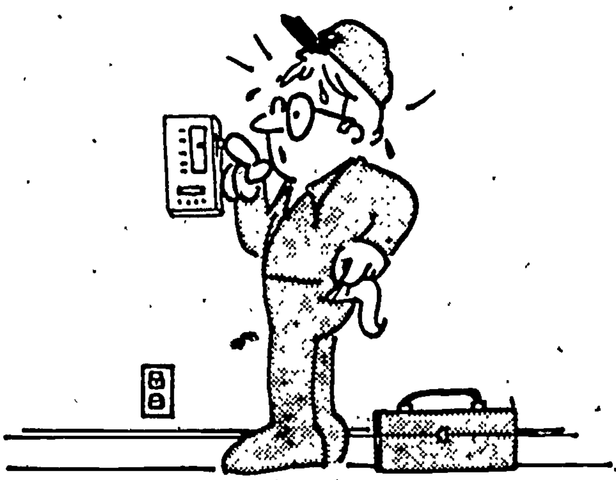
> the amount of energy needed to change the temperature of one pound of water one degree Fahrenheit. A single-wooden match produces approximately one BTU. Because the BTU is such a very small measuring unit, it is commony measured in units of a thousand (MBTU).

The standard BTU content for each fuel type has been determined, so that a standard measure of energy consumption can be used to calculate the total energy use in a building. The conversion factor for each fuel type is included in the Building Profile Form. Convert the amount of each fuel used to its corresponding BTU equivalent and add them together to obtain the total BTUs used in the facility over the given time period. To determine the number of MBTUs consumed, divide the BTU total by 1000.

a. Degree Days

Another important variable to be considered in evaluating energy consumption data is the Degree Day. Degree Days provide a method of balancing differences in temperature from one season to the next, so that energy consumption data for the two periods is comparable.

- The Degree Day is a measurement of weather effects on energy consumption. Actually, two different measurements are made: heating degree days indicate gross heating requirements; cooling degree days indicate cooling requirements.
- Heating degree days are based on the difference between the mean daily temperature and 65°F. For example, if the mean daily temperature is 35°F, the difference between 65 and 35 is 30, or 30 degree days. Daily figures can be added to determine heating degree days for a month or year. Degree Days are an effective indicator of heating energy requirements.



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- Cooling degree days are determined by the same method as heating degree days but relate to mean temperature above 65°. For example, if the mean daily temperature is 95°F, the difference between 95 and 65 is 30, or 30 degree days. Note that the base-line is 65°, even though it is not recommended that you maintain such low temperatures during the cooling season. However, cooling degree days are an indication of cooling energy requirements.
- This information can be used to compare energy usage during two different years when weather conditions were different. If one winter was mild and the next extremely cold, energy consumption might rise, despite conservation efforts. Degree days are used in the Building Profile Form (Appendix A).
- Your local U.S. Weather Service Office can supply you with information on heating and cooling degree days on a monthly basis. Subscription to the publication listing Degree Days for your local area is available for approximately $3.30 per month by contacting:

  U.S. Department of Commerce
  National Oceanic and Atmospheric Administration
  Federal Building
  Asheville, North Carolina 28801

b. The Energy Use Index

The next step, once all the energy-use data is compiled, is to calculate the building's Energy-Use Index (EUI). The EUI is determined by dividing the number of BTUs of energy consumed by the number of square feet of conditioned space within the building. Buildings vary drastically in construction type and design, making the use of the EUI a comparison tool. Although non-exact, this index is still useful as a management tool in providing a general indicator of a building's energy efficiency.

- The EUI can be used to prioritize buildings for energy conservation action and attention, and the available time, money, and manpower can be directed toward the most critical areas.

The EUI can also be used as a performance indicator of measuring a building against itself before and after the implementation of the energy conservation actions and to assure its continued efficient performance in this ongoing program. This use of the EUI is an accurate method of comparing energy consumption before and after the implementation of conservation measures.

The raw data collected by each Energy Management Team for the Building Profiles and the EUI calculated for each facility will provide the Energy Management Committee with the basic information it needs to develop a district-wide plan. While the data is being analyzed, the Energy Management Teams should distribute and use the Immediate Action Checklists found in Appendix B.

C. IMMEDIATE ACTION CHECKLISTS

The Immediate Action Checklists found in Appendix B should be distributed to each of the specific groups for which they were designed. The items on these checklists should be implemented while data collection and analysis is underway to insure that actions to meet the district's conservation goal are implemented as soon as possible. The checklists also provide a means for getting everyone involved in the conservation effort.

Many people don't know where to begin their conservation efforts. These checklists were designed to provide a starting point for each segment of the school system. Each checklist should be reproduced and distributed to each group in the school system as soon as the Energy Management Teams have been established.

Immediate Action Checklists have been designed for each of the following groups:

- Principals--As the chief administrator of the school, the principal's involvement will determine the effectiveness of the energy management program in the school. The principal must take the lead in the school's effort to conserve energy by supervising the efforts of the school staff and students.

- Teachers--Teachers have two major roles in energy conservation: they can control the use of energy in the classroom, and they can also increase student awareness and understanding of the need for and the methods of conserving energy.

- Students--Students should be involved in reducing energy consumption in the school as well as learning about energy conservation. The active involvement of students can go a long way toward getting others to participate and become enthused about saving energy.

- Parents--Public support is important, and parents can have a very positive impact on the school energy conservation program.
- Building Custodian--Custodial personnel have a very significant influence on energy consumption, since they are responsible for operating and maintaining the major energy-using systems in the building.
- Food Service Personnel--Food preparation and service can represent a large portion of a school's energy consumption. Special checklists are directed toward the personnel involved in food services.
- Transportation--Transportation checklists are provided for drivers, mechanics, supervisors, and administrators involved with the school's vehicles and transportation system.
- Central Office Personnel--Participation of the district administrator is important to the success of the program. The central office checklist is directed toward the personnel of the district's central office and administration.

It is important that everyone become involved in energy conservation. The distribution and use of these checklists is one effective way to accomplish this. Specific tasks can be assigned to help reinforce the individual's commitment. Because the efforts indicated on these checklists do not require large expenditures or high-level approval, they can be implemented at once, for immediate energy savings.

CHAPTER III
UNDERSTANDING ENERGY USE

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UNDERSTANDING ENERGY USE

Once basic energy consumption data on each facility in the school district has been collected, you are in a position to target specific facilities for a more detailed analysis. Comparison of facilities by using the Energy Use Index (EUI) and Building Profile Data will help you identify and set priorities for facilities that need immediate attention. However, before any detailed analysis is performed, the Energy Management Committee and Energy Management Teams should gain a basic understanding of how the energy-using systems in their facilities work. The team members should know how the operation and maintenance of these systems affects energy consumption. This chapter is designed to provide the committee and team members with a better understanding of the relationship between energy-using systems, operating practices, and energy consumption. The discussion of these items parallels their assessment in the Energy Audit Form (Appendix C).

Energy conservation opportunities in a school facility fall into two major groups: actions that affect the energy-using systems of the physical structure, and actions that affect operation procedures. This section discusses energy conservation measures affecting the physical plant, and energy conservation measures directed at reducing energy consumption by modifying operating procedures at the facility. Solar and innovative designs, which can be incorporated into new structures or remodeling projects, are also covered in this section.

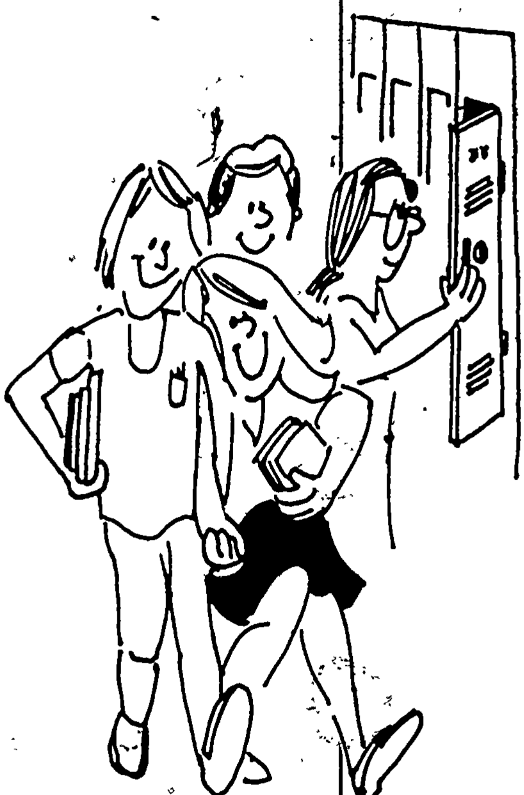
ENERGY SYSTEMS

This chapter explains how the characteristics of the building envelope, energy-using systems, and operating practices affect energy consumption. The following descriptions provide a general overview of all the energy systems of a building. The Energy Audit Form (Appendix C) may be used in conjunction with this discussion of energy systems to determine which conservation actions are appropriate. The Energy Audit Form lists no-cost/low-cost recommendations, as well as higher-cost capital improvements, that may be considered for each energy-consuming area. The information in this chapter can be used to help explain the Energy Audit Form.

A. Building Envelope

The building envelope is made up of the roof, exposed floors, exterior walls, windows, and doors. Heat is lost or gained through the envelope by heat transmission (transfer through the surface), ventilation (intentional intake or exhaust of air) and infiltration (unintentional air movement through a passage).

1. Heat Transmission



Transmission is a predominate cause of heat loss and heat gain. Since heat must be supplied at the same rate it is lost during cold months, or removed at the same rate it is gained during warm months, transmission is a very important energy consumption factor.

The amount of heat that is lost or gained through the building envelope is governed by three factors:

- The difference between indoor and outdoor temperatures;
- The exterior surface area; and
- The heat transmission resistance of the building envelope (R value).

Heat transmission is usually greatest through an uninsulated roof; however, if there is extensive glass area, the loss from windows and doors may be even greater. Transmission losses through floors are usually small.

Adding insulation, window shades and window film are common methods for reducing heat transmission. (See the Energy Audit Form, Appendix C, for specific recommendations.)

2. Ventilation

Air intentionally admitted and expelled from a building's windows, ventilators, and exhaust system is called ventilation.

Heat loss (or gain) due to ventilation is governed by four major factors:

- Fresh air intake and exhaust rates;

- The length of time ventilators operate;
- The difference between indoor and outdoor temperatures; and
- The difference in relative humidity between indoor and outdoor air.

Proper ventilation has a significant impact on the energy use in a building. At times it will be beneficial to let outdoor breezes into the enclosed space for their cooling effect. At other times, the intake of outside air must be restricted to insure efficient HVAC system operation.

Ventilation system type and operation will vary from building to building. Some buildings are designed to depend on mechanical systems, offering no opportunities to utilize natural ventilation. Older buildings often have an advantage because natural ventilation can be used. (See the Energy Audit Form, Appendix C, for specific recommendations.)

3. Infiltration

The unintentional movement of air through joints and cracks is called infiltration. Building envelopes are rarely airtight, so unwanted outside air enters through gaps around windows, doors, and other openings. This untreated outside air increases the load on the HVAC systems and drastically affects energy consumption.

Heat losses due to infiltration are governed by four factors:

- Building orientation;
- Wind velocity and direction;
- Size of crack; and
- The difference between the indoor and outdoor temperature.

Infiltration is greatest where operable windows seal against window frames and through ventilator fresh air intakes. Wind blowing against exterior fresh air intake grills can cause air to enter the building at more than the intended ventilation rate. A serious, but easily avoided, infiltration problem is caused when windows are left open while the heating system is operating.

Remedies for correcting infiltration problems are usually simple and involve little or no cost. Caulking around door and window frames and weather-stripping around doors and windows are excellent low-cost measures that will reduce air infiltration. (See Energy Audit Form, Appendix C, for specific recommendations.)

B. Heating, Ventilation, and Air Conditioning (HVAC)

Heating and cooling a building can consume as much as 40% of the energy used in a facility. In many cases, energy efficiency was not a priority when HVAC systems were designed, resulting in inefficient operation.

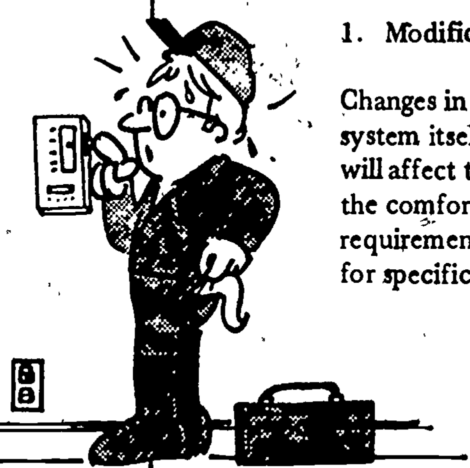
Three major variables influence the amount of energy used in an HVAC system:

- The condition of controls and equipment;
- The indoor temperature and humidity requirements; and
- The length of time the system is operated.

Although outside environmental conditions are significant factors in HVAC energy consumption, they cannot be controlled. Therefore, control settings, maintenance and operating procedures are important conservation measures. Implementation of many of the recommendations addressing HVAC efficiency will require a detailed systems analysis that should be performed by qualified service personnel. There are, however, a number of operational and maintenance techniques that can be applied in order to substantially reduce energy consumption.

1. Modifications to Operating Practices

Changes in operating practices can reduce energy consumption even if the system itself is operating efficiently. Most changes to operating practices will affect the temperature and humidity conditions in the facility; therefore, the comfort needs of the occupants and any other special climate control requirements must be considered. (See the Energy Audit Form, Appendix C, for specific recommendations.)



3-4

2. Maintenance Modifications

The implementation of a good maintenance program is vital to the efficient operation of HVAC equipment. Not only will effective maintenance ensure energy-efficient operation, but it will also prolong the useful service life of the equipment. Money spent on maintenance programs will be more than recovered from longer life and reduced energy costs.

Improvement in the efficiency of boiler combustion offers one of the most cost-effective ways for a school facility to reduce energy consumption and save money. Proper calibration of the school facility boilers can reduce fuel bills by 20 percent. School maintenance personnel must be instructed on the use of the necessary testing equipment and shown how to analyze the resulting data to calibrate the boiler for maximum energy efficiency. A periodic, systematic boiler calibration program should be established by the school district. Through a contract with the Governor's Energy Office, the University of West Florida has conducted a series of training workshops throughout the state. Instructors at vocational education training centers have been through these workshops and can assist in the training of school maintenance personnel. A list of vocational education instructors trained in boiler calibration can be obtained from the Governor's Energy Office.

All operation and maintenance manuals supplied by equipment manufacturers should be kept where maintenance personnel can use them for reference. By following the manufacturer's recommendations in manuals and service bulletins, the equipment can be operated at peak efficiency. (See the Energy Audit Form, Appendix C, for specific recommendations.)

3. Control Adjustment Modifications

Modifying and adjusting a HVAC system's controls can add to the energy-efficient operation of the overall system. The controls that were originally installed were probably selected on the basis of initial cost, not energy-efficiency. Additionally, after five years without adequate maintenance, the controls may be out of calibration. The controls should be checked and adjusted at the time the HVAC system is adjusted and balanced. (See Energy Audit Form, Appendix C, for specific recommendations.)

C. Hot and Cold Water

Depending on the type of hot water system in a school facility, water heating may represent a considerable portion of the facility's total energy consumption. Chilling water for drinking fountains also consumes a considerable amount of energy. The primary method of reducing energy costs associated with the water system is to use less hot and cold water.

Repairing all leaks and limiting the use of hot and cold water will minimize water consumption and reduce the amount of energy required to heat and cool the water. (See the Energy Audit Form, Appendix C, for specific recommendations.)

D. Lighting

Electric lighting is a major consumer of electrical energy in school facilities. Most school lighting systems were designed to provide the maximum level of light at the lowest possible equipment cost. As a result, these systems are very energy inefficient. It is possible to reduce the energy requirements of lighting systems through the application of some modifications that have been identified by recent research. These modifications can substantially reduce the amount of energy consumed by the lighting system while maintaining acceptable lighting levels for various tasks and functions.

Before undertaking any change, it must be recognized that a lighting system is just that -- a system. Its many elements are interrelated, just as the lighting system itself is interrelated with other systems in the building. While energy can be conserved by properly removing lamps and luminaires, it must be realized that such action should be taken only after the entire system has been analyzed and all options evaluated. Therefore, system modifications, other than disconnecting unused lamps and ballasts, should be considered only after a professional Technical Analysis has been performed (See Chapter 4). While conservation of energy is important, it must be achieved in a manner consistent with other requirements. Lighting must address productivity, visual comfort, aesthetics, and federal, state, and local codes and ordinances. It is especially important to recognize that major alterations to a lighting system can have a significant impact on heating and cooling systems, especially if they were designed to compensate for or incorporate heat given off by the lighting system. For these reasons, it is suggested that competent technical assistance be obtained before any significant modifications are made.

Energy consumption in the lighting systems can be reduced in several ways.

1. Usage Pattern Modification

An excellent method to reduce the amount of energy used for lighting is to modify light usage patterns. One way this can be accomplished is through a "lights out" campaign and the establishment of lighting usage guidelines. (See the Energy Audit Form, Appendix C, for specific recommendations.)

2. Maintenance

Proper maintenance of lighting systems will keep the systems operating at peak efficiency. A good program not only conserves energy, but also extends the life of the lamps and luminaires. (See the Energy Audit Form, Appendix C, for specific recommendations.)

3. Illumination Levels

Adjusting illumination levels to the minimum legal requirements will assure that proper lighting requirements are being met, while reducing energy consumption. Lighting levels are frequently over-specified because the building designer does not know the specific end use for the interior spaces and wants to assure adequate lighting levels. Using a light meter, a facility's lighting levels can be checked and reduced to meet minimum requirements.

The Florida Department of Education has published minimum design standards for new and remodeled buildings in its regulations. These standards call for the ability to provide 70 foot-candles for the work surface in classrooms. A reasonable design should specify dimmers so that the lighting levels can be adjusted to varying levels up to the 70 foot-candle requirement.

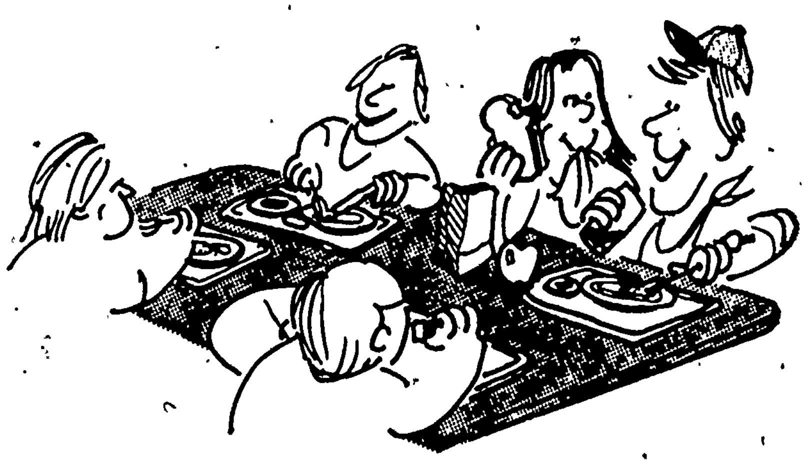
The following table provides general recommended lighting levels:

	Foot-candles
Classrooms, Library, Offices	70
Cafeteria, Gym	20-40
Corridors, Stairways	10
Restrooms, Stockrooms, Storage Rooms	10

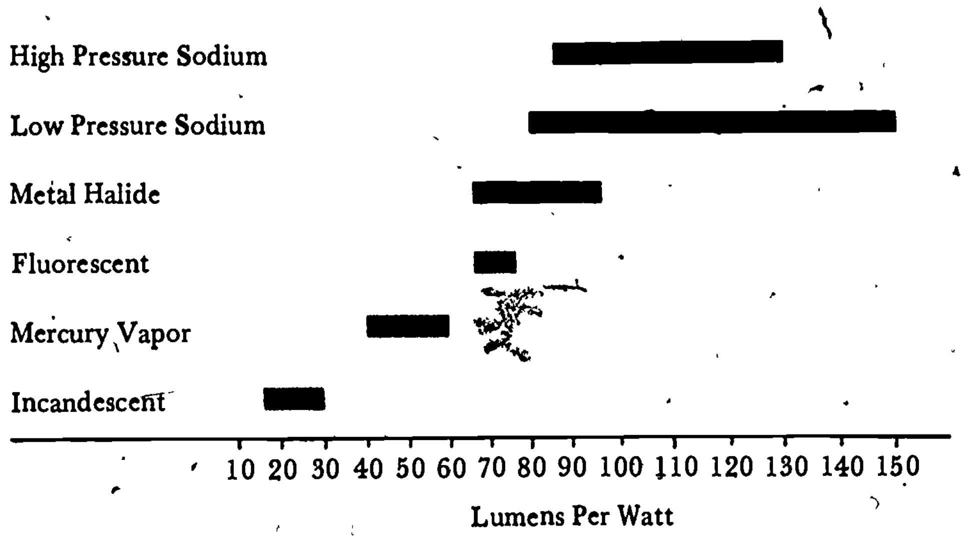
4. **Lamp and Luminaire Modification**

There are many ways to modify lamps and luminaires, including: the elimination of lamps, utilization of lower wattage lamps, and conversion to more efficient luminaires. Lamp modification should be selected based on lighting efficiency tables and current lamp costs. Luminary modifications should not be undertaken without the advice of a lighting specialist or reference to the Illuminating Engineering Society Lighting Handbook.

It is important to select the most efficient lamp for the intended application. The charts on page 3-9 indicate the efficiency and cost for varying lamp types. With the exception of fluorescent and incandescent, the lamp types listed are mainly for outside use. The first chart indicates the relative lamp efficiency in lumens per watt (the higher the number, the more efficient the lamp). The second chart relates lamp purchase and operating costs with color quality and expected life.



LAMP EFFICIENCY IN LUMENS PER WATT



LAMP COST, COLOR QUALITY AND LIFE EXPECTANCY

	Initial Cost	Operating Cost	Color Quality	Expected Life (Hrs)
Incandescent	Low	High	Excellent	1,500 - 12,000
Fluorescent	Moderate	Moderate	Good	10,000 - 12,000
Mercury Vapor	Moderate	Moderate	Fair	24,000+
Metal Halide	High	Low	Good	7,500 - 15,000
High Pressure Sodium	High	Low	Fair	24,000+
Low Pressure Sodium	High	Low	Poor	18,000

OPERATING PROCEDURES

This section addresses energy efficiency measures relating to procedures and activities within the school facility that affect the facility's energy consumption. These activities can be broken down into several main areas.

- Facility Utilization--General guidelines for reducing energy consumption by changing use patterns and scheduling.
- Transportation Management--General guidelines for managing a school transportation system are included. The topics of fleet management and preventive maintenance are covered.
- Procurement Practices--General policies and guidelines relating to efficient buying procedures, the utilization of life-cycle costing, and specifying energy-efficient equipment are discussed.

E. Facility Utilization

The way that school facilities are used has a major impact on energy consumption. Scheduling, space utilization, extracurricular activities, and occupant habits are important variables that can affect energy consumption. Modification of these practices can result in much lower energy consumption, without any capital outlay. Therefore, modifying facility utilization represents one of the most cost-effective ways to reduce energy consumption.

Of course, most of the instructional activities must take place during specified times, so scheduling flexibility is limited. However, extracurricular activities like assemblies, athletic events and community education programs can be easily rescheduled to reduce energy costs.

1. Scheduling

There are two major scheduling considerations that should be addressed. One is the number of hours the facility is in use. The other is the way that the school's activities are structured within the operating hours. Both can have a positive or negative effect on energy consumption.

(a) Hours of Operation

The amount of energy consumed in a facility is directly proportional to the number of hours it is in operation. This is true no matter how efficient the energy-using systems are. The scheduling of activities during normal operating hours can also affect the level of energy consumption.

Total operating hours may be reduced by consolidating some evening or weekend activities. This will also allow for more efficient use of all of the energy-using systems, particularly heating and cooling systems. School schedules can also be adjusted to account for the seasonal changes in heating, cooling, and lighting requirements. For example, winter heating loads are higher in the early morning, while summer cooling requirements are higher in the afternoon (see the Energy Audit Form, Appendix C, for specific recommendations).

