The Person Behind the Meter: An Ethnographic Analysis of Residential Energy Consumption in Oslo, Norway

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In an ethnographic study in Oslo, our purpose has been to shed light on important dimensions of residential energy-use behavior. Central questions in the study have been: how do people use energy in their homes; what are the behaviors, knowledge and awareness associated with energy use and conservation; and how are all of these tied to home culture? We have found wasteful heat and light behaviors and have related them to both the creation of ambiance and misunderstandings about where energy goes in the home. Another important finding is that people are poorly informed about the amount of energy which goes to space heat. We discuss two important reasons for this: invisibility of space heat and an energy billing system which hides the contribution of space heat to energy costs. We found awareness of the energy-use of major appliances to be extremely low, which makes energy efficiency a non-issue in purchase decisions. When it comes to the outer environment, people are concerned about pollution, but uncertain about how environmental problems are linked to their household's energy-use. Though people point to the automobile as the source of serious pollution problems, there is little willingness to change driving habits. Our findings need to be tested in a larger sample, but we have strong evidence that there is confusion on environmental issues and knowledge gaps on important energy-use in the home. Energy conservation programs should aim at eliminating confusion. They would also benefit from conveying the message that people can use less energy without negatively affecting home ambiance.

Introduction

There is ample evidence that household energy-use in Norway is excessive. One indication of this is that while the per capita residential energy consumption in other Scandinavian countries has decreased since the 1970's, Norwegian consumption has increased during the same period (see Figure 1).

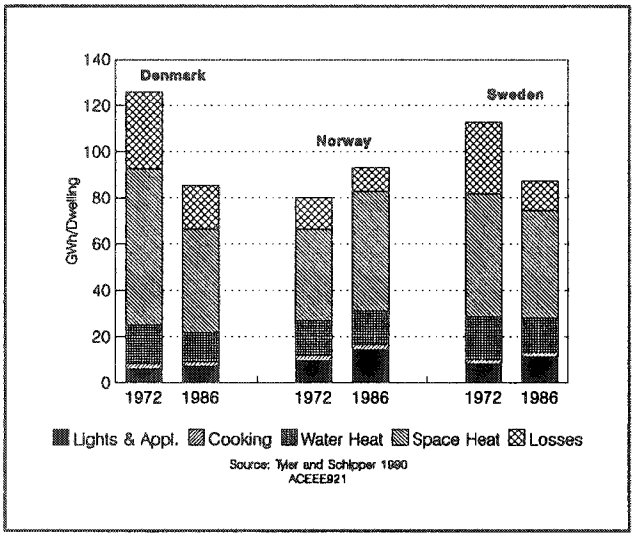

Figure 1. Residential Energy Use in Scandinavia

At the macro level, there are two good explanations for these differences. Norway has had access to cheap and abundant hydroelectric energy, and historically, prices for electricity have been low compared to the other Scandinavian countries.

