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ENERGY CONCERNS AND THE CHOICE OF DWELLING¹

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1. INTRODUCTION

A number of studies of households' energy consumption has shown that cultural factors like lifestyle and habits are very important explanatory factors. When comparing families who live in houses that are identical, technically speaking, one may find considerable variations in the amount of energy spent on heating, warm water, etc. (Van Raaij and Verhallen 1983, Gaunt 1985, Palmborg 1986, Lundstrøm 1986). Still, of course, the choice of dwelling is important to the energy consumption of a household. The technical quality, its size, the heating system and its spatial location have a considerable impact. In addition, the choice of dwelling is in many ways indicative of the lifestyle of a family which effects energy consumption. Consequently, the accounts of what people look for when they look for a new home give a lot of clues about basic features of their energy consumption behaviour. Another critical factor in this respect, is the ability of people to manage the technical systems of their houses. Even if people choose houses out of concern for energy and the environment, are they able to take advantage of the possibilities that new "green" houses may offer?

The first part of the paper presents the accounts some households give about the choice of their present dwelling and the presence/absence of energy concerns in these accounts. This is based on 30 open-ended interviews with different kinds of households in the Trondheim area. Trondheim is the third largest city of Norway, with urban as well as rural areas within the city limits. The second part presents some main results from a study of people living in houses equipped for sustainable energy consumption, concerning their ability to run the systems in an optimal way. We will start, however, by giving some background information.

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A survey conducted in 1991 showed that the average yearly consumption of energy of Norwegian households (exclusive of transport) was around 23 000 kwh. Behind this figure is considerable variations, in part related to the kind of dwelling people reside in. The average yearly consumption of single-family houses was around 31 000 kwh, compared to undetached houses (19 000 kwh) and apartments (14 000 kwh) (Ljones 1992). The patterns of social inequality are more complicated, and we will not go into that here. The large differences between single-family houses and other dwellings indicate how critical the choice of dwelling is. Here, one should note that the single-family house is preferred by a large majority of people. In fact, as is shown in table 1, a majority of Norwegian households live in such houses. Over time, the percentage of people living in single-family houses has increased, from 43 per cent in 1946 to 60 per cent in 1988. Today, a good majority of the population lives in the most energy-demanding form of housing. What are the choices leading to this situation?

Table 1. Distribution of Norwegian households according to the kind of dwelling the occupy, 1946-1988. Per cent. Source: Survey of Housing Conditions 1988, Central Bureau of Statistics of Norway.

	Farmhouse	Detached one-family house	Undetached house, houses with two or four flats	Houses with five or more flats, apartment houses, block of flats
1946	46%		53%	
1960	20%	26%	32%	18%
1970	15%	32%	32%	18%
1988	11%	49%	21%	19%

The decade after the energy crisis of 1973 saw a lot of psychologically oriented surveys that mapped out energy consumption patterns of households (e.g. Fishbein and Ajzen 1975 and 1980, Olsen 1981, Stutzman and Green 1982, Brown and Macey 1983, Seligman et.al. 1983). They tried to measure attitudes towards energy, energy saving and different energy saving actions. This approach to understanding the social dynamics of energy conservation has been severely criticized, in particular because attitudes are a problematic indicator of action (Ritchie et.al. 1981, Curtis et.al. 1984). Since positive answers are more legitimate than negative answers in relation to questions about the willingness to save energy and to implement energy saving technology and routines, these surveys were also criticized for overestimating the potential for energy conservation among the general public. Still, such surveys are interesting because they give an estimate of the upper limits of peoples' interest in energy

conservation. Moreover, when questions are more carefully phrased, some of the "yes, I am of course environmentally friendly" may be countered.

Table 2 gives some indications about present-day Norwegian attitudes to housing, energy, and consumption. What emerges is a pattern characterised by a high priority to housing and comfort and a low level of energy conservation consciousness. The neighbours may use too much energy, but not the respondents. Positive attitudes towards energy conservation is not normatively mandated in Norway.

