Energy Consumption in Supermarkets

Bill Younger, CEM

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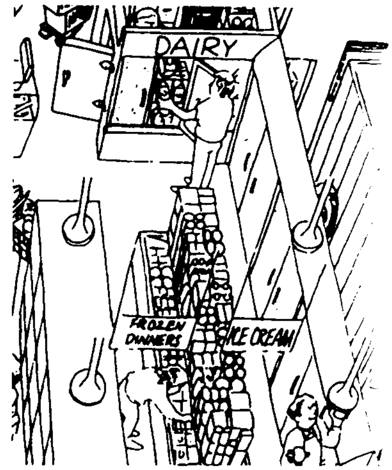

Energy Awareness is a growing part of the profit puzzle. As a store manager, one of the expenses you probably consider fixed is the cost of energy. But just as you manage your employees for greater productivity, you can manage your energy expenses for greater profits. Your task is to look for ways to conserve energy without sacrificing the appeal or efficiency of your store.

Effective management comes from an awareness of where and when energy is used in your store, proper operation and maintenance of the store's energy systems, and establishment of an ongoing monitoring procedure to ensure that the store continues to operate at its most effective level.

The first step is usually to make simple operational adjustments, such as reducing unnecessarily high light levels and moderating the temperature of the store. But heating, cooling and lighting account for only about one-third of the typical supermarket's total energy use. Refrigeration equipment, including fans and anti-sweat devices, can account for more than 60 percent of the energy budget. Unfortunately, these systems often require more intensive engineering analysis and higher retrofit costs to conserve energy.

Furthermore, a supermarket's energy-consuming systems are related to both one another and the building structure, which means that any adjustment to one system may affect the other system. For example, heat from the lights affects air conditioning requirements and refrigeration. On the other hand, waste heat from the refrigeration units can assist in water and space heating in the store. These interrelationships must be considered when implementing a store wide energy conservation program.

The exact amount of energy a supermarket consumes depends on a number of factors including:

- Geographic location
- Building size & orientation
- Age & condition
- Departments
- Operating hours
- Quality of operation and maintenance

Supermarket Energy Use
Typical End Use

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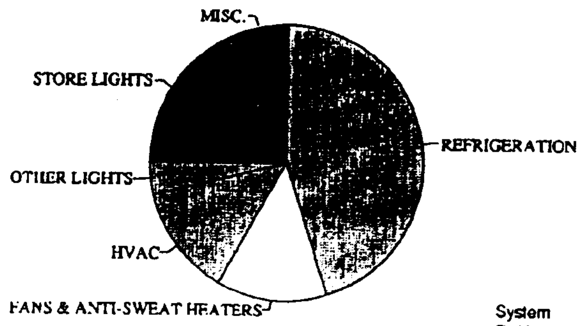

System	Percent
Refrigeration	40 - 50
Case fans & anti-sweat heaters	10 - 15
Case lights	1 - 2
Heating & cooling	10 - 15
Store lights	15 - 20
Outdoor lights	2 - 3
Hot water	2 - 3
Misc. (cash registers, doors)	4 - 8

Only a detailed audit will reveal precisely where and in what quantity energy is used in a particular building, but generalizations can be made from studies involving large numbers of stores. Such a generalization is shown on the pie chart. It is immediately apparent that the greatest portion of a supermarket's energy budget is spent keeping perishable food cold.

Awareness of where the energy is consumed in a particular store is an essential step toward controlling energy use and costs.

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Energy Accounting

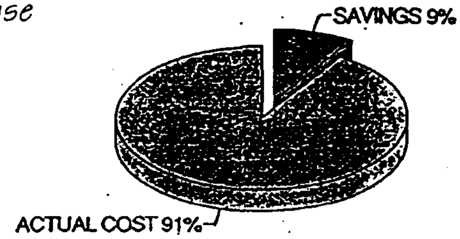
Bill Younger, CEM

NOTES:

Energy accounting is a system for tracking energy use and using that information to control energy costs. The goal is to provide energy data in an organized and usable form so that sound business decisions may be made. By understanding how energy is used in your organization, you can identify and prioritize energy management activities. Along with an energy awareness campaign and an aggressive operations and maintenance plan, energy accounting can help you cut costs without expensive investments in technology. This section will discuss collection, organization and analysis of energy consumption information.

The basis of energy accounting is recording energy-use data. Even minimal record keeping can help you:

- ☒ *account for current energy use*
- ☒ *identify savings potential*
- ☒ *justify capital expenditures*
- ☒ *see results of conservation*
- ☒ *gain management support*
- ☒ *detect increased consumption*
- ☒ *identify billing errors*



By analyzing the data further, it is possible to identify relationships between energy use and other factors such as occupancy. sales volume, floor area, and outdoor temperatures. Once seasonal patterns are established, any month's energy use that doesn't fit the pattern will signal that some change in business activity or energy efficiency has occurred. In this way, potential problems such as equipment failures can be identified and remedied sooner.