(b) Space Utilization

The way interior spaces are used is another important factor that influences energy consumption. The nature of educational programs often dictates the way interior spaces are designed and used. Room size, group size, task lighting requirement, and the time of day influence energy consumption within the enclosed space. The space selected to house a particular function should be selected on the basis of group size and function. The room should be just large enough to house the expected class size, without being too large. If a small class meets in a large room, energy is wasted to heat or cool and light empty space (see the Energy Audit Form, Appendix C, for specific recommendations).

(c) Extracurricular Activities

Extracurricular activities can have a negative influence on energy consumption by extending facility operating hours. However, the scheduling of these activities can be very flexible. Therefore, their energy impact can be minimized through efficient scheduling. All extracurricular activities should be scheduled to reduce energy consumption.

All extracurricular use of school facilities should be scheduled through the school principal or another administrator. The schedules should be consolidated so that several groups may use a building zone or pod at the same time to regulate the energy load more effectively. Sequential use of the space may reduce energy requirements further. Extracurricular activities schedules should be determined so that each group occupies a space appropriate to its size and function.

If some fee is charged for the use of a facility, it should reflect the extra energy required to support a group's activities. The energy consumption can be estimated, and the cost of the energy used can be included in the fee charged for use of the facility.

The facility manager should make sure that the group using the facility is familiar with the lighting, equipment, and controls they are using. They should also be told about any special operating procedures that may affect energy consumption.

If any in-school workshops are planned, a representative from each group using the facility should be included. They should be familiar with, and involved in, the school's energy conservation program.

(1) Athletics.

Athletics are the most energy intensive of all extracurricular activities. Nighttime events, such as football, baseball, track, and tennis, require energy for field lights. Indoor events require lighting, heating and cooling. Swimming and diving meets held in heated pools are perhaps the most energy intensive of all extracurricular activities, because they require such a large energy input for each participant. The energy cost of any of these activities is greatly increased if out-of-town travel is required.

Of course, reducing the level of activity in the athletic program is not the answer. Most people would agree that the benefits outweight a reasonable cost. However, there are some ways a good athletic program can be maintained and energy consumption reduced.

By rescheduling night events to the afternoon, lighting requirements may be eliminated or reduced. Afternoon games may require no artificial lighting if they are started at an early hour. If rescheduling events to weekday afternoons is objectionable, games can be scheduled on weekends.

Schedules should be developed to reduce out-of-town travel requirements. Conference and district boundaries may have to be reconsidered in order to reduce travel requirements. By doing this and making every effort to schedule games in the immediate area, long-distance travel requirements can be reduced.

Gyms can be used more effectively by adjusting schedules to hold more than one event per evening; for example; two basketball games, played back-to-back will require only one heat-up or cool-down cycyle from the HVAC system. Other activities can be scheduled before or after a basketball game both to save energy and to increase attendance at these events.

(2) Assemblies

Large assemblies should be scheduled only when necessary, because the assembly space may require heating or cooling, and lighting. The HVAC system will also remain on to maintain temperature in other areas, such as classrooms, temporarily vacated.

If an assembly is necessary, consider the time of day and the outside temperature when determining the schedule. During the cooling season, loads are lowest in the early morning, so assemblies should be scheduled during the first hours of the school day. In the heating season, the lowest loads will occur later in the day, so assemblies should be held during the early afternoon.

When weather permits, outdoor assemblies are desirable from a conservation standpoint. If an assembly is scheduled to kick off the energy management program, you could hold it outdoors to help drive the point home. Some other types of assemblies are particularly appropriate outdoors. Pep rallies can be held out on the practice field.

(3) Community Education

School facilities are often called upon to provide space for other extracurricular activities. Such after-hours use of the facilities increases energy consumption, but this extra load can be reduced through the use of thoughtful scheduling.

2. Occupant Habits

Occupant habits also affect energy consumption. If lights are left on needlessly or thermostat settings are constantly changed, energy will be wasted. The building occupants must operate the energy-using systems efficiently and effectively in order to reduce energy consumption. This can only be accomplished by securing the cooperation of everyone involved in the operation of the school, including the students.

One method for obtaining this cooperation is to use the Immediate Action Checklists found in Appendix B. These checklists should be distributed to every occupant group by the Energy Management Team to get the program started. In-service training should also be provided to develop energy awareness among the school staff. Incentives and rewards could be offered to insure staff involvement in the program.

F. Transportation Management

School transportation consumes a significant portion of a school district's energy requirement. The cost of motor fuel has risen alarmingly, making transportation a major drain on the education budget. This section includes some general guidelines for managing school transportation systems to reduce energy consumption.

The transportation manager faces the challenge of controlling the costs of equipment, fuel, and maintenance. The cooperation of the energy management team in the effort to reduce transportation costs is critical, because transportation is directly tied to school schedules, attendance boundaries, and zoning. Transportation policy can become an emotional, or even a political issue, involving public debate. So the transportation manager, school board, and administrators must develop and enforce an effective policy, and secure public cooperation.

One of the best tools available to the fleet operator to maximize economy is a good fleet management program. Whatever the size and composition of the fleet, a program can be developed to suit its needs. The objective of fleet management is to ensure that the vehicles required to render a specific service are available when needed, and are in good operating condition. This should be accomplished with a minimum number of back-up vehicles; thereby keeping the fleet at its optimum size, so that a sufficient number of vehicles are available for service at a minimum cost. The fleet management principles of equipment purchasing, maintenance, routing and scheduling, record keeping, and disposal that are relevant to all fleet operations are discussed here in the context of school fleet management.

1. Policies

Transportation costs are affected by the content and enforcement of the school district's transportation policy. The policies adopted by the school board can be an important factor in determining how many routes are needed and how many students must be transported. If these policies are lenient or not strictly enforced, transportation costs are maintained at an unnecessarily high level.

Special considerations for physically handicapped and special education students should also be made a matter of policy. Many of these students will be participating in special programs and will not be attending their neighborhood schools. Because of this, and the need for special equipment, different standards will apply. However, in order to maximize the efficiency of the system and effectively deliver the special services required, the same principles of fleet operation should be observed. Where students are mainstreamed, their special needs for transportation must be considered. Every effort should be made to include them in regular schedules and routes.

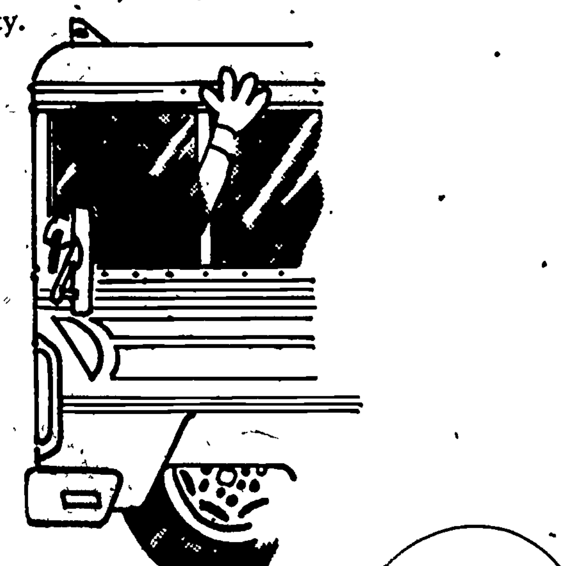
Consideration should also be given to cross-district attendance. Cross-district attendance may offer another opportunity to conserve energy and reduce transportation costs. Students residing near the edge of the district may be closer to a school outside of the district, and if they can attend the out-of-district school, the total transportation costs may be reduced. If the savings in transportation do not offset the loss in revenue, the loss may be recoverable through the agreement with the other district, or by adding students from outside the district.

2. Stop and Route Assignment

Stop and route assignments should be made on the basis of economy, not accommodation of the students. The primary considerations should be safety and efficient routing. As a matter of policy, bus routes should be designed for safety and efficiency.

Bus stops should be assigned where the greatest density of students exists along the route. In densely populated areas, only one stop may be required if students are required to walk to the bus stop. Door-to-door service will increase bus operation costs substantially, and minimizing stops may allow double tripping so that one bus can cover more than one route.

Load factors should also be considered. The actual load is usually somewhat less than the total eligibility. Many students are transported by parents, and some secondary students provide their own transportation. A survey may be necessary to determine the optimum route and bus size, particularly for secondary schools. Load factors may be determined by comparing eligibility factors against load counts from the previous year. During the year, actual load counts should be taken to determine the correct bus capacity for each route. Buses should be loaded to near maximum capacity, so that the fuel consumption per student is maintained at the most efficient level. School buses, like all other mechanical systems, are most efficient when used at or near their rated capacity.



The first step in developing an efficient transportation system is for the school board to adopt a realistic transportation policy within the state's guidelines. The transportation manager should propose a policy to the board that considers walk zones, walk to bus stop distance, number of students per stop, safety, and the transportation needs of younger and special education students. Other variables may be present in a particular case, but an adequate service that meets the basic needs of the students and preserves a high standard of safety should be provided.

If you are proposing a new policy that alters some features of the service that has been provided, you should expect to put forth an effort to justify your proposal. If you can estimate the cost savings involved and demonstrate that the safety of the students will not be adversely affected, you should receive the support of a board and superintendent who are committed to conservation.

Securing public cooperation to implement improved transportation management may be the most difficult part of the program. Changes in policy, the implementation of new bus routes, and changes in schedules will be noticed and are bound to inconvenience some students and parents. You should make sure that everyone affected knows about any changes in advance and that they know why those changes are necessary. Making changes at the beginning of a new school year should make them easier to implement and create the least negative reaction.

3. Eligibility

Student eligibility for transportation must be a matter of policy that is strictly enforced. The board must establish the walk zone for each school. In some cases, the zones may be smaller than the standard two-mile limit because of safety factors, but once reasonable zones have been established, no exceptions should be granted. When the safety of a walk route becomes a factor, the board should consider what improvements are necessary to make the route safe. The board should then recommend those improvements to the county, city, or state transportation agency responsible for road maintenance and construction along that route.

When defining eligibility, no exceptions should be granted. If one exception is made, another will be requested, and another, and so on, until more buses and routes will be required to accommodate all of them. Almost any exception will cause increased fuel consumption, even on existing routes, especially if the students requesting special consideration are spread over a wide area.

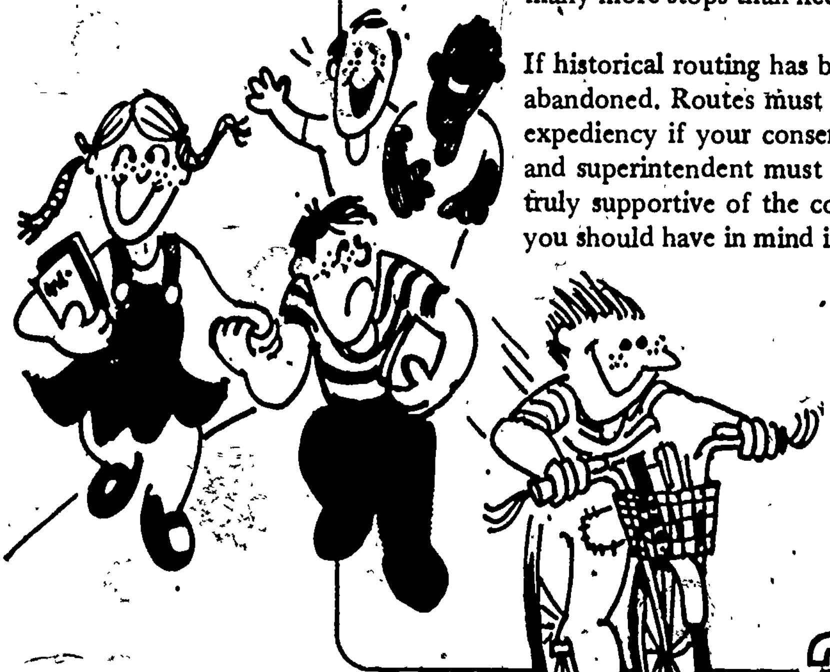
In some situations it may be cost effective to subsidize public transportation for secondary students attending urban schools. Adjusting school times and school bus routes can result in the elimination of some buses and reduce the total number of miles traveled. Coordination of the school schedule with the transportation system can result in a large net savings in fuel and total transportation costs. The cost per student is generally much lower when the transit system is used. If public transportation is available, the cost benefits of such transportation should be considered.

When all schools within a district operate on the same schedule, staggering school hours may result in a substantial savings. Staggering schedules can allow one route to serve more than one school, so that two buses are not required to carry elementary and secondary students to schools that are in proximity. Also, buses can cover more than one route, which will reduce equipment costs, and allow the disposition of older, inefficient units.

4. Route Planning

Most school districts develop and update bus routes on a historic basis. That is, the current year's routes are based on the preceding year's routes. Also, many features of these routes were developed as a result of special requests made by parents, school administrators, or school board members. As a result, many routes are haphazard and inefficient because they include many more stops than necessary and do not follow the most direct route.

If historical routing has been the practice in your district, it should be abandoned. Routes must be based on an economic rather than political expediency if your conservation efforts are to be effective. The board and superintendent must support this effort, and they will--if they are truly supportive of the conservation program. There are three goals that you should have in mind in planning the transportation program:



- Delivering the required level of service;
- Developing the shortest possible routes; and
- Meeting safety standards and the board's transportation policy.

Route planning can be accomplished in several ways. It is possible to lay out routes on a map using school enrollment and other information to plot the routes. But even a simple route can have many possible permutations. For example, a route with eight stops may have more than 40,000 possible routings. Therefore, a computer using a simple program will be very useful. The Department of Energy recommends that if your district operates 20 or more routes and has access to a computer, you consider doing a computer analysis of your transportation plan.

Elimination of unnecessary routes will drastically reduce operating costs by reducing the number of units needed. The same number of students may be served by combining routes in order to eliminate units without reducing service. By reducing the number of routes and units operated, not only will fleet fuel consumption be reduced, other operating expenses will be reduced as well.

Distance traveled can also be reduced by restructuring routes. Each route should be planned so that the bus follows the most direct path from the first embarkation point to the school or schools served. This is accomplished by changing routes and stops, perhaps by eliminating stops. Door-to-door service should be eliminated, and stops planned so they are convenient for the bus, not the student.

Changes in school schedules can also affect bus routes. In Section IV, the relationship between facility use, zoning, and transportation was mentioned. The Facilities Manager and Transportation Manager must work together to establish efficient school schedules and bus routes. Staggered hours, zoning, walk routes, and other factors peculiar to your district, must be considered to develop an effective and efficient transportation program.

The cost effectiveness of any route changes can be evaluated by completing the following questionnaire:

Last year's rider eligibility		______	
Current rider eligibility		______	
Number of buses reduced/added	±	______	buses
Driver time reduced/added	±	______	hours
Driver pay reduced/added	±	______	dollars.

Level of Service

Stops - Greater walk to stop distance
Less walk to stop distance
More stops
Less Stops

Routes - Average Increase/Decrease in route times	______	minutes
Average No. of routes per bus	______	routes
Increase/decrease routes per bus	______	bus
Average bus loads	______	Elementary
	______	Junior High School
	______	Senior High School

State Reimbursement

Has state aid increased/decreased due to rerouting? ______

This form can be used to analyze an individual route, or the entire system.

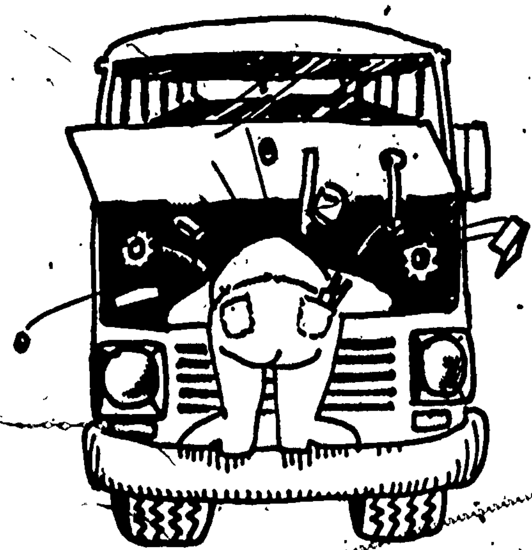
5. Preventive Maintenance

Another responsibility of the transportation manager is the establishment of a fleet preventive maintenance program. Preventive maintenance is the systematic inspection and servicing of equipment to maintain it in serviceable condition. The establishment of a program of preventive maintenance should aid in the detection and correction of minor problems before they become major, expensive, and time-consuming repairs, thereby reducing operating costs by increasing service life, decreasing down-time, and increasing fuel efficiency.

To be effective, the program must have the support of management and include the participation of the vehicle operators and maintenance personnel. Improvements in fleet efficiency will be most pronounced when there is a cooperative effort among all personnel involved in fleet operation and maintenance.

Each fleet should have its own preventive maintenance program. The general characteristics of a fleet that will have a direct bearing on preventive maintenance are:

- fleet size
- vehicle type(s)
- levels of maintenance
- terrain
- climate



Some specific maintenance actions that should be included in any program of preventive maintenance include:

- Tune ups--replace spark plugs and points (if installed), adjust timing and carburetor settings;
- Replacement of fuel and air filters;
- Servicing of automatic transmissions, including adjustment and fluid and filter changes;
- Oil changes;
- Inspection of fluid levels;
- Tire inspection for wear and proper inflation; and
- Wheel alignment.

Service intervals as recommended by the vehicle manufacturers should be observed.

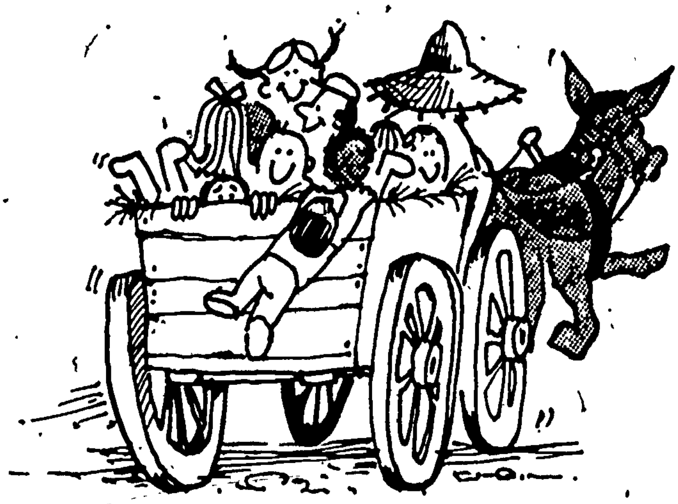
6. Record Keeping

One of the most important concepts in effective fleet management is an accurate reporting (or record keeping) system. The system should serve as the basis upon which management decisions are made. It provides fleet managers with data on operating, maintenance/repair, and depreciation costs for each vehicle. Mileage totals and purchase costs should also be available. These records, prepared on a monthly basis, track each vehicle's performance and operating costs, providing the manager with an effective tool for making decisions concerning vehicle purchase, reconditioning and disposal.

Basic records should include a master inventory of each vehicle used. Prepared monthly and maintained yearly, the inventory will provide a profile of each vehicle as well as fleet trends. The record of each vehicle should include:

- Mileage/engine hours;
- Fuel/oil consumption;
- Maintenance/repair costs by category of expenditure;
- MPG/HPG;
- Cost/mile or costs/hour based on fuel and maintenance costs; and
- Idle time/down-time.

Again, an effective program requires the participation of everyone. For example, each driver should keep accurate records of fuel consumption and distance driven for evaluation purposes. Every time a unit is serviced, the amount of fuel added and odometer reading should be recorded. This information should be used on a monthly basis to calculate each vehicle's mpg.



Record keeping can also provide a mechanism to increase accountability for fuel. Pilfering can be controlled by restricting access to supplies and providing attendants in refueling areas. This can also be achieved by using a key card system, which allows operation of the fuel dispensers only when a magnetically encoded card is used. These systems are often connected to a computer that records transaction data for each vehicle. Such a system not only provides control of refueling operations, but it can also provide fuel consumption data.

7. Purchasing New Equipment

Purchasing new, more efficient equipment may or may not be cost effective. The district's procurement manager will apply certain formulas to determine payback periods, annual depreciation costs, and return on investment. You should also calculate these factors in order to make the appropriate equipment requests.

Payback period is calculated by using the following formula:

$$\frac{\text{Initial Cost - Salvage Value}}{\text{Annual Savings}} = \text{Payback Period}$$

Annual Depreciation Cost is required to calculate Return on Investment. It is determined by:

$$\frac{\text{Initial Cost - Salvage Value}}{\text{Expected Life}} = \text{Annual Depreciation Cost}$$

Return on Investment is:

$$\frac{\text{Annual Savings - Annual Depreciation Cost}}{\text{Initial Cost - Salvage Value}} = \text{Return on Investment}$$

The most important factor for your consideration will be the payback period. This will help you determine the budgetary impact of a new purchase versus retention of existing equipment. Return on investment will determine the real savings that can be realized through replacement. These factors should also be considered when purchasing additional equipment or replacing scrapped equipment.

8. Driver Awareness

When you are attempting to reduce fuel consumption, you are asking drivers to change their behavior. This requires motivation, and there are several simple methods to accomplish this.

- An incentive program for suggestions and economical operation.
- Establishing driving habit guidelines and maintaining them for evaluation purposes.

Analysis of vehicle fuel efficiency is important. You may start by comparing fleet and driver fuel consumption to the national average, which is 7.4 miles per gallon per unit. Using this figure is, of course, accurate only for gross comparisons, because fleet composition, district size and other geographic factors can affect fuel consumption.

Each driver should keep accurate records of fuel consumption and mileage covered for evaluation purposes. Every time a unit is serviced, the amount of fuel added and odometer reading should be recorded. The fuel mileage data could be posted to create a friendly competition among the drivers. Incentives can be awarded to the driver that achieves the highest mileage and those showing the greatest improvement.

Drivers, having been made aware of the fleet's conservation program, must be provided with the information they need to improve their driving habits. This can be accomplished by implementing an in-service driver training program. DECAT (Driver Energy Conservation Awareness Training), developed by the Department-of-Energy, is one of the best available programs of its type. DECAT is a method by which drivers of fleet vehicles are taught to increase their fuel economy through vehicle care, planning and driving in an energy-efficient manner. Using slides, films and in-vehicle training, DECAT effectively demonstrates the need for and methods of achieving energy-efficient:

- Driving habits (adherence to speed limits, moderate acceleration, smooth driving maneuvers and anticipation).
- Scheduling and routing (avoidance of traffic congestion, consolidation of short trips).

- Maintenance practices (awareness of need for maintenance and performance of scheduled maintenance).

- Equipment usage (use of radial tires, use of downsized and appropriate vehicles).

These and many other measures, often of small consequence when taken separately, can yield substantial fuel and cost savings when conscientiously practiced. Using DECAT can result in an average fuel savings of 15 percent. Further information concerning DECAT is available from the Governor's Energy Office, 301 Bryant Building, Tallahassee, Florida 32304.

The following driving tips should be passed on to the drivers:

- Do not make courtesy stops.

- Accelerate smoothly through the gears. Avoid jack rabbit starts and sudden stops.

- Anticipate traffic flow.

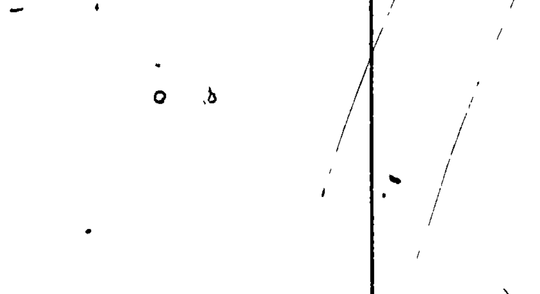
- Observe speed limits.

- Do not ride the brake.

- Do not idle the engine more than one minute. Shut the engine down for prolonged stops. Don't idle the engine for warm up, but drive away immediately.

- Do not pump the gas pedal.

- Stay on your assigned route.



In conclusion, the application of sound transportation management practices in the area of policy, fleet maintenance, and driver awareness can result in significant savings. Transportation is one area that has received a lot of attention because of the large amounts of energy consumed. Many school districts have made tremendous gains in this area, but there is room for further improvement that will result in even more savings.

