

# **A cross-cultural analysis of household energy-use behavior in Japan and Norway.**

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## **1. SYNOPSIS**

A cross-cultural comparison of household energy-use in Norway and Japan yields insights on the role of culture, knowledge and environmental attitudes in the formation of behavior patterns.

## **2. ABSTRACT**

A cross-cultural comparison can help to sort out why families choose to use energy the way they do. In this paper we compare and contrast the results of ethnographic investigations of energy-use behavior in Fukuoka (Kyushu), Japan, and Oslo, Norway. These studies show significant differences in end-use patterns for space heating, lighting and hot water use. We discuss how these patterns are related to cultural and economic factors. We introduce the concept of a "cultural energy service," a home energy use pattern with deep cultural roots. Our findings show that while energy-intensive space-heat and lighting habits have become an integral part of the presentation of the Norwegian home, Japanese space heat and light habits are more disciplined and less culturally significant. In Japan, the bathing routine is extremely important to the Japanese lifestyle and at the same time very energy intensive. These cultural "energy services" of Norwegian space heat/light and the Japanese bath will be resistant to conservation incentives. Demand-side management (DSM) programs targeted at these practices should concentrate on the technology input to these services, such as compact fluorescent bulbs (CFBs) and energy efficient shower heads. Other wasteful patterns are identified which do not have the same cultural significance, such as lax temperature setback in Norway and dish washing practices in Japan. DSM programs targeted at these behaviors should focus more on information-based programs than on technology. We find that environmental attitudes and knowledge levels about energy-use in the home are similar in the two samples, in spite of the big differences in culture and energy prices. People are concerned about the environment, but poorly informed about the nature of the problems and how they are related to energy use in the home. Information is needed in both Kyushu and Oslo which disaggregates the dwelling's consumption and costs by end-use.

## **3. INTRODUCTION**

Energy use in the home is related to physical and structural variables such as the dwelling's envelop, size, and appliances, and to occupant behavior. The behavior component is frequently underestimated or ignored in demand-side management (DSM) programs, partly because of its complexity. It is influenced by a matrix of interacting variables, among them socio-cultural traditions (attitudes, aesthetic norms, comfort, symbols), economic considerations, and knowledge levels (Lutzenhiser 1993 gives an excellent summary and review of social science perspectives on energy-use behavior).

A cross-cultural comparison can help to understand behavior. As Ruth Benedict (1946) put it, "A Japanese who writes about Japan passes over really crucial things which are as familiar to him and as invisible as the air he breathes. So do Americans when they write about America... Nothing is more helpful to the anthropologist [and this could well apply to any social scientist] than to study contrasts he finds between peoples who share many traits."

In this paper we compare and contrast the results of ethnographic investigations of energy-use behavior in Fukuoka

(Kyushu), Japan, and Oslo, Norway. This comparison is interesting because these are two developed countries with similar levels and patterns of material culture, but with different cultural traditions. It was thought that the comparison could shed light on the role of culture in the formation of energy-use habits and purchase patterns in the home. It would help us to sort out which patterns are deeply rooted in the culture, and thus impervious to rapid change, and which are more elastic. As we will point out, findings from the two countries evidence significant cross-national differences in end-use patterns for space heating, lighting and hot water use. We discuss these differences, their implications for understanding home energy use and lessons for DSM policies.

#### **4. METHOD**

The primary information gathering method in these two studies was the in-depth, open-ended interview, known to social scientists as the ethnographic interview. In the ethnographic interview, questions are worked into a conversational flow. Informants are encouraged to give their own explanations. Interviewers have the opportunity to ask follow-up questions. The ethnographic interview allows the researcher to flesh out the respondent's behaviors, attitudes, knowledge levels and motivations. The depth of information attained allows for an analysis and interpretation of complex culture-based household behaviors, something very difficult to achieve in a closed-format interview or from survey questionnaire responses. Data from interviews allows us to construct what Kempton et al (1995) call the "mental models" of household members, relate those models to respondent's behaviors and then look for patterns which are widely shared, which we call cultural patterns.

The Oslo interviews were conducted in the Spring of 1991 (results were reported in Wilhite and Ling 1992) and the Fukuoka interviews in the Spring of 1994. In both studies, 1 - 1.5 hour interviews were done with households in their homes. Eighteen households were interviewed in Oslo and 16 in Fukuoka. The Fukuoka interviews were done with an interpreter present. All interviews were audio taped and transcribed for analysis.

In both studies, participant families were selected so that the following important categories were represented, each of which has been shown to have a strong influence on energy-use behaviors (Frey and LaBay 1983; Baxter, et al, 1986; Langston and Williams 1988; Wilhite and Ling 1992).

- all stages in the family life cycle
- both home owners and renters
- both detached houses and apartments

We insisted that all household members be present at the interview. This gives a more balanced picture of energy-use issues in the home. It also allows for insights based on the way family members interact and express their views. Interviews in Oslo were done during the evening. Fukuoka interviews presented a methodological problem relevant to our analysis of energy use patterns: people return home from work late in the evenings, making evening interviews difficult to arrange. All interviews in Fukuoka were done on the weekends.