Organizing Utility Data

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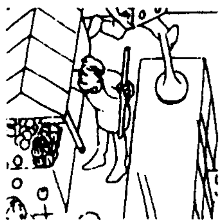

Monthly collection of data is usually sufficient to monitor energy management programs for most businesses and institutions. Organize all consumption data and graphs in a dedicated file and keep it up to date. Data must be recorded on a regular basis and made readily available to building operators and administrators as part of your ongoing energy management plan. It's a good idea to assign someone the responsibility of keeping the energy consumption data current.

Gather Information

Before beginning your energy accounting program, several steps must be taken to ensure you have all the information required to do a thorough and accurate evaluation of your energy consumption.

☒ Make sure you receive copies of all monthly utility bills.

☒ Sort utility bills by building or by meter, and organize them into 12-month blocks using the meter-read dates.

☒ Locate all meters and submeters. If numerous meters are used, it is helpful to clearly label them on a master blueprint for each building being monitored.

☒ Determine which building or space is being served by each meter.

☒ Calculate heated area (in square feet) for each building.

☒ Obtain historical energy data to establish a base year. If you don't have this information in your files, it can be obtained from your utility company.

☒ Obtain degree-day data. This information may be obtained from your utility company, local airport reporting station, National Oceanic and Atmospheric Administration, or your State Energy Office.

Spreadsheet Set-up

The forms used for recording energy data should be clear and usable to the people entering the data and to the analysts and managers interpreting the data. Record energy units (kWh, therms, gallons, etc.), electric demand (kW), and dollars spent for each fuel type. Units of production (number of units, occupied rooms, persons served, etc.) can also be included in your spreadsheet if such production is directly related to your energy consumption.

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Electric Demand

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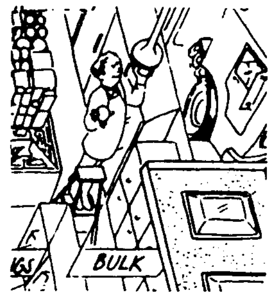

Care should be taken to distinguish between billing and actual demand on your utility bill. Actual demand is the figure registered on your meter and should be used to evaluate power requirements and load factor of the facility. Billing demand is the amount of demand for which you are actually billed.

This figure may be different than the actual demand due to various types of rate schedules. Rate schedules that include a ratchet clause, power factor adjustment, or first block of kW at no charge can cause billing and actual demand to be different. Tracking kWh and kW charges separately can be useful in evaluating the impact of demand on your monthly electric bill. High demand costs can sometimes be lowered by simply rescheduling or alternating run times of particular pieces of equipment.

Energy Accounting Year

The energy-accounting year may be any 12-month period for which energy data is entered. Common years are the calendar year or the July-to-June or October-to-September fiscal years. Choose an accounting year that best suits your needs. stat-t entering data for the month that begins the accounting year. The same accounting year must be used for all weather and consumption data.

The Energy Use index

Each energy type will be converted to a common unit (BTUs) for comparison and calculation of total energy consumed. The Energy Use Index (EUI) is the most common means of expressing the total energy consumption for each building. The EUI is expressed in BTUs/Square Foot/Year and can be used to compare energy consumption relative to similar building types or to track consumption from year to year in the same building.

Establish A Baseline Year

In order for energy consumption data to have meaning, a baseline year is needed as a standard for comparison. Typically, the year previous to initiating an Energy Management Program is used in order to show how much progress has been made since that year. If complete records aren't available for that year, use a more recent year or and average of several previous years to obtain typical values.

Conditioned Area

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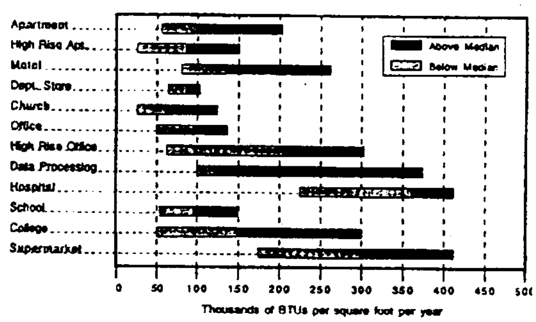
To calculate BTUs and dollars per square foot, it is necessary that an accurate assessment of heated area be calculated for each building. This can be done by referring to the dimensions in the blueprints or by measuring the outside dimensions of the building (length x width), and multiplying this area by the number of floors. Generally, basement areas and mechanical rooms are not included as heated areas unless heating units are installed and operating.

Electric Benchmarking

Energy Use Index (EUI) by Building Type



Supermarkets and grocery stores are electric intensive due to refrigeration and lighting needs. An "Electric Efficiency Benchmarking" system can be used by food stores to evaluate their energy efficiency performance compared to other stores.

The Michigan Public Service Commission (MPSC) recently conducted an electric efficiency benchmarking pilot targeted at grocery stores. The Michigan Grocers Association assisted in the pilot by distributing a survey to their 1,500 members. Eighty-three members, approximately 5%, responded to their survey.

Working with utilities who provided electric usage histories for participating stores, the MPSC calculated an annual kwh/square foot statistic for each store and an energy efficiency ranking of the 83 stores. Each participating store was provided their "Energy Efficiency Benchmark," their ranking, a bar chart showing the distribution of stores based on energy efficiency, some energy efficiency ideas, and a supermarket case study.