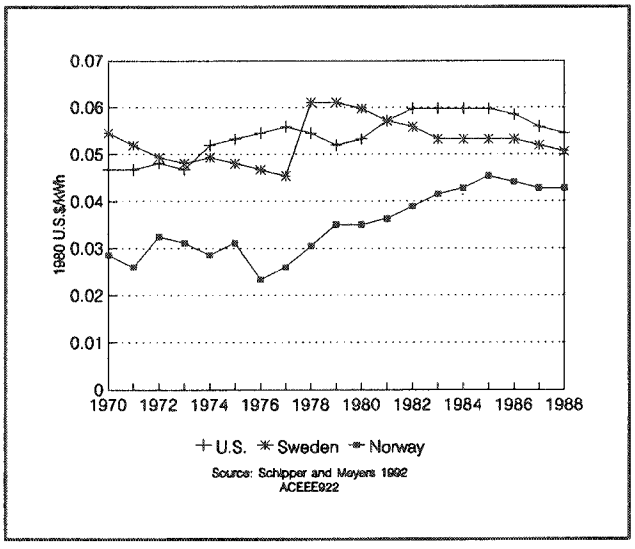

Figure 2. Electricity Prices in Norway, Sweden and the United States

An environment of abundant energy and low prices has contributed to a special home culture in which energy services are used largely without regard for what they cost (we define home culture as the complex of attitudes, knowledge and behaviors which contribute to the creation, presentation and maintenance of the home). To put it another way, energy desires and needs in the home have been linked to energy services (light, heat, refrigeration, etc.), but have been uncoupled from concerns about energy costs. This has resulted in wasteful energy-use habits which have become fixtures of home culture. This means that even though cheap energy provides a historical explanation for wasteful home energy habits, tinkering with the price of energy will not be sufficient to stimulate changes. Economic incentives are important, but to be effective, they will have to be complemented with information on what people can do to eliminate waste and how they can go about it without detracting from comfort and convenience.

In an ethnographic study in Oslo, our purpose has been to shed light on household energy-use. Important questions in the study have been: how do people use energy in their homes; what are the behaviors, knowledge and awareness associated with energy use and conservation; and how are these issues tied to home culture? Our research has been policy-oriented -- an important goal has been that our findings lend themselves to recasting in the form of policy recommendations. We have examined home energy culture and knowledge about energy use as a starting point for much needed marketing and information programs on household energy conservation.

After a brief discussion of methods, we discuss space heating and lighting behaviors and their link to the creation of home ambiance. We then take up misunderstandings about home energy use, focusing on space heat and major appliances. Finally, in view of an enormous increase in media attention and political discussion surrounding environmental issues, we have also examined environmental attitudes and their links to household behavior -- to what extent are people concerned about environmental problems, which do they see as the most serious problems and how do they link them to their own behavior?

Methods

Our findings are based on ethnographic interviews done in 18 homes in Oslo. The homes were selected randomly from the telephone catalogue. Households in the sample represent a wide range of age and income categories, from renters who had to work hard in order to make ends meet to upper-middle class homeowners. The homes in the sample consisted of both apartments and single family homes which range in age from 6 months to 100 years.

The majority of interviews were done in the evening and, in most cases, all the adult residents were present at the interview. The interviews were open-ended, allowing the interviewers to follow up on issues which were of interest. This allowed us to explore different dimensions of energy use, to examine alternative explanations, to spin off hypotheses about why it is that people do the things that they do. In interpreting responses, we were able to take into account body language, phrasing, pauses, and word choice. These, together with audio tapes and interview transcripts, gave a rich basis for our analysis.

Though households in the sample were randomly selected, the small sample size limits generalizability of the results. This is often a problem with ethnographic research, in which depth and validity are achieved at the expense of breadth and generalizability. Our conclusions should therefore be viewed as tentative, but highly valid. Their reliability are intended to be tested in a broader study in 1993.

Space Heating, Lighting and Home Ambiance

We found a number of wasteful heating and lighting habits and evidence that they are strongly coupled to notions of what constitutes a cozy home interior (Wilhite and Ling 1990). First, we will discuss heating and lighting habits and then relate them to our findings on home ambiance.

Norwegians like their living rooms to be very warm in the evenings. During the course of the interviews, most of which were done early in the evening in April-May, we measured the temperature in the living room. Temperatures varied from a low of 19.2 C to a high of 24.8 C (66.5 -- 76.6 F), with the average being 21.8 C (71.2 F). These findings are consistent with earlier reports of indoor temperatures in Norwegian homes (Ilstad 1981; Utvalget for Energisparing 1983).

We found that less than half of the sample set back living room or central thermostats at night. The usual pattern was to leave thermostats (or electric wall-heater settings) constant and to regulate bedroom temperatures by opening and closing the window. In the same vein, 5 households (about 28% of the sample) do not lower thermostat settings when they leave the house for a weekend trip or vacation.

Only 4 of 18 households reported using sweaters on a winter evening. Our impression from the interviews is that

for households in Oslo, wearing a sweater in the evening is as socially inappropriate as sitting in the dark. This may seem odd in a country which is known for its knitting heritage. It seems, however, that wearing a sweater is seen as a sign of exaggerated frugality, in much the same way as an improperly lighted house.