#### **5. CONTRASTS IN BACKGROUND VARIABLES**

Obviously, there are many differences in the energy using contexts in Fukuoka and Oslo, and there are some surprising similarities. In this section we point to differences in some of the important variables which are relevant to the formation, or the analysis, of home culture and home energy use patterns.

##### **5.1. Infrastructure.**

Oslo is a city of about 500,000 inhabitants, Fukuoka 1 million. Both are port cities with a level of development and infrastructure which are on a par with one another. Neither city has a large industrial sector. The residential sector constitutes the largest energy demand sector in both cities, and residential energy demand in both cities is increasing at the rate of about 3% per year.

##### **5.2. Climate.**

The climate of the two cities are quite different. Oslo has long, cold winters and moderate summers, while Fukuoka has short, moderate winters and hot summers. The average temperature in January is about -4 Celsius in Oslo, +5.8 in Fukuoka, and in July, +17 in Oslo, +27 in Fukuoka. While the heating season in Oslo runs from mid-October to mid-April (6 months), that of Fukuoka is considerably shorter, from December through March (4 months).

Climate is probably the main explanation for differences in building standards. Oslo dwellings are tighter than the typical Fukuoka dwelling. Oslo building codes require 15 cm. of wall insulation, while use of wall and ceiling insulation in Fukuoka is rare. All of the windows in the Fukuoka sample had single-pane glass, while the Oslo homes all had either double-glaze or double-pane glass.

Our a priori assumption was that these differences in climate would affect seasonal space heat and cooling habits, but that they would not have a big impact on lighting or hot water use. Our main objective concerning space heat was to find out what people do when it is cold (how many rooms do they heat, thermostat settings, thermostat setback, etc.). To achieve this in the interviews, we asked them about their habits on a cold winter day.

### **5.3. Electricity prices**

The price of delivered electricity to households in Oslo is about \$.072, while in Fukuoka it is \$.23, about 3 times as high. Differences in income, however, mediate the effects of these differences in price. Personal income levels in Kyushu are about 3 times that of Norway (\$21,500 and \$65,000 respectively). As with all monetary comparisons between Japan and the rest of the world, the strong yen exaggerates the price differences. As recently as 1990, the Norwegian kroner was worth twice as much against the yen as it is today. Naturally, the difference in price has an effect on use patterns and purchase decisions, but as we will point out, the effects are not consistent with what models based on economic rationality would predict.

### **5.4. Dwelling size.**

Contrary to the Tokyo-influenced Western image of the small size of the Japanese dwelling, dwelling sizes in Fukuoka and other medium-sized cities are compatible to that of an equivalent European city. The average dwelling size of our Fukuoka sample was 90.4 m<sup>2</sup> (close to the Fukuoka average of 84.3 m<sup>2</sup>), with apartments falling into the 40-60 m<sup>2</sup> range and detached houses in the 120-170 m<sup>2</sup> range. The Oslo homes ranged in size from 45 to 195 m<sup>2</sup>, with an average of 92 m<sup>2</sup>.

### **5.5. Work patterns and gender roles**

The families in both samples were in the middle- to upper income range, with the exception of one lower income family in Oslo. Of the couples who were of working age, all of the men in both samples were working. While 94% of the Norwegian working-age women had jobs, only 47% (7 of 15) of the working-age females in the Japanese sample were working (these percentages are close to the National statistics on women in the work force in each country).

There have been tremendous changes in Norway in household division of labor in the last decades, partly because more women are working. We found that while men in about 80 % of the Oslo households participated in household chores on a regular basis, none of the men in the Fukuoka households participated in household chores [1]. The absence of participation by men in Japan is exacerbated by the fact that they spend so little time at home on weekdays. Norwegian men in the sample used on average 8.5 hours per day for work and commuting. Japanese men used 12.6 hours per day, about 50% more. Japanese women are usually responsible for household budgeting, shopping and bill paying. These household economics are fairly evenly shared between man and woman in Norway. Since energy use is a part of almost every aspect of creating and maintaining the home, we expected that these lifestyle and gender differences would be reflected in the knowledge, awareness and division of responsibility about energy issues in the home.

### **5.6 Summary.**

These two cities have similar infrastructures and living standards are compatible. While homes are of about the same sizes, their levels of insulation are quite different, influenced by the contrasting climates. Energy prices in Japan are much higher than in Norway. Work routines and gender roles in the two cultures are also quite different. These similarities and differences form a backdrop for our comparison of findings on household energy use behaviors, knowledge levels and attitudes.

## **6. FINDINGS**

In this section we first present and contrast findings on space heat, lighting, and hot water habits. We follow that with a discussion of knowledge levels and environmental attitudes.

### 6.1. Space heat

We found significant contrasts between the two samples in space heating habits. On a winter evening, Norwegians tend to heat all rooms except for the bedroom. The entire house is made into a heated envelop which allows the occupants to move freely from one room to another without experiencing discomfort. Space heat is provided by a combination of central heat (oil or electric), electric resistance heaters or kerosine heaters. Three-fourths of all Oslo residences have some form for electric heat.

In Fukuoka the respondents tend to heat only one room, or to further restrict the heat to the part of the room they occupy. The traditional person heater is the "kotatsu," illustrated in figure 1. The kotatsu is a heating unit placed under the dining table. A comforter traps the heat around the lower torsos for those who are huddled up to the table.

