How Can We Utilize Energy More Effectively In The Food Industry

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This article deals with Energy Conservation as a major issue of our time. It advocates the establishment and implementation of an Energy Management Program suited to the Food Distribution Industry, that is based upon a change in our values, that would be reflected in the effective use of energy and its conservation. Suggestions and recommendations are outlined to obtain a reduction of 10 percent to 15 percent in energy consumption within the next six years, which this program will facilitate, through the following:

1. A reexamination of our values relating to the return on investment (R.O.I.) concept that is held in the business community today.

2. The leadership role that must be taken by various scientific, technical organizations and societies such as the Food Distribution Research Society to assist Government agencies in formulating and implementing an effective Energy Conservation Program.

3. The argument for the urging of Goverment, to reexamine its monetary policy, to provide some form of tax incentive to enable greater investment by the private sector in Energy Conservation Programs.

Five major components are described and examined for the implementation of the proposed Energy Conservation Program. I. Building Design; II. Equipment Selection; III. Effective Maintenance Programs; IV. Establishment of Energy Data Banks; V. Personnel Education Programs and Communication.

It is the contention of this paper that the establishment of an Energy Management Program by the Food Distribution Industry when paralleled with Government cooperation will lead to more responsible management by society of its energy resources, which will reflect the value of Energy Conservation.

The issue of energy is of major concern to everyone.

There are two views that are prevalent relating to this issue. One holds that energy is an inexhaustable source that will be abundant for many years to come certainly beyond our own life time. Whereas the second holds that energy is plentiful now, it is nevertheless finite and will inevitably at an increased rate be exhausted by our complex industrial society. Proponents of this argument have devised models that demonstrate inevitable collapse of society.

Without entering into a discussion of, nor debating the pros and cons of, the extreme positions I would suggest that both sides move in the direction that recognizes the need for effective planning of energy utilization. The responsible stand for us now is to plan for a viable future where resources are indeed utilized to maximum potential for the benefit of all society.

Pierre Elliott Trudeau, Prime Minister of Canada, in his New Year's message for 1974 said:

"Recent events, (he was referring to the crises of 1973) did not create the current situation, they merely hastened its coming. What we are beginning to experience now was in retrospect inevitable, because man has been consuming the nonrenewable resources of this planet with a voracious appetite that no wisdom or insight, be it religious, philosophical, scientific or political, has so far been able to curb. --to ensure natures continued bounty we are not asked to suffer, but we are being asked to be reasonable. We are being asked to adjust our demands to nature's limitation, to realize that restrained and unreasonable consumption by individuals, industry and the economic sweepstakes are not acceptable ideals."

Is this not a plea for society to reassess its existing social and economic values? I believe that we must expend our collective intellectual energies to reevaluate our priorities relative to the use of energy and its impact on society.

Only yesterday we were a continent with an abundance of inexpensive energy. Today we are a continent that has to pay a price and we cannot wait till tomorrow to accept this fact of life. For though our current dilemma lies in the availability of inexpensive energy, our ultimate dilemma may lie in the unavailability of energy at any price, unless we act now to conserve what we have and thus buy the time to develop new sources of energy.

Much has been written on the energy crisis; as to its causes, effects and remedies, but little has been written or said of the positive aspects of the crisis and the opportunities it provides to all thinking persons. No one will dispute or applaud the potential disastrous economic and social repercussions that this crisis can have on society. We as planners, whether it be in the field of economics, government, engineering or social; custodians of a very large slice of the national energy pie; must face up to and meet the challenge and opportunity it affords for responsible action.

It is my belief that we possess the intellectual and technical skills to reassess priorities and social values; to design, improve and upgrade our whole industrial process; to produce and manufacture highly efficient mechanical equipment and devices. No longer can we afford cheap machinery which is energy inefficient, be they the automobiles we drive, houses we live in, or machinery used in the manufacture and distribution of our most basic necessity of life--food.