Table 2. Norwegian attitudes towards their houses, comfort level and energy consumption. Per cent that agrees, disagrees or are neutral towards the statements listed. Source: Ljones 1992.

Statements	Disagrees	Neutral	Agrees
I do not want to spend much time and money on a dwelling	77 %	12 %	11 %
When choosing heating system, it is more important to me that it is cheap than whether it is environmentally friendly	30 %	32 %	38 %
When choosing heating system, I put more emphasis on simple handling than what is cheapest for me	40 %	25 %	35 %
In our dwelling we use a heating system that I think is sufficiently friendly to the environment	11 %	12 %	77 %
In our household we are willing to pay the necessary costs in order to have a comfortable indoor temperature in all rooms	26 %	18 %	56 %
We are used to an unlimited access to heat, hot water and cooking, and energy conservation should not be taken so far than any of this is taken from us	16 %	16 %	68 %
In my household we do not spend much more energy than we have to, but there are a great number of others who spend far too much	16 %	25 %	59 %
I believe that the energy costs constitute a too great part of the total household expenditure	33 %	22 %	45 %
As long as one pays, the individual should be free to spend as much energy one wants to	33 %	18 %	49 %

In sum, tables 1 and 2 suggest a pattern where energy concerns are low on the list of criterias which enter the decision to buy (or rent) a particular dwelling. Still, the decision has important consequences for the level of energy consumption in private households. The energy consumption of the individual family is of course affected, but even more important, the aggregate effects on the housing market may produce long-term shifts to bring energy demand up or down, according to the aggregate priorities. Thus, it is doubly important to look at the way people account for their choice of dwelling.

2. LOOKING FOR A HOME IS LOOKING FOR WHAT?

Our study is based on qualitative interviews in 30 households in three different towns in Norway. The households were selected to obtain variation in family structure and type of dwelling. We used open questions, structured by an interview guide. Each interview lasted for about 1 1/2 hour. In the interviews about housing habits, daily life routines, and energy consumption, a substantial part of the time was spent on the decision to acquire the present dwelling. As it turns out, *none* of our informants mentioned energy usage or form of heating as factors in choosing to purchase a home, or not to purchase a particular home they were considering. Even though we interviewed people of varied backgrounds in various types of dwellings, their arguments for choice of dwelling were surprisingly similar. We shall begin by looking in greater detail at three accounts from three different households, in order to describe and analyze the totality of the argument and the relationship between different dimensions.

*The Pettersen family*² lived in a row house development from the 1970's, 6-7 kilometres from the centre of town. The family consisted of: Bjørn, 37, mechanic, currently working at home; Hanne, 35, engineer; Siv, 10; Tor, 9; Trine, 5; and Mads, 2. They told of several points that were important for them in choosing this row house. Hanne started with its location: *"Close to the woods and close to school and ... a little ways out of town, but not so very far from town."* They did only have their first child at the time, but denied having thought in the long term. They mentioned that Bjørn had not known the area at all (both had moved to the town from elsewhere). They had looked at a duplex nearby, but both described that neighbourhood as somewhat depressing. Hanne's father and a girlfriend had tipped them that this house was being advertised: *"And they said 'You should go look at this.' So we really weren't particularly enthusiastic about this place at the onset. But then it was so good that we put in a bid, and we were lucky and got it."*

Their reasons were mostly related to neighbourhood and type of building, two aspects which they found it hard to separate. Bjørn was the first to speak: *"It has a little to do with the house,"* and Hanne added, *"Yes. When we first saw it, yes. When you say we didn't know the neighbourhood -- maybe it was just me who had some thoughts about locality, because that mattered to me. That it was near the woods and all that."* That the house should be *"a separate house,"* i.e. similar to a villa, did not count at the time. They had little awareness on that count, according to Hanne. They had set their sights on something small (the duplex they had looked at was somewhat smaller than the row house. As they explained: *"Yes, a smaller apartment, simply. Less to wash was one of the criteria [laughs]. I'm not fond of housecleaning."* But they were glad in retrospect that they had purchased something as large as they had. What with four children, they valued

²All names are aliases to provide anonymity for our informants.

the house for its spaciousness, the play area outside, that there was little traffic. Hanne also was glad it was some distance from the centre of town.