KWhs/square foot/year ranged from 7.07 to 84.62. The average was 45.84 and the median was 45.50. Larger stores tended to use more electricity:

Square Footage	KWh/ Sq. Ft./Yr.
2,000 - 10,000	41.45
10,001 - 20,000	44.48
20,001 - 30,000	47.31
30,001 - 40,000	47.25
40,001 - 50,000	49.29
50,001+	50.38

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Graphs and Reports

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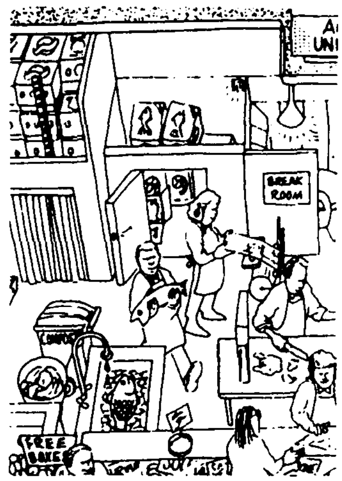
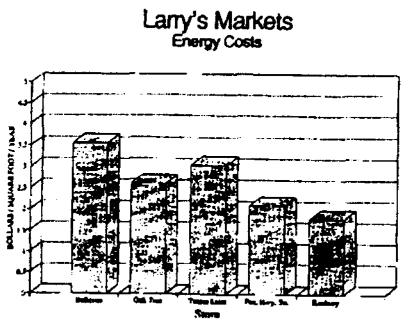


Once energy data has been collected and organized, it must be made comprehensible to those that will use it. This may include administrators, board members, building owner-s or managers and maintenance personnel, as well as accountants and energy analysts. It is important to identify and accommodate each audience that will be using the energy data to make decisions.

In addition to transmitting data, reports may be used to generate awareness, motivate and reward, or serve as a public relations tool. To best convey information it is necessary to get the reader's attention. Colorful graphs, tables and pie charts provide essential information, but in a more visually appealing form than text.



Choose the information for each graph to suit the target audience. For example, actual monthly consumption by fuel type may be of more interest to the maintenance staff while annual costs or dollar-savings information may be more appropriate for the store owner or other administrative personnel.

Energy Graphs

Standard graphs include the following:

- Natural Gas and Electricity use by month (MMBTU)
- Costs per month by fuel type
- Natural Gas use by month (CCF or THERM)
- Electricity Consumption by month (kWh)
- Electric Demand by month (kW)
- Degree Days by month
- Energy Use Index, BTU/Sq.Ft./Year, KWH/Sq.Ft./Year

Other graphs which can be valuable for presentations, annual reports and consumption analysis include the following:

NOTES:

- Avoided Costs
- Annual Savings
- 12-Month Rolling Summary (MMBTU, kWh, THERM, $)
- BTU/Sq.Ft./Degree-Day
- Utility Costs/Unit ($/THERM, cents/kWh, $/kW)
- Building Comparisons

These graphs generally require additional computations, but can be well worth the effort to emphasize a particular point or better understand a consumption trend.

Analyzing Energy Data

Analysis of graphs and consumption data is important in understanding how energy is used at your facility and which factors affect consumption the greatest. This is done by identifying energy using systerns in your building and determining how each system operates throughout the year. Some systems will operate all year long while others may only operate during the summer or winter months. Annual energy consumption is then broken into base and seasonal loads, and equipment is fit into each category. This helps identify which equipment or systems are most energy intensive so steps can be taken to reduce consumption in those areas.

Base Loads

Base loads are the energy-using systems that consume a continuous amount of energy throughout the year. The base load can be established by drawing a horizontal line across a graph of energy consumption or cost at the average point of lowest consumption for each energy type. The base load is that portion of consumption or cost below the line. Typical base loads include lighting, office equipment, appliances, domestic hot water and ventilation.

High-base loads indicate conservation efforts should be focused in these areas.

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Seasonal Loads

Seasonal loads, such as heating and air conditioning, are identified as the portion ofconsumption or cost located above the line used to establish base loads on the graph. Seasonal loads can be the result of changes in weather or operation of the building, such as the school season.

High seasonal loads may reveal an opportunityto reduce consumption by making improvements to the heating and air conditioning equipment, temperature controls, the building envelope, or other systems which are affected by seasonal operation.

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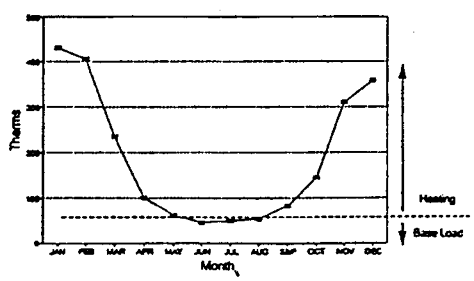
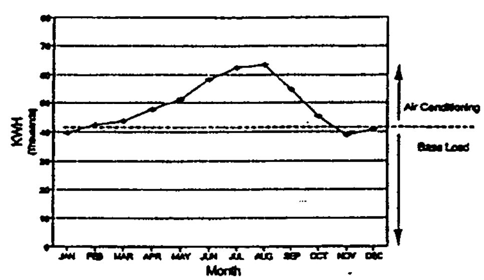
Natural Gas Consumption



Electric Consumption



Energy-Using systems

After utility use has been broken down by seasonal and base loads, make a list of the major energy-using systems in your building and estimate when each system is in operation throughout the year. As you develop your list, think about how each system uses energy and where potential savings may exist. You can add more specific components to the list as you learn more about the building.

