Market Signals Fall Short as Policy Instruments to Encourage Energy Savings in the Home

***Harold Wilhite, Ressurskonsult (Oslo), Jyukankyo** Research Institute (Tokyo)*

Energy conservation policy has been dominated by technical and economic approaches, the aims of which have been to get energy efficient technology into the market place and let its economic advantages direct it into the hands of end-users. The complexities of energy consumption decisions have been largely ignored or at best given superficial treatment. In this article, I discuss some of the social complexities behind home energy consumption. I point to barriers to "rational economic" decision-making, the strongest of which are informational barriers. Getting the price of energy right will move consumption patterns, but it is not sufficient to capture the potential created by end-users who are willing to change but who are poorly informed. Intervention is necessary, especially supplementary information. Consumers need better information on the links between their energy consumption and environmental problems; better billing information; information which clarifies the efficiency characteristics of energy equipment; and information which gives people a basis for better management of their home energy services. The latter is important but has not been emphasized in energy policy for a number of reasons, among them sensitivity about tampering with lifestyle and taboos about tampering with economic growth.

Introduction

Energy conservation has been a goal in energy policy since the energy crises of the 1970's. The ultimate aims have been to save money, both for the society as a whole and for the individual energy consumer; to save the environment, both from resource depletion and from pollution associated with energy production and use; and to strengthen national security by reducing dependency on energy imports. Energy conservation policy has been dominated by technical and economic approaches, the aims of which have been to get energy efficient technology into the market place and let its economic advantages direct it into the hands of end-users. The complexities of energy consumption decisions have been largely ignored or at best given superficial treatment. This is true for all end-use environments, but is especially true in the home, where economic and technical issues are only some of a myriad of complex issues which govern choices. In this article, I discuss some of the social complexities behind home energy consumption. I point to barriers to "rational economic" decision-making. I argue that policies which rely on the market miss much of the conservation potential in the home.

The Social and Cultural Complexities Behind Energy Consumption Decisions in the Home

Findings from social scientific studies of energy use in the home show that people are neither robotic maximizers of energy profits nor minimizers of energy costs (Owens and Wilhite 1988; Lutzenhiser 1993; Ilstad 1981; Hallin and Petersson 1986). "My home is my castle" is more than a popular saying - it is a reflection of the importance of the home in the United States and other Western countries. In Norway, the home has been called a part of a "Holy Trinity" for Norwegian families, on a par with spouse and children (Gullestad 1984). For many, the home is a sanctuary and a retreat. It is also a reflection to the outside world of the occupant's taste's and values. People are very particular about the ambiance they create for their home's interior and energy services such as heat and light are important elements in the creation and presentation of the home. For many people the act of home creation is never finished. Homes are put through phases of renovation activity in which energy projects figure prominently (Wilhite and Ling 1992).

Results from empirical studies in which I have participated illustrate the subordinate role which economic considerations play in home energy decision making. The first was an ethnographic study of energy-use decision-making in 60 households in Northern California in 1983, followed by similar studies in Norway in 1984 and 1989. In the California study, the sample was selected in such a way that 30 of the 60 households had invested at least $100 in energy conservation retrofits for their homes. Many families in the sample had spent in excess of $2000. Examples of projects were installation of wall and ceiling insulation, energy efficient windows, solar panels, heat pumps and even greenhouses. In depth interviews revealed that most of these projects were done in a context of improving the comfort or aesthetic of home. A desire to reduce energy costs did not rank high as an issue in the purchase decision. Payback times were calculated by only 3 families. Post-investment energy bills were only monitored by 1 family, evidence that people were not making an effort to assess the economic advantages of their projects.

In the course of the interviews, we were puzzled to discover that while people had spent so much on insulation and other projects, there were often visible gaps around doors and windows. Only 9 of the 30 households had installed weather-stripping around doors or caulked their windows, even though building stocks were old, the cost of weather-stripping was a only a few dollars and the payback time was less than one year. The economically rational decision would of course be to invest those few dollars. Why didn't most people do it? Our analysis showed that answer lay in the way home projects were cognitively categorized by families. Projects were largely grouped into "improvements" and "repair/maintenance". Improvements consisted of larger projects which had a highly visible result. They were something to brag about to friends, relatives and neighbors. Maintenance of roofs, fences, drainpipes, etc., was considered to be a necessary activity which people did grudgingly. For these families, weather-stripping was neither categorized as improvement or repair. On the one hand, it was not something to be bragged about. On the other hand, nothing was really "broken" in the usual sense of the word. It had neither the social benefits of home improvements nor was it part of established maintenance routines. Thus this perfectly rational economic behavior did not get done for perfectly good reasons (Wilk and Wilhite 1985).