This family did not reflect much on their energy consumption. They were conscious of what they paid for electricity and firewood, and noted that prices were rising. Still they saw no immediate reason to do anything about it. Their daily lives were busy with four children, and getting the days to function as smoothly and comfortably as possible was the most important point. Besides, they had only one income to live on, so investments in new heating equipment were out of the question. When they had shopped for a home, size was an issue in its own right. We know, of course, that dwelling size has consequences for energy consumption. It was not energy consumption that had been their concern, however, but cleaning tasks, because as Hanne said, she was not fond of housework. As this presentation shows, it was their impression of the neighbourhood that counted most in their choice of home. They also mentioned that it was largely the neighbourhood (and to a lesser extent cost concerns) that had kept them from moving to a larger house.

How do these priorities compare with those of a family with a larger income, a family who have retrofitted their home from the foundations up, and who express a desire to act in an environmentally responsible manner? Let us take a look at such a household, *the Stene family*. It consisted of three persons: Tor, 50; Gudrun, 47; and Helle, 23. Both Tor and Gudrun had full-time jobs, Tor as an architect and Gudrun as an accountant. Helle was a university student. They lived in a 60-year-old two-family villa which they shared with Tor's parents. Their apartment was still under remodelling -- a project which had continued throughout the 13 years they had lived there.

Their reasons for choosing the house were several. First of all, they had purchased the house together with Tor's parents. That made a two-family dwelling the only option. As price was a concern, the building standard had to be less so. They also wanted to make the house over to their own tastes: *"So getting hold of a two-family dwelling, in somewhat poor condition, at a reasonable price -- that was one possibility. So you might say that choosing a two-family dwelling, that was so that it might work as a multi-generation dwelling. And then we were looking for a place we could practically tear down to the ground and build up again, to get it just the way we wanted it."*

They had originally planned to buy something on the other side of town, where Spring arrived earlier, but when they heard of this house which was so well suited in other ways then they let their locality preferences ride. Not that they didn't like the neighbourhood they now lived in. Gudrun emphasized how important it was that public transportation was readily available so that they weren't dependent on a car. And after some thought, Tor continued: *"No, but when you look at a house as an object at first, then you start to think about the neighbourhood and find out that, yes, maybe it's not such a bad place. It has its advantages. The walk to school is short, we have light rail to town, and an*

acceptable walking distance to town. We have a short walk to the woods. So all in all, we found out that the area had its positive aspects, which outweighed the fact that Spring arrives a little later up here."

They had spent a year or so shopping for the house and had considered a number of others during that time. Both agreed that they didn't want to buy a house that needed no remodelling, but that they would tear down nonetheless to make it as they wanted it. That wasn't something they were willing to waste money on. Energy form and energy consumption were considerations in this process. Tor meant they were concerned with improving the insulation standard; but the prime motive was to achieve better comfort -- any savings were secondary: *"But it was comfort we were after."* Their retrofitting plans involved opening up the house between floors as well as removing dividing walls on the second floor so that kitchen, living room, hall and stairwell were all one space. Tor's comment on this was: *"But we're doing something here that is against all ... manner of rational thinking. In terms of dwellings and ... We're going to open up, take out all the dividing walls, open up from loft to cellar ... And that's irrational, when you come down to it, from an energy conservation point of view."* Their reasons for this were to achieve more spaciousness and a better view.

During the retrofitting process they had had plenty of time to consider heating equipment. Nevertheless, their final choice was made somewhat by chance. As Tor put it, they would at least use thermostat-controlled electrical heaters, but they had been too late with their decision to be able to install a heat pump. That they would have had to include in the early stages of the project, an opportunity they had missed.