Typical energy-using systems and areas of potential savings include:

- Lighting
  - *Lamp efficiency*
  - *Operation time*
  - *Light levels*
- Cooling (Air Conditioning)
  - *Economizer cycle*
  - *Set points*
- Refrigeration
  - *Anti-sweat controls*
  - *Case covers or strips*
  - *Case lighting*
  - *Staged defrost cycles*
  - *Proper loading*
- Heating System
  - *Boiler efficiency*
  - *Distribution system*
  - *Controls*
  - *Hours of operation*
  - *Envelope*
- Ventilation
  - *Amount of outside air*
  - *Night and warm-up operation*
  - *Exhaust system interaction*
- Domestic Hot Water
  - *Temperatures*
  - *Distribution system*
  - *Refrigeration heat recovery*

Consumption Trends

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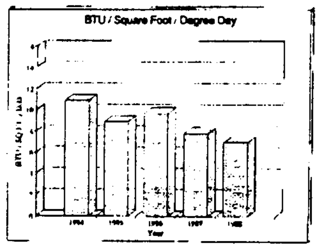
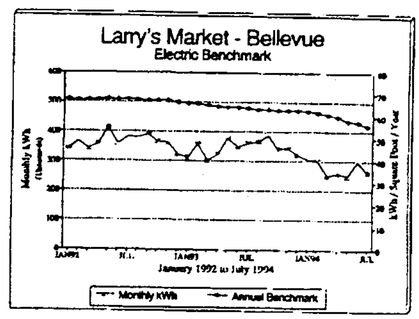


One of the easiest ways to evaluate consumption data is to watch for upward or downward trends in kWh, demand, natural gas or costs. This can be done by graphing two or more years of monthly data on one graph or by graphing only the annual totals for several years.

Rolling 12-Month Method

Another useful method for reporting monthly data is a rolling summary whereby a new l2-month total is calculated each month by dropping the oldest month and adding the newest. This method eliminates widely fluctuating values and allows simple comparison of present year energy use with any previous year. A graph of this type will remain a relatively flat line if no significant changes in energy consumption occur. Even though each monthly figure is an annual total, any sudden change is the result of that month's operation.



Increased Consumption

An increase in annual natural gas consumption can be the result of several factors.

- *Greater number of degree-days (colder weather)*
- *Added equipment or floor space (kitchen equipment, space heaters)*
- *Problem in operation of heating system (dirty air filters, time clock malfunction, steam trap maintenance needed)*

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Further analysis can determine which of these factors is most likely the cause of the increased consumption.

1) Determine THERM/Degree-Day consumed for previous year.

2) Multiply by number of degree-days for current year to obtain estimated natural gas consumption.

3) If actual consumption is equal to or less than estimated consumption, the increase is due to weather conditions.

4) If actual consumption is significantly greater than estimated consumption, factors other than weather are the cause of this increase.

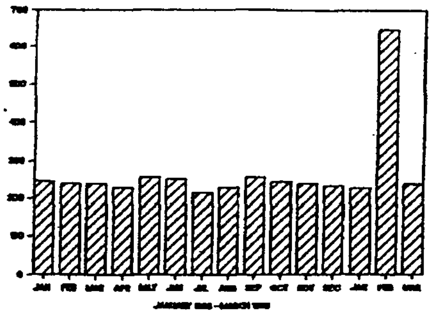
5) Determine if new gas-consuming equipment has been installed or floor space has been added.

6) If no new equipment or floor space was added, the increase in consumption is most likely the result of a problem in the heating system. Provide corrective maintenance and continue to monitor monthly consumption.

NOTES:

Unexplained Peaks

Anomalies and unexplained peaks in consumption or electric demand that go unnoticed can cost your organization money. Regardless of whether the peak is caused by equipment malfunction or an error in the monthly meter reading, it demands immediate attention. Malfunctioning equipment can damage other components if left unchecked.



This facility paid an additional $2,900 in demand charges in February because of an unnoticed error in the demand

If you suspect an error has been made on your billing statement, contact your utility representative immediately. Your utility company can be your best ally in identifying causes for unexplained consumption or demand peaks.

Load Factor

NOTES:

Load factor is the relationship between electric kWh consumption and kW demand. It is commonly calculated by dividing the monthly kWh consumption by the kW demand multiplied by the number of hours in the billing period. This gives a ratio of average demand to peak demand and is a good indicator of cost savings potential of shifting some electric loads to off-peak hours to reduce overall demand.

$$\text{Load Factor} = \frac{\text{Monthly kWh}}{\text{kW} \times \text{\# Hours}}$$

If a facility were to consume electricity at a steady rate at the highest demand registered on the demand meter, the load factor would be 1.00 (one), the theoretical maximum. This indicates that the facility does not have any variance in consumption or time of day peaks in demand. Other than installing more efficient electrical equipment, little can be done to reduce demand because this facility is already taking full advantage of the demand for which it is being billed.