G. Procurement Practices

The energy management effort will encompass many aspects of school administration, including purchasing. Purchasing will be involved in energy management, not only in administering contracts with consultants, but also in an ongoing effort to procure the most energy-efficient equipment and facilities.

The administrator who acts as the district's purchasing agent will have the primary responsibility to review bids, proposals, and specifications and will have to make many of the purchasing decisions.

The purchasing agent must do his homework. He should be able to make a sound decision, based on specification and price. Whenever possible, purchasing decisions should be based on such factors as energy efficiency and life-cycle costing.

1. Purchasing Research

Purchasing decisions must be made on the basis of fact. The information needed to generate specifications and make decisions will come from a number of sources. These sources include manufacturers' catalogs and brochures, salesmen, vendors, other purchasing agents, and various types of reference works.

There are a number of standard references that list manufacturers, suppliers, and products. All of them can be helpful in locating suppliers and identifying products. Some of them include detailed information on specific products and carry full specifications, normally as reprints from manufacturers' catalogs.

These references include:

Thomas Register of American Manufacturers
Conover Mast Purchasing Directory
McRae's Blue Book
Best's Safety Directory
Domestic Engineering Catalog Directory
Institutions Catalog Directory
Patterson's American Educational Directory
Sweet's Catalog File
...and others.

Technical handbooks are also valuable, primarily for specification data and conversion tables. The handbooks published by various engineering societies are particularly valuable in developing specifications for major building subsystems such as HVAC. Although these books are for use primarily by design engineers and architects, they can be very useful for evaluating competitive bids. They may be able to answer many of the technical questions that may arise in the purchasing process.

2. State Commodity Purchasing

School districts can increase their purchasing power by purchasing a number of commodities from the State Commodity Contract Bid List. This service is available to the schools through the Department of General Services, which makes commodities available at state bid prices. By purchasing in quantities far greater than individual districts can, the per unit price on the listed items is greatly reduced. To take advantage of this service, school district purchasing directors should contact:

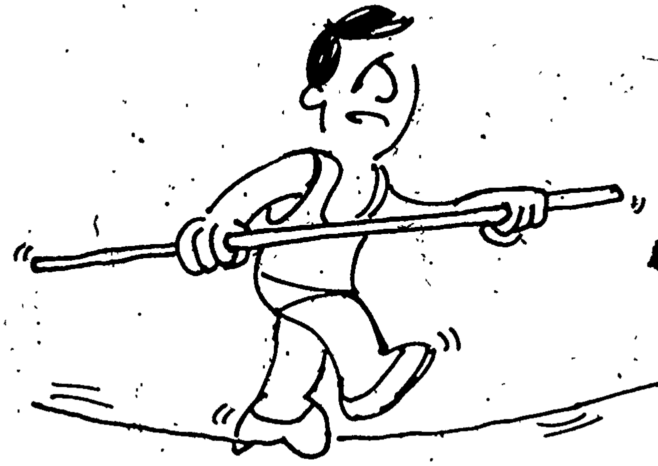
Department of General Services
Division of Purchasing
Fletcher Building
Tallahassee, FL 32301
(904)488-0018

3. Life-Cycle Costing

Life-cycle costing (LCC) is an extension of the low bid approach to purchasing that takes advantage of the additional information obtained through research. Unlike the low bid method, life-cycle costing considers other factors to arrive at a figure representing total costs over the life of the item. Life-cycle costing is an ideal method for including energy efficiency in the decision-making process because operating costs are considered along with the purchase price.

Life-cycle costing considers all costs: purchase price, installation, the price of money, inflation, energy, and maintenance. All of these factors affect the total cost to own and operate facilities and equipment, but many of them are overlooked when only initial costs are considered.

There are two basic methods of life-cycle costing that can be used in procurement decisions. Both are useful in identifying the best alternative. Note: In both methods, the cost of money is an important costing factor, and would be based on the current bond interest rate. For purchases made from the operating budget, the cost would be zero. In that case, the cost of money should not be considered.



(a) Present Worth Technique:

The present worth technique discounts all future costs to a present value. Applying the present worth technique to the purchase of one of two HVAC systems we have:

	System A	System B
Total First Cost	$ 1,000,000	$ 1,100,000
Annual Maintenance Cost	25,000	20,000
Energy Cost	95,000	70,000
Total O&M Cost	$ 120,000	$ 90,000

System A has the lowest initial cost by $100,000. If the purchase decision is made by the low bid method, System A wins. However, the projected operation and maintenance costs for System B are $30,000 less than System A. Assuming the cost of money to be 6% per annum, and the useful service life of the equipment to be 20 years, the present worth is calculated:

	System A	System B
Present Worth of Initial Cost	$ 1,000,000	$ 1,100,000
Present Worth of Annual Operations Cost	(120,000 x 11.47*)	(90,000 x 11.47*)
	1,376,000	1,032,000
Total Present Worth	$ 2,376,000	$ 2,132,000

*Calculated as $P.W. = \frac{(1+i)^n - 1}{i\ (1+i)^n}$

i = interest rate
n = project life

In this case, System B is chosen because its total present worth shows a savings of $244,000, even though a simple bid analysis would have selected System A.

Another way life-cycle cost can be calculated using the present worth method is shown below. It is similar to the first example, except that it tries to account for an assumed escalation of O&M costs. This must be carefully considered because the rate of cost escalation (inflation) usually varies from the cost of money (interest).

Using the same example:

	System A	System B
Present Worth of Initial Cost	$ 1,000,000	$ 1,100,000
Present Worth of Annual Operating Costs	(120,000 1 year escalating at 3% per annum) 120,000 x 24.48* = 2,938,000	(90,000 1 year escalating at 3% per annum) 90,000 x 24.48* = 2,203,000
Total Present Worth	$ 3,938,000	$ 3,303,000

* Calculated as $P.W. = \frac{a(a^n - 1)}{a - 1}$

where $a = \frac{[1 + \text{escalation rate}]}{1 + \text{interest rate}}$ n = project life

Again, System B is chosen. Notice the effect of inflation on the cost differential.

NOTE: In the first example of the Present Worth Method, the use of a higher interest rate would show System A to be more cost-effective. However, the escalation factor included in the second example would cancel this out because it considers the inflation factor. The second of the two P.W. calculations would be used when the cost of money and inflation is a factor.

(b) Annual Cost Method

The Annual Cost Method also evaluates all cash outlays in terms of the time - value of the money. Money value is determined by its cost, that is, the interest rate. In this method, the initial cost of the system is allocated as an equivalent annual cost. Using our example again:

	System A	System B
Total First Cost	$ 1,000,000	$ 1,100,000
Equivalent Annual Cost Substituted for Capital Cost	1,000,000 x .08718* = 87,000/year	1,100,000 x .08718* = 96,000/year
Annual Cost		
Maintenance	25,000/year	20,000/year
Energy	95,000/year	70,000/year
Total Equivalent Annual Cost	$ 207,000/year	$ 186,000/year

* Calculated as $CRF = \frac{i(1+i)^n}{(i+i)^n - 1}$

i = interest rate
n = project life.

In general, the Annual Cost Method provides a better visualization of the actual costs than the Present Worth Method. The use of either calculation method is optional, provided the appropriate interest and escalation factors are used in Present Worth calculations.

(c) Payback Period

The payback period is the amount of time after installation before savings begin to accrue. It is useful in determining the budgetary impact of a new purchase versus retention of existing equipment.

The payback period can be calculated by using the following formula:

$$\frac{\text{Initial Cost} - \text{Salvage Value}}{\text{Annual Savings}} = \text{Payback Period}$$

Return on Investment is:

$$\frac{\text{Annual Savings} - \text{Annual Depreciation}}{\text{Initial Cost} - \text{Salvage Value}} = \text{Return on Investment}$$

Calculating return on investment will determine the real savings that will be realized through replacement. It is used as a management tool to analyze and justify new capital expenditures.

The calculation of life-cycle costs, payback periods and return on investment should be used to evaluate the "real" cost of any large item, particularly energy-using systems and equipment. It is apparent that the use of life-cycle costing techniques can result in substantial savings over the low bid method. The application of life-cycle costing to bid evaluation also results in the purchase of better equipment, because equipment that is more efficient and has less down-time works better in the long run.

4. Specifications

Another method that can be used to insure that high quality, energy-efficient items are purchased is the practice of specification. Specifications are commonly used to insure the quality of: construction, functional equipment, and other purchased items. They can also be used to rate the energy efficiency of various components and insure the energy efficiency of new construction. The purchasing agent will be concerned with the procurement of replacement units for existing buildings and equipment. Efforts should be centered around obtaining replacements that are more energy-efficient than the original.

Specifications published by manufacturers can be used as a guide to purchasing the most energy-efficient equipment, but the buyer must understand some of the basic terminology. Electric motors and appliances are rated by amps and watts. Lower numbers mean lower energy consumption, and lower capacity. Gas and oil heating units, and air conditioners often carry an Energy Efficiency Rating (EER). A higher EER number indicates higher efficiency, but is not related to capacity, which is expressed in BTU output. EERs in the range of 8-10 are generally considered good. Lower ratings indicate that the equipment is inefficient. The EER is useful in evaluating smaller equipment purchases, where life-cycle costing is not practical. The efficiency of motor vehicles is rated in miles per gallon of fuel. Capacity is indicated by Gross Vehicle Weight (GVW), or passenger capacity.

Manufacturer's specifications are useful for determining the energy consumption of appliances and equipment to make simple comparisons, and to estimate energy costs to make life-cycle cost comparisons. For example: a fluorescent light fixture rated at 40 watts has the same light output as an incandescent fixture at 200 watts. The 40-watt fixture would consume .96 KWH in 24 hours of continuous use, while the incandescent fixture consumes 4.8 KWH.

The capacity of any item should be matched to the work required of that unit. All energy-using systems are most efficient when all of their components are operating at or near capacity. Replacements should be of the same capacity as the original equipment unless the original was overloaded. In no case should excessive reserve capacity be specified.

Manufacturers generally publish all pertinent specifications in their catalogs and other literature. The manufacturer's specs can be used as a guide for writing bid specifications or making comparisons when issuing purchase orders.

In conclusion, the use of efficient purchasing practices, such as the application of life-cycle costing techniques and the use of specifications, will result in significant reductions of energy use and considerable cost savings. These methods should be incorporated into every school district's purchasing procedures in order to save money and energy.

SOLAR ENERGY AND INNOVATIVE DESIGN

Opportunities exist for using solar and other innovative designs to reduce energy consumption. Solar and other technological innovations should be considered during the design and specification phase of any new construction or remodeling project. Appropriate, cost-effective, energy-saving innovations should be incorporated whenever possible. Qualified advice from an architect or engineer should be utilized at an early stage in the planning process whenever a solar or innovative design application is contemplated.

This section provides an overview of some of the solar and other innovative design applications currently available for school facilities.

More detailed information, and technical assistance, is available from:

The Florida Solar Energy Center
300 State Road 401
Cape Canaveral, Florida 32920
(305) 783-0300

H. Building Design

Building design and orientation can have a tremendous impact on energy use. In the past, energy efficiency was a low priority in building design, but since energy costs have risen drastically, more emphasis has been placed on energy-efficient design.

There are several design principles that should be considered:

- Building orientation, window size and location, and shading to minimize heat gain during the cooling season and maximize winter solar gains.
- Proper insulation and sealing for the building envelope.
- The inclusion of innovative design, including solar, in design priorities.

A building's basic design specifications should include energy efficiency. The school district should emphasize energy efficiency as a design priority when negotiating with the architect and engineer during the planning and design of any new facility. Design firms that are familiar with state-of-the-art, energy-efficient methods, and life-cycle costing methods should be selected.

Keep in mind that decisions made during the design phase will affect energy consumption throughout the life-cycle of a building. The building's orientation, insulation, window area and placement, HVAC system, and lighting system will all determine how much energy the facility will use. Buildings designed with energy efficiency as a priority will require substantially less energy to operate than those that are designed with construction cost as the predominate consideration.

I. Solar Water Heating

Solar water heating has been around for over 40 years; some systems have been in continuous operation for more than 30 years. Today's solar water heating is energy-efficient and cost-effective. Application of solar water heating should always be considered in the design of new buildings. Retrofit of solar water systems can be cost-effective, particularly when older equipment must be replaced.

The availability of sunlight is only one of several factors that must be considered when evaluating solar systems for heating water. Another consideration is whether the roof is strong enough to support the collectors.

Collectors can be ground-mounted, but, if so, it is generally recommended that they be mounted on a structure approximately four feet above the ground to facilitate maintenance. If ground-mounted collectors are to be used, provision must be made for protecting the collectors from vandalism. Also, the zoning of surrounding areas must be checked to insure that no buildings or structures will shade the collectors at some later date, and deed restrictions should be negotiated to assure solar access.

Similar care should be observed for roof-mounted collectors so that they may be maintained adequately. The strength of the roof structure must not be jeopardized, and access for roof repairs should be provided.

Orientation is another factor to consider. In order to operate effectively, the solar collectors should be installed at the proper angle to maximize the solar energy collected. The collectors should face south, but a directional deviation of 15-20 percent is still effective.

J. Other Solar Applications

The solar domestic water heating system is the most practical solar system to consider in the design of new facilities and in retrofit applications. However, it is possible to use solar energy for space heating and cooling in buildings and to provide electrical power.

Photovoltaic collectors for solar-to-electric conversions are very expensive, so they are not cost effective at this time. But because they can be effective generators of electricity, reducing the cost of photovoltaic systems is a major research priority.

Solar space heating can be accomplished with air systems or hydronic systems. Combined systems that provide domestic hot water, space heating and cooling are also available. However, both space heating systems and the combined systems are not always cost effective.

K. Earth Sheltering

An excellent design for preventing heat transmission in buildings is to either build the structure underground or pile earth up on the sides (berming). This age-old technology may seem extraordinary, but it has been used on schools in Virginia and in Osceola County, Florida. Careful design can include an acceptable number of windows, and still take advantage of the moderate, even temperatures experienced year-round a few feet beneath the surface. Such buildings in southern and central Florida could be built near the surface using earth berming to cope with the high water table. The major advantage of this type of building is its energy efficiency, but they are also less subject to storm or vandalism damage.

L. Landscaping

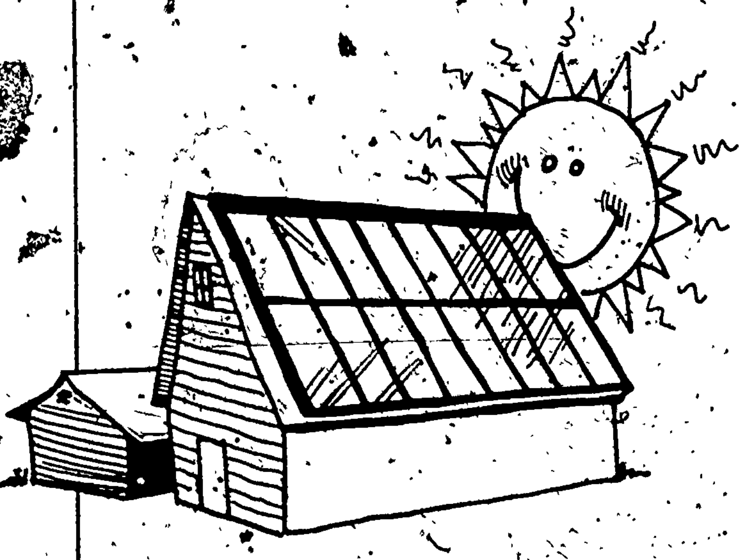
Landscaping can affect the energy consumption of the facility. Shading and windbreaks can have an impact on building temperatures and thermal comfort. Landscaping at new sites, or where old sites are being renovated, should be planned by a landscape architect in cooperation with the building design team.

Considerations are:

- The highest priority for energy-conserving landscaping is the placement of trees and shrubs that will shade windows exposed to solar radiation during peak-load hours in the hottest months.

- The second priority area for energy-conserving landscaping is blocking prevailing winds, if the school does not depend on natural ventilation for cooling. For a building in which air conditioning will be used only minimally, the vegetation near windows facing prevailing summer winds should not block these breezes, and in fact, should be strategically positioned so as to funnel the breezes into the windows in order to maximize natural cooling.

- Another priority area for landscaping is to provide shade around window air conditioning units. A tree should be planted fairly close to the unit so that its canopy will extend over the roof of the building. In addition, shrubs should be positioned and pruned so that leaves and branches do not interfere with the air flow around the air conditioner. By shading the unit, the ambient operating temperature will be reduced, thus reducing the cooling load on the unit.



CHAPTER IV
FROM PLAN TO ACTION

CHAPTER IV

FROM PLAN TO ACTION

The implementation of the items on the Immediate Action Checklists is an important first step toward reducing the school district's total energy consumption. However great these savings may be, they are limited and will be short-lived unless a comprehensive energy management plan that addresses systems modifications and improvements, as well as operational changes, is developed and implemented. Implementation of these more complex measures should be considered only after a planning process that establishes priorities has been undertaken.

The goal of this planning process should be to SAVE IT:

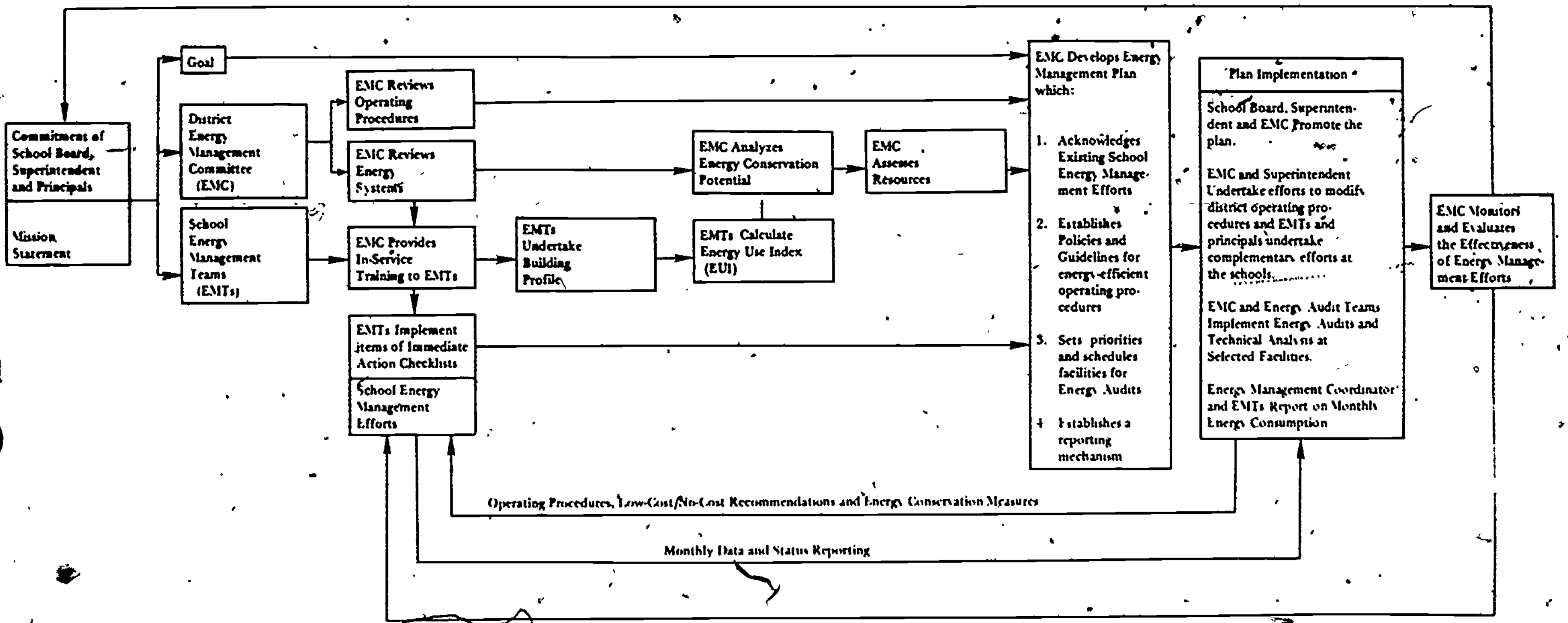
*S*pecify the goal;
*A*ccumulate the data;
*V*erify the data;
*E*stablish the plan;

*I*mplement the plan; and
*T*est the results.

In order to save it, the plan must consider existing energy conservation efforts, identify and assess available financial and organizational resources, select and prioritize facilities for detailed analysis, and identify the specific policies that can be implemented ~~to increase the energy-efficiency~~ of the district's operating procedures. When a comprehensive plan, such as the one described in this handbook, is implemented, energy and money will be saved.

The chart on the following page provides an overview of the energy management process.

The Energy Management Process



4-2

A. DEVELOPING THE ENERGY MANAGEMENT PLAN

The Energy Management Plan is a blueprint for addressing the question of: "How does the school district alter the use of energy to meet its energy-conservation goal?" The ability of the school district to develop such a blueprint is directly related to an understanding of the nature of current energy consumption and the factors which affect it. The energy management plan will provide:

- A reaffirmation of commitment;
- A statement of support for efforts to implement the Immediate Action Checklists and to expend other ongoing energy management efforts in the schools;
- An established policy of directives and guidelines to insure energy-efficient operating procedures;
- A prioritization and scheduling of facilities for detailed energy analysis;
- A reporting/monitoring mechanism; and
- A guide for energy management efforts in the schools and the district's offices.

1. Analysis of Energy Conservation Potential -

The first step in developing the Energy Management Plan for the district is the analysis of facilities and operating practices to determine the potential for energy conservation. This analysis should consider: the status of existing school energy management efforts in the district, the Energy Use Indices for the facilities developed through completion of the Building Profile (Appendix A), and the existing operating procedures at the district and school levels.

a. **Status of School Energy Management Efforts**

To analyze the energy conservation potential of the district, the established efforts at the individual schools must be considered. The potential for energy conservation is greater in a school where fewer efforts have been directed toward energy conservation. Since all schools should be implementing the items identified by the Immediate Action Checklists (Appendix B), every school should already have undertaken some level of energy management. An understanding of each school's involvement in energy management, combined with an analysis of its energy consumption, will provide criteria for further analysis. Facilities with high Energy Use Indices and relatively low energy management efforts would be obvious targets for detailed energy analysis (Energy Audit and Technical Analysis) and action.

b. **Prioritization of Facilities for Detailed Analysis**

To identify which facilities to target for detailed energy analysis and action requires knowledge of current efforts toward energy management in each facility. An understanding of the facility's energy consumption and how that consumption compares to other facilities in the district is also needed.

The Energy Use Index (EUI) for each facility in the district, calculated by the completion of the Building Profile Form (Appendix A), should be listed in order from the lowest to the highest rating. Since the type of construction and the use of the facility (scheduling, type of activities and number of occupants) will affect the EUI, the facilities with high EUI ratings should be compared to develop the priority list of facilities to target for detailed energy analysis (Energy Audit and Technical Analysis). The number of facilities on the priority list that will eventually be selected for detailed energy analysis should be determined only after a review of available resources.

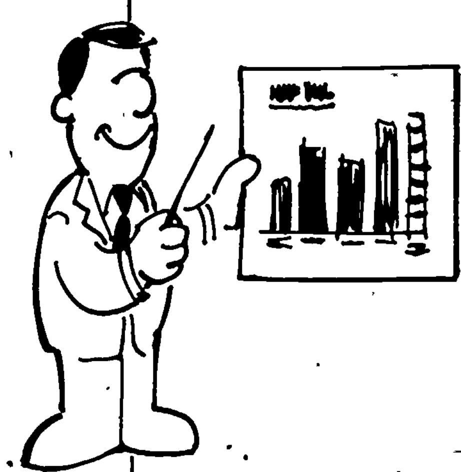
c. **Analysis of Operating Procedures**

The discussions and recommendations relating to transportation, procurement and facility utilization provided in Chapter III should be considered with respect to an analysis of the district's and each individual school's operating procedures. While the consumption of energy in facilities is the primary consideration of a district's energy management program, the operating procedures in these three areas can also have a significant impact on the district's energy requirements.

Along with the many other considerations associated with the transportation of students, the district must consider energy efficiency. A number of specific actions can be taken to reduce consumption while providing the flexibility required for the district to continue to address its traditional transportation needs and requirements.