When we introduced this family as environmentally conscious, it was in part due to the impression given by Gudrun, plus the fact that they were very aware of their car usage. For instance, it was important to them to live in an area where they would be as independent of their car as possible. None of their statements or actions with respect to the house itself, however, showed them to be particularly energy conscious. Location was also a concern, but was of far less importance than house type and condition. And as we saw, energy concerns did not enter into their choice of home. They offered many other arguments for their choice. The central argument, as we perceived it, was to have a house they could rebuild to their own tastes. In this rebuilding process, they could have put some emphasis on energy consumption, but had not taken it into consideration. In fact, they had chosen a floor plan which was very energy demanding (for further information on the "home improvement" issue, see Wilhite and Ling 1990).

Finally in this section, I will present a family who, while not expressing any ecological concerns in words, proved energy conscious in their actions. *The Tiller family* consisted of Siri, 33 and Vilde, 8. Siri was at university and working part-time as a substitute teacher. They lived in a 100-year-old house nearly completely retrofitted. The house was situated in an old section of a small town.

Before buying the house, Siri had rented various villas, the last of which was in the same neighbourhood as the house she had bought. Her reasons for buying the house were, *"I thought it was just the right size for us. Because we are just 1 1/2 people in the household. You don't need grand rooms when you're so few people. So I looked primarily by size, and price."* Locality was also of considerable interest. She was determined to live in the old section of town. She had lived there since 1990 and liked being close to work, school, etc. *"It's just perfect. The walking distance is fine to school and the post office and the bank and the shops and ... I think I live reasonably centrally in those respects."* That the house was old was also desirable: *"It appealed to me. I have ... a love for old houses."* Having been so determined at the onset, there had been no other houses she had considered and rejected. She had evaluated in advance what she could afford to pay and what she could expect to find for that price, and was convinced of her choice: *"I have spent NOK 200,000 on it. So when you add up the price I paid for it, plus what I've used on retrofitting, you come up with a sum I might have been able to spend on a "box" somewhere, a row house but that wasn't my preference."* The house she had was as close as she could get to her ideal. She therefore had no plans to move, although a change in jobs might at some point make a move inevitable. If so, she would look for the same type of house again: *"It has something to do with my lookout on life, I think, that they have ... that old houses appeal to me so, and that I'd rather buy cheaper or rent cheaper and do more upkeep to get ... to achieve my values."* A central location was a lesser concern, but having a detached house was important: *"It has to do with freedom, I think. Not that I play so much loud music, ordinarily, but I mean having the possibility, or having the feeling of being your own ... well, not master, but mistress at any rate. That you possess something of your own, that you have something of value to manage."*

Siri was, as we perceived her, environmentally conscious without being explicit about it. She had reflected on how she lived and wished to live. She didn't think she made much effort to save energy, but her lifestyle was nonetheless energy conserving. For instance, she did not own a car. She also didn't mind the house being cold when she got up in the morning, so she turned off the heat at night. She saved energy with respect to the two main energy "drains" -- transportation and heating. Nevertheless, energy had not been an issue in her choice of dwelling. Nor had she chosen a heating system on the basis of its energy efficiency. She simply chose the system she liked the best. One of her reasons was that *"I think electricity is clean and reasonable."*

As we have seen, other motives than energy consumption explain Siri's choice of home. Both location and house type count for a great deal. The order of priorities is difficult to determine as houses of this type tend to be found in old, central areas of town. Price was also a concern, resulting in her purchasing an inexpensive house and retrofitting it as her income allowed.

These three families were very different in terms of their composition, ages, educations. They had also chosen three very different types of dwellings. The arguments they used to explain their choices, however, showed a number of common traits. They focus primarily on three themes: the house's location, its design, and to some degree its price. Energy consumption or type of heating are not mentioned in this connection. These features are shared throughout the interview material. We shall expand on this below, looking at different ways to argue along the three dimensions.