A load factor below .20 is a good indication that a facility has demand spikes at some point in the billing period. In this case, action should be taken to identify when the spikes occur and operation of non-essential equipment should be restricted at that time or rescheduled for operation during off peak hours.

The ideal load factor should be as close to 1.00 as possible. However, most facilities don't operate 24 hours a day, so load factors will typically be considerably lower than the theoretical maximum. If a building operates only 12 hours a day, for example, then a load factor of .50 may be the highest possible for that building. The important thing is to monitor your load factor and establish what is normal for your building, noting any significant changes in the kWh consumption and kW demand ratio. Many energymanagement control systems (EMCS) have demand limiting and load shedding-capabilities which help maintain acceptable load factors.

Submetering

Often the limitation of many energy accounting systems applied to existing buildings is the lack of adequate metering. submetering of individual buildings and energy systems such as lighting, ventilation, computer rooms, etc. must be considered if meaningful energy information is to be readily available for optimum building operation. The latest developments in automated energy accounting systems include-on-line remote data acquisition capability which eliminates most manual data collection and entry.

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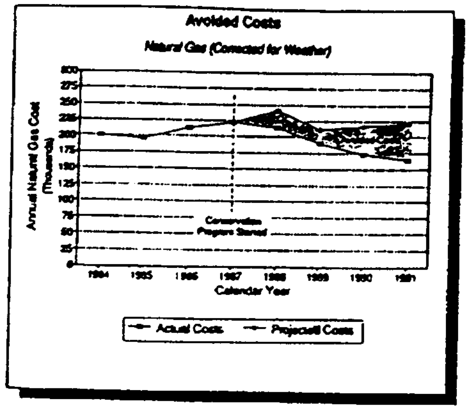
Avoided Costs



To measure the success of energy management programs, you must convert energy savings to cost-avoidance figures. Avoided costs are calculated by multiplying the difference in current and baseline energy use (corrected for weather if necessary) by the present cost of energy. Consumption relating to base loads such as lighting and hot water does not typically require weather correction while consumption for seasonal loads such as heating and air conditioning should be corrected for weather before calculating avoided costs.

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Energy Accounting Software

Theadvantages of a computer-based energyaccounting system are well documented. Once the software has been personalized for a given facility and the monthlydata entered, a variety of calculations and reportscan be generated with little effort. Numerous software programs exist so a careful study of individual accounting needs is necessary.

Before a computer is able to offer its benefits, the energy accounting procedures used will need to be thoroughly understood.

Finally, someone confident with computers is required to be in charge of operating and maintaining a computerized energy accounting program.

Summary

The first step in maintaining control of your energy costs is to understand how your building uses energy so informed decisions on conservation investments can be made. More energy management programs fail because of lack of information and organization than because of poor design or faulty equipment.

Developing an energy accounting system that works best for you demands taking a close look at the buildings and equipment as well as the people who use them. Energy accounting can be simple or complex, but it must be tailored to the needs and capabilities of the people using the system.

> Only by motivating and educating building managers. operators and occupants will energy management programs achieve their intended savings.

The Energy Manager

NOTES:

There is an increasing need in business and industry to manage energy effectively. Efficient management of energy costs can lead to significant savings and increased comfort. Lower maintenance costs and extended equipment life are further benefits of this approach. A successful energy management program requires a designated lead and a realistic plan. This need has given rise to a new and important role - - the energy manager.

The energy manager requires a varied background and is expected to balance several different roles of responsibility. Effectively understanding and communicating energy goals to building owners, upper management and employees make this job a difficult one.

Four major areas of responsibility include:

- *Management*
- *Technical Analysis*
- *Financial Analysis*
- *Coordination*

This section will look at these different roles, and suggest a plan for setting up an effective energy management program.

Management

In this particular area, the energy manager must develop a level of expertise that builds credibility with top management. This credibility is important, as a recent study showed that 67% of the decisions about energy improvements were made by only one person (usually the owner or president of the business).

At the outset, a review of historical energy usage and a preliminary site assessment are performed which lead to the development of energy management-goals and policies. These goals are prioritized, often listing those actions in order of payback. The list of goals should include energy conservation measures (ECMs) as well as operation and maintenance measures (O&Ms). Operation and maintenance measures are often listed as a first priority because they are easily done and have ability to save energy at little or no cost.

After accumulating a base history of energy costs, the energy manager must develop both written and oral reports for top management as well as others affecting energy usage. This creates important communication which is paramount to a successful program. The reports act as a guideline for later decision making, and give perspective to the overall energy goals.

Furthermore, the reports directly relate to budget considerations for future years. The strategy is to accomplish as many energy goals in one year as the budget allows, and then build on these accomplishments the next year. Energy improvements often overlap from one year to another, and it is important to develop a consistent, steady approach.

Technical Analysis

NOTES:

The second role of the energy manager is technical analysis. An in-depth knowledge of the building system is required. This includes the envelope, lighting, heating, ventilation, air conditioning, refrigeration, electrical equipment and hot water systems. It's also important to understand utility metering and how monthly bills are calculated. Graphs showing energy consumption, with consideration to all fuel sources, are helpful in evaluating energy usage and costs. The energy manager should establish a program to develop technical expertise of facility operations staff members.

