BUYING TIME

In The Energy Crisis

by Edward Olsen

Waste not, want not, is the maxim I would teach.
Let your watchword be dispatch, and practice what you preach:
Do not let your chances like sunbeams pass you by,
For you never miss the water till the well runs dry.
—*Rowland Howard*

One hundred and fifty years ago the typical American heated his home and cooked his food with heat energy from burning wood. The wood had to be cut by hand, transported by horse-drawn wagon, and manhandled into sheds or piles to keep it more or less dry through an entire winter. Obtaining his heat energy requirements was a sufficiently impressive chore that it was used in sparing fashion, a part of a whole life style and ethic that came to be called "Yankee conservatism."

This ethic never really died, though it has certainly waned. It survived into the early part of this century in rural areas, and the Great Depression of the 1930s forced it upon even the most cavalier city dweller. America moved from using wood to using coal, natural gas, and oil products by the turn of the century. It is interesting that John D. Rockefeller, with his Standard Oil Company, accumulated his fabulous millions before 1900, when the automobile was still an experimental novelty. Most of his oil was sold for lighting and heating purposes.

Gas and oil have the nice properties of being easy to handle and transport. When they occurred in abundance the forces of a free economy market made them less expensive, and less impressive upon the average person's mind than the hard-won pile of wood in the woodshed of his grandfather. Thus, we have evolved into a nation of energy consumers, few of whom concern ourselves with the conservation of that energy. It is the exceptional American today who turns off a light bulb (which operates at less than 5 percent efficiency) when he leaves a room unoccupied for a period of time.

We are currently dependent upon petroleum products that are dwindling domestically, and we find ourselves in the difficult position of having to rely upon imported sources. This reliance has negative effects on our economy (balance of payments), political abilities, and national security. We do have some additional domestic petroleum resources, very large coal resources, and an inventive technology that can tap novel sources of energy; however, in each case we face what is called "lead time." It takes about seven years from the time a new oil field is discovered to start it into production on a commercial basis. Depending on the circumstances, a new coal mine can take more than five years to get into production. New energy sources, such as solar, wind, tidal, geothermal (wet and dry), water-temperature-gradient systems, fuel cells, atomic fusion, and so on will take decades to become major factors in the energy-supply picture. Thus, we are faced with a problem of buying time until additional sources can be developed. The only way to do this is to stretch what we have now and return to the old conservation ethic that was a part of our national life style when this country was young.

Energy Conservation

At present we use over 25 percent of all our energy in commercial and residential heating (including water heating), cooking, refrigeration, and air-conditioning. Great savings of energy can be made in this sector. Insulation of walls, ceilings, and floors, and the

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addition of window and door weather-stripping and storm windows, would save 42 percent of the energy used in heating alone. In terms of our national energy total this comes to a saving of about 7.5 percent or over 1.4 quadrillion calories—the equivalent of about one billion barrels of oil each year.

Most space-heating furnaces today, whether burning oil, gas, or coal, lose about one fourth of their heat up the chimney *if* they are well maintained. Most are not, however, and they lose 50 to 65 percent of their heat to the outside. Although an electric heater is close to 100 percent efficient at the point where it is operating, when electrical line transmission losses are considered, and the inefficiencies inherent in present electrical generating facilities, the electric space heater comes out only about 30 percent efficient.

Thus, great conservation can be attained by insulating older buildings as much as possible (and it is, of course, impossible to insulate them completely without dismantling and rebuilding them), and requiring that new construction be fully insulated. By tax incentives, individuals and companies could be encouraged to maintain their heating equipment so that their best efficiencies can be achieved.

In the area of refrigeration, it is known that self-defrosting refrigerators use 50 percent more electricity to operate than the kind that require manual defrosting. On the other hand, the energy lost in manually shutting down a refrigerator and then, later, running it excessively to achieve cooling temperatures again, could balance out the difference in apparent operating costs if the manual refrigerator requires defrosting several times each year. This depends on the simple matter of how well the door seals are maintained and on whether the door is left open for long periods of time during meal preparation. Leaving the door open, especially in humid summer months, can cause frost to build up rapidly, lower the efficiency of the food-cooling unit, and require more frequent defrostings. It comes thus to the matter of developing more cautious personal habits.

In this regard, there is the erroneous notion abroad, that a light bulb has its life shortened if it is repeatedly turned off and on, and that it is cheaper, in the long run, to leave it on if one is going out of a room for moderate periods of time. This is not true. The old habit (of depression years) of turning bulbs off when leaving a room, even for a few minutes, saves energy in the long run. On the other hand, the lifetime of a fluorescent tube can be shortened by repeated turnings off and on. A fluorescent tube uses about one fourth as much energy to operate per unit of light as does a bulb. Deciding whether or not to turn off a light should be determined by how long one plans to be out of a room.

Home gas ovens and stoves, gas-fired furnaces, gas-fired water heaters, and gas clothes driers, all use significant amounts of natural gas just to keep their pilot lights burning. Gradually these might be phased out in favor of units that use electronic spark ignition devices. By the same token, gas lamps that serve to merely decorate the front lawns of residences will have to go.

The current trend in large cities, such as Chicago and New York, is to build gigantic office buildings with "internal climates." These have smoky glass windows to diminish the sun's light, air-conditioning, heating and humidity control, and uniform lighting. There is, then, a certain amount of light per square yard, whether or not persons are working in that square yard, as opposed to the old system of individual desk lamps. In fine weather there is no way to open a window, nor any way to let in natural light. Thus, a building such as the World Trade Center in New York City uses more energy than the entire city of Schenectady, New York, population 100,000!