After the interview, we counted the number of light bulbs in the household's living room. The number ranged from 4 to 16, with the average for the 18 households being 9.6.[1] Interestingly, only one household in our sample had a ceiling light in the living room, and this person was a short-term renter. The lighting of the homes which we visited consisted almost exclusively of floor, table or in a few cases wall lamps. Almost all lighting is either shaded or directed. When it comes to light management, only 1 of the 18 households reported that they turn off lights when they leave a room, and less than half of the sample turn off all of the lights when they leave the house.

In a country which has long, dark winters, it is understandable that heat and light are both valued commodities. Nonetheless, all indications are that Norwegians are in a class by themselves in terms of their habits regarding both. In a Scandinavian perspective, the Oslo homes in our study are 1.5 C (2.7 F) degrees warmer than the average reported from two Swedish studies, and 1 C (1.8 F) degree warmer than the average reported in dwellings in Copenhagen (Gaunt 1985; Widegren-Dafgård 1983; Jensen 1984). They are about 2 C (3.6 F) degrees higher than the average indoor temperature reported from a study of 60 households in Northern California (Wilk and Wilhite 1983).

Scandinavian variations in lighting use are also dramatic. Figure 3 shows that Norwegians use almost 3 times as much electricity to light their homes as do the Danes and Swedes.

In our interviews we explored the reasons behind these excessive space heat and lighting habits. We found that they are strongly tied to notions of what constitutes a correct interior ambiance, meaning the atmosphere in a room which is created through a combination of physical objects and sensory dimensions such as heat, light, color and sound. The light and heat dimensions of ambiance are composed of both natural and conventional energy inputs. In winter Norway, where the sun is not around to make a significant contribution, ambiance-creation relies heavily on conventional energy input.

In earlier works we have discussed how the choice of energy-related equipment is influenced by concerns about home ambiance (Wilk and Wilhite 1985; Wilhite and Ling

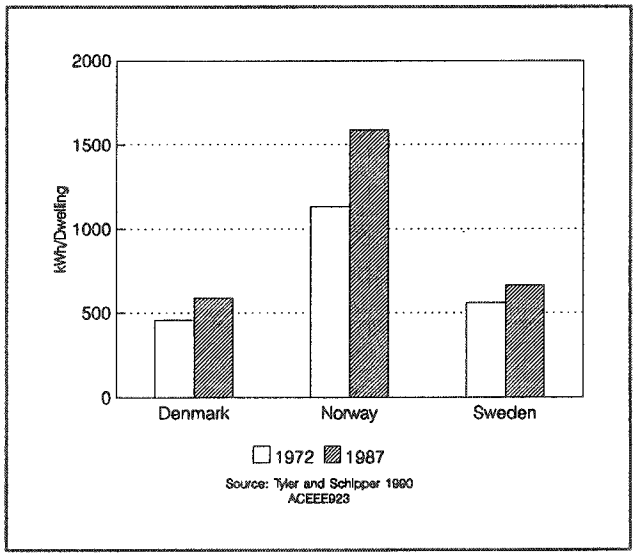

Figure 3. Lighting Electricity Use in Scandanavia

1990). Things which are part of the house's envelope, such as windows, insulation and weatherstripping, are more likely to be chosen if they are thought of as making a positive contribution to ambiance; or to put it another way, energy conservation improvements which are thought of as "ambiance-detractors" are less likely to be chosen. Similarly, in this study we have seen how energy-use habits are set in accordance with ideas about what constitutes a cozy interior.

Our respondents used the expression "godt og varmt" (good and warm) as a positive attribute of a home's ambiance. It is the same expression which is part of the typical greeting formula when a guest enters the hosts home: "Her er det godt og varmt" (Here it's nice and warm). For all of our respondents, a home which is not warm enough for the residents to go around in shirtsleeves and stocking feet is not properly heated. For a guest in a home to give any signs that they are uncomfortably cold is a serious disgrace for the host. Unlike other cities in the world where excessive heat may tag the inhabitant as wasteful, it seems that in Oslo an extra warm house is an extra good house.