New product analysis is important to the technical energy manager in making a wise investment. New energy products should be compared and evaluated based on their savings potential, reliability and convenience. Often, a seemingly high-priced device quickly pays for itself due to fuel and maintenance savings.

Financial Analysis

This role includes knowledge of investment analysis. There are many factors to consider in making a wise energy investment.
some of these include:

❖ Current Inflation Rate

Generally this is between 3-8 percent.

❖ Fuel Escalation Rates

Availability of different fuel types, cogeneration opportunities and increased natural gas purchasing options require continual evaluation of impacts to your fuel costs.

❖ Capital Investment

The amount available for energy investment is often balanced with the fuel savings per year. An attractive payback is influenced by the percentage and length of a loan, depreciation, operating costs, availability of utility incentives and marginal tax bracket of the investor. some states offer investment tax credits as further incentives.

❖ Life Cycle Cost Analysis

Life cycle costing is a method of calculating the total cost of ownership over the life of an asset. This approach is justified when two or more alternative systems are being compared, efficiency from operation and maintenance changes add substantial savings, investment and energy costs are large, and life of equipment is several years.

Coordination

NOTES:

In this particular role, the energy manager must put all the pieces together. This involves education of the staff, so everyone understands the roles and responsibilities and is able to implement them.

A checklist of energy-saving tips can be helpful. A procedures manual for all equipment and its operation is also important. A thorough understanding of the procedures will save a lot of time and energy later, and is essential in keeping up with changes in company personnel.

Evaluation and follow-up of past energy decisions allow for constructive criticism and continual adjustment to the energy plan. If an energy policy doesn't work, change it to one that does. Periodically review goals and set new ones as needed.

Continue to report on the status of the energy management program to management, facility staff and building occupants on a regular basis. Include regular reports on operation of new equipment, energy and cost savings, operation and maintenance savings and improvements, comfort improvements, and training activities.

With success in the program, consider making a long-term commitment including ongoing education and training.

Energy Management Program Implementation

The following section will suggest steps in setting up an energy management program. Future items may be added as needed and the plan should be flexible to the particular company or building. For example, "selling the program to top management" (point 4) may in some cases be the first item on the list because management support is crucial for success of the program.

1) Perform an energy audit. The energy audit is a survey which tries to examine the different features of a building. Three steps to the audit are generally followed: Identify all energy systems, evaluate condition of systems and write up a situation report. This report explains the existing conditions of the building(s) in terms of the envelope, equipment, lighting and occupancy.

2) Develop a plan for energy management. From the situation report, certain areas for improvement will become apparent. Identify energy conservation opportunities within each system as well as interactions among systems. Evaluate and prioritize available operations and maintenance items (O&Ms). Certain features in a building, such as replacing bad ballasts reducing water heating temperature and correctly programming setback thermostats, offer ways to economize at low-cost or no-cost with a fast return on investment.

Short-term and long-term goals should bedetermined, with specific ways to meet these objectives. The energy plan includes both O&Ms and capital investments. A time frame (e.g. 1-3 years, 3-5 years, 5-7 years) is often helpful in scheduling improvements that overlap from one year to the next.

NOTES:

3) Evaluate staffing needs. Can the existing staff perform the requirements of an energy plan? Will additional personnel or training be required? Will there be an additional time commitment for maintenance and accounting? Most often O&Ms can be performed by in-house staff.

4) Sell program to top management. It is imperative for those who make the energy decisions to understand and support the suggestions in the overall energy program. The financial benefits from such a program can positively influence both the present and future operation budget. Comfort benefits also make a building a more desirable and productive place to work.

5) Determine funding source needed for capital improvements. Grants and loans for energy improvements are often available through local utilities and state energy offices. Some states allow tax incentives (investment credits), to help offset the initial cost.