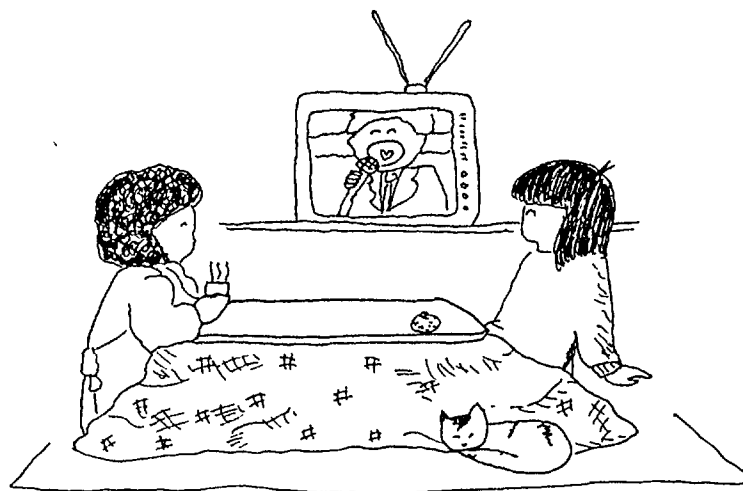


Figure 1. The Japanese kotatsu body heating system.

Traditionally, people would have dinner around the Kotatsu, take a hot bath and then dash off to bed. Today, the kotatsu is still a focal point for meals for many families, but the habit of bathing and going to bed early is changing, leading to an decreased use of the kotatsu and the diffusion of other kinds of heaters, including electric carpets, heat pumps, kerosine heaters and electric resistance heaters.

Over half of the sample (9 households) had a kotatsu. Eight households had an electric carpet, a more modern version of the person heater. Only two households had neither. The carpet is easy to move and to clean. It can be placed under the dining table where it functions like a kotatsu, or it can be placed in the middle of the room, where children play and adults relax or watch television. In the three families which had both, they reported that they are gradually using the carpet more and the kotatsu less.

Our Fukuoka interviews indicate that the use of space heat, and space heaters such as kerosine stoves, heat pumps and electric resistance heaters is increasing. Every household in the sample had at least one space heater, and 11 had two or more. Nine of the families heat more than one room on a winter evening. Comfort tastes are changing in tact with changes in family lifestyles and social interaction. The families in our sample are spending less time socializing and more time in individual activities. This trend encourages heating more of the interior space of the house to allow greater freedom of movement on cold evenings. This increased use of space heaters is one reason behind higher evening indoor temperatures in Kyushu homes. We were surprised to find that the average winter-evening living room temperatures reported in the Fukuoka sample (21.6 C) was almost identical to that measured in the Oslo sample (21.8 C).

Norwegians do not use space cooling, but it is interesting to note that there is a transition underway in space cooling preferences in Kyushu which parallels the change in space heating habits. Air conditioners are on the way "in." Fourteen of 16 families had at least one air conditioner (77.4% of Kyushu homes are air-conditioned). We found evidence that artificial cooling is becoming one of the indications of an appropriate indoor climate. Those who have them are gradually extending the hours which they use them and people who have resisted buying them in the past because they were comfortable without them are buying them not purely for comfort reasons, but rather to make their home an "appropriate" home.

Several people in the sample had bought them in spite of a belief that artificial cooling is unhealthy (a finding also reported by Kempton et al 1992 in a study in the United States). One older man in the study who lived in a traditional Japanese house expressed exasperation with the fact that his daughter kept pressing him to buy an air conditioner. He and his wife were comfortable with natural cooling. They were against the "aesthetic damage" which would accrue from putting an air conditioner in the wall of their living room. But the impression the man gave us was the daughter was not to be denied. Her purpose may not be only to make her parents comfortable, but rather to provide evidence to neighbors and relatives that she is executing her filial responsibilities.

We found a strong parallel to this situation in one of our interviews in Norway, where a woman expressed extreme irritation with her father, who lived alone. He had the habit of lighting only the room he was in. His house for her was a "sad house" and the symbolic message to the outside world was that he was poor. Every time she visited her father, she insisted that he use more light.

Our interviews showed that in Norway, space heat and light have an important symbolic value. They are used in combination to create what the Norwegians call "coziness (koslighet)," a state of comfort which is practically mandatory for Norwegian living rooms. It is important for a family to be cozy on a winter evening. When friends or relatives visit, an absence of a strong affirmation of coziness is a social disaster. It begins with a standard "Her er det godt og varmt (Here it is good and warm) when the guest enters. At intervals throughout the evening, the guest will say "Det er saa koselig" (It is so cozy here) or "Vi koser oss" (we are having a cozy experience). The strong social significance of coziness causes overheating and over lighting as insurance against social failure. Coziness has become what we call a cultural energy service, a set of energy-use behaviors which are deeply rooted in the social, cultural and symbolic presentation of the home.