Purchasing policies can also have a direct impact on the energy consumption of the school district; therefore, these policies should be addressed in the energy management plan. Through purchasing research, evaluation of commodity efficiency ratings and use of the state commodity purchasing contract, an energy-efficient procurement policy can be developed.

It has been pointed out that the required hours of operation dictated by the established schedule is the most important factor in a facility's energy consumption. While some scheduling and space utilization issues are inflexible, the hours of operation and the use of space during those hours can be managed to effect energy savings.



Operating procedures for the district and each school should be thoroughly reviewed, and practical recommendations made to increase the energy efficiency of the facility. The plan must provide specific policies and guidelines to address these operating procedures. Many operating procedures based on occupant habits and tradition can be altered to produce greater energy efficiencies with little inconvenience.

2. Methods for Detailed Energy Analysis

Facilities that have high EUIs should be subject to detailed analysis, in order to determine what conservation measures should be implemented. This is accomplished by conducting an Energy Audit (see Appendix C) and completing a Technical Analysis of potential capital expenditure measures. The Energy Audit is designed to identify the facility's deficiencies, identify specific low-cost/no-cost corrective measures, and indicate potential capital expenditure measures. The Technical Analysis will include a detailed evaluation of the capital expenditure measures in terms of energy savings potential, initial cost, and return on investment.

a. Energy Audit

An Energy Audit (EA) is a detailed examination of the physical characteristics of facilities and an analysis of energy consumption patterns. Low-cost/no-cost operations and maintenance recommendations for immediate action and appropriate higher cost measures requiring further study are determined from the results of the EA. Low-cost/no-cost measures should be implemented immediately. Higher cost, capital investment measures should be subject to further study before implementation.

Energy Audits should include:

- A review and verification of all data on the Building Profile Form (Appendix A);
- An on-site survey to observe conditions, gather additional temperature and humidity data, and measure lighting levels;
- Recommendations of specific low-cost/no-cost measures that should be implemented immediately; and
- Identification of capital expenditure measures requiring further study.

The Energy Audit Form can be completed by qualified in-house personnel or by a certified energy auditor. The quality of the EA will depend on the knowledge of the person completing the audit. The individual(s) selected to complete the audits should be completely familiar with the audit form and the nature of energy consumption in school facilities. The auditor must be able to detect problems and identify specific solutions. It is recommended that two to five person audit teams, with a diversity of expertise, be established. A member of the Energy Management Committee, preferably the Energy Management Coordinator, and a representative of the facility's Energy Management Team should be part of the audit team. The audit team may also include a qualified engineer and the building superintendent.

The basic procedures to follow in completing an Energy Audit are:

- Study and analyze data on the Building Profile Form (Appendix A), to become completely familiar with the facility configuration and energy consumption pattern before conducting the on-site survey. Review the building plans, if available.

- Contact the school principal and arrange for:
  - access to the facility;
  - coordination with the Energy Management Team (or include a member on the audit team);
  - access to all equipment; and
  - assistance from the building superintendent.
- Obtain and become proficient with required measuring instruments, which include:
  - light meter;
  - thermometer;
  - 100-foot tape measure;
  - sling-psychrometer (measures wet-bulb and dry-bulb temperatures to obtain relative humidity); and
  - infrared heat detector (optional).
- Conduct the on-site survey by completing the Energy Audit Form (Appendix C):
  - take temperature/humidity readings in each room;
  - check temperature measurements against thermostat settings to check for proper thermostat calibration;
  - take lighting level measurements in each room to determine illumination levels; and
  - check for air leaks around windows and doors.
- Analyze findings to determine appropriate low-cost/no-cost measures for immediate action and to identify capital expenditure measures for further study.

The Energy Audit Form can be used by the auditor or audit team to determine which items and system components to review. It also recommends specific corrective measures. However, the ability of the auditor or audit team to identify an energy consumption problem and determine appropriate remedies will influence the potential benefits to be derived from the energy audit.

b. Technical Analysis

To take advantage of every energy conservation opportunity, it will be necessary to make some capital expenditures. If the initial investment for such measures can be recovered within five years, their implementation should be seriously considered. A Technical Analysis (TA) should be conducted prior to implementing any capital expenditure measures. The TA will calculate costs, savings, and payback periods, allowing the school district to establish priorities for implementing capital expenditure measures. A Technical Analysis should be completed by a qualified architect or engineer or by a certified Technical Assistance Analyst. A list of qualified analysts is available from the Governor's Energy Office.

Technical analysis of capital investment measures should include, at a minimum:

- A complete inventory of energy-using equipment;
- The energy budget for the building;
- The current deviation from the energy budget;
- An estimate of fuel and cost savings that would result from implementing the suggested changes; and
- An estimate of the capital investment required and the payback periods for replacement or retrofit of equipment and other capital investment options.

3. Assessment of Resources

The district's energy conservation potential depends upon the availability of resources to effectively implement the specific energy conservation measures that are identified by the Energy Audit and Technical Analysis. The Energy Management Committee should make a complete evaluation of the district's resources that can be used to develop and implement the energy management plan. The committee should identify all available sources of funds, in-house expertise and manpower, and outside sources of assistance. Based on their findings, the Energy Management Committee should make recommendations to the Superintendent and school board on funding requirements. The district's budget should reflect these recommendations.

a. District Resources

When evaluating the resources available to the district, the Energy Management Committee should consider both financial and manpower resources. The resources the district is able to commit to the energy management program will influence its ability to reduce energy consumption and control costs. With proper planning, the need for financial resources can be minimized, and in-house expertise and manpower can be utilized to produce significant savings.

It may be necessary to redirect school budget funds previously dedicated to other projects to implement the plan. However, the Energy Management Committee should attempt to identify other sources that can be used before resorting to re-allocation. The financial assessment should review the current amount budgeted for energy management and conservation activities and the amounts budgeted for utility expenses. By analyzing the projected expenditures for energy conservation activities and utilities, the Energy Management Committee can establish a recommended budget for energy management efforts.

In-house expertise and manpower are significant resources available within the school district. The school district possesses an often-overlooked wealth of talent and expertise that can be used to solve energy problems. For example, industrial arts and vocational teachers can design class projects to implement some of the no-cost/low-cost measures.

The Energy Management Committee should consider innovative approaches to obtain the assistance of in-house manpower. Incentive programs can be very effective in promoting the involvement of district personnel in energy conservation efforts. One type of incentive program to encourage teacher participation is to provide in-service credit toward certification renewal for certain activities relating both to the energy program and to their subject field. Another type of incentive mechanism is to offer a rebate of monies saved at each school facility to that individual school for use in its discretionary budget. Both of these motivational techniques are discussed in detail later in this chapter.

b. Outside Sources of Assistance

In addition to resources available within the district, the Energy Management Committee must identify outside sources of assistance. Assistance is available from community programs, utility companies, and state and federal programs.

Utility companies often have information, educational materials, and technical expertise that can be useful in promoting and implementing the energy management program. Most utilities have representatives who can provide information on the utility's policies and procedures and assist the Energy Management Committee by identifying efficient energy management methods. The local utility should be contacted to determine what specific assistance they can provide. A list of utility contacts is provided in Appendix G.

Information and assistance are available from several agencies at the state and federal levels. On the state level, the Governor's Energy Office provides assistance for energy management planning and energy education curriculum development. This office maintains current information on all aspects of school energy management and has full-time staff available to assist school districts with energy conservation and energy education efforts. For additional information about the services available, see Chapter V or contact:

The Governor's Energy Office
301 Bryant Building
Tallahasssee, Florida 32301
(904)488-2475

The Florida Department of Education, Office of Environmental Education, provides assistance to school districts in the areas of energy education and energy management planning. For more information on the services available through this office, see Chapter V or contact:

Office of Environmental Education
Department of Education
Knott Building
Tallahassee, Florida 32301
(904)488-6547

The U.S. Department of Education, Energy and Education Action Center, administers a program that provides technical assistance and information, assists in the development of curriculum materials, supports in-service training, and identifies career and vocational education programs. This program engages a network of technical experts from various federal agencies, universities, and private consultants. For more information contact:

Energy and Education Action Center
Department of Education
Room 1651, Donohoe Building
400 6th Street, S.W.
Washington, D.C. 20202
(202)472-7777

c. Sources of Funding

Sources of funds for Energy Audits and Technical Analyses must be carefully analyzed.

Two directions can be taken in addressing the funding issue. The school district either can utilize its own funds and resources or can seek funding assistance from the National Energy Conservation Policy Act (NECPA). NECPA is the only established grant program available for schools to proceed with more detailed analysis. This program provides 50/50 matching funds for conducting energy audits, detailed technical engineering studies, and the installation of energy conservation measures.

Participation in the NECPA program offers the benefits of direct funding to proceed with energy analysis and conservation measures. The program parameters should be reviewed in detail and compared with the benefits of using district funds and manpower. Specific internal district factors, such as availability of in-house expertise and the structure of the district's budget, will have a bearing on the decision to apply for a NECPA grant. In general, the prospects for the district to receive funds to implement energy conservation measures and the continued availability of funds from this program, will determine the advisability of participation in the NECPA procedures, for Energy Audits and Technical Analysis. The Governor's Energy Office encourages all school districts to consider participation in this program.

The NEPCA program, commonly called the Institutional Building Grant Program (IBGP), is divided into two main phases:

Phase I--Preliminary Energy Audit (PEA) and Energy Audit (EA).

The Preliminary Energy Audit is a data-collecting activity used to determine the overall energy profile for the building; the audit can be conducted by in-house staff. The Building Profile Form (Appendix A) closely parallels the data contained in the NEPCA Preliminary Energy Audit and provides all pertinent information for completion of the NEPCA form.

The Energy Audit is a more detailed examination of the building and the energy-using systems. Energy Audits acceptable under the IBGP must be conducted by a state-certified Energy Auditor. Matching funds, up to $450 per building, are available to pay for Energy Audits. A list of certified Energy Auditors is available from the Governor's Energy Office.

Phase II--Technical Assistance Program (TAP) and Energy Conservation Measures (ECMs)

The Technical Assistance Program is a detailed engineering analysis of the building and its energy use. This analysis results in a detailed report estimating the cost of applicable building modifications and installation of new equipment recommended in the Energy Audit. The TAP must be performed by a licensed engineer or architect who has been certified by the state. A list of certified engineers and architects is available from the Governor's Energy Office. All applications for matching TAP funds will be ranked according to the state plan.

Funds will be awarded according to the state's ranking procedures until federal funds are exhausted.

The Energy Conservation Measures (ECM) phase includes the design, purchase, and installation of materials and equipment that will reduce energy consumption or substitute an alternative energy source. Applications for ECMs will be ranked according to the state plan, and funds will be awarded in the same manner as TAP funds.

The Technical Assistance Program (TAP) and Energy Conservation Measures (ECM) are subject to funding cycles established by the federal government. While the future of this program is not known as of this writing, it is expected that additional funding cycles will be scheduled. School districts are advised to keep informed regarding the dates and amounts of funding available in future funding cycles.

In contrast to TAPs and ECMs, Energy Audits are funded independently of the funding cycles. This means the EA funds are available on an as-submitted basis, as long as funds are available. School districts should utilize the available EA funds and keep abreast of changes in the funding requirement for possible inclusion of local government facilities for TAP and ECM monies.

EA, TAP and ECM grant awards are based on a 50/50 match with local (non-federal) funds. In hardship cases, additional federal money (up to 90% of the cost) can be awarded. The hardship must be documented and evaluated to determine the amount of hardship funds for which a facility is eligible.

Application for participation in the NECPA program can be made through the Governor's Energy Office. Grant applications are received, evaluated and awarded in accordance with the state program. TAPs and ECMs are subject to approval by the federal Department of Energy. Additional information can be obtained from:

The Governor's Energy Office
301 Bryant Building
Tallahassee, Florida 32301
(904)488-6764

Other grant sources should be explored by contacting the appropriate state and federal agencies. One source of additional grants for school energy conservation is through the State Department of Education, Office of Environmental Education. This office provides funding to school districts, schools, and individual teachers for the development of energy education and conservation programs. Mini-grants are available to school districts and to individual schools and teachers. More information on this program, including application procedures, is available from:

Office of Environmental Education
Department of Education
Knott Building
Tallahassee, Florida 32301
(904)488-6547

4. A Blueprint for Action

Once the potential for energy conservation has been determined, the methods for detailed energy analysis have been studied, and the availability of resources has been assessed, the energy management plan can be developed. The energy management plan will provide a blueprint to guide energy management efforts in the schools and in district offices. This blueprint will include:

- A reaffirmation of commitment to energy conservation and the district's goal to reduce energy consumption;
- A statement of support for efforts to implement the items in the Immediate Action Checklists and to expand other ongoing energy management efforts in the schools;

- Policy directives and guidelines to insure energy-efficient operating procedures in transportation, procurement and facility utilization;
- A prioritization and scheduling of facilities for detailed energy analysis (EA and TA); and
- A reporting and monitoring mechanism.

Together, these items will constitute the district's plan for meeting the energy goal and reducing energy costs. The district's energy conservation goal provides the needed foundation for plan implementation. The level of commitment given to the plan is directly related to the prospects for savings. The original mission statement, with the established goal, should be included in the plan to reaffirm this commitment.

The operating procedures in the areas of transportation, procurement, and facility utilization must be carefully reviewed and the suggestions included in Chapter III should be considered. The development of policy directives and guidelines to address operating procedures must be included in the plan. Given the nature of issues to be addressed, the District Superintendent, school principals, and top administrators should be involved in the analysis of all operating procedures. The district may elect to assign the responsibility for reviewing current procedures and for developing recommendations for specific policy directives and guidelines to the Energy Management Committee. Whatever method is employed to review operating procedures, the analysis must be thorough and the resulting policy directives and guidelines must be explicit.

The plan cannot wait for the detailed energy analyses (EAs and TAs) to be completed. Instead, the energy management plan should establish priorities and a schedule for detailed energy analyses of facilities based on an evaluation of present consumption patterns and available resources. The schedule for completion of Energy Audits will help determine the implementation process. Through continuous monitoring and evaluation, the process of undertaking EAs and TAs will be reassessed.

The plan must provide a reporting mechanism to facilitate evaluation. The reporting mechanism must provide for both the upward and the downward flow of information. The district office usually receives all utility bills and controls budgeting for energy use, without much involvement by the schools themselves. Therefore, the plan must provide some mechanism to insure that the principals and the Energy Management Teams receive information on the facility's energy budget and monthly consumption. This information will provide immediate feedback to the schools concerning the effectiveness of their energy management efforts.

The energy management plan must also provide a reporting mechanism to insure that the Energy Management Coordinator receives sufficient information about each individual school to evaluate the effectiveness of the plan. The reporting system adopted by the district in its energy management plan should provide a direct flow of information from the Energy Management Coordinator to the Energy Management Teams and then back. This structure will allow the Energy Management Coordinator to collect, review, and prepare all the necessary forms at the district level and then distribute the appropriate data back to each school facility. The Energy Management Teams can then review and verify the data covering their facilities and use the information to increase the effectiveness of their programs. The reporting mechanism established in the plan should be made mandatory by the Superintendent and School Board.

The exact reporting procedures and forms can vary, but should include at a minimum:

- A detailed accounting of the energy consumed at a facility by fuel type, on a monthly basis;
- A comparison of monthly energy consumption at each facility with the previous year's consumption for that month (from Building Profile Form);
- A calculation of energy savings at each facility, as compared to the previous year's consumption for that month, in total BTUs, dollars and percent decrease (from Building Profile Form);
- A graphic depiction of the energy consumed at each facility for the months of the current year in total BTUs and dollars; and
- A monthly, narrative status report on current energy conservation efforts at each facility.

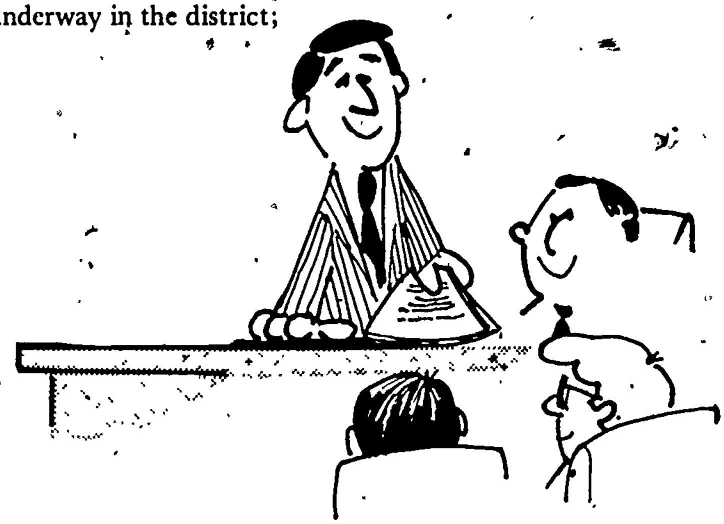
The schools should receive the reports on their facilities and a copy of the district report. Accurate reporting is essential if the plan is to be successful. With accurate data and information, the plan can be fine-tuned to produce even greater savings.

B. ADOPTING THE ENERGY MANAGEMENT PLAN

Once the energy management plan has been developed, it must be adopted by the school board and superintendent. The adoption process should provide for input and possible modification to the plan prior to formal adoption. The degree of additional input at this point can vary, but should include comments from the Superintendent and school board along with final input from the Energy Management Committee, the Energy Management Teams and the public. The procedure for obtaining and refining those comments should be coordinated by the Energy Management Committee at the district level and the Energy Management Teams at the school level. The possibility of holding a special meeting of the school board to solicit comments may be considered.

The energy management plan, after it is refined, will then be presented to the school board for final review and approval. Once adopted by the school board, the plan will guide the district's energy conservation efforts. A good plan will provide the following:

- Acknowledgement and endorsement of all energy conservation activities currently underway in the district;



- Formal adoption of all policies and procedures intended to reduce energy consumption and promote energy efficiency in the school district's operating procedures;
- Prioritization and scheduling of facilities for further energy analysis (Energy Audits and Technical Analysis); and
- Establishment of reporting requirements and a monitoring network to provide for periodic revision and updating of the plan.

C. TAKING ACTION

While the adopted energy management plan represents a significant effort, the district's energy cost will not be reduced if the plan is not actively implemented. Implementation will require the involvement of all segments of the school district, led by a reaffirmation of commitment by the school board and top administrators. The plan and its provisions must be promoted to ensure that all segments of the district are familiar with the plan, why it will be implemented and what their responsibilities are. The policies and guidelines for increasing the energy efficiency of the district's operating procedures should be communicated throughout the district by the Energy Management Committee and the Energy Management Teams.

Combined with previous efforts, and the implementation of the items on the Immediate Action Checklists, the adoption of policies and guidelines relating to transportation, procurement, and facility utilization will establish the formal energy management effort at each school. Low-cost/no-cost recommendations resulting from Energy Audits must be incorporated into each school's program as the audits are completed. The capital expenditure measures that the district decides to implement after a Technical Analysis will represent a further refinement of already well-established district and school energy management programs. The school board and Superintendent, with the assistance of the Energy Management Coordinator, must assume a leading role in promoting the district's plan and its implementation throughout the district.

1. Promoting the Plan

The effort to change attitudes and habits will require an effective public relations program. The district's public relations program should seek to direct many different interests toward a common goal of energy efficiency by producing energy awareness in each individual and group. If the public relations effort is lacking, both the school system personnel and the public will focus on the perceived inconveniences, rather than the benefits that result from effective energy management.

The goal of the energy management program and the effect that attaining this goal will have on the school district's budget must be clear to everyone involved. The responsibilities of each constituent group must be shown as part of the overall effort. Initiating a training program can facilitate this understanding.

Training can play an important role in producing acceptance of the plan and determining the effectiveness with which it is implemented. Training is a form of motivation that produces involvement to achieve the desired goal and, at the same time, produces an interest in the effort. Providing in-service credits is an excellent method of creating involvement and participation in the training programs.

The School Flag Awards Program provides another resource for promoting the school district's program. Under this program, administered by the Governor's Energy Office as part of the "Save It, Florida" campaign, school districts with established energy management programs and energy consumption reporting mechanisms are eligible to receive two "Save It" flags for their district. The first flag is flown at the district office building and the second flag is periodically rotated among schools in the district based on the effectiveness of their energy management efforts as determined by the district. Flying the flags symbolizes the energy management efforts to people in the school system and the public. Participation in the School Flag Awards Program signifies that the school district is acting responsibly to reduce energy consumption.

Another excellent method for promoting the plan is to establish a rebate mechanism that returns a percentage of the energy dollars saved to the school. Under this system, the principal of the school receives a portion of the savings resulting from his school's conservation efforts in the form of a rebate for use in the school's discretionary budget. This money can then be used to purchase extra books, provide for additional teacher's aides, or for other school-related needs. The criteria and procedures for using a mechanism such as this should be developed by the Energy Management Committee and approved by the school board and Superintendent. Once approved, the Energy Management Coordinator can administer the rebate in accordance with the energy use data collection activities. This method of creating involvement, participation and enthusiasm in a school district plan has met with tremendous success in several school districts and should be considered when evaluating resources and motivational techniques.

If the district elects to incorporate an incentive rebate mechanism to reward schools for energy-saving efforts, an accurate reporting system is needed. The rebate program should be established as part of the reporting system. It should be based on a percentage of energy dollars saved as determined by school board policy.

2. Modifying Operating Procedures

Operating procedures should be modified in accordance with the recommendations of the plan. The Energy Management Committee should take the responsibility for clarifying and expanding the policies and guidelines of the plan. Each area should be addressed independently, and workshops held for the appropriate personnel. Based on the results of these workshops, the committee should develop an expanded set of implementation guidelines for presentation to the Superintendent, who is ultimately charged with implementation of the plan. Once adopted, these guidelines should be used to redirect the activities of all operational personnel and to reorient facility utilization procedures throughout the district. The Energy Management Committee and Teams must work directly with the key operational personnel to insure effective implementation.

3. Refining School Energy Management Efforts

The energy management efforts coordinated by the Energy Management Teams at the individual schools are to be refined and expanded to address the plan's policies and guidelines for district operating procedures. Although essentially a central district activity, the new policies and guidelines for transportation and procurement will require input from the schools to be effectively implemented.

While the Energy Management Committee's implementation guidelines will provide general direction, the Energy Management Teams and the occupants of the individual schools must develop and adopt specific procedures to address their particular circumstances. Other than some of the major capital expenditure measures, energy-efficient facility utilization procedures can have the most significant impact on the reduction of energy costs. As noted previously, hours of operation and the use of space during these hours have a significant impact on energy consumption.

The school energy management efforts represent the implementation of district-wide policies and guidelines within the context of the particular circumstances at each facility. The district-wide goal adopted by the school board must direct each school's energy management efforts. The policies and guidelines refined by the district's Energy Management Committee will provide direction to the schools for meeting the district goal.

4. Implementing Selected Energy Audits/Technical Analyses

After the facilities to be audited have been selected, Energy Audit teams must be selected. Every member of the Energy Audit Team should be familiar with the auditing process and possess the necessary skills to effectively complete the audit.

Each team should include two to five members. Potential team members include; an engineer or energy auditor, the Energy Management Coordinator, representatives of the facility's Energy Management Team, and the Building Superintendent. Every team member should be familiar with the Building Profile Data, the Energy Audit Form, and the contents of Chapter III.

The completed Energy Audit for a facility will provide a set of recommended low-cost/no-cost measures for implementation and an identification of capital expenditure measures for further review. The audit team should report the recommended low-cost/no-cost measures to the principal for immediate incorporation into the school's energy management program. The capital expenditure measures identified by the Energy Audit should be reviewed by the Energy Management Coordinator and presented to the Superintendent. After the Energy Audits have been completed, the Superintendent and Energy Management Committee must determine whether to conduct a Technical Analysis for identified capital expenditure measures or to perform additional Energy Audits. The district might choose to audit the highest priority facilities before undertaking Technical Analyses or implementing capital expenditure measures. The availability of resources will be a determining factor.