The same relationship holds true between light and goodness. For many households, the well-being of the family is revealed by the brightness of the house. Several of our respondents used the following formulation to express this idea: "a dark house is a sad house." In the following sequence, a young woman tells about her impressions of her father's home.

Woman: When I come home it is totally dark.
Interviewer: How do you feel about that?
Woman: I feel like he is stingy. I mean it. Why in the world can't he turn on some lights? Then I think, 'maybe its because he can't afford it,' but I know that's not it.
Interviewer: It couldn't be that he is being careful about expenses?
Woman: Yeah, but I think it looks sad.

Interestingly, people are not only concerned with brightness, but with the kind, or quality, of light. Most people make a clear distinction between work spaces (kitchen, office) and living areas. Whereas ceiling lights are the norm for work spaces, they are rarely found in Norwegian living rooms. As we pointed out above, a cozily lighted living room is one which has many point lights around, casting their glow on limited parts of the room.

Interviewer: Do you like ceiling lamps?
Wife: No, not in the living room. . . . I think that they give such cold light. I want a lot of small lamps instead.
Friend: They are more aesthetic.
Wife: I think that it is more cozy with small lamps.
Husband: It is more idyllic.
Wife: It is too cold with a ceiling lamp in the living room.

Small table lamps, reading lamps and spot-lamps have become as necessary a part of home furnishings as a sofa or a chair. One of our respondents said:

When we are in the room here we have all of the lights on. When I sit there I like to see special things in the room. . . . I have to have the table lamps on so that there will be a special glow in the room. I will never have just a ceiling lamp for example. I am very conscious about my use of lighting.

A few households acknowledged the energy-intensity of their lighting preferences and rationalized it by saying that light bulbs are also small heaters; by having a lot of light points they reduce their need for heating load. This attitude can also be found among Norwegian policy makers. Until recently, lighting conservation has not been on the energy conservation policy agenda, in spite of the evidence of wasteful lighting practices (Moen, Wilhite and Ling 1991).

Marianne Gullestad, a Norwegian anthropologist, has written that "For both the husband and wife the trinity of spouse, home and children has central importance for identity and self-realization" (1984:85). Our results show that one cannot understand Norwegian space heat and lighting patterns without placing them in the context of Norwegian home culture. The presentation of the home is seen as a presentation of the family, and the picture which emerges should be clean, cozy, and harmonious. It would seem that space heat and lighting conservation programs in Norway are up against well entrenched attitudes about home ambiance. Policies should be oriented to showing people how they can get the same ambiance for less energy (thermostat management, light only the room you are in, purchase energy efficient bulbs, etc.), and to motivate people to alter their notions of proper ambiance; for example, by making the cost of the heat and light components of ambiance more visible. We give some thoughts on how that might be done in the next section.

Misunderstandings About Where Energy Goes in the Home

We found that households are poorly informed about the relative amounts of energy going to the various end-uses in the home. We take up two serious problems: space heat and major appliance use.

Underestimation of Energy Going to Space Heat

We have discussed how overheating and wasteful space heating habits are related to notions of ambiance. Our findings show that they are also related to ignorance about the dominant role of space heating in the home.

To get an idea about knowledge levels on end-use, we asked each household to estimate the percentages of energy going to space heat and light (in an average home in Oslo, about 60% of delivered energy goes to space heat, while about 15% goes to lighting). Seven of 18 households (38%) made estimates which we judged to be within 20% of the actual amount. The remaining 11 were far off the mark, and of those, four respondents (22%) made a serious misjudgment -- they estimated the amount of energy going to space heat was less than that going to lighting.[2]

We suggest two reasons for the underestimation of space heat energy: the invisibility of space heat and the fact that the consumption and costs of space heat energy are hidden by the Oslo energy billing system.

Heat Is Invisible. For many of us there is a strong cognitive link between electricity and light. This probably stems from school book descriptions of the "discovery" of electricity by Edison, in which the presence of electricity was evidenced by the production of light from a primitive light bulb. For many years, energy utilities were called "Light Companies." Oslo Energi was called Oslo Lysverker (literally translated "Oslo Light Works") until 1991.