In terms of specific behaviors, we found big differences in temperature setback habits between the two samples. In Oslo, less than half the sample set back temperatures at night and 5 households (28%) did not lower thermostat settings when they left the house for a weekend trip or vacation. The Japanese families in our sample were much more disciplined in their heating setback habits. Every household in the Japanese sample had the habit of turning the heat down (or off) when they went to bed and off when they leave the house. The Japanese discipline is probably related to the higher cost of energy, to concerns about fire safety and perhaps to the person-heat tradition as well. Japanese are accustomed to entering cold rooms, something which Norwegians prefer to avoid.

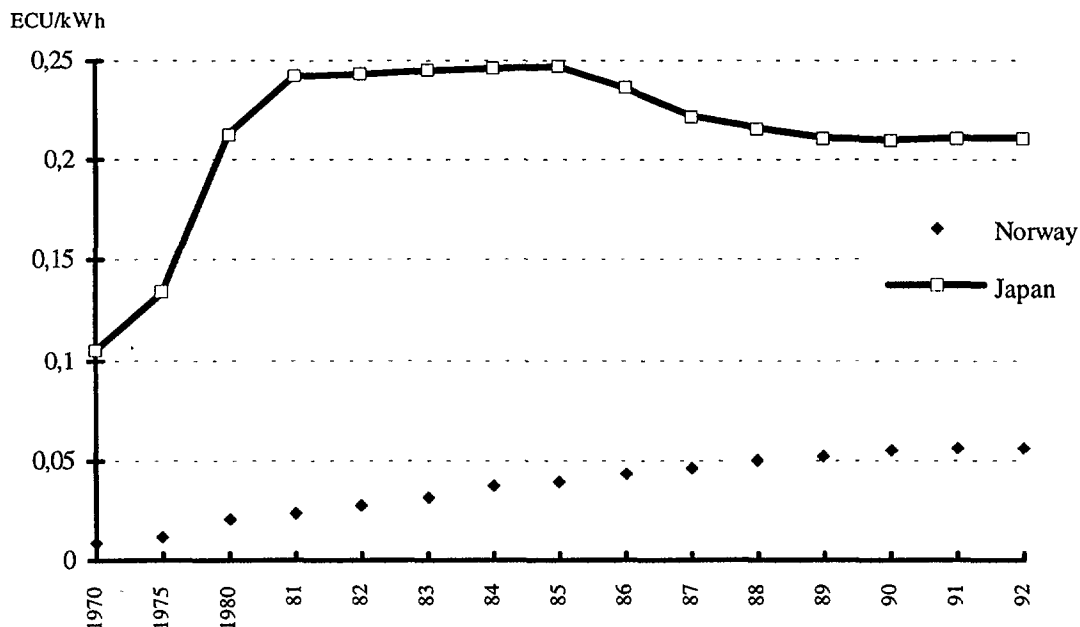


Figure 2. Norwegian and Japanese electricity prices, 1970-1992

The ample use of space heat and lax setback habits in Norwegian homes were formed and fostered by many years of low electricity prices. While low prices were likely a factor in habit formation, steadily rising prices over the past decade have not lead to changes. Poor billing information hides the rising cost of space heat. Bills for actual use come only once a year. People are sent an invoice for 25% of their estimated yearly costs three times a year, and on the final bill, their actual consumption is shown and a cost correction (between actual and estimated) are invoiced.

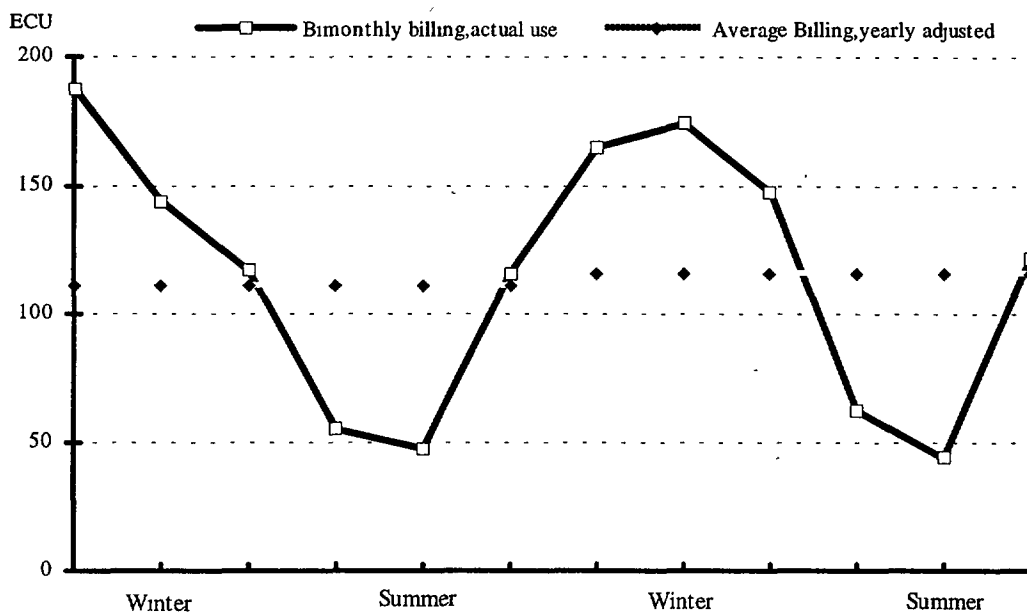


Figure 3. The user's view of seasonal variation in energy costs.