Implementation of the low-cost/no-cost measures identified by the Energy Audits will enhance school energy management efforts and assist the district in reaching its goal. The Energy Audits, Technical Analyses, and capital expenditure measures should be implemented according to the priority schedule established in the plan. Through continuous monitoring of the district and school level energy management efforts, the Energy Management Committee can determine the effectiveness of ongoing actions and suggest possible changes to the energy management plan.

D. MONITORING AND EVALUATION

The energy management plan implemented by the school district and the individual schools was designed to reduce energy consumption in accordance with the goal set by the Energy Management Committee. The effectiveness of the measures in addressing the desired reduction of energy consumption must be evaluated. A process of continuous monitoring of energy consumption during the program is required to evaluate the success of the plan and to identify changes that might be required to reach the goal.

The monitoring and evaluation procedures must be designed to provide timely data to the Energy Management Coordinator. The Coordinator should report this data to the Energy Management Committee and major decision-makers concerning the effectiveness of the energy management plan and its implementation. Each Energy Management Team or principal should appoint an individual to monitor the specific activities and measures implemented at their facility. The data provided by the plan's reporting mechanism will allow individual schools to evaluate their efforts and, after being consolidated with data from other facilities, will provide necessary information for the central district to evaluate the district-wide program's effectiveness in meeting the goal.

The data collection process is essential to the continued operation of the program. Every district should establish mandatory reporting requirements for each school. The data collected should be accurate and complete. All data should be analyzed by the Energy Management Coordinator in order to evaluate the progress made at each facility and in the district as a whole. The Coordinator's analysis should be reported to the Superintendent and the school principals on a regular basis. The coordinator's reports should include a comparison of energy consumption for the reporting period to the EUI for the same period in the previous year. With this information, the effectiveness of the conservation effort at each school, and in the district as a whole, can be evaluated.

The monitoring and evaluation process must be continuous. While the new operating procedures and scheduled Energy Audits are underway, the monitoring and evaluation will provide a determination of whether the goal is being met and if changes are warranted. From this determination, the district's plan can be periodically updated, allowing the full potential for energy conservation to be realized.

CHAPTER V
ENERGY EDUCATION

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ENERGY EDUCATION

Preparing students to meet the challenge of changing energy realities requires the concerted efforts of every educator. Our society's energy consumption habits were developed when fuel was inexpensive and seemingly plentiful. The new energy realities of higher costs and dwindling reserves dictate a change in our old habits. This change will require that our youth be prepared to respond to the new energy realities. Energy education must be a major concern of every educator.

The magnitude of the energy problems confronting society tends to generate a feeling of helplessness in most people. The problems seem to be so large and complex as to be beyond control. A common response is to look to government, business, and science to produce a technological solution. While the efforts of these institutions are necessary, it is equally important that individual citizens be aware of the measures they can implement to deal with the day-to-day effects of the energy situation. If citizens are to take effective action, they must recognize the limitations of institutions and take individual responsibility to prepare themselves for changes in energy supplies and prices, and the resulting changes in life-style. Students must be prepared to actively and responsibly address their energy future.

Today's students will be called upon to find solutions to the energy problem. They must be provided the educational background needed to meet this challenge. The complexity of energy issues requires that energy education be incorporated into every discipline. The past cannot be changed, but the present and future can.

A. COMPONENTS OF AN ENERGY EDUCATION PROGRAM

An ongoing energy education program will greatly assist the district and the individual schools in their energy management efforts. Similarly, the district-wide energy management program and the specific efforts at the school will provide a forum to expand energy education--by demonstration.

The purpose of energy education is to help people to understand basic energy concepts and give them the ability to make informed decisions regarding energy utilization. The following five objectives are components of an energy education program that would meet this general goal:

1. To enable people to understand the nature and importance of energy.

   - Energy forms (heat, light, and motion) and states (potential and kinetic);
   - Energy sources (depletable and renewable);
   - Energy uses; and
   - Energy flows (extraction, distribution, use, and dispersal).

2. To provide information about changing supply and demand factors for various energy sources.

   - Historical trends;
   - Present conditions;
   - Future possibilities; and
   - Mathematical implications of growth.

3. To prepare people to consider the individual and societal implications of different energy sources at the local, regional, national and international levels.

   - Economic implications:
     * Supply, demand, and price of energy and other related goods and services.
     * Employment ramifications.
   - Political implications:
     * Domestic.
     * International.
     * National security.

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- Social/lifestyle implications for various sectors of society.

- Environmental/ecological impacts.

- Scientific and technological considerations, including production system options (centralized and decentralized, renewable and non-renewable).

4. To provide information about conservation.

   - Rationale for conservation.

   - Conservation techniques.

5. To prepare people to make personal and societal decisions related to energy supply disruption.

   - Career.

   - Consumer.

   - Environmental.

   - Political.

A comprehensive energy education program contains numerous interrelated components that can be introduced as basic concepts and carried to increasing levels of complexity. While energy concepts can be taught in specialized courses, it is not necessary to isolate energy education as a separate discipline. Instead, it can be integrated into a wide range of existing subjects at all grade levels. The important consideration is that students develop competencies associated with the above list of objectives, regardless of instructional organization.

B. HOW TO DEVELOP AN ENERGY EDUCATION PROGRAM

The first step toward establishing an effective energy education program is an assessment of current efforts. This assessment should provide a clear understanding of the current status of the school's energy education program and should reveal the nature of the actions that must be undertaken to address the five objectives of an effective energy education program.

Such an assessment will require a careful review of established curriculum and an analysis of the efforts of individual teachers.

With a clear understanding of the status of energy education, efforts to initiate a comprehensive program can begin. While the nature of actions to be undertaken to provide an effective program will vary from school to school, the following list provides guidance on specific actions that should be incorporated:

1. Develop a good teacher in-service program in energy education.
2. Establish a faculty committee to incorporate energy into the curriculum.
3. Develop a source book or list of local organizations or institutions providing free technical assistance.
4. Develop a source book or list of available instructional materials and sources of funding for energy education activities.
5. Develop a system or committee to assist in obtaining funds for energy education activities.
6. Provide samples of available instructional materials in a central location.
7. Develop a mechanism for communicating energy education efforts to faculty, students and their families.
8. Establish a program to educate faculty and students as to the energy systems used in your school.
9. Consider energy conservation in the delivery of instructional programs and extracurricular activities.
10. Establish specific exercises for students, such as:
    - Conducting an energy survey of a school building;
    - Staging an Energy Fair for the school and community;

- Conducting a poster contest;
- Staging a school-wide Energy Week;
- Constructing solar projects, such as cookers, greenhouses, and other devices;
- Forming a Student Energy Speaker's Bureau/Debate Club;
- Conducting field trips to energy production/distribution plants;
- Conducting Student Home Energy Audits;
- Having students contribute energy articles to school/community newspapers;
- Having students design plays, puppet shows, role playing and media presentations;
- Having students investigate local energy issues/concerns;
- Having students research historical patterns of energy use;
- Using math and art classes to design and construct graphical representations of the school's energy consumption patterns;
- Analyzing the energy consumption of various steps in food processing and preparation;
- Analyzing gasoline consumption in school and home transportation patterns; and
- Having students design energy-efficient schools/homes, utilizing alternative sources of energy.

These activities can be the basis for development of an energy education program. Since each school has its own particular set of circumstances and in-house expertise, the programs at each school should be expanded to address existing circumstances and to capitalize on available expertise.

C. SOURCES OF ASSISTANCE

In developing their energy education programs, school districts should review the efforts of other districts. Many school districts in the state have already established effective programs that can provide guidance and direct assistance. Reviewing the efforts of other districts at the outset of developing an energy education program can facilitate program development and increase the dissemination of creative approaches.

An Energy Management Coordinator and an Energy Education Curriculum Coordinator have been appointed in each school district, establishing a network of energy contacts throughout the state. Ongoing communication between these individuals has been established and promoted through the efforts of the Governor's Energy Office and the Florida Department of Education. The office of Environmental Education has a field staff that maintains continuous communication with these contacts. The expertise of the energy education coordinators should be utilized in the development of the district's energy education program.

Over the past few years, the Governor's Energy Office and the Department of Education, Office of Environmental Education, have worked closely with the representatives from the school districts and other individuals and groups to develop instructional materials, a series of curriculum guides and the *Florida Master Plan and Action Guide for Energy Education.* These materials have been developed and distributed at workshops conducted throughout the state. They are available free to school districts from:

Office of Environmental Education
Department of Education
Knott Building
Tallahassee, Florida 32301
(904)488-6547

Governor's Energy Office
301 Bryant Building
Tallahassee, Florida 32301
(904)488-6143

A series of teachers' guides entitled *Energy and My Environment* for teachers in Kindergarten through Grade 12 are among the instructional materials developed for use in Florida's schools. These guides were designed to increase energy awareness and teach specific skills in relation to energy conservation.

The seven concepts covered at each grade level include:

1. Energy is the ability to do work;
2. Energy comes in many forms;
3. Energy can be changed from one form to another;
4. The sun is the earth's chief source of radiant energy;
5. People use energy to satisfy their needs;
6. Energy supplies are limited; and
7. Living things are interdependent with one another and their environment.

There are three lesson outlines covering each of these topics, for each grade level covered in the curriculum guide. These lesson outlines are excellent starting point for exploring the subject matter. The teacher may, after using these lessons, develop more lessons and activities, using the outlines as a guide.

Supplemental energy education materials have been developed for use in conjunction with the *Energy and My Environment* teaching guides. An abstracts booklet available from the Office of Environmental Education and the Governor's Energy Office lists and describes many of these materials.

Additional energy education curriculum materials can be obtained from:

U.S. Department of Energy
Technical Information Center
P. O. Box 62
Oak Ridge, Tennessee 37830

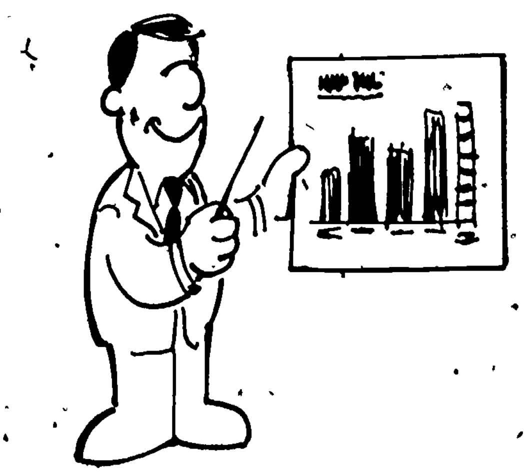
Florida Solar Energy Center
300 State Road 401
Cape Canaveral, Florida 32920

National Science Teacher's Association
1742 Connecticut Avenue, N.W.
Washington, D.C. 20009

The Division of Vocational Education of the Florida Department of Education is developing new energy education materials for use in established courses. New careers and jobs in energy dictate that the vocational-technical schools begin training programs to fill the need for personnel to fill those positions.

D. COORDINATING ENERGY EDUCATION AND ENERGY MANAGEMENT

The district's energy education and energy management efforts should be coordinated. The energy education program provides the awareness and understanding of energy issues essential for effective implementation of an energy management program. Conversely, the energy management program conducted by the school district provides a specific resource to demonstrate energy issues. While the energy management program outlined in this handbook includes the direct involvement of teachers and students, the energy education program must provide the training necessary for their acceptance and successful implementation. The superintendent and principals must ensure that these two efforts are complementary. When energy management and energy education are well integrated, schools save dollars and students learn that saving energy makes sense.



CHAPTER VI
EMERGENCY CONTINGENCY PLANNING

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EMERGENCY CONTINGENCY PLANNING

Florida is particularly vulnerable to energy emergencies because most of the state's energy needs come from sources outside the state. If energy supplies were interrupted or cut back substantially, the "normal" services schools provide may need to be curtailed. This curtailment of services might be in response to the limited availability of fuel, accompanying higher fuel costs and the inevitable higher cost of other goods and services.

In the event of an energy emergency, schools might also be expected to assist the community in coping with the emergency. Schools have traditionally been important community resources in time of crisis, being used for emergency shelters or communication centers.

The best time to address emergency planning is before the situation occurs, not during the emergency. The term "Emergency Planning" implies the projection of various scenarios and the development of contingency plans to cope with probable conditions. By examining options ahead of time, an efficient and effective response to the emergency can be developed. Implementing an effective planning process for addressing potential problems is what contingency planning is all about. In essence, the basis for the plan is: "If this type of emergency occurs, these actions will take place."

The purpose of this chapter is to provide an understanding of the actions that must be taken to develop and implement a district plan and to outline some of the considerations that should be incorporated into the school emergency contingency plan. It is important to formally adopt a plan of action that incorporates the specific actions to take in a given emergency situation. In this way, the school system will be prepared to respond quickly and effectively to the emergency situation when it arises. Minimizing disruption and maximizing available resources are key objectives and benefits of the emergency contingency planning process.

A. DEVELOPING A PLAN

As in the development of the district's ongoing energy management efforts, the request for development of an emergency contingency plan for the school district must be initiated and supported by the school board. The method for developing and adopting the plan once the commitment is made by the board can vary, but should always be based on efforts to address specific direction from the school board to provide a course of action that can be implemented readily if an emergency arises. The Energy Management Committee, in coordination with the established Energy Management Teams, should be charged with development of the contingency plan. The school board and top administrators should provide continuous feedback in the plan's formulation and should act to approve the plan. The development of this plan should be a responsibility of the Energy Management Coordinator.

Development of the emergency contingency plan should consist of a logical sequence of steps that build on one another.

1. Identifying the Problem

Plan development begins with exploration and identification of options available to deal with the varying types of energy shortages; for planning purposes; multi-level or phased scenarios should be examined. For example, the first level could be a moderate energy emergency that would be a shortage in which energy supplies would be cut to a degree that would disrupt normal operation, but not severely restrict the district's ability to continue most of its important activities. The second level would be a serious energy emergency, a situation where a severe shortage or interruption of the energy supply would result in disruption of normal activities.

Planning for and monitoring the energy situation will allow the development of the most appropriate set of responses to an anticipated set of emergency conditions. By asking questions such as, How would an energy emergency affect our school system? and What actions would we take to cope with the emergency?, you will begin to establish the framework on which to build an effective plan.

2. Evaluating Current Conditions

In order to determine the most appropriate actions in an energy emergency, an assessment of those current conditions that would be affected by a curtailment of energy supplies needs to be undertaken. This assessment should include an evaluation of:

- Fuel use pattern by end use, storage capacity, inventories, suppliers, and fuel type;

- Existing emergency plans, including city, county, state, private business and utilities as they relate to the school system, utilities and public transportation; and

- The school system's legal authority and responsibilities as they might relate to energy emergency situations.

Fuel storage capacity should be considered during the planning process in order to determine how well the district can cope with a serious shortfall. If fuel reserves are maintained at fairly high levels, it may be possible to cushion the impact of a fuel shortage. If the district's storage facilities are not very large, adding more capacity should be considered.

Alternate suppliers should be located, and the necessary arrangements made to purchase any additional quantities of fuel should the normal suppliers not be able to deliver all the fuel needed.

3. Developing Appropriate Measures

Once the district has analyzed the potential implications of a fuel shortage on its ability to maintain operations, the next step is to develop and select the specific measures to implement in an energy emergency. These measures should be developed according to the specific set of conditions existing in the school district. Each measure considered should be evaluated in terms of:

- The impact of each measure on the school system;
- Projected energy savings;
- Monetary, student, and convenience costs;
- Public acceptance;
- Funding and budget considerations; and
- Legal implications.

The measures considered should address the policies and programs of the district's schools concerning the following activities/services:

- On-site food preparation;

- Athletics and other extracurricular activities;
- Heating and cooling;
- Transportation;
- Adult education and community programs;
- Schedules; and
- Lighting.

Appendix D contains a listing of recommended emergency measures developed by a group of Florida educators and energy managers. While this list does not cover every possible action, it does provide a basis for determination of measures to be incorporated in the district plan. The district should also incorporate other possible measures that address its particular needs in the event of a fuel shortage.

4. Concept of Operation

If a plan is to work effectively in the event of an actual energy emergency, it must provide for the actions necessary to implement the measures in the school system organizational structure. This means consideration of the following questions:

- Who will do what?
- Who has authority to select and direct the implementation of measures?, and
- What is the chain of command, both within the county as a whole and within the school system?

These questions need to be answered, and the actions expected of each group need to be clearly outlined and accepted well before any energy emergency occurs.

The school district's energy emergency plan should be coordinated with the contingency plans of other agencies and governmental units. There may be demands placed on the school system by other contingency plans. For example, school buildings may be needed for emergency shelters, and school buses may be required to provide emergency transportation. In developing the plan, this requirement should be considered and incorporated.

When a county-wide plan is being developed, the school officials should involve themselves to insure that the needs of the school are effectively met.

Early in the planning process, the personnel responsible for developing the emergency contingency plan for the school district should review contingency plans developed by the state and federal energy agencies. These plans can serve as models and provide some of the information that the energy management team will need to assure that the school's plan is consistent with plans already in place.

5. Consideration for Special Funding

There are presently no provisions for schools to receive special priority fuel allocations in the event of a cutback in gasoline, motor fuel, and heating oil. A shortfall or disruption in supply will result in drastic price increases and an even greater shortfall in the ability of budgeted funds to provide needed supplies to maintain or deliver services. Thus, it is necessary for school districts to plan for and provide a means of purchasing essential fuel at drastically increased prices if an energy crisis should occur.

6. Consideration of Building Shutdown

As a last resort, schools may need to be closed down in the event of an extended or severe energy emergency. If complete shutdown of a building becomes necessary, some precautions must be taken to avoid damage to the building and equipment. The guidelines presented in Appendix D will assist in insuring that the building and its subsystems have been safely and completely shut down.

B. ADOPTING THE PLAN

Once the plan is developed by the committee, it should be presented to the school board for review and adoption. The school board should be informed of all aspects of the plan and the conclusions of all assessments made. Presentation of the plan should delineate financial, legal and implementation considerations, as well as how other existing contingency plans are incorporated and considered.

After presentation, review, and possible revisions, the plan should be adopted by the school board. The plan then becomes a formally adopted planning tool ready to be implemented in the event of an actual energy emergency.

C. IMPLEMENTING THE PLAN

The plan is in effect once it is adopted by the school board; however, implementation does not occur unless actual energy emergency conditions develop. In the event of an energy emergency, the plan is implemented in accordance with the procedures established in the plan relative to the degree of the emergency.

All administrators in the district should be made aware of their responsibilities in the event of an energy emergency. This can be accomplished by developing and distributing checklists that identify specific actions that should be undertaken if an emergency is declared. Individuals must be aware of what they should do, so they can act quickly, without confusion, to implement emergency procedures. This information should be developed and distributed prior to any actual energy emergency. Contingency planning must be integrated into the energy management process.

During an actual emergency, the lines of communication should be kept open. The first information released should indicate the degree of the emergency and the appropriate actions. The Energy Coordinator, with the approval of the board or superintendent and the assistance of the Energy Management Committee, should be placed in charge of initiating the emergency measures. By establishing a central authority to direct the school district's energy policy in an emergency, effective direction can be given to the effort at every level. The Energy Coordinator will be able to give direction to each school facility manager (or other responsible member of the staff), who, with the assistance of the school's Energy Management Team, can direct the efforts of the rest of the staff.

The energy emergency plan should be updated periodically to reflect changes that may have occurred in technology and the school district's facilities and operations. This updating will also ensure that new decision-makers are aware of, and in agreement with, its provisions. School district personnel involved in the plan's implementation should be informed of any changes, so that they will be prepared to take appropriate action in the event of an energy emergency.

APPENDIX A

BUILDING PROFILE

NOTE: This form closely parallels the NECPA Preliminary Energy Audit Form and includes all pertinent information required for completion of the NECPA Preliminary Energy Audit.

BUILDING PROFILE

School or Facility: ____________

I. INVENTORY & DESCRIPTION

Address: ____________________
(Street)

____
(City) (Zip)

- Principal: ____________________ Phone: ____________
- Energy Contact: ____________________ Phone: ____________
- Facility Use:

______Elementary ______High School ______Administrative

______Secondary ______Vocational ______Other (Explain)

____

- Construction Type: _______Masonry _______Wood Frame

_______Brick _______Other (Explain)

____

- Building Configuration & Orientation Sketch

BUILDING PROFILE School or Facility: __________

Lighting

- Type of Lighting: Incandescent ______ %
  Fluorescent ______ % Other ______ %

- Square Feet of Conditioned Space: ________________

- Occupancy Pattern (include all periods of partial use, civic group use, and vacations as applicable):

Daily/Hourly Usage	Average Occupancy (No.)	Days	Hours Per Week	Hours Per Year
____to____	____________	thru	______	______
____to____	____________	thru	______	______
____to____	____________	thru	______	______

Custodial Hours Per Week	______________
After Dark Hours, Summer	______________
After Dark Hours, Winter	______________
Saturdays	______________
Sundays	______________

BUILDING PROFILE

MAJOR ENERGY USING SYSTEMS:

Primary Heating Systems

GAS

Hot Water Boiler ___
Steam Boiler ___
Unit Heaters ___
Infrared ___
Dual Fuel ___
Other ______ ___

ELECTRIC

Heat Pump ___
Hot Water Boiler ___
Steam Boiler ___
Unit Heaters ___
Infrared ___
Other ______ ___

STEAM

Purchased Steam ___
Coal Fired ___
Other ______ ___

OIL

Hot Water Boiler ___
Steam Boiler ___
Unit Heaters ___
Other ______ ___

Primary Cooling Systems

Heat Pump ___
Absorptive ___
Central Elec. ___
Turbine Driven ___
Incremental Elec. ___
Other ______ ___

Terminal Heating & Cooling Delivery System

Reheat ___
Finned Tube Water ___
Finned Tube Steam ___
Radiator Steam ___
Radiator Water ___
Air ___
Window Units ___
Other ______ ___

Primary Air Handling Systems

Constant Volume ___
Variable Volume ___
Dual Duct ___
Hot/Cold Deck ___
Roof Top Units ___
Multi-Zone Units ___
Other ______ ___

Domestic Water

Electric ___
Gas ___
Oil ___
Steam Coil ___
Hot Water Coil ___
Other ______ ___

Special Systems

Kitchen ___
Laundry ___
Swimming Pool ___
Lighted Athletic Field ___
Other ______ ___

BUILDING PROFILE

II. ENERGY USE DATA

School or Facility: ________

ANNUAL ENERGY SURVEY________ BUILDING(S)________ YEAR________

MONTH	ELECTRICITY COST	ELECTRICITY KWH	GAS COST	GAS MCF	NO. 2 OIL COST	NO. 2 OIL GAL	NO. 6 OIL COST	NO. 6 OIL GAL	COAL COST	COAL TON	BOTTLED GAS COST	BOTTLED GAS GAL	HEATING/COOLING
JAN													/
FEB													/
MAR													/
APR													/
MAY													/
JUN													/
JUL													/
AUG													/
SEP													/
OCT													/
NOV													/
DEC													/
TOTAL													/

ELECTRIC DEMAND RATE (IF APPLICABLE)

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL TOTAL
KW-KVA													
POWER FACTOR													
COST													

BUILDING PROFILE School or Facility: __________

III. ANALYZING THE DATA

BTU CONVERSION

Fuel Type:	Units Used	x Conversion Factor	=	BTUs	
Electricity:	_______	KWH x 3,413	=	________	BTUs
Natural Gas:	_______	MCF x 1,030,000	=	________	BTUs
Fuel Oil No. 2:	____	GALs x 138,690	=	________	BTUs
Fuel Oil No. 6:	____	GALs x 149,690	=	________	BTUs
Coal:	___________	Tons x 24,500,000	=	________	BTUs
LP Gas:	_________	GALs x 95,475	=	________	BTUs

TOTAL ENERGY CONSUMED IN BTUs ======= BTUs

DEGREE DAY COMPARISON

	Heating/Cooling Previous Year or Base Year(s)	Heating/Cooling Present Year	Difference Heating/Cooling
J	_____/_____	_____/_____	_____/_____
F	_____/_____	_____/_____	_____/_____
M	_____/_____	_____/_____	_____/_____
A	_____/_____	_____/_____	_____/_____
M	_____/_____	_____/_____	_____/_____
J	_____/_____	_____/_____	_____/_____
J	_____/_____	_____/_____	_____/_____
A	_____/_____	_____/_____	_____/_____
S	_____/_____	_____/_____	_____/_____
O	_____/_____	_____/_____	_____/_____
N	_____/_____	_____/_____	_____/_____
D	_____/_____	_____/_____	_____/_____

ENERGY USE INDEX (EUI)

EUI = Total Energy Consumption ÷ Square Feet of Conditioned Space.