This link between electricity and light is reinforced by our ability to instantaneously command and register light: flip a switch and it is light, flip it again and it is dark. The link between energy and space heat is not so obvious. In the winter season, many heaters stay on all of the time, or are regulated by thermostat, so that one is less cognizant of the link between the switch and the resultant heat. Further, when we do switch it on, the result is not instantaneous. It can take time before the space to be heated warms up, and time to cool down after things are turned off.

Another contrast between heating and lighting concerns losses. The amount of energy going to space heat is affected by loss of heat through the house's shell, around and through windows and doors, up chimneys and through poorly insulated walls. People tend to ignore or underestimate heat losses, partly because the exiting of heat from the house is invisible. Raising awareness about heat loss would help to correct misunderstandings about space heat energy. There is evidence that infra-red photographs, infra-red scanners and colored smoke can be effective for this purpose (Birdsall 1990; Gonzales et al 1986).

Energy Bills Reinforce Invisibility. The undervaluation of the contribution of space-heat is reinforced by the billing system in Oslo. Bills report consumption and associated costs only once a year. Otherwise, residents receive "averaged" bills three times a year, which are no more than an invoice for approximately one-fourth of the previous year's costs. Wilhite and Ribeiro have discussed the poor informational quality of such bills (1986). An important issue is that people never actually see seasonal peaks due to space heating, thereby hiding the high contribution of space heating to end-use.[3]

There is evidence from a billing study in Oslo that making seasonal variation more visible leads to energy conservation (Ling and Wilhite 1992). In the second year of the study, in which experimental groups are provided with a bi-monthly bill for actual use, the experimental groups used 10% less energy than the control group. One of the experimental groups receives only the increased billing, while the two others receive increased billing and additional information. There were no statistically significant differences among experimental groups, implying that we can attribute the differences between control and experimental groups to increased billing.

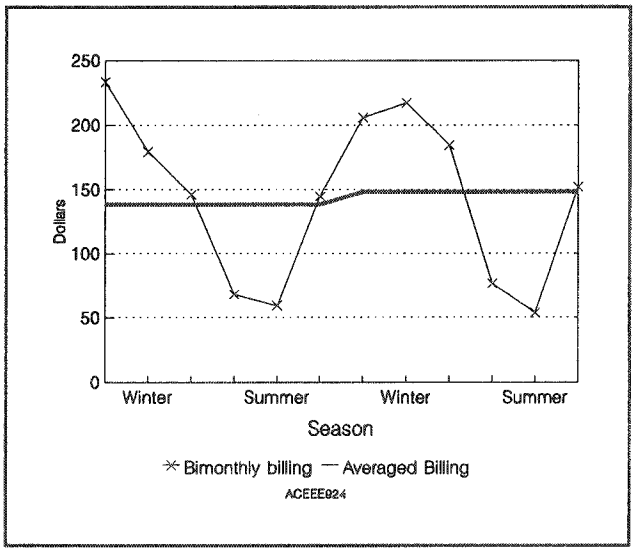

Figure 4. The Household's View of Seasonal Variation in Their Electricity Consumption

Figure 4 illustrates how seasonal variation is made more visible with more frequent billing. This visibility, in effect, disaggregates space heat. People get an idea of how much of their energy costs is attributable to space heat. We looked closer at this issue by examining the following subcategories of houses: all electric heating, partially electric heating and no electric heating. The first two categories, which see the seasonal variation, have both saved more than the average of 10.7 %. In the third category, which does not see seasonal variation in their electricity bill, experimental groups have actually used more energy than the control group. This implies that disaggregation may be the main reason for the savings in the experimental groups.

Ignorance About Appliance Energy-Use

One of the starkest findings from the study was a "knowledge-vacuum" concerning the energy-use characteristics of major household appliances. First, none of the 18 families interviewed had evaluated energy-efficiency in any of their major appliance purchases. Second, respondents from four families were not even aware that energy efficiency varies from model to model for a given appliance. The following interview sequence is from our interview with a female university professor living in a detached home in an upper-middle class neighborhood.