We must be prepared to change our views and ideas even at the risk of receiving severe criticism from entrenched interest groups, be they business or social, that we have become accustomed to when energy resources were thought to be abundant, inexhaustible and inexpensive. We must be prepared to rethink and reevaluate accepted concepts and values that our society has held in order to meet the challenge that in ten years from now we will enjoy the same standards we do today. Through creative engineering, scientific research, social study, and planning we can contribute strategies which will conserve and protect our diminishing nonrenewable natural resources, protect and preserve the environment we live in, for the sake of national survival and in the end profit.

A beginning has already been made:

Since 1974 there have been a multitude of meetings, workshop seminars and fact finding sessions, where over 200 companies and 20 trade associations in the ten most energy intensive industries, have produced a number of voluntary action programs.[1]

The Aluminum Association is working towards a 1980 goal of reducing its energy consumption by 10 percent. This is 10 percent in 6 years. With less than two years into their program, they had achieved a 5 percent reduction--half way there in one third the time.

The American Paper Institute goal also 10 percent over six years. They have outdistanced their 1976 benchmark by experiencing a 4.1 percent improvement of their objective in 33 percent of the scheduled time.

Meat packing is another industry with a 10 percent goal but has already achieved almost 70 percent of its goal.

One segment of the Glass Industry has already exceeded its 1980 goal and another segment is less than three points short of its 15 percent goal.

Pursuant with the goal of an effective Energy Management Program which we in the Food Distribution Industry must set for ourselves and parallel with my previous remarks, I would like to share a number of thoughts with you.

The industry as a totality and here I refer to the total Food Distribution Industry from producer to the consumer, must take the initiative if it has not already done so, and set for itself a goal of reducing its energy consumption within the next 6 years by 10 percent to 15 percent.

Industries that do not regulate themselves adequately invite the government to do it for them. It is essential that this industry take the initiative in the process of formulating and setting in motion an effective Energy Management Program in the context of the industry's particular requirements. It is up to us to advise government what is needed. What programs should government plan and implement? What type of incentives should government be offering to promote energy conservation? In short, what should come next and how we should proceed to achieve these goals? What I am saying is that if we are convinced that responsible action in the area of energy conservation is needed then we cannot sit back and await government action and initiative.

At a recent seminar which I attended in Toronto, Ian H. Rowe - Senior Advisor - Special Projects - Minister of Energy Province of Ontario, said the following;

> "We have entered a crucial stage in Public Policymaking as far as Energy Conservation is concerned. I urge you not to leave these decisions to government alone. There are industrial and professional associations which are excellent vehicles within which to study such questions and articulate practical suggestions.
>
> If our joint efforts succeed; we can reduce the total amount of capital which would otherwise be required on energy development; we can lessen the environmental damage that results from the misuse of energy; we can extend the life of our non-renewable resources; and we can save money. Clearly, the benefits for business, for the province

> and the country as a whole, warrant our continued support of Energy Management".

The reference made is to the Province of Ontario, but can easily be applied to any location on the North American Continent.

For many years now industry and business have maintained that if the return on investment (R.O.I.) in capital equipment is not within two years then it does not warrant a capital investment. I submit that within the context of our energy conservation program this view is short sighted and can be harmful to society and the way of life which we enjoy. It is time I believe that we rethink this concept in the long term, in development and implementation of an effective Energy Management Policy.

There are on the market today numerous devices, construction techniques, and equipment that can be built into new or renovated projects as part of our effort to achieve an energy conservation program. Many of these devices and techniques may, in an R.O.I. analysis, go beyond the time span that has been the accepted norm. Why then should we disregard these devices because the payback period is 3, 4 or 5 years? Are we not trying to achieve an energy management and energy conservation program that will be suitable for the next 10, 20 or 30 years?

Part of the answer may be that the industry should be making more concerted representation to government for more liberal tax incentives to stimulate conservation investment. Dr. Joseph Kates Chairman of the Science Council of Canada expressed this thought at a recent National Conference on Industrial Energy Conservation held in Toronto in the spring of 1976. A program of fixed duration would alter energy consumption patterns without a massive permanent government regulating agency creating bureaucratic red tape. A tax credit incentive administered through customary tax audits should be based primarily on actual energy reductions and on investments, to certain limits, needed to achieve the savings.