STEP 1: Obtain Total Energy Consumption in BTUs.
STEP 2: Obtain Square Feet of Conditioned Space from Sheet 1.
STEP 3: Divide Figure from Step 1 by Figure from Step 2.

BUILDING EUI = ______________ BTUs Per Square Foot Per Year.

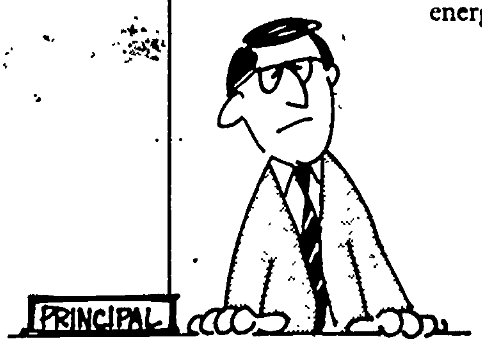
APPENDIX B

IMMEDIATE ACTION CHECKLISTS

PRINCIPALS CHECKLIST

- [ ] Make sure thermostats are set at 65°F in winter and 78°F in summer.
- [ ] When outside temperatures are moderate, turn off heat and air conditioning units and use open windows or air handlers for ventilation.
- [ ] Make sure doors and windows are kept closed while heat or air conditioning is on. Drapes on windows that receive direct sunlight should be closed when air-conditioning systems are on and at night during the winter.
- [ ] Consider reducing the number of breakfast and lunch periods, and use the cafeteria at full capacity whenever possible.
- [ ] Do not use assembly areas, such as the auditorium or gymnasium, for small groups that can comfortably meet in smaller areas.
- [ ] Avoid holding assemblies at times when heating and cooling demands are high. In the winter, hold assemblies in the middle of the day. Summer assemblies should be held in the early morning.
- [ ] Schedule as many activities as possible outdoors. Avoid using auditoriums and gyms for pep rallies and other activities that can take place outdoors.
- [ ] Schedule the use of classrooms and other spaces to reduce energy consumption. Do not allow teachers or students to use vacant classrooms. Use the fewest number of rooms necessary for summer and night programs. Schedule teachers into one room for preparation periods, and place support staff in fewer rooms, if possible. Turn off the room size HVAC units and close the registers when the room is not in use.
- [ ] Avoid fire drills when the outdoor temperature is below 45°F or above 85°F.
- [ ] Do not allow the use of portable electric heaters.
- [ ] Schedule classes to maximize the utilization of classroom space in permanent buildings. Avoid classroom vacancies during any period of the day.

- [ ] Maintain user logs for all reproduction machines.
- [ ] Establish a window, door, and transom check at the end of each school day to insure that they are closed.
- [ ] Implement a lighting policy. Keep lights off where space is unused.
- [ ] Schedule office hours to make the most of natural daylight.
- [ ] Reduce night lighting of buildings. Replace old security lights with the sodium vapor type.
- [ ] Use portable units for support services rather than as classrooms, when possible.
- [ ] Reduce the movements of students and staff in and out of buildings.
- [ ] Close off unused storerooms, and combine storage areas.
- [ ] Centralize food preparation in the school kitchen. Eliminate office refrigerators, hot-plates and other such food preparation appliances.
- [ ] When repainting buildings, specify light, reflective colors.
- [ ] Establish a resource center for energy education in your school.
- [ ] Solicit feedback from students and staff on energy conservation.
- [ ] Inform the public, parents, and other groups about your school's energy conservation efforts.

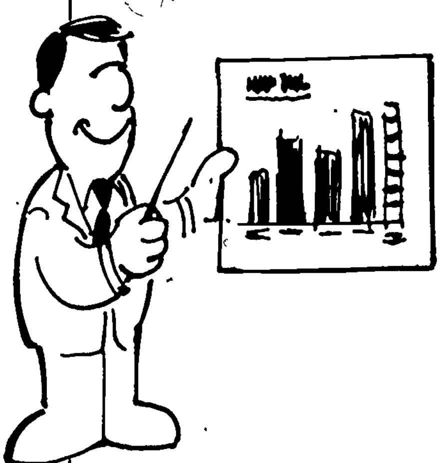


TEACHER'S CHECKLIST

- [ ] Do not block classroom air supply and return grills with furniture or displays.
- [ ] Keep classroom doors, windows, and transoms shut when heat or air conditioning is on.
- [ ] Open windows when outside temperatures are moderate and heating or air conditioning is off.
- [ ] Close and lock all windows, doors and transoms when leaving the classroom at the end of the day.
- [ ] Use natural light whenever possible. When air conditioning is on, close the draperies or shades on windows that are subject to direct sunlight.
- [ ] During winter, open drapes on south-facing and east-facing windows to take advantage of solar heat gain. Close the drapes at night to trap some of the heat (provided that this action is consistent with school policies regarding security).
- [ ] Encourage students to use both sides of their paper.
- [ ] Avoid reproducing printed materials whenever possible.
- [ ] Do not cover or adjust thermostats.
- [ ] Do report faulty thermostats and other equipment.
- [ ] Wear warm clothes in cold weather, and encourage students to do the same.
- [ ] Hold classes outdoors when weather is pleasant.
- [ ] Have an exercise period in the classroom during the heating season. This will generate heat, which will warm the room.
- [ ] Combine classes when practical, especially when using AV equipment.

BUSINESS TEACHER'S CHECKLIST

- ☐ Restrict the use of electric typewriters and office machines to class and practice periods.
- ☐ Use task lighting instead of overhead lighting, when practical.
- ☐ Keep office machines in proper working order. Machines that are out of adjustment waste energy.
- ☐ Make sure all office machines are turned off when not in use. Teach students to switch off equipment during breaks and at the end of class.



HOME ECONOMICS TEACHER'S CHECKLIST

- [ ] Reduce pre-heating of ovens. Ten minutes is usually sufficient.
- [ ] Turn off pilot lights at the gas supply valve when equipment will stand idle for an extended period of time.
- [ ] Don't open oven doors until cooking is complete. Use timers.
- [ ] Attempt to use all burners on a range top at the same time. Don't use more than one range unless necessary.
- [ ] Use the lowest setting on ovens and burners that gives satisfactory results. Glass or ceramic containers allow lower oven settings.
- [ ] Use covered pans for cooking.
- [ ] Use tea kettles instead of sauce pans for heating water.
- [ ] Always use the smallest appliance that will do the job.
- [ ] Match the pot size to the size of the range burner or element.
- [ ] Load the entire oven at one time.
- [ ] Cook several dishes in each oven.
- [ ] Don't use ovens as space heaters.
- [ ] Keep ovens and burners clean. Follow appliance manufacturers' recommendations.
- [ ] Adjust gas flames so they are blue. If flame stays yellow, call a service representative to adjust the gas-to-air ratio.
- [ ] Allow frozen foods to thaw before cooking to reduce cooking time.
- [ ] Cook vegetables by steaming, or cook a short time in a small amount of water. These techniques preserve nutritional value as well as saving energy.

- [ ] Design menus that minimize cooking and baking.
- [ ] Open refrigerators and freezers only when necessary. Keep them as full as possible.
- [ ] Check door seals on refrigerators and freezers for cracks and leaks. Have leaky seals replaced.
- [ ] Clean dust from coils on back of refrigerators.
- [ ] Report malfunctions in ovens, ranges, and refrigerators immediately.
- [ ] Use dishwashers only when full, setting the shortest possible cycle.
- [ ] Turn off all appliances and serving machines when not in use.
- [ ] Disconnect irons when not in use.
- [ ] Use range hoods only when necessary. Do not use them as supplementary ventilation.
- [ ] Conduct an energy survey of equipment to determine which units are most efficient. Maximize the use of the most efficient appliances.
- [ ] Develop a preventive maintenance schedule for all equipment.
- [ ] Use the lowest effective temperature in clothes washers. Rinse clothes in cold water.
- [ ] Clean dryer lint filters after each use.
- [ ] Dry loads consecutively whenever possible, to avoid re-heating a cold dryer.
- [ ] Include a unit on energy conservation in your curriculum. Teach students to follow these guidelines in school and encourage them to practice conservation at home.

SCIENCE TEACHER'S CHECKLIST

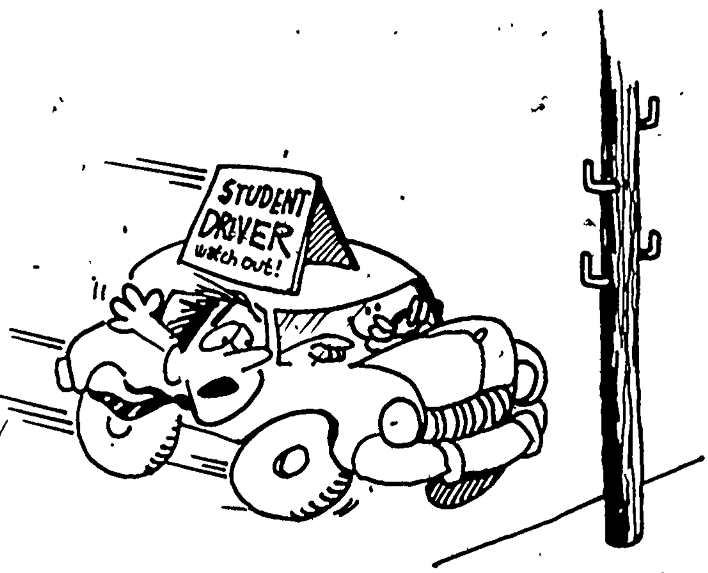
- [ ] Do not turn on equipment or burners before needed.
- [ ] Have several students share burners and other equipment.
- [ ] Avoid buying materials that require refrigerated storage.
- [ ] If you have refrigerators and freezers, make sure they are in good repair and the door seals are tight.
- [ ] Keep hot water temperatures at a minimum and wash equipment in cold water when possible.
- [ ] Avoid running water continuously.
- [ ] Report water and gas leaks immediately.
- [ ] Turn off pilot lights on unused equipment.
- [ ] Turn off lab exhaust fans when not in use. Don't use exhaust hoods for ventilation.
- [ ] Use fluorescent or natural light for terrariums, aquariums, and horticultural experiments.
- [ ] Include energy and resource conservation units in the science curriculum.

VOCATIONAL TEACHER'S CHECKLIST

- [ ] Have several students share equipment when possible.
- [ ] Plan shop projects to provide useful services, such as building maintenance and improvements.
- [ ] Make sure all equipment is off when not in use.
- [ ] Have defective equipment repaired immediately.
- [ ] Emphasize preventive maintenance. Follow manufacturers' recommendations for lubrication and maintenance. Keep cutting tools sharp.
- [ ] Do not start equipment under load.
- [ ] Do not load equipment beyond capacity.

DRIVER TRAINING TEACHER'S CHECKLIST

- [ ] Use simulators as much as possible. Limit road instruction to a minimum.
- [ ] Use the most fuel-efficient cars available.
- [ ] Teach students fuel-conserving driving and maintenance habits.
- [ ] Have several students share one car for range and road instruction.
- [ ] Take full carloads on road instruction and allow each student to drive a short distance. Have students observe each other and surrounding traffic as a learning experience.



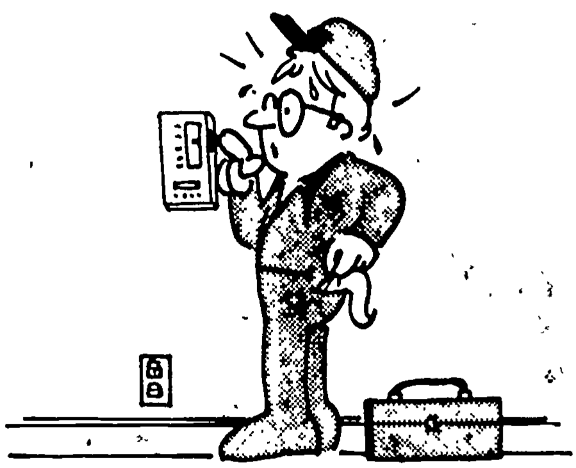
PHYSICAL EDUCATION TEACHER'S AND COACH'S CHECKLIST

- ☐ Monitor the use of showers.
- ☐ Install flow restrictors on showers.
- ☐ Reduce hot water temperatures.
- ☐ Consolidate and reduce swimming pool operating hours for heated pools, and reduce heating temperatures.
- ☐ Have class and practice sessions outdoors whenever possible.
- ☐ Limit the number of night events. Use lights only when necessary.
- ☐ Keep swimming pools covered when not in use.
- ☐ Have students supply and launder their own towels and uniforms.
- ☐ Limit the number of "away" games requiring travel.
- ☐ Shut off ventilators and lights when gym is not in use.
- ☐ Use electric scoreboards only during games.

CUSTODIAL SERVICES CHECKLIST

- [ ] Check for proper thermostat settings and function.
- [ ] Check for overheated and overcooled areas.
- [ ] When possible, turn off air conditioners 30 minutes before the end of classes, but continue to ventilate until classes end. Shut down equipment when school is not in session.
- [ ] Check all building insulation, caulking, and weatherstripping. Repair caulking and weatherstripping as necessary.
- [ ] Secure all attic and roof hatches.
- [ ] Inspect heating and air conditioning equipment periodically. Replace worn seals, fittings, traps, etc. Check ducts for leakage. Check hydronic systems for leaks and damaged valves.
- [ ] Insulate ducts and hydronic system pipes which pass through uninsulated spaces.
- [ ] Adjust dampers to reduce the number of air changes per hour to the legal minimum.
- [ ] Remove unnecessary heating and cooling units.
- [ ] Turn off power ventilators and exhaust systems when not needed.
- [ ] Isolate unoccupied spaces from heating and cooling systems.
- [ ] Keep door closers in good working condition.
- [ ] Inspect windows and doors for proper closing.
- [ ] Repair damaged windows and doors immediately.
- [ ] Turn off lights in unused spaces.

- [ ] Measure lighting levels throughout the facility. Remove unnecessary lamps and ballasts.
- [ ] Adjust security light timers to coincide with changes in sunrise and sunset.
- [ ] Keep refrigerator compressors and condensers clean.
- [ ] Inspect drinking fountains for proper operation and leaks.
- [ ] Check all plumbing for leaks.
- [ ] Reduce hot water temperatures to 105°F except in food preparation areas.
- [ ] Disconnect all unused electrical equipment.



FOOD SERVICES & CAFETERIA CHECKLIST

- [ ] Plan menus to minimize cooking, especially in warm weather.
- [ ] Keep refrigerators and freezers as full as possible.
- [ ] Consolidate baking to one day a week, whenever possible, to meet that week's needs.
- [ ] Do not open oven doors except when cooking is complete. Use timers.
- [ ] Do not use ovens as space heaters.
- [ ] Make sure appliances are completely off when not in use.
- [ ] Keep ice makers in proper working order. Servicing should be done by qualified personnel.
- [ ] Do not operate ice makers when school is not in session or during vacations.
- [ ] Use dishwashers only when full. When hand washing dishes, use a full sink or pan. Do all rinsing at one time.
- [ ] Turn on steam tables 30 minutes before use and keep them covered. Turn off steam tables and food warmers as soon as possible.
- [ ] Set refrigerators at recommended operating temperatures. Lower temperatures reduce equipment life and waste energy.
- [ ] Keep stored products away from cooling coils.
- [ ] Turn off the light when leaving walk-in refrigeration units.
- [ ] Allow hot foods to cool in shallow containers before placing them in refrigerators.
- [ ] Remove unnecessary packaging on refrigerated items. Packing retards product cooling.

- [ ] Keep a daily record of refrigerator and freezer temperatures. Report any critical variations to maintenance personnel.
- [ ] Make sure there is adequate ventilation around condensers and compressors. If air flow is restricted, equipment life is reduced and energy is wasted.
- [ ] Follow manufacturers' recommendations to defrost freezers.
- [ ] On gas ranges, adjust the flame so it is blue. A yellow-orange tip means the flame should be turned down. If you cannot get a blue flame by turning the flame down, clean the burner with a stiff, wire brush. If the flame is still too yellow, have a service representative adjust the gas-to-air mixture.
- [ ] Clean encrusted food from gas burners by soaking burners in water and a good grease solvent. Boil burners in a solution of salt, washing soda, or detergent at least twice a year.
- [ ] Keep kitchen hood filters clean.
- [ ] Keep the ovens clean to maximize heat transfer to the food. Don't forget to clean the heating elements.
- [ ] Check oven temperatures with a thermometer. Have thermostat recalibrated if necessary.
- [ ] Keep pots and pans covered when cooking.
- [ ] Adjust gas flame to just cover the bottom of the pot. Match pot and element size on electric units. On all ranges, the base of the pot should be in complete contact with the heating surface.
- [ ] When food boils, turn heat down to simmer position. More heat will not cook the food faster; it will only waste energy.
- [ ] Preheat ovens only when baking. Bake with a full oven whenever possible.

- [ ] Cook at the lowest temperature that gives satisfactory results. Slow cooking not only saves energy, it reduces meat shrinkage and preserves nutrition.

- [ ] Use exhausts and hood fans only during food preparation.

- [ ] Make sure ranges are completely off when not in use.

- [ ] Keep lights off in dining area when not in use. Heat or cool the dining area just before and during serving hours only.

Special procedures are required for convection ovens:

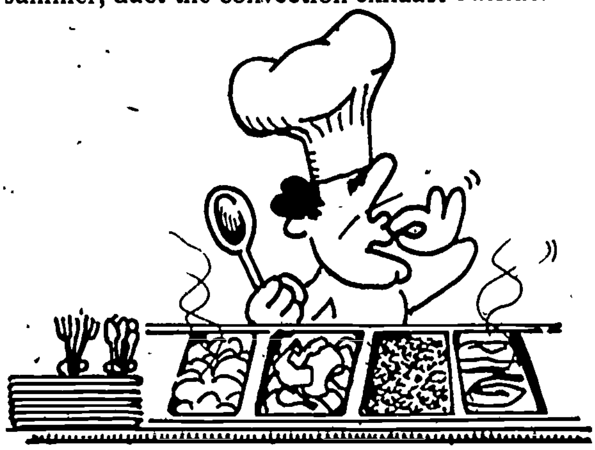
- [ ] Always use the fan when using the oven.

- [ ] Set oven time and temperature at the recommended settings. Times may be reduced after the oven has been used. When reducing the time, make sure the meal is properly heated.

- [ ] When using convection ovens, do not thaw meals, but move them quickly from the freezer to the preheated ovens. Ovens must be preheated and work most efficiently with a full load.

- [ ] Remove meals at the end of the warming period. Do not remove the foil coverings; they keep the meal warm. The students can remove the covers. Don't keep meals in the convection ovens longer than the recommended time, or over-cooking will result.

- [ ] In the summer, duct the convection exhaust outside.



TRANSPORTATION & DISTRIBUTION PERSONNEL CHECKLIST

Vehicle Maintenance

- [ ] Establish and follow a routine maintenance schedule for all vehicles. Scheduled maintenance should include:
  - [ ] Tune-up engine.
  - [ ] Check tires for wear and proper inflation.
  - [ ] Check all fluid levels, hoses and belts.
  - [ ] Check all lights and safety equipment.
  - [ ] Change engine oil and lubricate chassis.
  - [ ] Consider the use of radial tires as replacements.
  - [ ] Consider the use of gas-saving synthetic lubricants. Their higher cost is more than offset by fuel savings and longer oil change intervals. Compare with standard lubricants on a life-cycle cost basis.
  - [ ] Keep maintenance logs on each vehicle.
  - [ ] Record gasoline usage and calculate fuel economy. Identify inefficient vehicles for repair. Phase the most inefficient vehicles out of service or place them in back-up service.
  - [ ] Keep fuel supply tanks full to avoid excessive evaporation.
  - [ ] Keep fuel supplies under lock and key to curtail unauthorized dispensing. Consider the installation of a "key-card" system to control and record fuel and oil dispensing.
  - [ ] Do not heat or air condition garages or storage areas.

Vehicle Operation

- [ ] Warm up the engine by driving the vehicle slowly for the first few minutes.
- [ ] If the vehicle will stand idling for more than two minutes, shut off the engine.
- [ ] Observe all speed limits.
- [ ] Do not make courtesy stops. Pick up and discharge students at scheduled stops only.
- [ ] Do not ride the brake.
- [ ] Maintain a steady speed.

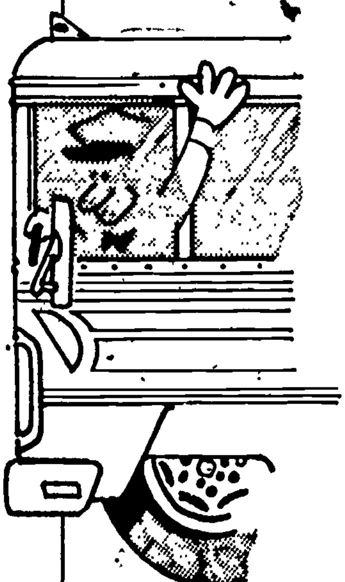
Transportation Planning

Plan bus routes so they:

- [ ] Avoid unpaved roads.
- [ ] Use the most direct route possible.
- [ ] Limit the number of stops.
- [ ] Include more right turns than left turns to reduce idling.
- [ ] Can serve more than one school.
- [ ] Use the smallest and most efficient vehicles on the longest runs if they have adequate capacity.

- [ ] Consider installing trip meters to record and control vehicle use.
- [ ] Buy the smallest, most efficient vehicles that will do the job.
- [ ] Set up satellite parking for buses. Park buses at the last school where they discharge students and shuttle drivers back to the terminal.

- [ ] Plan truck loads and regular delivery routes to reduce the mileage driven.
- [ ] Install two-way radios in buses and trucks to redirect operation when necessary. Have truck drivers call in from each location so that schedule changes may be made while they are enroute.
- [ ] Increase driver and mechanic in-service training. Include training on economical operation and maintenance of vehicles.
- [ ] Consider awards or other incentives for reducing fuel consumption.
- [ ] Consolidate field trips to utilize full buses.
- [ ] Limit the number of field trips.
- [ ] Use chartered transportation for long-distance trips.
- [ ] Eliminate bus transportation for after-school activities.



STUDENT'S CHECKLIST

- [ ] Conduct a survey to discover energy use in the classrooms and hall-ways.
- [ ] Find out what energy sources are used on the school site.
- [ ] Find out how energy use is measured with light meters and thermometers.
- [ ] Find out how to read electric and gas meters, and learn what these measurements mean.
- [ ] Identify the misuse of energy, such an unnecessary lighting, heating and cooling.
- [ ] Discuss labor saving vs. energy saving equipment.
- [ ] Identify alternative energy sources.
- [ ] Develop problem-solving activities by analyzing real or fictitious consumption figures for buildings, bus routes, and equipment.
- [ ] Participate in efforts to keep doors and windows closed and lights off when not in use.
- [ ] Dress appropriately for the season and weather.

PARENT'S CHECKLIST

- [ ] Have children dress appropriately for the weather and school conditions.
- [ ] Pack student's lunches, reducing the school kitchen load.
- [ ] Express concern to school officials for more energy conservation and education activities.
- [ ] Participate in energy conservation workshops.

CENTRAL OFFICE PERSONNEL CHECKLISTS

- [ ] Set office thermostats at 65°F in winter and 78°F in summer.
- [ ] When weather is moderate, open windows and use natural ventilation.
- [ ] Keep windows, doors, and transoms closed when heating or cooling equipment is on.
- [ ] Keep drapes closed on all windows that receive direct sunlight when air conditioning is on.
- [ ] Open drapes on south-facing windows during the heating season to use heat from the sun. Close drapes at night to retain heat.
- [ ] Turn lights off when not in use.
- [ ] Do not use portable electric heaters unless the use of one or two of them allows a large unit to be shut down.
- [ ] Wear clothing appropriate for the season and weather.
- [ ] Shut off electric office equipment when not in use.
- [ ] Reduce inter-school travel by using the telephone. Review travel activities to identify opportunities to consolidate trips.
- [ ] Combine instructional and support functions in fewer buildings.
- [ ] Review building and space utilization at all district schools. Consider relocation of support staff and changing attendance assignments to maximize building use. Close buildings and rooms that are not needed, starting with portables and older, inefficient buildings.
- [ ] Prepare energy and resource conservation bulletins for schools.
- [ ] Establish a district-wide energy monitoring program to measure energy use.