A recent experiment in Oslo demonstrated that increasing billing to bimonthly lead to a 10% reduction in energy consumption (Wilhite et al 1993). A portion of these savings may be due to the fact that for the first time, participants understood how much of their energy costs went to space heating.

In Kyushu, households receive an energy report once a month (the bill is actually paid directly from the respondents bank account). This makes seasonal variations in the bill easier to track. Kyushu families had a better knowledge of seasonal variations in their energy costs (discussed below).

The contrast in attitudes about space heat and specific space heating habits reinforces our conclusion that Norwegian space heating patterns are a culturally rooted pattern and that space heat has achieved the status of a cultural energy service. In Fukuoka, heating patterns are in flux, moving towards the Western norm. In terms of cooling, the artificial cooling provided by air-conditioners is fast becoming culturally significant.

## 6.2. Light

Light is another important component of the Norwegian definition of a cozy home. In the living room, brightness is not the goal, but rather the effect which is created through a number of shaded floor and table lamps. The households in our Oslo sample had on average 9.6 light bulbs per living room, while the Japanese had on average 2.5. Ceiling fixtures and fluorescent light are considered absolutely inappropriate for living room lighting. Consider the following quotes from our Oslo interviews (Wilhite and Ling 1992). In these and following quotes, I = interviewer, F = female, and M = male.

- (I) Do you like ceiling lamps?
- (F) 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.
- (F) I think that it is more cozy with small lamps.
- (M) It is more idyllic.
- (F) 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 painting. One of the Norwegian respondents said:

(W)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.

Only 1 household in the Oslo sample had a ceiling fixture in their living room and none used fluorescent lighting. Ironically, ceiling fixtures and fluorescent lights are virtually standard in Fukuoka living rooms. Fourteen of the 16 households in our sample use exclusively fluorescent lighting in their living rooms. All of the 16 have ceiling fixtures.

These opposing preferences, and the reasons for them as expressed by our respondents, are fascinating. Consider the following quote from a Fukuoka woman in her early 30's (married with no children):

(I)I see you have florescent light. Do you think that comfortable light? Do you like fluorescent?  
(F)I prefer florescent. Because it seems to be more bright than incandescent. I think that Europeans and Americans seem to feel that the incandescent light is warm. But I think what is warm for Japanese are the natural features [Our impression is that the thing for her which is warm is the things which are illuminated, not the light itself]. And though our Japanese don't dislike the incandescent, we think that it is not suited for our life.

In the following exchange, the man (a 36 year old husband with no child) uses the same association of fluorescent lighting and "atmosphere" that the Norwegians use with incandescent lighting [2].

(I) Do you prefer the bright fluorescent light in the living room?  
(M) Yes.  
(I) Is that because you can see things better?  
(M) Not only that, but also because of the atmosphere.

The following man (36 year old husband and father) not only prefers fluorescent, but discounts Norwegian theories about incandescent as "image."

(I) In Norway everyone chooses incandescent lights for living and dining areas. They think incandescent is more comfortable. What do you think about that?  
(M) I think it is an image, but not true.

Several Fukuoka respondents associated incandescent lighting with hotels or restaurants. The first sequence is with a young couple and the second with a young mother.

(M) I feel blue with it [incandescent] on because it is too dark.  
(F) We are used to the fluorescent, so when we experience incandescent we feel it is dark.  
(I) In Norway, it is more important to create a mood than to have it bright.  
(F) Same mood as a hotel room, isn't it?  
(I) Don't you like the lighting which you find in a hotel room?  
(F) It makes me calm down.  
(I) Then why don't you make the lighting in your home like the lighting in a hotel room?  
(F) The atmosphere doesn't fit our home - this is not a hotel.

(I) Why do the Japanese like the bright incandescent?

(F) I don't think incandescent is necessary in our house. I like it other places though. When we have meals out, I like it when they have incandescent or spot lighting in the interior of the restaurant.

Diametrically opposing preferences were also found for lighting of bathrooms and kitchens. In Norway, fluorescent lights are common in both, whereas in Fukuoka these are the only places in the home where one usually finds incandescents. Several of our Japanese respondents said that incandescent lights were appropriate for the bathroom, because when you enter you need light in a hurry.

Norway has shorter periods of winter daylight than Japan, but it is not apparent why that would favor multiple point lighting in lieu of ceiling lighting. These customs may be related to historical home lighting traditions. Prior to the advent of electricity, Norwegians used candles, fire places and kerosine table lamps for lighting. They carry on this custom in their "hytte" (vacation cabins), which are regarded as places of ultimate coziness. Table and spot lighting have persisted in spite of steadily rising electricity prices over the last 30 years (see figure 2). Norwegian lighting

tastes lead to a very energy intensive lighting culture and one which is culturally significant. As we have pointed out, lighting preferences are one of the important components of the cultural energy service we have called coziness.

Japanese use of ceiling lights (candle and kerosine) in living areas can be traced back several hundred years. Also, while European tastes for "mood" lighting, fostered by restaurants and cafes, has consisted of lower lighting levels with pools of light and shadow, Japanese restaurants have traditionally been very well-lighted, usually with fluorescent light. Japanese are more interested in visibility than in mood. As one of our male respondents succinctly explained: "I like to see what I am eating," and eating usually takes place in a combined living/dining area.