The two Oslo studies revealed that the fetish for home improvement is equally strong in Norway (Wilhite 1984; Wilhite and Ling 1991). Again, energy conservation projects were most often done in conjunction with home improvement. Saving energy or money was secondary. Very few respondents monitored their energy bills to measure the advantages of their investments in energy efficiency [1]. These and subsequent studies showed that Norwegians have the same lack of interest in payback times for home energy projects as Northern Californians (Ljones 1992). These and other empirical studies demonstrate how the calculation of payback time, so fundamental to the economic model of energy purchase decisions is of marginal importance in decisions (Lutzenhiser 1993; Faelt et al. 1983). This is not indicative of irrational decision making, but rather of a rationality which involves a weighing of other costs and benefits than strictly economic ones.

This secondary role of energy running costs and payback times is also a fact of life in the Scandinavian market place for major energy appliances. In a study of transactions in over 50 retail appliance stores in the Nordic capitals, fewer than 20% of the customers interviewed were interested in energy running costs (Ling and Wilhite 1992). Size, appearance and brand were all factors which took precedence, a finding consistent with studies in the United States and Australia (Dyer and Maroni 1988). One reason for this low priority is poor information on the energy efficiency characteristics of products. Given a choice of two refrigerators, identical in every detail except that one is more energy efficient, consumers would of course choose the more efficient machine. The problem is that in countries which have not yet instituted energy efficiency labeling, it is very difficult to figure out which machine is more energy efficient. A review of Nordic brochures in 1991 showed that only a very small percentage gave the energy-efficiency information in a form that could be understood by an average consumer (Ling and Wilhite 1992). The energy decision environment was improved in 1993, when energy labelling was instituted in the Nordic countries.

These studies show that energy and the services which it provides serve a number of non-economic goals, among them home improvement, ambiance creation, comfort and status. While energy services and energy-using products have a cost, those costs are often ignored or relegated to the background. To put it another way, household decisions to invest in energy efficiency or to change energy-using habits do not turn on price and cost considerations alone.

Unfortunately, the models most often used as a basis for policy assume economically rational behavior. This view supports the argument to free up "market-forces." The market will send correct price and cost signals, permitting economically rational end-users to make decisions to be more energy efficient when it is appropriate. The examples above illustrate serious flaws in this model. In the next section I show how informational barriers exacerbate the problem.

The Murky Relationship Between Energy Consumption and Its Costs, Services and Consequences

Even if consumers were perfectly "economically" rational, there are several barriers which prevent price and costs from being given thorough attention in consumption decisions.

Price Signal Static

Results of studies in many countries show that the average energy consumer is not aware of the price they pay for energy; the most recent changes in price; or their periodic (monthly or annual) energy costs (Stern and Aronson 1984). Part of the problem lies in the way in which energy price and consumption information is conveyed to consumers. Most billing systems do not function well as carriers of information. This is particularly true in many European and Asian countries, where bills come infrequently, do not present information clearly and do not provide enough information for customers to be able to follow trends in their consumption.

The standard billing systems in Oslo and Helsinki are representative of many systems around the world: residents receive only one bill each year on which actual consumption is the basis for the bill. The utility sends additional bills (3 in Oslo, 9 in Helsinki), but they are invoices for a fraction of the estimated annual energy costs (usually based on the previous year's consumption). A recent study showed that greater billing frequency and improved billing information can lead to significant energy savings. In 1989 a sample of about 1400 households was selected in Oslo and 800 households in Helsinki. The samples were divided into control and experimental groups. Their energy consumption was monitored for three years. The control group received the usual bill. In Oslo, the experimental groups received bills for actual consumption at increased frequency (6 times per year). One experimental group received a graphic showing consumption trends and a second group received the graphic and energy conserving tips[2]. In Oslo, experimental groups saved 10% of their electricity use as compared to the control group. In Helsinki, the group which received maximum feedback saved about 4.7% with respect to the control group. This study showed how feedback in the form of a clarification of price, costs and consumption trends, has the potential to encourage significant changes in consumption patterns (Wilhite et al. 1993).