- [ ] Use energy-saving specifications when considering any new equipment. Evaluate large equipment purchases by life-cycle costing.
- [ ] Upgrade insulation and equipment in older buildings.
- [ ] Establish in-service training programs in energy conservation for all levels of staff.
- [ ] Monitor the use of reproduction machines with written logs. Consider the use of auditrons to control copier usage.

APPENDIX C

ENERGY AUDIT FORM

TEMPERATURE MEASUREMENT

DATA SHEET

CHECK ONE: [ ] HEATING [ ] COOLING

Room No. Or Location	Average Dry Bulb Temperature (°F)	Average Wet Bulb Temperature (°F)	Percent Relative Humidity	Thermostat Setting	Thermostat Reading

AVERAGES	(°F)	(°F)	(%)

LIGHTING

DATA SHEET

Room No. Or Location	Activity	Type of Lighting*	Average Measured Light Levels (ft-c)			Recommended Light Levels/Notes
			Lights On (Daytime)	Lights Off (Daytime)	Lights On (Night)	

*I - Incandescent
F - Fluorescent
M-V - Mercury Vapor
S-V - Sodium Vapor
M-H - Metal Halide
TL - Task Lighting

A. BUILDING ENVELOPE

1. HEAT TRANSMISSION

CHECKPOINT

Has the building insulation been checked?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Inspect insulation in roof, ceiling and walls. Make insulation corrections on the basis of an expert technical analysis.

CAPITAL EXPENSE

- Make sure roof insulation is adequate. Add roof insulation, or insulate the ceiling and install a vapor barrier.
- Insulate all exterior walls and walls adjoining unheated spaces if practicable.
- Upgrade or install insulation under floors above unconditioned spaces.
- Use insulated metal doors as replacements for exterior doors.
- Add roof deck insulation, especially on older buildings.

CHECKPOINT

Have drapes and shading devices been installed and used?

Yes [ ]   No [ ]

Notes: ______________________

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CORRECTIONS

LOW-COST/NO-COST

- Keep drapes and shades in good repair. The use of shading devices can cut transmission through windows by 50%.
- Keep shading devices closed during hours of direct sunlight when A/C is on.
- Keep shading devices closed at night.
- Install opaque or translucent shading materials on unused windows.

CAPITAL EXPENSE

- Consider installing reflective or heat absorbing film on windows.
- These films can reduce solar heat gain by as much as 80%, but they also reduce light transmission.
- Line drapes with reflective material to reflect solar heat when drapes are shut.
- Install light-colored indoor shading devices.
- Install outdoor shading devices, such as louvers, sun shades or solar screens, to reflect heat before it enters the building.
- When reglazing, consider double glazing or insulated glass.

CHECKPOINT

Were the grounds landscaped with energy efficiency in mind?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS
LOW-COST/NO-COST

- Plant trees to provide shade in summer, sun in winter.
- Plant evergreens to provide windbreaks where necessary.

2. VENTILATION

CHECKPOINT

Have mechanical ventilation systems been inspected recently. Has routine maintenance been performed?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS
LOW-COST/NO-COST

- Limit outside air supply to properly balance the system.
- Inspect, adjust, or repair outside air dampers.
- Reduce exhaust air quantities.
- Close the outside air dampers during the first and last half hour of occupancy.
- Close dampers on exhaust vents when unit is off.
- Shut down mechanical systems when the building will be closed for an extended period.
- Regulate restroom exhaust fans by wiring them to the light switches.
- Adjust air dampers to proportion air intake to occupant loads.
- Consider cutting off outside air to restroom and other odorous areas; instead, allow air to migrate from other areas and be exhausted.
- Inspect and replace filters on a regular basis.

CHECKPOINT

Is natural ventilation used to the maximum practical extent?

Yes [ ] No [ ]

Notes: ______________________

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CORRECTIONS
LOW-COST/NO-COST

- Open windows to use natural air movement when building design and weather permits.
- Open interior doors, if necessary to take advantage of natural ventilation.
- Supplement air movement with fans in order to remove heat.

3. INFILTRATION

CHECKPOINT

Have all doors been inspected recently?

Yes [ ] No [ ]

Notes: ______________________

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CORRECTIONS
LOW-COST/NO-COST

- Replace worn or broken weather-strips.
- Rehang misaligned doors.
- Caulk or recaulk around door frames.
- Inspect automatic door closers.
- Install signs next to doors to remind occupants to keep doors closed.
- Direct all personnel to keep doors closed.

CHECKPOINT

Have exterior surfaces been inspected for cracks and open joints?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Caulk, gasket or weatherstrip all exterior joints, such as those between walls and foundation, roof, and wall panels.
- Caulk or seal all openings provided for pipes, conduits, air louvers, outside cooling units, etc.
- Cover all window and through-the-wall units when not in use. Fitted covers are available at low cost.
- Repaint or clean exterior walls and roof to improve reflective characteristics.

CAPITAL EXPENSE

- Consider building vestibule or air-lock type entrances.
- Consider installing economizer enthalpy controls on air handling units to minimize cooling energy requirements by using the proper amounts of outside and return air.

CHECKPOINT

Have windows and skylights been inspected recently?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Replace broken or cracked window panes.
- Replace worn or broken weather strips.
- Caulk or recaulk around window frames.
- Rehang misaligned windows.
- Make sure that all operable windows have sealing gaskets and latches.
- Install signs beside operable windows to remind occupants to close them.

B. HVAC

1. OPERATING PRACTICES

CHECKPOINT

Is the heat and air conditioning operated in an energy-efficient manner?

Yes [ ]   No [ ]

Notes: ______________________

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CORRECTIONS
LOW-COST/NO-COST

- Observe proper thermostat settings, including nighttime setback.
- Do not cool the building below 78°F.
- Isolate storage areas from occupied areas. Do not heat or cool storage areas unless temperature-sensitive materials are present.
- Shut off heating and cooling in garages, docks, and platforms.
- During the cooling season, flush the building with cool night breezes.
- Close supply registers, turn down thermostats, and turn off heaters in corridors and lobbies.

CAPITAL EXPENSE

- Adjust and balance system to eliminate over-cooling and over-heating. Contributing causes include poor zoning, poor distribution, improper location and controls, or improper control. Retain a qualified expert to direct this action.

CHECKPOINT

Do other practices interfere or aid efficient operation?

Yes [ ]   No [ ]

Notes: ______________________

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CORRECTIONS
LOW-COST/NO-COST

- Avoid the use of portable heaters, except when their use allows a larger system to be shut down.
- In mild weather, use fans to move air for a cooling effect.
- Turn off non-critical exhaust fans.
- Wear clothing appropriate for the season and weather.
- Reduce internal heat generation as much as possible during the cooling season. Some sources of heat are people, lights, appliances, and machinery.

CHECKPOINT
Are HVAC operating hours observed?

Yes [ ]   No [ ]

Notes: ________________

CORRECTIONS
LOW-COST/NO-COST

- Preheat building so that the temperature reaches 65°F by the time occupants arrive. Complete warm up during the first half hour of occupancy.
- Turn off heat during the last half hour of occupancy.
- When building is not occupied, shut down all mechanical cooling, except when required to maintain environmentally sensitive equipment, such as computers.
- Begin pre-cooling so that the interior temperature is 5°F below the outside air temperature, but not below 80°F, by the time occupants arrive. Complete cool down during the first hour of occupancy.
- Consider closing outside air dampers when air handling is off.
- Develop after-hours checklists for custodial staff and other after-hours personnel.
- Schedule maintenance work during daylight hours if possible.

2. MAINTENANCE MODIFICATIONS

PUMPS

CHECKPOINT	CORRECTIONS LOW-COST/NO-COST
Do all pumps operate properly, with no leaks? Yes [ ] No [ ] Notes: ________________	• Check packing for wear that causes leakage. Repack as necessary. • Inspect bearings, repair or replace as necessary. • Keep bearing lubricated in accordance with pump manufacturer's recommendations. • Inspect drive belts and adjust for proper tension. • Adjust pump output to maximum load requirement.

MOTORS

CHECKPOINT	CORRECTIONS LOW-COST/NO-COST
Do all motors function properly and efficiently? Yes [ ] No [ ] Notes: ________________	• Check and correct alignment between the motor and driven equipment. • Check wiring connections. • Keep motors clean. • Eliminate excessive vibration. • Follow manufacturer's lubrication recommendations. • Replace worn bearings. • Inspect and adjust tension on drive belts and pulleys. • Investigate and correct causes of overheating. • Balance three-phase power sources to motors. • Check for over voltage or low voltage and correct.

FANS

CHECKPOINT

Do all fans operate properly?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS LOW-COST/NO-COST

- Check for excessive noise and vibration.
- Keep fan blades clean.
- Inspect and lubricate bearings as required.
- Inspect and adjust tension on all drive belts.
- Keep inlet and discharge screens on fans clean.
- Inspect fans for proper rotation.

AIR HANDLING EQUIPMENT

CHECKPOINT

Is all duct work tight, well insulated, and functioning properly?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS LOW-COST/NO-COST

- Seal leaks with tape or caulk.
- Inspect insulation. Repair or replace as necessary.
- Inspect for blockages, such as malfunctioning dampers, and correct.
- Inspect air duct valves in junction boxes for leakage. Repair or replace as necessary.
- Clean and replace air filters as needed.
- Inspect damper blades and linkages for proper operation. Repair and adjust as necessary. Clean and lubricate on a regular basis.

CHECKPOINT

Do dehumidifiers, heating coils, cooling coils, etc. work properly? Are they cleaned on a regular basis?

Yes [ ] No [ ]

Notes: ______________________

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CORRECTIONS
LOW-COST/NO-COST

- Clean coils.
- Inspect electronic air cleaners on a regular basis and maintain them in accordance with manufacturer's recommendations. If excessive accumulations are found on the ionizing and grounding plate section, the filter should be replaced.
- Adjust fans and dampers for proper operation.
- Inspect for leakage around coils and out of casings. Repair as necessary.
- Inspect air inlet and outlet grills. They should be kept clear of dirt, debris, and obstructions.
- Inspect air washers and evaporative cooling units for proper operation. Clean damper blades and nozzles as necessary.
- Follow guidelines for fan maintenance.

REFRIGERATION EQUIPMENT

CHECKPOINT

Are all refrigeration controls and indicators normal?

Yes [ ]   No [ ]

Notes: ______________________

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CORRECTIONS LOW-COST/NO-COST

- If bubbles are seen in the sight glass, the system is low on refrigerant. Add refrigerant and inspect system for leaks.
- Use a leak detector to check for refrigerant and oil leaks. Repair as necessary.
- Inspect liquid line leaving the strainer. If it is cooler than the line entering the strainer, it is blocked. Clean out lines if required.
- Listen to the system in operation. Unusual sounds usually indicate a malfunction. Repair as required.
- Check all gauges for normal operating pressures and temperatures. Adjust and repair as necessary. Increased system pressures may be caused by dirty condensers. High discharge temperatures may indicate faulty compressor valves.
- Inspect tension and alignment of all belts and pulleys.
- Lubricate motor bearings and other moving parts in accordance with the manufacturer's recommendations.
- Inspect insulation in liquid and suction lines. Repair and replace as necessary.

CHECKPOINT

Have gas and suction lines on refrigeration equipment been inspected for leaks?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS
LOW-COST/NO-COST

- Check for refrigerant leaks. Repair as necessary.
- Check moisture-liquid indicator. Have system repaired if moisture is present.
- Check refrigerant level. Add refrigerant as necessary.
- Check lines. Open clogged lines.
- Listen for unusual noise. Correct any problems.
- Check gauges for abnormal temperature or pressure. Correct.
- Inspect insulation on liquid and suction lines. Repair or replace as necessary.

CHECKPOINT

Does the evaporative condenser operate properly? Is it given proper maintenance?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS
LOW-COST/NO-COST

- Inspect piping joints, and seal leaks.
- Remove dirt from the coil surface.
- Inspect and clean inlet screen, spray nozzles, water distribution holes, and pump screen.
- If mineral deposits are left on the coil, have water treated.
- Follow guidelines for fan and pump maintenance.

CHECKPOINT

Does the water-cooled condenser operate properly? Is it given proper maintenance?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Clean condenser shell and tubes with a brush and clean water.
- Chemical cleaning, if necessary, should be accomplished by qualified personnel only after consultation with a local water treatment company.
- Check back pressure.

CHECKPOINT

Does the compressor operate normally, with no leaks?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Observe compressor operation. Continuous running or frequent stops and starts indicate inefficient operation. Correct the cause(s).
- Listen for excessive noise. Check mounting drive coupling and bearings.
- Check compressor joints for leakage. Seal as necessary.
- Inspect purge valve for air and water leaks. Seal as necessary.
- Inspect indicators for normal readings.

CHECKPOINT

Does the air-cooled condenser operate properly? Is it given proper maintenance?

Yes [ ] No [ ]

Notes: ______________________

CORRECTIONS
LOW-COST/NO-COST

Keep fan belt drive and motor properly aligned, and lubricated.

Keep refrigeration pipe fittings on the condenser coil tight. Seal any leaks.

Keep condenser coil face clean to permit proper air flow.

Determine if hot air is being bypassed from the fan outlet to the coil inlet. If so, correct the problem.

CHECKPOINT

Are cooling towers properly maintained?

Yes [ ] No [ ]

Notes: ______________________

CORRECTIONS
LOW-COST/NO-COST

Chemically treat water to maintain solids at an acceptable level.

Check overflow pipe clearance for proper water level.

Inspect fan, motor, and drive belts for proper alignment and tension.

Lubricate fan and motor as required.

Follow guidelines for fan and motor maintenance.

Keep the tower clean.

Clean the intake strainer.

If there is air bypass for tower outlet back to the inlet, baffles should be added or the discharge stakes should be made higher.

Inspect the spray nozzles. Clean as necessary.

Inspect gravity feed towers for even water depth in distribution basins.

Monitor the effectiveness of the water treatment program.

CHECKPOINT

Do chillers receive proper maintenance?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS
LOW-COST/NO-COST

- Inspect and clean strainer and seal tank on a regular basis.
- Inspect for evidence of clogging.
- Chillers should be serviced by qualified mechanics in accordance with manufacturer's recommendations.

CHECKPOINT

Does absorption equipment receive proper maintenance?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS
LOW-COST/NO-COST

- Inspect and clean strainer and seal tank on a regular basis.
- Lubricate flow valves on a regular basis.
- Follow manufacturer's recommendations for proper maintenance.

CHECKPOINT

Do all through-the-wall and window units operate properly? Do they receive proper maintenance?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Inspect and clean evaporator and condenser coils on a regular basis.
- Clean air intake louvers, filters, and controls often. Replace filters on a regular basis.
- Caulk around openings between the unit and the wall or window.
- Check for proper supply voltage and current. Full input requirements must be met to insure efficient operation.
- Maintain individual components in accordance with applicable guidelines and manufacturer's recommendations.

HEATING EQUIPMENT

CHECKPOINT

Are boilers in good working order and receiving proper maintenance?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Periodically inspect boilers for scale deposits. The rear portion of the boiler is most susceptible to scale buildup which can greatly reduce boiler efficiency. Heavy scale buildup can damage the boiler and other equipment.
- Inspect the furnace and tubes for deposits of soot, ash and slag. The refactory surface on the boiler should also be inspected. Soot

decreases heat transfer and lowers efficiency. Heavy soot buildup over a short period of time indicates a poor fuel-air mixture. Clean soot away and adjust fuel/air ratio as required.

- Monitor vent outlet temperature. Unusually high temperature indicates clogged tubes, which should be cleaned.
- Clean mineral deposits or corrosion from gas burners.
- Inspect oil strainers on a regular basis. Replace dirty strainers.
- Inspect oil nozzles or cups on a regular basis. Clean if necessary.
- Treat water to minimize scaling.
- Inspect boiler insulation, refractory masonry, and the boiler casing for hot spots and air leaks. Repair and seal as necessary.

CHECKPOINT

Are boiler controls set properly and in good operating condition?

Yes [ ]   No [ ]

Notes: ______________________

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CORRECTIONS LOW-COST/NO-COST

- If stacks are not free of haze, burner adjustment may be necessary.
- Inspect control linkages for tightness. Adjust to eliminate slippage or jerky movement.
- Set aquastats at 100°F during shut-down.
- Replace obsolete or seldom used pressure vessels.
- Install insulation on all units not already well insulated.
- Check and repair oil leaks at all valves and fittings.

- Inspect oil pre-heaters to insure that oil temperatures are maintained in accordance with manufacturer's or oil supplier's recommendations.
- Inspect coal-fired stokers, grates and controls for efficient operation. Unburned coal in the ash indicates incomplete combustion.
- Inspect contacts and relays.
- Inspect heating elements on a regular basis. Replace as necessary.
- Check controls for proper operation and calibration. Adjust as necessary.
- Turn off pilot lights during non-heating seasons and when building will not be occupied for long periods.

CORRECTIONS
LOW-COST/NO-COST

- Review operating procedures when more than one boiler is involved. It is more efficient to use one boiler instead of two at half capacity, because the more units used, the greater the heat loss.
- Monitor temperature and pressure readings on a daily basis. Maintain a log, so that normal levels can be established and unusual conditions can be detected and corrected. The firing rate should also be noted.
- Make sure that the fire is extinguished immediately when the unit shuts down. If the fire continues to burn, even briefly, fuel will be wasted. Repair or replace solenoid valve to correct the problem.

CHECKPOINT

Are correct boiler operating procedures followed:

Yes [ ]   No [ ]

Notes: ____________________

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- Check burner firing period for compliance with specifications. If the firing period is out of spec, the controls are faulty or need adjustment.

CHECKPOINT

Has the boiler stack output been analyzed?

Yes [ ]   No [ ]

Notes: ____________________

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CORRECTIONS
LOW-COST/NO-COST

- Check boiler stack temperature. It should not be more than 150°F higher than the steam temperature. If the stack temperature is excessive, adjustment of the fuel burner and/or tube cleaning is indicated.
- Flue gas analysis should be performed on a regular basis. Check levels of oxygen, carbon monoxide and carbon dioxide. Oxygen concentration should be no more than 1 or 2 percent. There should be no carbon monoxide present. CO_2 concentration should be 9-10% for gas-fired units, 11.5-12.8% in units using No. 2 oil, and 13-13.8% units using No. 16 oil.
- Maintain the lowest possible steam pressures for supplying the radiators.

CHECKPOINT

Are furnaces and other heaters cleaned and maintained on a regular basis? Do all units function properly?

Yes [ ]   No [ ]

Notes: ____________________

CORRECTIONS
LOW-COST/NO-COST

- Clean heat exchanger surfaces on a regular basis.
- Check and adjust air-fuel mixture on a regular basis.
- Inspect burner couplings and linkages for proper fit. Repair as necessary.
- Inspect casing for air leaks. Seal all leaks.
- Inspect and keep any insulation in good repair.
- Follow guidelines for fan and motor maintenance.

CHECKPOINT

Are radiators, convectors, baseboard, and finned tube units operated and maintained for efficient operation?

Yes [ ]   No [ ]

Notes: ____________________

CORRECTIONS
LOW-COST/NO-COST

- Move all obstructions from around units. Air flow is essential for efficient heat exchange.
- Make sure that hot air is vented away from hydronic units.
- Keep heat transfer surfaces clean.

CHECKPOINT

Are all electric heaters functioning properly? Are units inspected and cleaned on a regular basis?

Yes [ ]   No [ ]

Notes: ____________________

CORRECTIONS
LOW-COST/NO-COST

- Keep heat transfer surfaces clean and unobstructed.
- Keep obstructions away from units to allow proper air flow.
- Inspect fans, heating elements, and controls on a regular basis. Repair and replace as necessary.
- Check reflectors on infra-red heating units for proper beam direction and reflectance. Clean reflectors on a regular basis.
- Check for proper operating voltage. Consult manufacturer's literature.

CHECKPOINT

Are hot and chilled water distribution systems checked on a regular basis?

Yes [ ]   No [ ]

Notes: ____________________

CORRECTIONS
LOW-COST/NO-COST

- Inspect and test controls for proper operation. Adjust, repair, or replace as necessary.
- Inspect fittings and valves for leaks. Seal all leaks.
- Check in-line instrumentation for accuracy and adjust as required.
- Inspect pipe insulation. Replace any worn or damaged insulation after repairing any leaks.
- Inspect and clean strainers on a regular basis.
- Inspect heat exchangers. If a large temperature difference is noted, it may indicate problems. Repair any causes.
- Inspect and clean vents on a regular basis.

CHECKPOINT

Are pneumatic compressors inspected and maintained properly?

Yes [ ]   No [ ]

Notes: ______________________

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CORRECTIONS
LOW-COST/NO-COST

- Inspect fittings and connections for air leaks. Seal any leaks.
- Observe compressor operation. Correct the cause(s) of unusual operation. If the compressor seems to run excessively, there may be a pressure loss in the tank, controls or fittings.
- Inspect air pressure in supply tank and supply line pressure regulators for proper limits. Consult manufacturer's literature.
- Check belt tension and alignment.
- Periodically inspect filters and replace as necessary.
- Maintain motor in accordance with manufacturer's recommendation.

CHECKPOINT

Are heat pumps maintained and operated in an efficient manner?

Yes [ ]   No [ ]

Notes: ______________________

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CORRECTIONS
LOW-COST/NO-COST

- Keep air supply and return registers unobstructed.
- Check accuracy of thermostats and recalibrate as necessary.
- Replace filters on a regular basis.
- Follow manufacturer's recommendations for maintenance.
- Inspect ducts for air leaks. Seal leaks with tape or caulk.
- Inspect compressor and refrigerant lines for leaks. Seal all leaks.

CHECKPOINT

Are all steam pipes and distribution controls in proper working order?

Yes [ ] No [ ]

Notes: ______________________

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CHECKPOINT

Have all steam traps been inspected?

Yes [ ] No [ ]

Notes: ______________________

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CORRECTIONS
LOW-COST/NO-COST

- Inspect insulation on piping and other distribution components. Repair and replace as necessary.
- Check automatic temperature controls and other controls to insure that the system is properly regulated to meet heating needs.
- Inspect zone shut-off valves so that steam will not go to unoccupied areas.
- Inspect all valves and fittings. Repair all leaks.

CORRECTIONS
LOW-COST/NO-COST

- Inspect steam traps for proper operation. Trap failure can cause a marked loss in system efficiency. Several tests can be used to check traps:
  * Listen to trap to determine if it opens and closes when it should.
  * Feel the trap on the down stream side. If it is excessively hot, it is passing steam, which can be caused by dirt, excessive steam pressure, or a malfunctioning trap valve. If it is moderately hot, it is passing condensate, and is functioning properly. If it is cold, it is not functioning at all.
  * Check for back pressure on downstream side.
  * Check temperature of return lines with a surface pyrometer, by measuring temperature drop across the trap. Lack of temperature drop indicates steam blow-by.

CHECKPOINT

Have all energy-using equipment and controls been located?

Yes [ ] No [ ]

Notes: ______________________

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CORRECTIONS
LOW-COST/NO-COST

- Note the location of all equipment and controls.
- Locate all environmentally sensitive equipment in a common area if practicable.

C. HOT AND CHILLED WATER

CHECKPOINT

Are hot water temperatures correctly regulated?

Yes [ ]   No [ ]

Notes: ____________________

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CORRECTIONS LOW-COST/NO-COST

- Check settings on water heaters.
- Add a cycling timer to electric water heaters to regulate use in accordance with demand.
- If hot water is circulated by a pump, turn pump off when hot water is not needed.
- Regulate water temperature according to use—105°F for hand washing and bathing—140°F for dishwashing.

CHECKPOINT

Are energy and water conservation practices observed?