Interviewer: Are the energy-use characteristics of appliances something which you and your husband have thought about in your purchase decisions?
Woman: No.
Interviewer: Will you think about it in your upcoming decision? (they are thinking of buying a new refrigerator)
Woman: No.
Interviewer: Do you feel like that it's easy information to get hold of? When you buy a refrigerator, is it easy to compare running-costs?
Woman: I have no idea. It is something which I have never thought about.
Interviewer: Would you be positive to a label on the refrigerator which compared its energy consumption to others?
Woman: That sounds reasonable if there really are differences. I have never considered the fact that there might be differences. I know that there are differences with vacuum cleaners, but I have never thought about refrigerators.[4]

Another woman living in an apartment in a working class section of Oslo had the impression that all major appliances, regardless of type, use about the same amount of energy. When we asked her whether she examined energy efficiency when she shopped for an appliance she responded "no" and then went on to say "I thought, you know, that all electric appliances used, you know, the same. The washing machine used 2000 (kW), the dishwasher used 2000, the drier used 2000 ..."

It was clear to us from the interview that she also confuses a machine's maximum load (kW) with energy consumption (kWh). This has implications for purchase behavior, where load and efficiency are not directly related. The focus on kW is probably related to the fact that in Oslo, circuits in many older apartment buildings are not designed to accommodate the demands of modern appliances. People have had to learn how to orchestrate appliance use so as not to blow fuses.

In spite of the fact that load and running costs are not directly related, feedback on load seems to have had a positive effect on the energy-use knowledge of two families in the study. They have wattmeters in their kitchens (there was a period when wattmeters were installed in some apartment buildings in Oslo). Through observing variations in load while various machines are in use, these families have gained insights into the relative energy consumption of various machines. Both families pointed out the wattmeters were a tool which had contributed to an increase in their understanding of energy-use in their homes. In the course of the interview it became clear that both these families were, in fact, much more knowledgeable about appliance use and other issues surrounding home energy use. We see this finding as another indication of the power of direct feedback. There are meters available today which display both load and rate of consumption. A program to install such meters, which provide two kinds of feedback, could improve awareness and lead to significant energy savings.

Environmental Attitudes and Household Energy-Use Behavior

Environmental attitudes, energy-use behaviors and their relationship were important themes in the interviews. In response to the question "Is pollution a problem?," every interviewee answered in the affirmative. We can conclude without reservation that everyone in our sample is "concerned about the environment" at a general cognitive level. Our next question was "What are the biggest environmental problems?" At this point, most respondents began to fidget in their chairs or scratch their heads. Everyone eventually came up with an answer, but we got the impression that most people were reaching. There were almost as many answers as there were respondents, but answers can be grouped roughly as follows: about 1/3 named automobile-related problems, but in all but one case no more specifically than to name automobile exhaust; about 1/3 named garbage disposal and recycling; and the remaining 1/3 of the answers made up a mixed bag, including acid rain, chimney smoke, phosphate emissions from laundry soap, CFC emissions from refrigerators and the destruction of tropical rain forests. Only one person named the greenhouse effect specifically, and only one person volunteered electricity use as an environmental problem.

When we then asked what the respondents felt they could do about the problem, the responses were similarly vague. Five respondents placed the source of the problem somewhere else, alleviating themselves of the responsibility to do anything. There is some truth in this in the case of acid rain, which has been a serious problem in Southern Norway. The primary sources are Great Britain, the former Soviet Union and Northern Europe. For the other problems which people named, however, especially those associated with the automobile, the primary sources are Norwegian. The following figures exemplify the dramatic increase in Norwegian automobile use over the last four decades.