> "It would make good business sense for government, in that savings which are not taxed, would not have occurred at all without the program. Industry gets a good return on its investment of course but government shares substantially in subsequent profits". Said Dr. Kates.

What is the food industry doing now and what must they do in the future in their drive to effect an Energy Conservation Program?

In 1973, 1.7 trillion kilowatt hours was purchased, nationwide in the U.S. by all consumers. A U.S. Federal Energy Administration report concludes that the entire food system from harvest to home consumes 16.5 percent of the total U.S. expenditure. The retailing end of this industry namely the supermarkets consumes 4 percent of this total or 68 million kilowatt hours.

A more detailed look of the energy consumption of a typical modern supermarket can be shown to be as follows:

1. Refrigeration low & medium temp.	39%
2. Sales area lighting	19%
3. Case fans & lights	9%
4. Heating electric	8%
5. Back room office & sign light	6%
6. Case anti-sweat heaters	6%
7. Air handler blower	5%
8. Air conditioning	4%
9. Miscellaneous operations	4%
TOTAL	100%

You will note from the figures that the refrigeration compressors, refrigerated cases, and heating and cooling consume 65 percent of the entire energy consumption. In any conservation program for food stores special attention must be paid to this area, as well as sales area lighting.

The food industry, I believe, must set for itself a goal of 10-15 percent reductions in power consumption. This can be achieved by embarking on an energy management program. This program would consist of 5 components:

I Building Design
II Equipment Selection
III Effective Maintenance Program
IV Data Banks
V Personnel Education & Communication

Without entering into extensive working details, I will describe in broad terms what each component will contribute in the Energy Management Program.

I. Building Design

All new buildings and wherever possible existing buildings should be insulated to meet current ASHRAE recommendations as outlined in their 90-75 standards of u factors of .06 for roofs and .20 for walls.

Limit glass exposure to the minimum to meet merchandising requirements and to double glaze all glazed exposure.

Limit building orientation to minimize the effect of solar heat gain and, where required, install tinted glass.

In designing food stores or remodeling existing stores, consideration should be made for a maximum of 100 foot candle in sales areas; 80-100 foot candles in preparation areas and 50 foot candles in storage areas.

In addition control devices such as time clocks, switches, etc., should be installed to enable the shuting down of lights when not required. In sales areas; lighting circuits should be wired to enable control of alternative fixtures, thus reducing illumination as required without creating holes of darkness.

Existing stores should be studied with a view to eliminating or replacing existing fixtures with more than 2 fluorescent bulbs per fixture. A dramatic illustration of this is within our own organization where 2 lamps were removed from 4 lamp fixtures with a reduction from 170 ft. candles to 120 ft. candles, with no loss in merchandising sales.

This is an area where a reevaluation of existing merchandising values and philosophy could have dramatic energy savings.

An area to which we must give serious consideration in future store design is store environmental systems. For maximum energy efficiency of energy used in heating and air conditioning, it is essential to view a food store as a complete integrated system. The ever increasing use of multi-deck refrigerated cases in store merchandising has created a number of problems but has also given us an opportunity to reduce energy required in store environmental systems. One of the problems created by the use of multi-deck display cases has been the cold aisle situation where temperature as low as 55°F. could be experienced. An effective means of controlling this situation is the introduction of under floor return air systems where multideck display cases are installed. A number of benefits have accrued because of this solution. The effect of properly capturing the cold air from the aisles has effectively lowered the return air temperature thus reducing the total installed A/C. An example of this design approach is a recent food store of 53,000 square feet where the calculated cooling load was 102.4 tons. With an underground return air system we were able to reduce the A/C capacity to 53 tons. Secondly, by the proper choice of air handlers it is now possible to recapture efficiently the heat of rejection from store refrigeration compressors. The recaptured heat can be used for store heating and humidity control. As an illustration of the heat recovery system I refer you back to the food store discussed previously where the total heat loss for the store is 540 KW. The total heat recovery including lights 297 KW. Installed heating 243 KW.

