Non-Price Barriers that Impede the Performance of Economically Viable Energy Conservation Measures in the Norwegian Residential Sector

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In 1990, the Central Bureau of Statistics conducted a nationwide residential energy use survey. More than 40 percent of the households reported they have little or no possibility of conserving energy. Furthermore, more than 10 percent of the households who stated they could conserve energy did not feel there were benefits to be derived from making the necessary changes. These findings are rather surprising because of the discrepancy between the estimated potential level of energy use that could be achieved from the implementation of economically viable measures and the current level of energy use in this sector. In light of this discrepancy, one may pose the following question: What types of non-price barriers prevent households from undertaking these energy conservation measures?

The 1990 Residential Energy Use Survey is used to identify households who encounter barriers of: (1) limited access to capital, (2) split incentives, and (3) limited access to information. The survey is also used to examine households' attitudes towards energy conservation possibilities in their homes and their perceptions of the benefits achievable from making changes. The relationships between barriers, attitudes, and the performance of 8 energy conservation measures are analyzed.

This analysis reveals that the households' performance of economically viable energy conservation measures is impeded by the above mentioned barriers, and attitudes. The degree a given measure is hindered is dependent on the type of measure, barrier(s), and attitudes. However, after these barriers and attitudes are taken into account, there still remains, in most instances, a hidden barrier.

Introduction

"What people define as real is real in its consequences" (Thomas 1931).

Norway is a country endowed with abundant, inexpensive hydroelectric power. In 1989, the average price of electricity in the Norwegian residential sector was 43 øre per kWh (6.2¢ per kWh) versus 7.6¢ per kWh in the American residential sector (International Energy Agency 1992). However, Norway also has a cold climate (the long-run average number of heating degree-days in Norway is 4,069 (base 18 °C) versus 2,585 (base 18 °C) in the United States) (Ketoff, et al. 1987). Because of the energy expenditures associated with heating a home in a cold climate, decisions to install insulation, heating system controls, and weather-stripping are all cost effective.

Indeed, during the past 20 years, there have been substantial improvements in the thermal integrity of the new dwellings entering the housing stock, and many structural improvements have been made to existing dwellings. However, most households have not made all of the structural or technical improvements justified at the current energy price level, and some households have undertaken few, if any of these measures. A Norwegian consulting firm estimated that energy demand in the residential sector could be reduced by nearly 25 percent (11 TWh), if all cost-effective structural and technical improvements were undertaken (Energidata 1991). But, this firm also stated that only 60 to 70 percent of these reductions would be permanent because households "take back" as much as 40 percent of the energy savings by increasing their comfort levels.[1] Results from the 1990 Residential Energy Use Survey indicate Norwegians maintain high indoor temperatures in the living area(s) of their dwellings (the average temperature was 21.5 °C) and have been reluctant to make any sort of behavioral changes (e.g., lowering room temperatures, using less hot water, or turning off lamps not in use) that may be perceived as compromising their comfort levels.[2] Wilhite and Ling (1990) reported that Norwegian households'

energy-using behavior (especially, with respect to their use of space heating and lighting) is strongly associated with their perceptions of what constitutes a good home environment. In the authors words, "...a good house is a warm house" (Wilhite and Ling 1990).

In Norway, there have been no empirical studies that attempted to analyze the degree to which barriers affect the improvement of energy efficiency in the residential sector. This paper attempts to identify certain non-price barriers that impede the households' performance of economically viable conservation measures using results from the 1990 Residential Energy Use Survey.

Households are first grouped by barriers. Barriers are then broken down by attitude towards the energy conservation possibilities in the home and perceptions of the benefits achievable from making changes to conserve energy. An examination is made of the relationships between barriers, attitudes, and the performance of 8 economically viable energy conservation measures. Finally, the limitations of this approach are discussed and recommendations are made for future work in this area.