In line with their space heating habits, Japanese light setback behavior is also very well-disciplined. They tend to turn off the light when they leave the room and when they leave the house. Most light only the room they are in. Thirteen of the 16 households turn off all lights when they leave the house - the remaining three left one light on, usually in the entrance way or front foyer. Again, Norwegians are as lax as the Japanese are disciplined. In the Oslo sample the occupants of only 1 of 18 households turn off the lights when they leave the room and 10 of the 18 leave one or more lights on when they leave home.

### 6.3. Hot water

#### 6.3.1. Bathing

The importance of the bath for Japanese is on a par with the importance of a "cozy" living room for Norwegians. As Ruth Benedict observed (1946:178):

One of the best loved minor pleasures of the body in Japan is the hot bath. People wash and rinse themselves all over before they get into the tub and then give themselves over to their enjoyment of the warmth and relaxation of soaking [3]. They value the daily bath for cleanliness' sake as Americans do, but they add to this value a fine art of passive indulgence which is hard to duplicate in the bathing habits of the rest of the world.

This description is as valid today as it was 50 years ago. All of the bathrooms in our sample were designed so that people can shower and soap outside the tub. The tub itself is used strictly for relaxation. The bath water is often reheated and reused for the next bather. In twelve of the 16 households, water was reused by all household members. Water is reheated in two ways: one is to use a heating element in the tub which reheats the water, the other is to add hot water from the tap.

The Norwegian bathing procedure is closer to the Western norm. People in our sample either showered or bathed, but not both. Bath water is never reused. While energy efficient shower heads have been taken into use to some degree in Norway, they are rare in Kyushu.

#### 6.3.2. Clothes and dish washing

The clothes washer is an integral part of a Fukuoka dwelling. Ninety-nine percent of dwellings have washing machines, while only 40% of Oslo dwellings have washing machines. All 16 of our Fukuoka sample owned a washing machine, while only 5 of the Oslo sample owned one. The apartment dwellers usually share a common washing room in the basement of the building.

There were no significant differences in the number of loads washed each week across the two samples, but there is a sharp contrast in the temperature at which the clothes are washed. In the Oslo sample, the average temperature for washing white clothes is about 60 C, 50 C for colored. In Japan, all clothes are washed at room temperature. Further, some families engage in a practice unheard of in Western countries: after the family members have all bathed in the same bath water, the water is transferred to the washing machine for the clothes wash. Seven of the 16 households in the sample engaged in this practice.

Washing dishes by hand is still predominant in both countries. Dish washing machines are owned by less than 5% of Japanese households and less than 20% of Norwegian. None of the families in either the Oslo or the Fukuoka sample owned a dish washer. We found a significant contrast in dish washing habits: while all of the Oslo families use a basin to soap dishes, only 5 of the Fukuoka families used a basin. In other words, 11 Fukuoka households leave the water running throughout the washing and rinsing of the dishes. These inefficient Japanese dish washing habits are interesting in light of frugal clothes washing practices. Tradition is part of the explanation for reuse of bathwater to wash clothes - water was transferred from one tub to another. Today, the water is moved to meet the clothes in the



washing machine, an inconvenient exercise (done either manually or with a small pump). Dish washing habits, however, are not tied to any traditional routine. Since the Japanese sink is small, the more convenient "running water" method is used. These contrasts are not what one would expect from an economically rational actor, who would consistently minimize cost and convenience.

All of the Norwegian families used hot water in either the soaping or rinsing of the dishes, or both. Some Japanese households use cold water (2 in our sample), but we were puzzled to find that many vary their hot water use by season. Only six of the Japanese households use hot water throughout the entire year. Eight households use hot water in the winter and cold water in the summer. After several interviews, we finally understood that hot water is not used for hygienic reasons in Fukuoka, but is rather used to help warm the person washing the dishes. This was confirmed in subsequent interviews. There are two interesting observations based on this contrast. One is that the Japanese do not share the Western obsessive link between hot water and hygiene. Another is that in the winter months Japanese use hot water as person heat, a very inefficient and costly practice. Again, convenience takes precedence over cost considerations.

#### 6.4. Knowledge and awareness about energy use issues

The Fukuoka sample was more knowledgeable about the breakdown of their energy consumption by end-use than was the Oslo sample. They were also more aware of the seasonal swings in their energy costs. Households in neither sample were cognizant of differences in energy efficiency when they shopped for appliances.

In the Oslo study we used space heat energy to gauge knowledge on how much energy goes where in the house. Seven of the households (38%) made estimates which we judged to be within 20% of the actual amount (which in Norwegian houses is usually around 60%). The other 11 households underestimated the amount of energy which goes to space heat. In the Fukuoka sample, because of the complex mix of fuels for space heating, we used space cooling as a gauge of knowledge about end-use. We asked what percentage of the summer electricity bill could be attributed to space cooling. Two of the households did not know and four others underestimated by about 20%. Thus 10 of the 16 (63%) households had a reasonably good idea of the amount of summer electricity which goes to cooling. On this and other issues, we found the Japanese households to be better informed than their Norwegian counterparts. Actually, the woman in the Japanese household was consistently far more knowledgeable about energy use than the man.