In Oslo, traffic across the city limits increased by 30% from 1985 to 1989. The Norwegian Pollution Control Authority (NPCA) estimates that 150,000 people of Oslo's

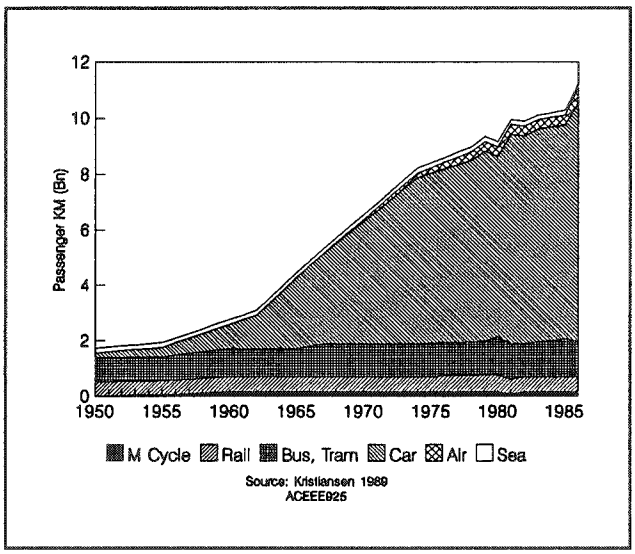

Figure 5. Passenger Travel in Norway by Mode

half a million population are "strongly plagued" by traffic noise (1990:2). Increased traffic has made the greatest contribution to Oslo's air pollution problem; it is estimated that one third of Oslo residents live or work in areas in which air pollution exceeds recommended limits for air quality (NPCA 1990:3).

Sixteen of the 18 households in our sample owned at least one car. Of those 16, 13 used at least one car for commuting. No one participated in a car pool. Those households which owned a car rarely used public transportation. The other principle uses of the car were shopping and travel in conjunction with free time activities.

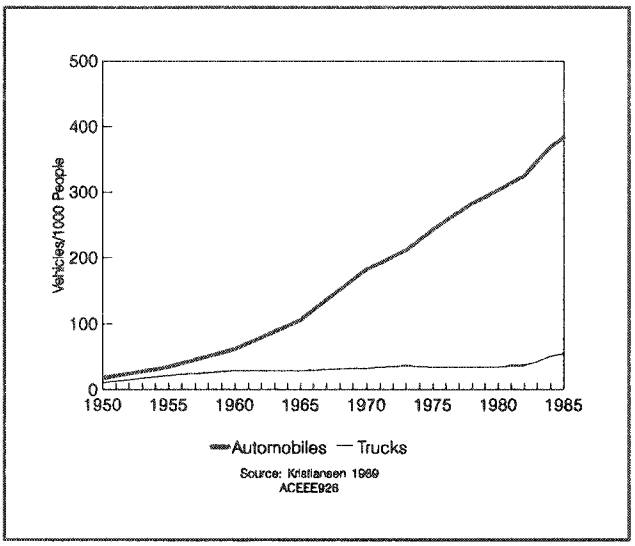

Figure 6. Motor Vehicles in Norway

Our assessment from the interviews is that automobile habits are well-entrenched. In spite of the fact that many of the respondents indicated that the car was the biggest environmental problem, few were inclined to reduce the use of their automobile. The following interview sequence is indicative of the dichotomy between attitude and behavior on this issue.

> Wife: Sometimes I don't think it should be allowed to drive.
> Interviewer: Are you concerned about local or global problems?
> Wife: Global.
> Interviewer: Does this influence how you use your car?
> Wife: Yes, but I must admit that I am the one who uses the car the most. That's because I have two small children and they have to be driven to and from the park and such.

Some justified their car-use because of children, others said it saved time in otherwise busy lives, some named convenience (children can sleep in the car, one doesn't get wet or cold waiting for the bus, etc.) and a few pointed to problems with public transportation, mainly the cost ($2.50 per trip) and the inadequate route system.

We got another indication of the rigidity of automobile habits when we asked about how gasoline prices and highway tolls influence driving habits. None of those who have cars said that gasoline prices (which are ca. $4.50 per gallon) make any difference to the way they drive. None said that they were affected by the new toll on entryways to the city center (ca. $1.70 per entry).

Some respondents expressed a sense of resignation -- that changes in their own personal behavior would not make any difference. The following quote is representative of how of this attitude was expressed.