3. ACCOUNTING FOR THE CHOICE OF DWELLING: SPACIAL QUALITIES, DESIGN, PRICE AND OWNERSHIP

3.1. Spatial qualities

The term "location" or "locality" covers a broad set of concerns. Many of those we interviewed whose families included children emphasized the "child-friendliness" of their neighbourhood -- limited traffic, playing areas, short distance from school. As one mother put it: *"You have a very good environment for children up here, which we can see in Eskil now. For instance, all the children he goes to school with, they mostly live in this area."* Or as a father of three said: *"That you can send the children out to play without them getting run over by a car, because we couldn't do that where we lived before. There was a lot of traffic there, and no real yard space. Here the yard is enclosed so they don't just wander off, because it's surrounded by hedges and fence."*

Some wish to live near the centre of town, others have the opposite opinion. But regardless of distance from the city centre, most mentioned access to necessary service institutions. One man living in an established row house neighbourhood put it this way: *"Living here is ideal. You have a medical centre, you have a post office, you have a store, you have everything over here. You have a centre right down here. So it's all within walking distance, you see."*

In addition to the practical aspects, people looked for a pleasant location. This was expressed most by those who had built their own homes. One elderly man who had had a house designed and built 30 years ago said he had been most particular about choosing a building site: *"First of all, it was unexposed. And then it is relatively ... it's not too steep. At least for the most part is quite pretty around the house."* Or as one woman said: *"And then there was ... we found it a rather nice spot, with a good view and not crowded in by houses in all directions."*

3.2. Design

The area of design is where we would expect to find arguments dealing with energy consumption. Both house form and size affect energy consumption. In addition, we would include considerations of form of heating under this heading, something which might affect choice of home or which one might change when remodelling. But as we have mentioned before, energy was not emphasized when choosing form of home. Our informants argued their choices in terms of needs, floor plans, standard, etc. For some it was important not to have to remodel, that the interior met with their tastes. Others looked for a house which was "run down" as that was a prerequisite for reshaping it as they pleased.

One man had looked at a number of houses before making his choice, and turned down several on the grounds that he didn't like their style: *"First you pay fifty thousand extra, then you tear it down and toss it out."* A young single woman, on the other hand, preferred not to have to remodel. She turned down a house in her favourite neighbourhood, choosing instead a recently remodelled apartment she liked. An apartment meeting with the standards she wished for would have been too expensive in the neighbourhood she liked best.

Many emphasized how important it was that the house was practical in terms of their needs. One elderly man was convinced that the type of house he had chosen was energy demanding, but practical concerns prevailed: *"I might as well tell you from the start that -- you can make note of this right now that this type of house, it leads to more ... it demands more energy that for instance a multi-story house, especially a block of flats and that sort of thing. Because here you have a large external surface to all sides. But it's very practical not to have stairs and all."* Then too, he had carefully considered heating systems and had chosen a ceiling heat system because they had been recommended to him as a comfortable and practical heat source. Here again, practical aspects were emphasized. As we will recall from the Stene family, Tor argued for an energy demanding solution. His reasons were aesthetical: spaciousness and view. One of the elderly women we interviewed had not considered energy conservation at all, but had nevertheless chosen an energy conserving living style (second floor flat in a high-rise, very low energy costs). Her choice, however, came of looking for a dwelling that was easy to care for.

In addition to finding a home which filled practical needs and was pleasant, the matter of yard or no yard was an issue all our informants mentioned. While some preferred a yard and a separate entrance, others argued for the opposite -- that it was an advantage to have little yardspace, or not to have any garden maintenance responsibilities. As one single mother put it: *"The way I live now is just fine, I think. I really don't long for anything more. I think this is big enough, and that the yard is big enough. Because otherwise I wouldn't ... I'm no gardener. So this is enough."*

If we look back to table 1, we see that the majority seem to prefer detached houses. Most of these will have gardens. But the picture is not unambiguous. It is not simply the matter of economic ability that leads some to prefer a flat in a high-rise. While the dominant house ideal is the single-family house, there are competing ideals that are preferred by some groups of people.