Yes [ ]   No [ ]

Notes: ____________________

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CORRECTIONS LOW-COST/NO-COST

- Place flow restrictors in shower heads and hot water faucets.
- Inspect all pipes, fittings, faucets, and connectors. Repair any leaks.
- Inspect all hot water regulators and controls. Repair and replace as necessary.
- All hot water tanks and pipes should be insulated, especially if they are in unheated, uninsulated space. Add or repair insulation as necessary.
- Replace existing hot water faucets with spray type or flow restricting faucets. Consider installing spring-handled hot water taps.
- Deactivate water heaters, including the pilot lights, when they are not needed for an extended period.
- Disconnect refrigeration on water coolers.

- Discontinue treatment of drinking water if possible.

CAPITAL EXPENSE

- Relocate water heaters so they are adjacent to the point of use.
- Consider installing a water heat recovery system on the air conditioner.

CHECKPOINT

Have all tanks, pipes and fittings been inspected?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Inspect for leaks. Repair as necessary.
- Inspect insulation on tanks and exposed pipes. Repair or add insulation as required.
- Inspect and test controls for proper operation. Adjust, repair or replace as necessary.
- Check in-line instruments for accuracy. Adjust, repair or replace as necessary.
- Inspect and clean strainers on a regular basis.
- Inspect heat exchangers. If a large temperature difference is noted, it may indicate air binding, clogged strainers, or scale buildup. Determine cause(s) and correct.
- Inspect and clean vents on a regular basis. Clogged vents restrict air elimination, reducing system efficiency.

D. LIGHTING

1. PATTERN OF USE MODIFICATIONS

CHECKPOINT

Is artifical lighting used in an efficient manner?

Yes [ ]   No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Use natural light to the maximum practicable extent.
- Place "lights off" signs near switches.
- Keep windows and skylights clean to maximize light transmission.
- Establish a lighting usage program which includes a lighting schedule corresponding to occupancy patterns. Use only the number of lights necessary and make sure that the lights are off when not in use.
- Move desks closer to sources of natural light. Group desks so that they can take advantage of natural light and luminaires. It is cheaper to move desks than it is to move lights.
- Arrange work so that sidewall daylight crosses at right angles.

2. LUMINAIRE MAINTENANCE

CHECKPOINT

Are lamps and fixtures selected and maintained for energy efficiency?

Yes [ ]   No [ ]

Notes: ____________________

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CORRECTIONS

LOW-COST/NO-COST

- Use lower voltage lamps as replacement when light output is acceptable. For example, a 35-watt fluorescent lamp uses 20% less energy than a 40-watt lamp.
- Keep lamps and reflective surfaces clean.
- Clean walls and ceilings on a regular basis.
- Remove unnecessary lamps and ballasts.
- Replace defective ballasts with the high efficiency type.
- Avoid using "long-life" bulbs. They are not efficient.
- Clean lenses and shielding in fixtures.
- Keep windows clean to maximize light transmission.

CAPITAL EXPENSE

- Repaint walls with light, reflective colors.
- Replace light fixtures with more efficient units.
- Install automatic lighting controls.
- Install dimmers in classrooms.

3. ILLUMINATION LEVELS

CHECKPOINT

Are lighting levels maintained that are appropriate for the task and energy efficiency?

Yes [ ]   No [ ]

Notes: ______________________

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CORRECTIONS

LOW-COST/NO-COST

- Using a light meter, adjust lighting levels by removing lamps and fixtures as required. Use dimmers where installed.

CAPITAL EXPENSE

- Replace old fixtures with more efficient types.
- Replace lamps where they are operating at 70% of their original output, as measured by a light meter.
- Add switches and timers, or photo cells, to provide greater control over lighting.
- Repaint walls using light, reflective colors.

E. FACILITY UTILIZATION

1. SCHEDULING

CHECKPOINT

Is facility use planned for maximum efficency?

Yes [ ]   No [ ]

Notes: ____________________

CORRECTIONS
LOW-COST/NO-COSTS

- Schedule cleaning and maintenance activities during daylight hours, whenever possible.
- Consolidate activities to reduce building usage.
- When rescheduling is not possible, use lights and equipment only in areas where personnel are working.
- Reduce thermostat settings to 50° F during the heating season, when the building is unoccupied.
- Turn off all air conditioning units whenever the building is unoccupied.

CHECKPOINT

Has the interior space of the facility been evaluated and adjusted from the perspective of energy use?

Yes [ ]   No [ ]

Notes: ____________________

CORRECTIONS
LOW-COST/NO-COST

- Adjust schedules so rooms are in continuous use.
- Eliminate tasks and instructional elements that consume excessive amounts of energy.
- Turn off heating and cooling system, or turn off registers in unoccupied areas if nothing in that space will be adversely affected.
- Evaluate instructional programs and schedule room use to reduce energy consumption.
- Examine the tasks and instructional elements of curriculum programs, and incorporate energy lessons.
- Reduce heating and cooling demands of unoccupied areas with appropriate control systems.

2. OCCUPANT HABITS

CHECKPOINT

Have all personnel been instructed to implement specific conservation measures?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS
LOW-COST/NO-COST

- Instruct staff about specific conservation measures by distributing checklists. (See Appendix C.)
- Post thermostat temperature setting reminders.
- Instruct staff to keep windows and doors closed while heat or air conditioning is on.

CHECKPOINT

Are all personnel aware of the importance of conserving energy?

Yes [ ] No [ ]

Notes: ____________________

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CORRECTIONS
LOW-COST/NO-COST

- Offer in-service training to instruct personnel about the importance of conserving energy.
- Use placards and signs to remind personnel about conservation techniques.
- Keep the building occupants informed about the energy conservation guidelines.
- Institute a preventive maintenance training program.

APPENDIX D:

RECOMMENDED EMERGENCY CONTINGENCY MEASURES

RECOMMENDED EMERGENCY PROCEDURES

If an energy emergency is declared, every school district should consider the following actions. Some of these actions require suspension of State Board Regulations, Florida Statutes, or Federal Regulations. Proper authority must be granted before these actions can be implemented.

Stage I - Moderate Energy Emergency

Facilities

- Serve cold lunches and breakfasts only.
- Avoid serving site-prepared lunches.
- Limit all extracurricular air-conditioned, heated, lighted events.
- Total shutdown on evenings, weekends, and holidays when unoccupied, except for freeze protection.
- Turn on air-conditioning one half hour after beginning of school and off one half hour before closing, if the temperature is above 80°.
- Set thermostats at 78-80°F for cooling; 65-80°F for heating.
- Reduce lighting to 50 foot candles in all areas.
- Eliminate hot water showers.
- Reduce (mechanical) outside air ventilation to 4 cfm.

Transportation

- Eliminate transportation of less than 2 miles.
- Eliminate non-instructional transported field trips.
- Limit transported instructional field trips.
- Limit all out-of-town extracurricular activities in districts with five or more schools.

- Transport students to the nearest appropriate school center.
- Increase distances between bus stops.
- Restrict out-of-county travel and curtail in-county travel.
- Transport school personnel on school buses on a space-available basis.

Calendar and Instruction

- Restrict driver's education to classroom training.
- Establish a plan for 4-day school week with extended hours.
- Waive 180-day rule for a 300 minute day and plan for a 250 minute day (hold FTE harmless).
- Consolidate programs in central centers.
- Curtail adult and community education classes to points where energy efficiency is a criterion and limit summer and adult school to compensatory, promotions programs.
- Schedule vacations so entire buildings can be closed. Schedule closings during periods of high energy need.
- Provide in-service energy emergency training for school staff.
- Place greater emphasis on energy conservation in the instructional program.

Stage II - Serious Energy Emergency

Facilities

- Reduce lighting to 30 foot candles or less.
- Reduce mechanical ventilation to 3 cfm.
- Eliminate air conditioning in schools with operational windows.

Transportation

- Suspend court-ordered busing for desegration.
- ~~Eliminate all transported field trips.~~
- Establish a minimum load per unit based on fuel efficiency.
- Establish a ride-sharing program for students, parents and faculty.

Calendar and Instruction

- Declare a 4-day school week.
- Reduce instructional day to 250 minutes.
- Eliminate adult and community school programs.
- Eliminate energy-intensive programs.
- Establish comprehensive high schools.
- Centralize in-service programs. Use ITV and group leaders.
- Establish a "hold harmless" on all FTE funding.

Guidelines for Building Shutdown

- Locate all mechanical, gas, oil, and electric equipment and appliances. Disconnect all electric items and make sure pilot lights are extinguished on gas and oil burners.
- Prepare all equipment and appliances for storage in accordance with manufacturer's recommendations.
- Insure that all items have been removed from refrigerators and freezers. If some items in laboratory refrigerators can not be moved safely, consider disposal, following proper procedures.
- Remove water from all water-carrying systems, including radiators on standby generators and other equipment if freeze protection has not been provided.

- Close and secure all windows and doors.
- Disconnect all emergency lights so that they will not burn needlessly and deplete their battery charge.
- Throw main power switches off.
- Place any remaining fuel supplies (oil and bottled gas) under lock and key. Consider removing all remaining supplies to a central location to prevent loss.

APPENDIX E:

REFERENCES

- *ASHRAE Handbook of Fundamentals, 1972.* New York: American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., 1974.

  This handbook explains the function and design of all types of HVAC systems. It includes information that will be helpful when testing, balancing, and maintaining HVAC systems.

  Available from the Florida State Library: Call number 697 AME.

- Baron, Stephen L., P.E., Ed. *Manual of Energy Saving in Existing Buildings and Plants, Vol. 1. Facility Operation and Maintenance.* Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1979.

  This book explains the energy management process in the industrial setting. Many of the operating procedures covered in this book are applicable to schools because the energy-using-systems are often identical to those installed in industrial or commercial facilities.

  Available from the Florida State University Library: Call number TJ1635 B84 B37.

- Dervin, Ronald and Carol Nicols, *How to Cut Your Energy Bills.* Farmington, Michigan: Structures Publishing Company, 1979.

  This little book is oriented toward the homeowner. But many of the suggestions contained in it are very useful in the school setting. Many of them have been included in this handbook.

  Available from the Florida State Library: Call number 644 DER.

- Dubin, Fred S. and Chalmers G. Long, Jr., *Energy Conservation Standards.* New York: McGraw-Hill, 1978.

  This work discusses various standards in the area of building design, climate control and lighting as they relate to energy conservation. It may be reviewed before evaluating plans for new construction or remodeling projects.

  Available from the Florida State University Library: Call number TJ163.5 B84 D79.

- Dumas, Lloyd J., *The Conservation Response.* New York: D.C. Heath and Co., 1976.

  This book examines the conservation response, e.g., the ways in which institutions, including government and industry, must respond to energy shortages and environmental crises. It would make excellent reading for advanced high school social studies classes..

  Available from the Florida State Library: Call number 621 DUM.

- Haines, Yacov Y., ed. *Energy Auditing and Conservation.* Washington, D.C.: Hemisphere Publishing Corporation, 1980.

  This book describes the energy auditing process. It may be reviewed by the members of the energy audit teams so that they may better understand the method and goals of an Energy Audit.

  Available from the Florida State University Library: Call number TJ163.5 V6 N36, 1979.

- *Here Comes The Sun, 1981.* Boulder, Colorado: Joint Venture, Inc., 1975.

  This little book examines a series of very innovative solar designs conceived by a group of architects and visionaries. It makes interesting reading. It should be of interest to high school art and architecture teachers and students.

  Available from the Florida State University Library: Call number TH7413 J64, 1975.

- Jones, Philip G. "...To Help Your School Cope With The Energy Crisis", *The American School Board,* Vol. 161, No. 1 (January 1974), p. 30.

  This article points out the need for schools to take steps to cope with the energy crisis. When this article was written, energy management was a brand new concept, but it still indicates the necessity of planning and management to cope with energy shortages.

- Landsberg, Dennis R. and Ronald Stuart. *Improving Energy Efficiency in Buildings.* Albany: State University of New York Press, 1980.

  This book describes strategies for improving energy efficiency through retrofit and energy-efficient new design.

  Available from the Florida State University Library: Call number TJ163.5 B84 L36.

- Roose, Robert W., P.E., ed. *Handbook of Energy Conservation for Mechanical Systems in Buildings.* New York: Van Nostrad Reinhold Co., 1978.

  This technical manual describes how energy can be conserved by modifying mechanical systems and implementing improved maintenance practices. This book should be useful to building superintendents and engineers.

  Available from the Florida State University Library: Call number 696 HAN.

- Smith, Craig B., ed. *Efficient Electricity Use.* New York: Pergamon Press, Inc., 1976.

  This enormous book covers all phases of electrical use. It includes standards and procedures for improving the efficiency of all sorts of electrical items. The sections on lighting should be very helpful when lighting modifications are to be analyzed.

DOCUMENTS

The following documents were reviewed during the preparation of this handbook. Many of them include plans developed by school districts and other states for energy management programs. The best features of these plans were incorporated in this handbook. Copies may be available from the publishing organization.

Broward County Energy Conservation Program. Tallahassee: State of Florida, Department of Education, Office of Environmental Education, 1976.

Broward County Energy Conservation Programs. Broward County School Board, 1978.

Comprehensive Program and Plan for Federal Energy Education Extension and Information Activities. Washington, D.C.: U.S. Department of Energy, Assistant Secretary for Conservation and Solar Applications, Office of State and Local Programs, Office of State Grants Program, 1978.

Draft Contingency Plan for School Districts. Tallahassee: State of Florida, Governor's Office, Office of Emergency Planning. (Unpublished).

Energy Conservation. Clay County Public Schools, 1979-1980.

Energy Conservation and Heating Handbook. Raleigh: State of North Carolina, Office of the Controller, Division of Plant Operation of the North Carolina State Board of Education, 1974.

Energy Conservation and Management Plan. Okaloosa County School Board, 1980.

Energy Conservation and Management Program for the Superintendent's Office, Brantley County School System. The Southeast Georgia Area Planning and Development Commission, Management Services Division, 1977.

Energy Conservation, Lee County Public Schools. Tallahassee: State of Florida, Department of Administration, State Energy Office, 1978-79.

Energy Conservation Plan. Madison County Public School Board, 1979.

Energy Conservation. Seminole County School Board, 1978.

An Energy Conservation Handbook for Orange County School District. Orlando, Florida: Orange County, 1979.

Energy Conservation Plan. Sumter County School Board, 1979-80.

Energy Management. Jacksonville: Duval County Public Schools (First Draft).

Energy Management. Miami: Dade County Public Schools.

Energy Management for School Administrators. Columbus, Ohio: Ohio Department of Education.

Energy Management Handbook for Public Schools (First Draft). Tallahassee: State of Florida, Department of Administration, State Energy Office, 1978.

Energy Management Plan. Indian River County School Board, 1980.

Energy Management Plan. Montgomery: State of Alabama, Department of Education, Bulletin No. 24, 1980.

Energy Management Plan of the Holmes County Public Schools. Tallahassee: State of Florida, Department of Education, Office of Environmental Education.

Energy Management Plan of the Liberty County Public Schools. Tallahassee: State of Florida, Department of Education, Office of Environmental Education.

Florida Energy Conservation Manual. Tallahassee: State of Florida, Department of General Services, Division of Building Construction and Property Management.

Florida Life Cycle Analysis Manual. Tallahassee: State of Florida, Department of General Services, Division of Building Construction and Property Management.

Interim Florida Energy Emergency Contingency Plan. Tallahassee: Governor's Energy Office (Unpublished).

The Local Energy Program Manual for School Administrators. Raleigh: North Carolina Department of Education, 1980.

Making Cents of Your Energy Dollar. Washington, D.C.: U.S. Department of Energy, Assistant Secretary for Conservation and Solar Applications, Institutional Building Grants Program Division.

Managing Brevards Energy. Brevard County School Board, 1980.

North Carolina Department of Education Energy Conservation Plan. Raleigh: North Carolina Department of Education, 1976.

Okeechobee County School System Energy Conservation Plan. Okeechobee County School Board, 1978.

Palm Beach County Utility Management Program. Palm Beach, Florida: Palm Beach County, 1977.

SEED: Schoolhouse Energy Efficiency Demonstration. Houston: Tenneco, Inc., Public Affairs Department.

South Carolina Energy Management Policy. N.D.

The State Educational Agency and Energy Conservation in Educational Facilities, Colorado. Building Systems Information Clearinghouse. Educational Facilities Laboratories, Inc., November 5, 1974.

System Save$ Through Energy Management. Palatka, Florida: Northeast Florida Educational Consortuim.

Texas Energy Conservation Program: Schools. N.D.

Total Energy Management. Washington, D.C.: U.S. Department of Commerce. N.D.

Total School Energy Management Program. Washington, D.C. U.S. Department of Energy. N.D.

APPENDIX F

CROSS-REFERENCE INDEX BY GROUPS

This handbook has been arranged so that the Energy Management Coordinator may distribute selected portions among the school system's personnel. The following index identifies some of the topics covered by the handbook that would be addressed by different individuals. Because the structure of the energy management program will vary from district to district, and some individuals may perform more than one function, the following index may be used as a guide for identifying those portions of the handbook that should be reviewed by personnel from the various functional areas.

FACILITY MAINTENANCE PERSONNEL — Page No.

SUPERINTENDENT | Page No.

APPENDIX G:

SCHOOL DISTRICT AND UTILITY CONTACTS

SCHOOL DISTRICT CONTACT PERSONS

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BLN - City of Blountstown
FPL - Florida Power & Light Co
FPC - Florida Power Corporation
FTP - Ft Pierce Utilities Authority
GCS - City of Green Cove Springs
GLD - Glades Electric Coop
GPC - Gulf Power Company
GVL - Gainsville/Alachua Co Regional Utilities Board
JEA - Jacksonville Electric Authority
KEY - City of Key West Utility Board
OUC - Orlando Utilities
PRC - Peace River Electric Coop
SEB - Sebring Utilities
SUW - Suwannee Valley Electric Coop
TAL - City of Tallahassee
TEC - Tampa Electric Co

APPENDIX H:
GLOSSARY OF TERMS

GLOSSARY OF TERMS

ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers.
BALLAST	A device used for starting fluorescent and other types of lamps.
BUILDING PROFILE	A description of all facilities in a school district by energy use and consumption characteristics (EUI).
BTU	British Thermal Unit. A standard measure of energy that allows comparison of two different energy sources. One BTU is the amount of energy required to raise the mean temperature of one pound of water one degree F.
BUILDING ENVELOPE	The outer shell of a building consisting of the roof, walls, windows, doors, and floors exposed to the outside.
CAULKING	A flexible substance applied to cracks surrounding doors and windows to minimize the leakage of air and water.
CHILLER	A refrigeration device used to transfer heat from a fluid (such as water in a chilled water system) to another fluid.
COIL	A heat exchanging device which usually contains an arrangement of finned tubes.
CONDENSER	A heat exchanger that removes heat from a vapor, changing it to a liquid state.
COOLING LOAD	The amount of heat that must be removed from a building by a cooling system as a result of heat gain into the building.

COOLING TOWER	A device that cools water by evaporation.
DAMPER	A gate-like device that controls the volume of air passing through a duct, outlet, or inlet.
DECAT	Drivers Education Conservation Awareness Training Program.
DEGREE DAY	The difference between the mean daily temperature and 65°F. For example: if the mean temperature is 80°, the difference between 80 and 65 is 15, or 15 degree days for the one day period. Degree days are calculated for monthly and annual periods by the U.S. Weather Service.
DEMAND FACTOR	The ratio between the demand placed on a system and its rated capacity.
DISTRIBUTION SYSTEM	A system of ducts, blowers, and other devices.
DRY BULB TEMPERATURE	The temperature taken when the thermometer is not in contact with water and is not affected by radiated heat.
DUCTS	Channels or passageways through which air is delivered in HVAC systems.
ENERGY	The work that a system is capable of doing.
ENERGY CONSERVATION	Any activity that results in the reduction of energy consumption in any energy-using system or device.
ENERGY MANAGEMENT PROCESS	A management technique for arriving at the most energy-efficient operation of a facility or facilities.

EA - ENERGY AUDIT	Any organized, detailed review of a facility and its energy-using systems that identifies immediate low-cost/no-cost measures and recommends items for a detailed engineering study (Technical Analysis).
ENERGY AUDITOR	Individual certified by the Governor's Energy Office or possessing particular expertise in the area of energy-consuming systems.
ENERGY MANAGEMENT COMMITTEE	A committee formed at the district level to direct the energy management effort.
ENERGY MANAGEMENT COORDINATOR	The individual in charge of the district's energy management efforts.
ENERGY MANAGEMENT TEAM	A group of individuals who are responsible for energy management at the school level.
ENERGY USE INDEX (EUI)	An indication of energy consumption of a facility expressed in BTUs per square foot per year. EUI equals the total energy consumption in BTUs divided by total number of square feet of conditioned space of a facility.
EVAPORATOR	A heat exchanger that adds heat to a liquid, converting it to a gas.
FOOTCANDLE	A measure of light output. One footcandle equals the light output of a standard candle at one foot.
HEAT GAIN	The amount of heat gained by a space from all sources. Also, the amount of heat that must be removed to maintain comfort.

HEAT LOSS	The amount of heat that must be added to maintain comfort. Also the cooling effect of the outdoor climate on a building.
HEAT PUMP	A refrigeration device that is capable of reversing its cycle so that it may heat or cool a space.
HEATING LOAD	The amount of heat that must be supplied to a building to account for the total heat loss due to conduction, convection, radiation, infiltration, and ventilation.
HVAC	Heating, Ventilation, and Air-Conditioning.
IES	Illuminating Engineer's Society.
INFILTRATION	The invasion of outside air into the interior spaces of a building.
IMMEDIATE ACTION CHECKLISTS	Low-cost/no-cost actions for specific groups of personnel within the school system that can be taken immediately to begin saving energy.
KILOWATT HOUR (KWH)	The amount of energy consumed when 1,000 watts of electrical power are dissipated over a period of 1 hour. 1 KWH = 3,413 BTU.
LIFE-CYCLE COST	The total cost of an item or system over its life span, including initial cost, operating costs, and maintenance expense.
LIGHT METER	A device that measures light energy. It operates by using a photovoltaic or similar cell to convert radiant energy to electrical energy.

LUMEN	A unit of luminous flux used to measure light output.
LUMINAIRE	A lighting unit designed to produce a specific lighting effect. Luminaires may be simple or complex. The term is usually applied to outdoor lighting fixtures, or to units designed for a special purpose.
MISSION STATEMENT/ GOAL	A school board's adopted statement of support, commitment and reduction goal of the school district's energy consideration program.
NECPA	National Energy Conservation Policy Act. A federal act establishing programs to assist various institutions in analyzing and funding for energy conservation activities.
PEAK DEMAND	The highest power demand experienced by a system. A large power demand that generally exists for a short period of time.
POWER FACTOR	Ratio of volt-amperes to voltage.
PREVENTIVE MAINTENANCE	A system of planned maintenance, performed at regularly scheduled intervals.
R-VALUE	A measure of the resistance of heat flow through a material.
RADIATOR	A thermal unit for distributing heat which consists of a system of tubes connected to a hot water or steam source; the heated tubes emit heat by radiation and convection to heat a given space.

REGISTER	A combination grill and damper assembly covering an opening on a HVAC duct.
RELATIVE HUMIDITY	The moisture content of air expressed as a percentage of saturation.
SUPPLY AIR	Air delivered to a HVAC system. Supply conditions should offset the building's heating or cooling loads.
TASK LIGHTING	Specifically lighting an area to meet the requirement of a particular job or task while producing reduced lighting levels in the surrounding areas (usually not less than 1/2 to 1/3 of the task lighting level).
TA - TECHNICAL ANALYSIS	A detailed engineering study of measures identified by an Energy Audit. These activities will require capital expenditure for implementation. The TA identifies costs and payback periods for the proposed corrections.
UNIT VENTILATOR	A thermal unit containing a coil, dampers, fan, filters, and motor. Its principal function is to ventilate while providing some conditioning.
WEATHERSTRIPPING	A gasket installed between mating surfaces on doors or windows to minimize the leakage of air.
WET-BULB TEMPERATURE	The lowest temperature obtained by evaporating water in air without adding or removing energy. The temperature taken with a thermometer whose bulb is enclosed in a wet sock. The wet-bulb temperature is a means of determining the humidity of the air.

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