In spite of their greater awareness, many of the Japanese households were frustrated by not having a better overview of the amount of energy going to the various end-uses in the home. When we asked whether energy efficiency had been an issue in the choice of the last refrigerator, one woman (young mother) responded "I didn't care about that. But the bill only shows the cost per month of electricity, you know? I'd like to see the electricity use of the refrigerator like you can see with a car."

We asked households in both samples which characteristics they had been most interested in when they shopped for their last refrigerator. In both samples, size and capacity were ranked most important. This is consistent with findings from a broader study in Oslo (Ling and Wilhite 1992) and studies in the U. S. (Dyer and Maroni 1988) and Australia (ANOP 1985). In neither sample were energy running costs or energy efficiency volunteered as a concern, nor did any respondent in the Oslo sample respond "yes" to the follow-up question, which asked directly if energy efficiency had been an issue in the selection of a refrigerator. In Fukuoka, only one respondent answered that energy efficiency had been an issue, but that was because her brother-in-law, who owns an appliance store, had informed her about differences in energy efficiency among refrigerators. One reason for indifference to efficiency may be that in neither Norway at the time of our study, nor in Japan, do refrigerators have energy labels showing comparative efficiency. Labelling began in Norway in 1994. A study of the pros and cons for labeling in Japan has been completed, but there are no immediate plans to begin labeling in Japan (ECCJ 1994).

#### 6.5. Environmental attitudes

There is a significant difference in the nature of electricity generation in the two countries. Norway is virtually totally hydropower based, while Kyushu relies on several sources: nuclear makes up about 35% of power generation, 55% is fossil-fuel based thermal power and 8% is hydropower. This means that the environmental consequences of energy-use in the two countries are quite different. In Norway, the major problem with electricity generation is the alteration of the ecologies of the rivers, lakes and valleys affected by hydropower regulation. 70% of all of Norway's rivers and lakes are artificially managed, and this has had a significant impact on local ecosystems. Kyushu power generation contributes to the fossil fuel-related problems of acid rain and global warming, as well as the nuclear power problems of safety and waste disposal.

In view of these differences and in the many contrasts in behavior which we noted between the samples, it was interesting to note similarities in environmental attitudes and knowledge. Only one of 18 Oslo families, and 3 of 16 in Fukuoka, linked their own household energy-use habits to environmental problems. About 75% of both samples had heard the term "global warming," but only about 25% of either sample could relate it to carbon dioxide or the use of fossil fuels. Many confused global warming and the destruction of the ozone layer, a confusion shared with families in other developed countries (Kempton 1991; Lofstedt 1992).

Households in both samples were ambivalent about the building of new power plants. In Norway, where virtually 100% of electricity is generated from hydro-electric power, power generation is pollution free. This was emphasized in a large state-supported information campaign in Norway in the late 1980's. Seventeen of the 18 Oslo families characterized energy use as "environmentally benign." The Oslo households were confused about the environmental reasons for saving energy. When asked whether the building of new hydropower dams were an environmental concern, most people became flustered. They acknowledged that it is a problem, but had difficulty in evaluating its seriousness in relation to other problems like global warming and acid rain. Japanese were also ambivalent about the building of power plants, but for different reasons. We asked about nuclear power, the Kyushu utility's preferred energy source of the future. Our respondents see the building of nuclear power plants as a necessity for upholding the economy, but half of the sample expressed concern about the safety of nuclear power plants. All were willing to support Kyushu's policy of building new nuclear power stations, but many were against placing them in their own community. The following is a representative quote from a young father:

- (I) Do you think that the electric utility should keep building nuclear power plants in the future?
- (M) We wouldn't survive without it. But it would be better and safer if we had other energy instead of it, though. I might not feel so good if the nuclear power plant was built close to our house. I can tell that the people around here are against it.

## 7. A SUMMARY OF CONTRASTS AND SIMILARITIES IN ENERGY-USE BEHAVIORS

Table 1 summarizes the most significant contrasts in energy-use practices.

Activity	Norway	Japan
Space heat	Area heating Lax temperature setback habits	Person heating (1) Strict temperature setback habits
Lighting	Incandescent in living areas Table, floor and spot lighting Fluorescent in bathrooms, kitchens	Fluorescent in living areas Ceiling lighting Incandescent in bathrooms
Bathing	Either shower or bath No reuse of bathwater	Usually shower and bath Bath water sometimes reused
Clothes	Ample use of hot water Never use bathwater	No hot water used Sometimes use bathwater
Dish Washing	Hot water use is usual Basin usual for wash	Hot water use in winter only Basin not usually used

(1) A transition to more area heating is underway

Table 1. Contrasts in energy-using behaviors.

We have pointed out that Norwegians heat most of the living area most of the time, while the Japanese traditionally heat only where they are, at the time they are there. Part of the explanation for this is climate. When it is very cold outside, as it often is in the Norwegian winter, it is both physically and psychologically comforting to have it very warm inside. Another explanatory factor is price. Energy has been cheap over a long period in Norway. We have pointed out, however, how price increases in the 1980's do not seem to have affected space heating habits. In Japan, where prices have been stable over the past decade, the use of space heat is also increasing [4]. To paraphrase the economist J. K. Galbraith: behavior which may have economic underpinnings has been transformed into social virtue, and must be understood as a social, not an economic activity (quoted in Wolf 1991:20). Space heating in Norway and

air-conditioning in Japan have taken on symbolic values which make them integral to the culture and presentation of the home, i.e., they have become cultural energy services.