For residents in mass metered apartment buildings and condominiums, cost signals are virtually completely eliminated. Residents do not pay for their own energy consumption, but rather pay a percentage of the building's total energy costs. Further, the energy payment is often hidden in a total monthly payment to the building landlord or building cooperative. Changes in price, consumption and energy costs are completely masked in this kind of billing system. Knowledge about price, costs and energy use issues tend to be very low (Wilhite 1984). There is no economic incentive for individual residents to reduce their own consumption. This lack of incentive is demonstrated quite clearly in a study of a building in California which converted from mass to individual metering. The change resulted in a reduction in energy consumption by 40% (Hackett 1984).

Energy Is Invisible

For most residential purposes, energy is invisible. Also, it has absolutely no value to the user before it is converted to a service. People use lumens, thermal energy and motive power, but pay for kWh, cubic meters of gas, or liters of gasoline. This makes it difficult to associate a given service, and the set of behaviors and equipment which are behind it, with a particular amount of energy. Since the costs of energy services are not disaggregated on energy bills, most of us have no idea what percentage of our energy cost goes to which end use. People tend to overestimate the visual (lighting and cooking) and underestimate space heat (Kempton and Layne 1988; Kempton et al. 1984; Wilhite and Ling 1991). Should a household be motivated to reduce energy costs for some reason, this lack of knowledge about where energy goes means they are not likely to choose the most effective strategies.

Another related problem is that it is very difficult to judge the rate of energy consumption associated with a given energy service (an exception is vehicle use, where we observe the gasoline gauge in its progression towards "empty"). There are no bells that ring or sirens that go off to tell us how energy consumption rates change when we turn up space heating thermostats, take 20 minute showers, or leave lights on in every room in the house. We have few points of reference for adjusting behavior[3].

For many applications, the consumption of energy service is displaced from the point of energy conversion. A good example is space heating, where heating units are placed in basements and where the service (heat) is felt but not seen. This contributes to the consistent underestimation of the proportion of a home's energy-use which goes to space heat. We suspect that in the Nordic billing study discussed above, one of the main reasons for savings in the experimental groups in Oslo was the fact that increased billing frequency made the contribution of space heat more visible. The usual case is that the Oslo resident is invoiced 3 times per year for the same amount each

time: one-fourth of the total amount of their previous year's energy costs. On the last bill, people pay the difference between last year's energy costs and the total of this year's invoiced payments. This invoice system flattens out energy costs and gives the user the impression that energy consumption is constant over the course of the year. This masks the costs of space heat, which normally would be revealed in the differences between winter and summer consumption. The experimental bills, which reported actual consumption every 60 days, showed seasonal differences to people for the first time. This clarification woke many participants up to the high cost of their space heating habits and spurred them to make changes (Wilhite et al. 1993).

Environmental Consequences Are Neither Directly Experienced Nor Directly Costed

The environmental consequences of energy consumption are seldom a factor in habit formation, in spite of evidence from many countries that people are concerned about the environmental consequences of their consumption routines. The problem is that information is lacking, both in the form of price and feedback on consequences. Environmental externalities are not included in the price we pay for energy. For most of us, the power plant is out of sight and the pollution happens somewhere else. We are only rarely confronted with the potential problems of nuclear fission or fossil fuel combustion (an exception is Eastern Europe and former Soviet States). Global warming has still not reached a critical threshold and there is evidence that even highly educated people do not understand the problem or how their energy use contributes to it. Global warming and its causes are often confused with the ozone depletion problem (Kempton 1991; Lofstedt 1992). The result is that people have no basis on which to adjust consumption patterns to minimize or avoid environmental consequences. Market prices need to be adjusted to reflect environmental externalities, but a price correction will not be sufficient. People need supplemental information which spells out the environmental consequences of energy consumption and shows how various consumption routines contribute to the problem.