3.3. Price

As the three family presentations showed, price played some role, but this was not an argument our informants expanded on at length. Most had limited means and had to decide on their priorities when choosing a home. As some neighbourhoods are more expensive than others, sometimes locality had to be weighed against design, looks, and standard. Priorities varied, but locality and design were always considered. None of our informants had taken the house's running costs, if we can call them that, into consideration -- that is, what it would cost to heat the house, or whether transportation costs would increase after a move. When we look at heating systems, we find that some families supplement electrical heating with wood heating, but none had more advanced systems of heat control than manually operated thermostats. Knowledge about heating and temperature regulation varied, but most had their own conceptions as to what best suited them -- conceptions which did not necessarily conform with optimal utilization of their technical installations. Nevertheless, as mentioned earlier in the paper, lack of knowledge concerning heating systems or heating in general led to no greater consequences than that all paid their electrical bills without complaints.

The lack of concern of energy consumption and energy costs is reflected in the way housing is advertised. The information offered by real estate agents, usually covers the kind of heating system installed, but never the cost of heating the dwelling. Deep down their hearts, Norwegians seem to think that they live in the land, not of milk and honey, but of oil and hydro-electric power.

3.4. Implications

Energy concerns are not explicitly present in the choice of dwelling. Energy is in some sense an invisible effect of the choice. This implies that Norwegian energy conservation policy should address some of the issues with which people really are concerned. To educate them about the importance of energy conservation may prove to be a tough task.

The option usually taken up in Norwegian policy is to improve the technical standard of houses. Building regulations make demands about insulation and other qualities that affect the need for energy to heat the dwelling. Support

for retrofitting for energy conservation -- information and economic funds -- has been available for a long time, and a great many Norwegians have made considerable improvements in the technical standard of the dwellings (NOS Boforholdsundersøkelsen 1988, Ljones et al 1992). However, the Stene family is probably typical with respect to the motivation to retrofit. One wants improvements in the comfort level. Consequently, recent Norwegian campaigns to diffuse energy conservation technologies have focused on reduced costs and improved comfort, not on conservation and environmental issues.

Our data suggests the importance of an additional, but far more controversial option, to confront the dominant ideal of detached single-family houses by increasing the attractiveness of other forms of dwelling. This would imply an effort to have a long-term influence on the structure of the housing market by affecting the present spatial distribution of dwellings to reduce transport, and to give priority to other values than house and garden. Our data shows that there are different value systems that could be supported.

Most people choose a dwelling with certain logistic and aesthetical qualities. Usually, they do not choose the heating system. That is a part of the whole package deal. Some may change the heating system as part of their retrofitting or for other reasons. However, the impact of choosing electricity or oil, a central heating system or a decentralised one, is small. Of much greater concern would be the choice of alternative systems. When would such systems be preferred, for what reasons and to what effect? Turning to our second study, we will look at a situation where heating systems and running costs were central to the marketing of the dwellings.

4. EXPERIENCES FROM BROMSTAD -- AN ENERGY CONSERVATION HOUSING PROJECT

In this section, we will present the main results from a study of people living in houses equipped for sustainable energy consumption, with particular emphasis on their ability to run the systems in an optimal way. Bromstad, the site of the study, is an area with 47 new houses, situated in Trondheim. The study accounted for here, evaluated energy use and indoor climate in 41 of these houses. The planning and building of this area was done independently of this evaluation, and it was not related to any research project. We are talking about ordinary houses, owned and used by people who differ in terms of family structure, age, education and occupation. The technical installations used for heating and ventilation, were products available on the market, not special designs. However, the houses were designed and built with this equipment for heating and ventilation. The people who bought the houses, had no options with respect to these qualities.