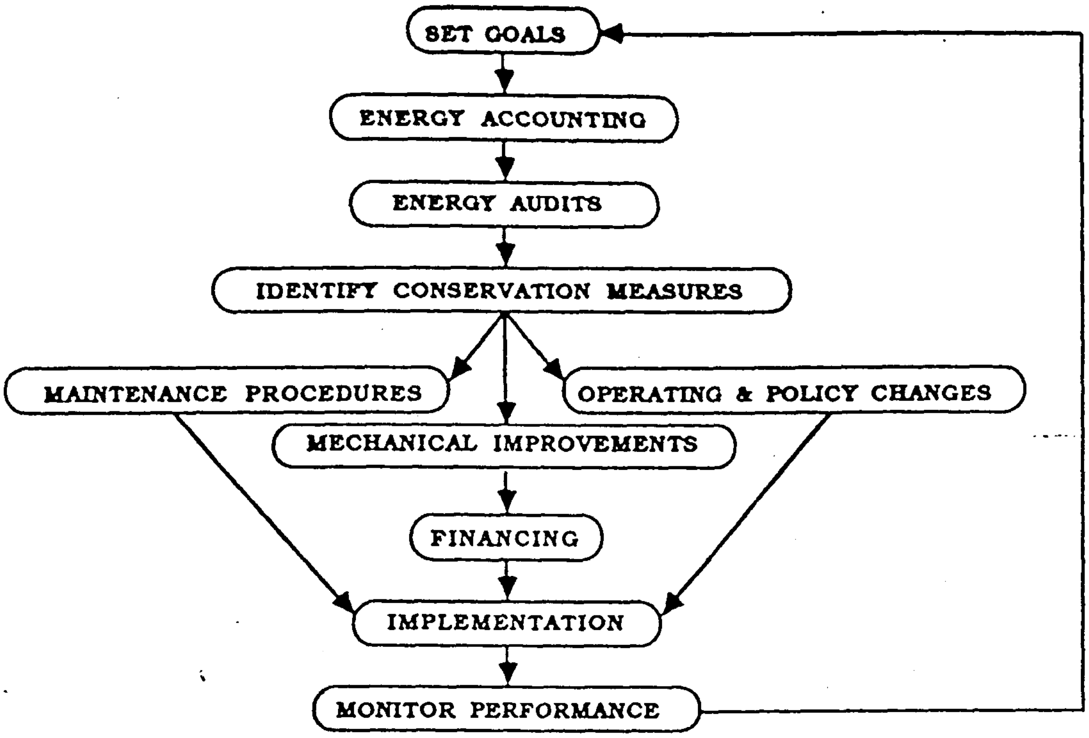
6) Select consultants (beyond expertise of energy manager). For example, certain design or equipment features such as a heating/cooling storage system or computerized energy management system may require complex technical analysis. An energy manager should be able to do a preliminary audit, while a comprehensive energy analysis is often performed by an engineering firm or other technical assistance group.

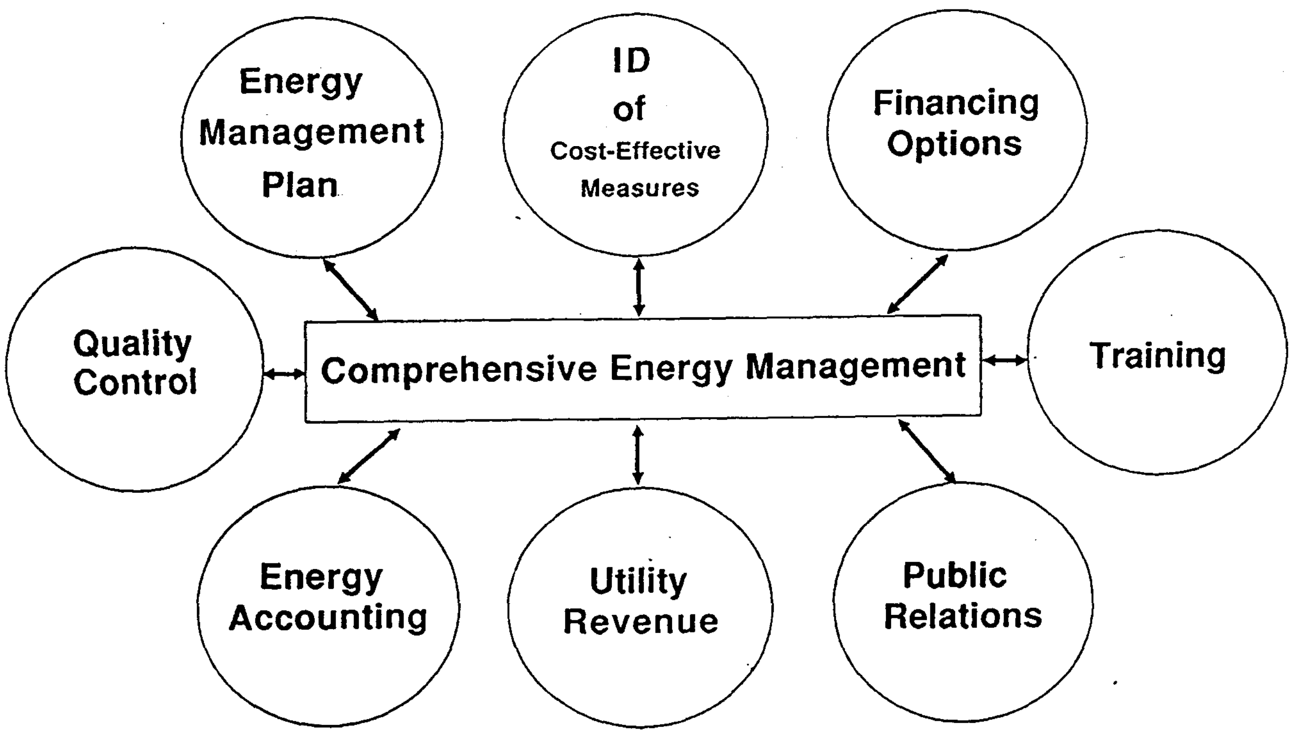
7) Keep up-to-date. Literatureand advice is availableon most products and equipment from manufacturer representatives, utilitiesand state energy offices. To test products before you buy, arrange for a trial demonstration period. Workshops and seminars are offered by utilities, professional associations and state programs on a variety of topics and are usually at low cost. Developan energy library and product file from material gathered at seminars, at trade shows and from local vendors.