Market Signals Are Not Enough

If Energy Were Bananas

If energy were bananas or hoola hoops, there would not be much concern about whether the ebb and flow of the price signal were sufficient to direct optimal consumption. These products are separate from all of the other products in the store and their price is clearly marked. Their functions are rather straightforward: to satisfy an appetite and as an object of play, respectively (ignoring the important role of banana peels in practical jokes). A shortage of either is not a grave collective concern, nor is either produced in a great enough volume to precipitate serious global environmental problems. From a resource, consumer interest or environmental perspective, there is no reason to single these products out for special attention.

Energy, on the other hand, is a special kind of product, and as I have pointed out, energy consumption is a unique kind of consumption.[4] Energy is produced and consumed in tremendous volumes. Its production and transmission have serious impacts on the environment. Its purposes are multiple and in the home the uses are not tagged with individual prices. Even the periodic aggregate bill for all energy services in the home is in many cases unclear. Given this special context for energy consumption, the market place alone cannot provide sufficient information to encourage significant changes in consumption patterns. Even a motivated consumer is groping in the dark.

Supplemental information is needed. In the Environmental consequences section above I argued for information on environmental problems and their links to energy use. I see the need for three additional kinds of information: clarification of the user's consumption and costs; clarification of efficiency characteristics of equipment; and information on how to better management energy services.

Consumption and Cost Information

The first category is a clarification of the carrier of consumption and cost information, the energy bill. The receipt and payment of the energy bill is the one regular event in which consumers are confronted with energy-use information. It provides the household with some basis for assessing the consequences of their energy-use behavior, both in terms of consumption and costs. It can function to raise awareness about energy-use and at the same time act as a carrier of important information. Many North American energy utilities have significantly improved their billing information in the last decade, but they can do more (every test of additional billing information of which I am aware has been positively received by consumers). The billing systems of most European and Asian utilities, on the other hand, have a long way to go when it comes to providing information. At a minimum, utilities need to increase their billing frequencies and to start billing for actual consumption, so that customers can more easily relate their energy use routines to the cost of those routines. All utilities should make efforts to report disaggregated costs of the various end-uses in the home.

Product Information

The second category is a clarification of the energy efficiency characteristics of energy using products, especially major appliances. Energy audits and energy efficiency labelling have had positive results in North America and Australia. They have recently been implemented in Scandinavia and in the European Community. As I pointed out above, labels tend to make energy efficiency an issue in purchase decisions. The increased transparency of energy efficiency also tends to pressure manufacturers to make more efficient machines.

Product information should clearly point out that energy efficient products save money, but information should not be limited to money issues. As was discussed above, home products serve aesthetic and "home improvement" goals as well. Product marketing should take advantage of these goals. Energy efficiency should be portrayed as an investment in coziness and solidity. An effort should be made to eliminate a popularly held notion that energy efficient appliances are somehow more austere and clumsy than others.

Better Management of Energy Services

Another important category of information is that which attempts to foster better management of energy services; i.e., shows people how to save energy with the same constellation of home equipment and appliances. The focus here is on service, not products: how to get the same energy service with less energy, and how to detect and eliminate wasteful services. Some examples of typical management problems are misunderstanding and misuse of space heat and air conditioning thermostats (Kempton et al. 1992); wasteful management of space heat and lighting systems (Moen et al. 1991); and wasteful water use (Lundstroem 1982). Several studies from a number of countries have demonstrated savings from 15% to as much as 34% through using relatively inexpensive informational interventions (Seligman et al. 1978; Winett et al. 1982; Jensen 1984). Another rapidly growing problem is "leaking electricity" from the increasing number of appliances with "standby" positions. Information about how much energy is leaking, why it is leaking and what to do about it (turn it off or unplug it) could save an enormous amount of energy (Sandberg 1993).

"Management" information has not been given an important role in energy conservation policy, partly because better management does not involve a market transaction: it encourages a change in consumption behavior without anything being bought or sold. No commercial actor profits from energy conservation which is accomplished through a user's better management of light, heat, or hot water, or by the user simply deciding to make do with less of something.[5] It is the individual consumer and the environment which profits from better energy management. The absence of commercial incentives and the existence of individual and collective benefits make a good argument for intervention.

Encouraging better energy management implies a change in policy approach to "energy lifestyles, " something which has been tiptoed around in most energy policies. This is a sensitive arena where blunders have been made. Information in the 1970's in the United States wrongly associated lifestyle changes with discomfort and sacrifice. Energy policies can do better than that. We can show how better management can actually add to the aesthetic of the home and increase comfort without really adding inconveniences. We can correct misinformation and ignorance about how much energy goes where. We can give better information on the environmental consequences of individual home energy use patterns and on the ways patterns can be altered to reduce environmental impacts.