The dwellings at Bromstad are semi-detached houses with a garage between each of them. They are built with an intention to support reasonable energy use and create a good indoor climate. The individual owner has been responsible for the foundation walls, while craftsmen have done the rest of the work. The design of the houses is in accordance with standard Norwegian building style and building regulations, including the use of standard insulation and windows with two-layer clear energy glass.

All the houses have installed so-called balanced ventilation. This is a mechanical ventilation system where the supply of fresh air and the outlet of used air is taken care of by a fresh-air fan and an outlet fan. The outlet air is taken from bath/washing rooms and kitchen, while the fresh air is let into the livingroom and the bedrooms. A separate kitchen fan is installed which leads through an outer wall, to avoid dirtying the main outlet channel. The ventilation system is constructed with a fresh air quantity of 0,5 air exchange pr. hour. This is in accordance with expected average demands for the whole building in new Norwegian building regulations. Measurements of the exchange suggest that it is somewhat larger.

All the houses have installed a heat pump that recovers heat from the ventilation outlet. This heat is used to produce hot water or to warm fresh air before it is let into the rooms. In addition, the heating system consists of electrical panel heaters and floor heating in the bathroom. There is a system for time-based regulation of the panel heaters and the heat pump. The control system makes it possible to partition the house in up to twelve zones (courses) with individual control and regulation of the room temperature.

A survey was conducted among the dwellers between December 1992 and February 1993, 1/2 to 1 year after they had moved in. The questionnaire was in part filled in through interviews, in part by the dwellers themselves. 33 participated. All of them had the heat pump running, intermittently or the whole time. 64 per cent thought they had received sufficient or good information and training related to the technical equipment, while 36 per cent meant that it was insufficient. Nearly everybody (97 per cent) answered affirmatively that they had made themselves acquainted with the working of the technical equipment in their house. All of them maintained that they had a "good" or "medium" understanding of how heat pump, ventilation system and the timebased control system for panel heaters worked. At this stage, no one said that they "feel this is far too complicated".

When asked how they in sum felt about the system, 49 per cent were well satisfied, 42 per cent were medium satisfied, while 9 per cent were dissatisfied. Compared to a previous survey, conducted just after the dwellers moved in, the scores had improved on all variables concerning the subjective evaluation of their own understanding of the equipment that had been installed. Still, the yearly energy consumption measured in the fall of 1993 was higher than what the dwellers had been promised. That led to a third survey of November 1993 to look

at the real use of the technical systems. Maybe the systems were more difficult to run than assumed by users as well as by designers?

A particular feature of the technical installations in the houses was that when both the heat pump and the panel heaters are used for heating, it is important to the economy of the system that one gets as much energy as possible from the heat pump to warm the air before the electrical ovens start to work. This demands that the thermostat of the heat pump should be put at a higher value than the panel heaters, a responsibility falling to the users. The third survey showed that 42 per cent of the respondents did not adjust the thermostats according to the manual (this does not concern the period of reduced temperature at night). Thus, these installations do not function in an optimal way regarding the consumption of energy, in spite of the results from the previous surveys which showed that most of the users felt competent about the equipment. What seems to be the case, is that there is a problematic understanding of the interactive working of the energy conservation systems with the effect that the systems do not work optimally. If the dwellers really understand how the systems work, we have to conclude that they are not particularly concerned with energy saving.

The follow-up study among the dwellers at Bromstad showed that they were very satisfied with the indoor air quality, a feature considered very important by many people. This is a consequence of the balanced ventilation system. As much as 90 per cent told that they experienced an improvement in the indoor air quality of the new house, compared to their previous dwelling. Many have commented positively on the systems ability to remove tobacco smoke, and several families who have children with asthma, think that the improved indoor air quality has improved their health.

However, the energy consumption is higher than expected. Some of the residents have gained sufficient savings of energy to make the investment in energy conservation profitable. Still, the average reduction is not sufficient to justify the necessary extra investment of around 3 000 ECU pr house for the chosen energy conservation equipment.