A third benefit that has appeared from under floor return system has been a more effective and efficient means of controlling supermarket humidity. Not only is proper humidity control essential for the prevention of frost build up on modern display cases but it plays a key role in the operation of case anti-sweat heater and in lowering the number of defrost cycles required by refrigeration systems. As indicated previously anti-sweat heaters account for approximately 6 percent of the total annual store usage. It has been found through actual tests that if a supermarket can be maintained at 40 percent R.H. or lower, then the use of anti-sweat heaters can be eliminated. By the use of slightly higher A/C capacity and the use of a heat recovery system it is possible that the R.H. can be reduced to 40 percent or lower thus eliminating the need for anti-sweat heaters.

The effect of maintaining the R.H. at 40 percent has the added effect of reducing the operating cost of the case refrigeration system.

As new devices are developed and introduced they must be tested and evaluated for their effectiveness and efficiency. Examples of these are exchangers to recover rejected heat from store refrigeration systems for domestic hot water requirement and exchangers to recover wasted heat of rejection for heating of back store areas.

Another area in building design that must be reevaluated are those areas that have been long neglected namely loading docks and vestibule. These areas that account for as much as 25 percent of the total heat loss, must be designed to minimize infiltration--resulting in heat losses and heat gains.

II. Equipment Selection

In the past, sad to say, most supermarkets as well as other buildings were designed with first cost as the sole criteria. The only consideration was the least first cost per square foot of floor area which in turn affected the cost of mechanical and electrical equipment. As a result such short term thinking structures were built with no insulation in walls and minimum insulation on roofs. Equipment with short life spans and low efficiency, requiring more maintenance and frequently inaccessibly located which made maintenance all the more difficult further reduced their life spans. But our values must change and various factors such as:

1. Initial cost.
2. Expected life of mechanical and electrical equipment and building components.
3. Expected life of a building.
4. Annual energy consumption including allowance for fuel escalation cost.
5. Extent of annual maintenance.
6. Comfort conditions, i.e. temperature, ventilation rate lighting level, must now be considered in order to arrive at an optimum design.

Just as it was wrong in the past to place overemphasis on initial cost, so today and more so in the future it would be wrong to base our design solely on energy consumption consideration. It is quite within the realm of architectural and engineering capability to design a building with minimal energy consumption, but the first cost would be so high as to make it uneconomical.

III. Effective Maintenance Program

More emphasis, time and money will have to be spent in the future to develop, initiate and maintain effective maintenance programs. As developers, architects, engineers and operators, we are able to design and build buildings with optimum energy saving equipment. In order to maintain the equipment and structures at maximum efficiency we depend upon our maintenance personnel.

Management must be made aware of the importance of efficient operating equipment, while maintenance personnel will have to be educated as to the importance of looking after seemingly routine items and accept its role in the long range goal of energy conservation. In short, maintenance personnel must ensure that equipment is operating at its optimum. The need for effective maintenance program will become more accute, especially as energy costs and shortages escalate in the next 5 to 10 years.

IV. Energy Data Banks

It will become increasingly important as part of any Energy Management Program to establish and maintain what I propose we call Energy Data Banks. These will be historical data on the energy consumption of each building under management control. The proper implementation and continued updating of the data bank will enable management, engineering, operations, and maintenance on the basis of up-to-date feedback to assess each location and red flag those buildings, supermarkets, etc., that do not meet the norms and standards set by management as an integral component of its energy conservation program. It will enable an evaluation and realignment when indicated of energy saving programs that are being experimented with as well as those that have been implemented.

V. Personnel Education and Communication

This is by far the most important aspect of any Energy Management Program. Because the key to every successful program is the person who is committed to the value of energy conservation. This applies on every level of the company from the President downward.