> Wife: . . .one feels that the situation is so hopeless, the world is so big, what does it help if I put my car in the garage . . .
> Husband: We really have an unsolvable problem. We turn off a lamp here and there and try, but you get very dejected when you think about all of the fires in Kuwait and all of the rain forests that disappear every day. Does it make any difference what you do yourself?

Only one respondent linked environmental problems to their own energy-use behavior in the home. One reason for this is that about 75% of delivered energy to Norwegian homes is hydroelectric-based. When we asked

if electricity use was environmentally benign (the direct translation from Norwegian is "environmentally friendly"), 15 households responded yes. Three were uncertain. No one answered an unequivocal no. When we then followed up by asking if damage to local micro-ecology from dams and reservoirs were not a problem, people became confused and their answers were vague. Most respondents acknowledged that dams were also a problem, but one of lesser magnitude than other problems, especially those related to the burning of fossil fuels.

There are good reasons for uncertainty on this issue. How does one weigh the relative damage of the various kinds of environmental problems associated with energy use? Even the experts do not have a good answer to that question. The problem has been exacerbated in Norway, where the electric utility industry has bombarded the public with information campaigns characterizing electricity as "clean energy." Some utilities have even instituted decreasing-step tariffs for household electricity, where the more energy units one uses the less each unit costs. Their purpose is to sell more electricity in the current situation of oversupply, which has come about due to a series of mild, wet winters.

We question the long-term wisdom of incentives intended to increase the short-term sale of electricity. Our study shows that Oslo residents are confused about which is more "environmentally-friendly," using more or less electricity. This confusion has obscured their understanding of the rationale for energy conservation. It may result in people making purchases and establishing wasteful energy-use habits which have a long lifetime, perhaps even into the next period of cold winters, increased energy demand, and/or scarce supply (which in Norway corresponds to low precipitation).

Conclusions and Policy Implications

To start with the environmental issue first, our results show that people are concerned about the environment, but that they are not certain to which problems they should give priority, nor what they should do about them. The exception is a recognition of the problem of automobile-use, but there seems to be little willingness to do anything about it. The only way to make an impact on automobile habits in Oslo may be through improvements to the alternatives, such as public transport and bicycling; stronger regulations, such as rationing or automobile-free-zones; and strong economic disincentives.

When it comes to energy-use in the home, we observed little or no link between concern for the environment and household behavior. Again, our sample size is small, but the finding is glaring and deserves further investigation, since many household energy conservation programs play on this link. If environmental protection is to be used as a motive for household energy conservation, it may only make inroads if people are given more specific information on how activity in the home is linked to the environment.

While household energy-use behavior is weakly linked to attitudes about our shared environment, an equally glaring finding from our study is that it is strongly linked to attitudes about the home environment. Conservation incentive programs should capitalize on this link, showing how energy-efficient equipment can add to home ambiance (or at least not detract from it), and how the same levels of comfort can be achieved with less energy. At the same time, people need to be better informed on the energy costs of their comfort choices. This is especially true for space heating, the energy input to which is underestimated by many households.

Acknowledgements

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Endnotes

1. A study based on a random sample of Oslo homes in 1991 yielded 10.9 light points per living room, or one light point per 3.5 m2 of floor space (Ling 1991).

2. The overestimation of heat at the expense of light is not confined to Norway. Studies have shown a similar result both Germany and the United States (Kempton et al 1982)

3. There is another serious informational problem with average billing. If a household moves into a neighborhood after the yearly reading (meters in a given neighborhood in Oslo are read in a given calendar month) they must wait up to a year for the next reading and first bill based on their own consumption. Until that time, they receive bills which are based on the former occupant's energy consumption. They are thus provided with misleading information during the critical period when they are forming their energy-use habits and making purchases which will directly or indirectly affect their energy-use (Wilhite and Ling 1990).

4. Many vacuum cleaners available in Norway have a rheostat on them which allows one to adjust the power input. This may be an explanation for this woman's awareness of differences in energy-use among vacuum cleaners.

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