This study has unearthed stark contrasts in lighting habits. Norwegian homes are extremely light-energy intensive compared to Japanese homes. Again, historical price differences are a factor, but as with space heat, lighting in both countries appears to be a crucial component of an aesthetically correct home interior. Future increases in electricity prices are not likely to significantly impact on well-entrenched Norwegian preferences for incandescent light. There are no signs that there is a transition in Kyushu towards a preference for incandescent.

Another intriguing contrast concerns bathing habits. In this case it is the Japanese who have habits which are both culturally important and very energy intensive. The daily bathing routine, which has deep historical roots, has persisted in the face of expensive energy. The bath is important among all groups and ages. Our interviews would suggest that the routines surrounding the bath are likely to persist in the face of both better information and higher energy prices.

Cleanliness and good hygiene are highly valued in Japan. At the same time, we have deduced from our interviews that hot water use in Japan is not strongly connected to cleanliness or hygiene. Hot water is used for comfort, not to kill germs. This is a sharp contrast to the Norwegian perception, shared in many Western countries, that cleanliness can only be achieved by using very hot water. In another curious inversion from a resource point of view, Oslo residents, who have ample water resources, are more conscientious about water conservation in dish washing than are Fukuokans, who experience occasional water shortages.

We found the Japanese to be better informed about energy end-use, but we found the following similarities in knowledge levels and attitudes:

- Both samples would like to have better information about how much energy goes where in the home.
- Both showed an almost total lack of interest in energy efficiency when shopping for appliances.
- Both samples were concerned about the environment, but were not well-informed about what to do.

## 8. CONCLUSIONS AND POLICY IMPLICATIONS

Our findings indicate that the ambiance of Norwegian living rooms, created mainly through heat and artificial lighting, and bathing practices in Japan are both culturally significant and energy intensive. Their cultural importance will make the "cultural services" themselves (coziness and "passive indulgence") impervious to rapid change. These service levels are not lucrative targets for DSM programs. The DSM focus for these practices should be on reducing their energy input. This means promoting technologies which provide the same service with less energy and on promoting better management of the energy services. For Norwegian space heat this means a continued emphasis on standards for the shell of the house (insulation and windows), incentives which favor retrofits to the shell, and on information which lays out the potential savings which can be achieved through temperature setback. Norwegian residential lighting policy should push compact florescent bulbs (CFBs), which approximate incandescent light at much lower wattage. There is an enormous potential for replacing living room incandescents with CFBs, but they are still expensive. Policies should provide financial incentives to reduce payback gaps, and equally as important, information which shows how CFB lighting is not significantly qualitatively different from incandescent lighting. The Japanese will not get much mileage out of pushing CFB's in residential use, since standard florescents are already preferred. They can, however, use information and incentives to capture some of the huge potential for the energy efficient shower head.

Neither Norwegian clothes washing habits nor Japanese dish washing habits have the cultural significance of space heat and bathing habits. Here the emphasis might well be on encouraging changes to the respective service routines. The Western myth of the necessity of superhot water for cleanliness should be one focus of information and education programs. The relaxed Japanese attitude to using hot water in dish and clothes washing might somehow be used to rebut the myth. The reverse is appropriate in the case of dish washing habits, where the fact that Norwegians get the dishes clean without leaving the water running throughout might make an impression on the Japanese.

The low knowledge levels of the households in these two samples in vastly different cultural, climate and price situations, make a strong argument for the need for better information on energy efficiency and on the links between energy and the environment. Energy flow in the home needs to be made more transparent for users. This can be achieved through better billing practices (more feedback and disaggregation of end-use), appliance labelling and the use of home energy audits. All of these should be given high priority by policy makers in both Oslo and Kyushu. An

evaluation of a utility sponsored energy audit program in Oslo in the early 1980's revealed that people were very positive to the program, aside from concerns about it involving too much paper work (Wilhite 1984). A home visit, or audit, program has never been tried in Kyushu. When we described the program to our Kyushu sample, people were uniformly positive to the idea.

All of the findings on contrasts should be validated through further testing in a larger interview sample. Nonetheless, the consistency of many of the habits indicate their validity for large segments of both populations.

## 9. ENDNOTES

1. A recent study by the Labor Ministry showed that for two income couples, wives spent 3 hours and 51 minutes on housework each day, while husbands spent 12 minutes per day (Japanese Department of Labor 1994).
2. A interesting finding was that 15 of 15 Japanese males preferred fluorescent, while 10 of 15 females preferred fluorescent. Is this indicative in a coming change in tastes? The reasons for the gender difference are intriguing and merit further investigation.
3. To be precise about the bathing routine, people usually douse themselves with water, then climb into the tub, then get out to soap and rinse again, then reenter the tub for a final soak.
3. The Japanese families were well aware of their energy costs and of the electricity price (most often the women, not the men). They all predicted that prices would either remain stabilize or rise slightly.

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