An intensive well designed education program on the need and importance of energy conservation must be planned and implemented. As a group; developers, builders, operators and food distribution managers, it is possible for us to design and build highly efficient food distribution centers. But if our personnel do not consistantly recognize their role in the energy conservation program; we will continue to operate inefficient, energy wasting supermarkets and buildings. Operating personnel must be educated to use energy only when required for example; turn off machines, equipment and lights when not in use; operate A/C and ventilating systems only when required; load refrigerated cases to recommended levels; to name a few of a multitude of seemingly minor operations that must be carried out if we are to effect energy saving programs. When energy was inexpensive there was no concern with its consumption and was often wasted. But we are into a different era, our values and philosophical outlook must be reconsidered and updated. This type of change can only be facilitated through ongoing educational programs.

Improved communication network within the company would provide a channel for continuous information flow. Persons on various levels and divisions with the aid of outside consultants as required would share their views on the critical issues from various vantage points. This would in turn facilitate more effective decision making as a team in the planning and implementation of the Energy Management Program. We at Steinberg's have made a start in this direction by holding periodic meetings and seminars with Management, Design, Engineering, Maintenance and Operations.

In conclusion I would like to say that if we are committed to the goal of energy conservation it is up to us to formulate a well defined policy which will then be reflected in a workable Energy Management Program. Every corporation both large and small has a moral obligation and an economic incentive to reduce energy consumption. Each of us can do something about energy conservation in a responsible and accountable manner.

This organization has taken a step in the right direction by providing a forum through which the food industry can share the relative success of programs which are presently in effect or under consideration amongst ourselves and the people representing various disciplines that are present here.

It is my belief that we must take the initiative and involve government to take a more serious look at the whole issue of Energy Conservation. In this way we ensure that they recognize the needs of the food industry so that whatever energy policy and programs are being developed will best suit our interest and needs. For if we do not, programs may be forced upon us that may not be to our liking nor suitable to the particular problems that we face as an industry in its broadest sense from the farm to the dinner table.

We must further take the initiative to foster an attitude of cooperation and improve channels or communication within each organization among the industry and government.

Changes in our attitude to the use of energy will have to be realigned to the goal of energy conservation. We will have to learn to value energy, to plan for its use in a responsible manner for the benefit of all. This is the challenge we are facing in the next ten years.

HEATING-COOLING LOADS, JUNE 1977

AREA

Sales Area	38,499 Sq.Ft.
Back Store	14,432 Sq.Ft.
TOTAL	52,931 Sq.Ft.

COOLING LOAD

Total Sensible	987,555 BTU/HR
Total Latent	121,368 BTU/HR
Outdoor Latent & Sensible	120,000 BTU/HR
TOTAL	1,228,923 BTU/HR or 102.4 Tons

Credit due to effect of refrigerated counters
Total BTU/HR of refrigerated counters = 789,920 BTU/HR

Sensible Credit
65% or
789,920 BTU/HR = 513,448

Latent Credit
10% of
789,920 BTU/HR = 78,992

TOTAL CREDIT	592,440	592,440
NET A.C.		636,483BTU or 53 Tons

A 46% Reduction in Air Conditioning Capacity

HEATING LOAD

Total Heat Loss 515 KW

Sales Area	312 KW
Back Store	83
Mezzanine	10
Loading Docks - Vestibule (1)	135
TOTAL	540 KW

Note: Vestibule-Receiving Platforms Present 25% of total heat loss

Credit

Lights	180 KW		
Heat Recovery Coil	117 KW	(2)	
	297	(3)	297
Net Heat Loss			243 KW

Insulation

An example of decision making for the long view rather than initial cost outlay was a reevaluation of a department store with 160,000 sq.ft. of roof area including 53,000 of supermarket area noted above. A decision was made to increase the roof insulation from 1-1/2" to 2" at a cost of $15,000.00. A 20% or $4,000.00 per annum saving in heating cost will be realized.

NOTES:

1. 25% of total heat loss

2. A 21% reduction in installed heating

3. A 54% reduction in installed heating

FOOTNOTE

[1] Managing Industrial Energy Conservation 1977 AMACOM Division of American Management Associations.