TABLE 1
Energy Consumption for Passenger Transportation*

Means of Transportation	Calories Per Passenger Mile	
	Urban Travel	Intercity Travel
Bicycle	50	
Walking	75	
Bus	925	400
Railroad		725
Automobile	2,025	850
Airplane		2,100

*After E. Hirst, Oak Ridge National Laboratory

Transportation, especially personal transportation, is a big factor in energy conservation. It takes, for example, 27 times more energy to drive to a store to buy a loaf of bread than it does to walk there and, surprisingly, 40 times more energy than to bicycle there! Table 1 shows some comparative values of calories per passenger mile. For those who wish to lose weight, walking is a far better deal than biking. Suburban communities and their shopping centers, that have built up over the past few decades, are based on the automobile. The ability to drive, inexpensively, to shop is the reason they can exist. As fuel prices increase, suburbanities will have to consider more efficient shopping practices, that is, waiting to shop until they get a long list of items to purchase, perhaps car-pooling with neighbors, and encouraging suburban bus routes. In addition, the average American car gets only about 12 miles per gallon, whereas the average European car gets about twice that mileage. The trend to more efficient cars has started in the United States and will certainly continue. Chrysler Corporation has already announced that it intends to phase out all of its full-size autos and produce only compact models.

In both private and commercial sectors the use of air-conditioning has increased enormously over the past decade. The efficiency of air-conditioning units varies widely from as little as 1.2 calories of cooling (*i.e.*, heat removed) for each watt of electricity used per hour, to as much as 4.1 calories. This is about a 340 percent difference!

This large difference involves several factors; however, it is clear that the average efficiency of such units will have to increase toward the higher number of calories removed. It is estimated that if all home window air-conditioning units could be upgraded to about 2.5 calories of cooling per watt of electricity for each hour of operation, it would total up to a saving of 13.6 trillion calories per year in the United States.

Further, more careful use could be made of air-conditioning units. In private homes the use of attic fans can diminish heat build-up during hot summer days and reduce the need for air-conditioning. As simple a measure as having a few deciduous trees shading a house roof in the summer can make a big difference, as the dwellers of homes in the Old South learned a long time ago. Also, these trees lose their leaves in winter, which allows the winter sun to warm the roof, reducing some of the heating needs at those times.

In housing, there has been a dramatic rise in the sale of premanufactured homes—mobile homes and similar prefabricated units. About 25 percent of all new housing in the United States consists of mobile homes. These are thin-walled and usually poorly insulated. They are high users of energy, winter and summer. Obviously, stricter standards are going to have to be applied to the construction of such homes.

Industry is likely to respond to energy shortages more rapidly than individuals. Industry consumes about 40 percent of the energy used in the United States. For example, between 1960 and 1968 the energy needed to produce a ton of steel went from 7.5 million calories to 6.5 million calories, a drop of 13 percent. Much of this was due to increased efficiency of blast furnaces. New furnace designs are expected to effect even more dramatic reductions.

In the electrical-generating utilities, the efficiency of converting coal (in coal-fired generators) to electricity was only 5 percent in 1900. That is, 95 percent of the energy of the burning coal was lost in the process. The current efficiency is about 38 percent, and likely to improve. Most present nuclear power plants (light water reactors) produce electricity at about 31 percent efficiency. By innovations in this area, this can increase to about 50-60 percent.

Many industries are currently looking into systems to recover wasted heat, to recycle it, and increase their overall efficiency. For example, if a company uses diesel electrical generators, present practice is to vent the engine heat to the outside. This heat can be used to heat water or ducted air for their own space heating needs. Similarly, companies that require steam for a process (as in paper-making) could use the waste steam to run electrical generators to provide for their own electrical needs and, in some cases, have enough to sell to adjacent industries. Such systems are called *cogeneration systems*. They are being examined by a number of large industries to cut fuel costs and conserve energy.

TABLE 2
Energy Consumption for Freight Transportation*

Means of Transportation	Calories per Ton Mile
Pipeline	112
Railroad	168
Ships, barges, etc.	170
Truck	950
Airplane	10,500

*After E. Hirst, Oak Ridge National Laboratory

Incentives for Conservation

How we came to be a nation that forgot its Yankee conservative ethic is a complicated history of personal, commercial, industrial, and governmental practices. For example, because the government has subsidized road-building and airports, the public has responded by using these inherently inefficient means of transportation. Such trends will have to be reversed. Individuals, as well as industry, respond to increased prices rapidly. Tax incentives to promote sales of smaller, more efficient automobiles are clearly needed. Similarly, tax and interest rate incentives can promote the better insulation of new and old housing. Special, low natural gas and electrical rates by utilities to large users must be reviewed and new practices established depending on the nature of the use. Federal railroad regulations, many dating back 100 years, hamstring railroad companies and limit their ability to compete with other forms of transportation and cargo hauling—and even with themselves. In many other industries, accelerated depreciation allowances would promote the installation of new, more efficient equipment.

A strong energy conservation program by government and industry is clearly the only way we can buy time to the point where domestic energy production and consumption balance, and permit a modest annual growth. Volunteerism will not be enough.

In the private sector we are, each of us, going to have to increase activities that do not require much energy, especially petroleum. Long, cross-country trips in motor homes that get less than 10 miles per gallon will have to be replaced with excursions using public transportation—something Europeans learned long ago. Further, such low energy consumptive activities as handicrafts and arts, volunteer programs to help the aged, the young, and the sick; teaching, and involvement in political and public affairs, will all be avenues for individuals, rather than the more energy-consumptive free-time activities of the present. Energy conservation will have many personal repercussions. We may even get to know our neighbors again—another Yankee tradition revisited. □