A successful energy management program requires documentation on the equipment and products it uses. Includedescriptive information (model number, etc.), maintenance procedures, warranties, manufacturer's representatives (addresses and phone numbers) and repair history.

8) Become a part of the long-term planning process. The energy manager should be directly involved in monitoring the program and remain committed to its future success.

Energy Management Program





Energy Management Plan

A TYPICAL ENERGY MANAGEMENT PROGRAM WITH A HIGH PROBABILITY OF SUCCESS

How have businesses with successful programs done it? This model represents the shared experience of over 500 energy managers in business and industry.

YEARS 1 AND 2

GOAL: To save 10-15% of base year energy index
PLAN OF ACTION:

- Determine how, when, and where energy is consumed. Use building profiles, energy records, and energy audits as tools.
- Tune systems to peak efficiency.
- Operate systems only when needed.
- Set and follow a maintenance schedule.
- Make no-cost/low-cost modifications.

COST TO IMPLEMENT: 25% of the expected annual savings.
COST TO MAINTAIN: 10% of expected annual savings.

YEARS 3-5

GOAL: To save 15-40% of base year energy index
PLAN OF ACTION:

- Plan and perform energy conservation projects with paybacks of under four years.
- Purchase energy-efficient equipment.
- Revise operations to optimize energy use.
- Determine how energy availability and price changes might affect your business.

COST TO IMPLEMENT: 50-400% of expected annual savings.
COST TO MAINTAIN: 15-30% of expected annual savings.

YEARS 6 AND BEYOND

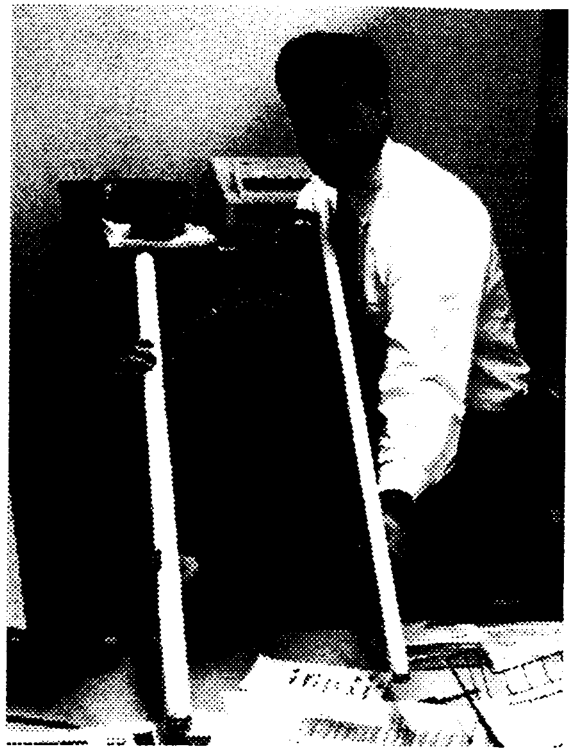
GOAL: To save 35-50% of base year energy index
PLAN OF ACTION:

- Perform energy conservation projects with paybacks of 5 years or longer.
- Examine indirect energy use of your business product or service.
- Include renewable resources in your building or remodeling plans.

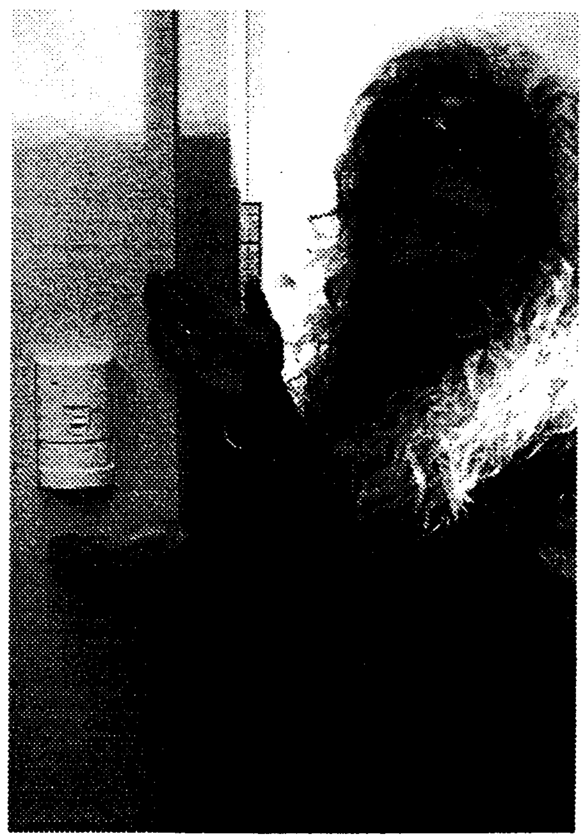
COST TO IMPLEMENT: 400-600% of expected annual savings.
COST TO MAINTAIN: 15-30% of expected annual savings.

Courtesy of Bonneville Power Administration

NOTES:



T8 fluorescent lamps are about 30% more efficient than standard T12 fluorescent lamps.



Occupancy sensors are often a good energy conservation measure.

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