There is evidence that energy policy efforts have been overly timid in their approach to lifestyles. Surveys from many countries show that people are more concerned about the environment, and more willing to make sacrifices, than policy makers are willing to give them credit for. Willett Kempton makes a strong case for broad public concern and commitment in the United States in his recent review for The Annual Review of Energy Environment. In one of the surveys he discusses, 79% of those polled said "I would be willing to give up convenience products and services I now enjoy if it meant helping preserve our natural resources (Dunlap and Scarce 1993). " The long-term trend in attitude is shown in a study by Cambridge Reports. Respondents were asked to choose between "We must sacrifice economic growth in order to preserve and protect the environment, " and the converse. Those who would choose to sacrifice economic growth grew from 38% in 1976 to 64% in 1990. Those preferring to sacrifice environmental quality fell from 21% to 15% ("Don't Know" halved from 41% to 21%) (Kempton 1993).

Growth paradigms and the association of "more with progress" have inhibited a focus on energy services. There is evidence, however, that many policy makers themselves feel frustrated by models which over-reward service growth and undervalue the environment (Craig et al. 1993). In a study of the attitudes of senior policy makers in Austria, the United Kingdom, Sweden and Germany, many revealed ethical values concerning the environment which went far beyond what they felt they were allowed to exercise in their roles as policy makers. Many cited frustration with the economic models which they felt bounded by. The following quote is representative: "... the whole idea behind the market economy is to increase

the consumption of materials all the time. That is very much contrary to my values. Certain aspects of the market economy are fantastic. Another aspect is working completely contrary to my personal views. And I can't resolve this. I'm probably desperate. I don't know what to do (Craig et al. 1993: 149)."

Even the most ambitious energy efficiency scenarios (in which demand for services is allowed to grow) still predict a total increase in energy demand in OECD countries over the next decades, an unacceptable development in light of global warming, nuclear waste disposal and the other side effects of conventional energy production (Wiel 1994). In order to cut the growth in energy demand, the taboos of service growth and lifestyle will have to be addressed.

Conclusion

From an environmental point of view, it is absolutely imperative that there be a change in energy consumption patterns in Western countries. In the home these patterns are rooted in the complex context of home culture and are insulated from signals to change by ignorance and misinformation. At the same time, there is a willingness to change. Getting the price of energy right will move consumption patterns, but it is not sufficient to capture the potential that the combination of willingness and misinformation create. Intervention will be necessary and information must be given an important role.

Endnotes

1. In Kempton and Montgomery (1982), the authors have shown that when people do make the effort to monitor the benefits of energy conservation, they do so by comparing dollar amounts on bills, not by comparing energy consumption. Since more energy conservation investments are done during times of increasing prices, this practice reduces the apparent value of the improvements and discourages further efforts.

2. In Helsinki the information was sent in the form of a separate report, mailed shortly after the bill was sent.

3. There is at least one exception that I am aware of to this absence of "bells and whistles." Until around 1980 in Norway, households paid extra when the total wattage in the house exceeded a given load. Watt meters were installed prominently on kitchen walls. They had a red zone to indicate when wattage was excessive. In 1990, people who had those meters in their kitchens still recalled the "feedback information" which they provided (Wilhite and Ling 1991).

4. Nonetheless, the consumption of all material goods affects the environment in some way, and increases in the level of global consumption is one of the reasons why many environmental problems are approaching, or have exceeded, critical points. Recently, there has been increased international concern, evidenced in such fora as the Commission For Sustainable Development (CSD) and the World Bank, about the relationship between Western consumption patterns and environmental problems. In a recent report to the CSD, I argued that policy efforts directed at changing unsustainable consumption patterns (encouraging "green" consumption) can profit from the energy experience. The most important lesson is that surcharges and other forms for price increases, while necessary, are not sufficient to encourage significant changes in consumption patterns (Wilhite 1993).

5. With the very important exception of the energy utility, in the situation when demand is projected to exceed system capacity. The energy utility can acquire "demand-side" energy very cheaply through providing energy management information.

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