The reasons why energy consumption is higher than expected may be summarized in three points: (1) Suppliers and consultants had created expectations about the potential of energy savings that were unrealistical high. (2) Several features of the chosen technical solutions in relation to the heat pump make the system work sub-optimally. (3) Many users did not use the system in an optimal way, even if they believed themselves to be sufficiently knowledgeable.

An obvious implication of these results is that the technical systems to be used in ordinary houses should be designed to cater for energy and indoor climate without demanding much follow-up from the users. Alternatively, one could emphasize the need for such systems to be far more user-friendly. This implies that the systems must appear to be "transparent" for the average inhabitant, so that he or she may understand the consequences of the different operational options.

However, in the context of this paper, we will stress the fact that the above results indicate that users' skills may be an underestimated factor in energy saving policies towards households. In their analysis of a leaflet used in Norwegian campaign to promote systems of time-based control of panel heaters, Sørensen, Aune, and Hubak (1992) show that the most obvious reading of this leaflet is that such systems are complicated and difficult to use. The up-front message provided is focused on the systems assumed potential of economic savings. Skills are not a concern. This ambiguous information -- it is money-saving, but difficult to use -- probably renders the advertisement inefficient. People do not bother to save money if they are not able to trust the technology.

5. CONCLUSIONS

The energy consumption of households is partly a product of the technical qualities of the dwelling, partly of the lifestyle and energy-related behaviour of the inhabitants. When people are choosing their dwelling, they act in an intersection of the technical and social dimension of household energy consumption so-to-speak. The lifestyle is in a sense materialized into the dwelling, while the dwelling allows for a further development of the very same lifestyle -- possibly on an expanded level. Thus, the accounts people give of their priorities and premises when choosing a dwelling are of great importance as a basis of improved understanding of the socio-technical dynamics of energy consumption.

What we are told about the criterias of choice, is really not very surprising. People want a house or an apartment situated in a 'suitable' neighbourhood, they want their home to have a 'nice' design and to be of a 'fitting' type, and it should be 'affordable' as an investment. 'Suitable', 'nice', 'fitting' and 'affordable' mean different things, according to age, income, and values. Still, there is a dominant ideal -- the detached, single-family, houses, preferably spacious -- that reflects and is reflected by a high-energy lifestyle that is preferred by a majority. This represents a solidified energy consumption trajectory, a trajectory embedded in a physical structure of buildings and roads as well as in social practices.

The effect is that a high energy consumption pattern is stabilized through a socio-technical entrenchment process. To moralize about the resulting consumption pattern can have a limited effect only because the short-term changeability is limited. Thus, to increase peoples awareness that when they acquire a dwelling, they should be concerned about the energy needed to live there, would have a double impact. On the one hand, to make them more energy-conscious in their short-term dealings. On the other, to install a long-term interest in dwellings that promote energy conservation behaviour.

However, the Bromstad study cautions us that -- at least at the present stage -- there is no automatic reduction of energy consumption from installing

energy conservation systems. To some extent, this is due to technical deficiencies and insufficient user-friendliness. However, it is important to educate people to be able to run their heating and ventilation systems in an optimal manner. This may be the case also with conventional systems. The way thermostats work, for example, is poorly understood by many people. Maybe the educational system should be more concerned to provide us with a better understanding of how the things that surround us, really work. To understand the way thermostats work may prove to have greater importance than some superficial knowledge of quantum mechanics.

The efficiency of educational measures is nevertheless debateable. Mainly, our findings provide for pessimism on behalf of energy conservation. To change the energy consumption of households, one may need more drastic measures like regulations or radical changes in the principles of the current physical planning regime. This regime reinforces the high energy consumption pattern by stimulating mobility and increasing the availability of single-family dwellings. As long as this regime is in place, energy conservation will be an "up-hill" task.

6. REFERENCES

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