Barriers

Many studies have analyzed types of barriers, obstacles, market imperfections, or market failures that may impede the efficient use of energy (Carlsmith et al. 1990; Connor-Lajambe 1992; Fisher and Rothkopf 1989; Jochem and Gruber 1990; Robinson 1991; Ruderman, et al. 1987; Sutherland 1991).[3] The types of barriers examined have been varied. The most common types of barriers that have been discussed are: limited access to capital, split incentives (e.g., landlord/tenant problems or the occupancy hypothesis), and high information and transaction costs. Some studies have also included broader barriers such as: externalities (e.g., national security and environmental quality), lack of competition in the energy supply industry, uncertainty about fuel prices, government policies, codes and standards, and supply infrastructure limitations. A few studies have included a barrier referred to in Krause and Eto (1988) as "non-economic consumer rationality." This type of barrier is present when the consumer's decision-making process is not solely based on economic rationality, but it takes into account factors such as: appearance, fashion, social status or the opinions of peer groups, personal obligation, convenience, health and safety, trust in information carriers, competence and interest in new technologies, and habit persistence (Krause and Eto 1988; Robinson 1991; Wilk and Wilhite 1985).

The Identification of Barriers and Underlying Attitudes

There exist a large energy saving potential in the Norwegian residential sector. While this potential has been estimated, there have not been any studies of the types of, and the degree to which, barriers obstruct the performance of economically viable energy conservation measures. The 1990 Residential Energy Use Survey can be used to identify households who face the barriers of: (1) limited access to capital, (2) split incentives, and (3) limited access to information. The survey can also be used to examine households' attitudes towards the energy conservation possibilities in their homes and the benefits achievable from making changes to conserve energy.

Households that are subject to the "limited access to capital" barrier, have been characterized as having limited disposable income to finance conservation measures and difficulties in borrowing money from financial institutions. Households with a combined gross income of under kr. 100,000 (approximately $14,420) were assumed to face this barrier.[4]

Households that encounter the "split incentive" barrier have been categorized as: (1) renters, that are prohibited from making structural improvements (their landlords generally do not pay the energy costs associated with their dwelling, and subsequently, have no economic incentives to improve it), (2) households living in apartment blocks (where the decision to perform structurally related energy conservation measures are made by a steering committee or property management firm), and (3) households that pay for a portion of their energy costs indirectly (i.e., in the form of a monthly payment that includes maintenance costs, other joint costs, and/or a portion of the mortgage). Households in one or more of the above categories were assumed to face this barrier.[5]

The "limited of access to information" barrier has been defined as the following: (1) too much (an overwhelming amount), too little, confusing, manipulative, conflicting, or wrong information, (2) the lack of feedback on energy use (e.g., infrequent billings), (3) the lack of information on new technologies (including the limited availability of some new technologies, and lack of consumer confidence with respect to the reliability, installation, and use of new technologies), and (4) lack of information on the links between energy use and the environment. (See, for example, Connor-Lajambe 1992). These types of information were not collected in the survey. However, a scoring system was developed to serve as a proxy for this barrier.

The survey contained a question where the households were asked to rank the effectiveness of 5 energy savings measures. Based on the household's responses to each part of this question, they were awarded points when they responded correctly, and penalized when they answered incorrectly. (See Appendix 1.) Households that received a total score of less than 50 percent were assumed to face this barrier. (The implications of the use of this method are discussed later in the paper.)

Based on these barriers, the households were placed into the following 8 groups: (1) limited access to capital (only), (2) split incentives (only), (3) limited access to information (only), (4)-(7) combinations of these barriers (i.e., multiple barriers), and (8) none of the above barriers. (See Figure 1.)

Slightly more than 75 percent of the households confront at least one of above types of barriers. The "limited access to information" is the most prevalent type of barrier. Around 55 percent of the households face this barrier either alone, or combined with other types of barriers. Nearly 40 percent of the households encounter the "split incentive" barrier either alone, or combined with other barriers. Only 8 percent of the households face the "limited access to capital barrier", or this barrier combined with other types of barriers. Two percent of the households confront all of the barrier types.

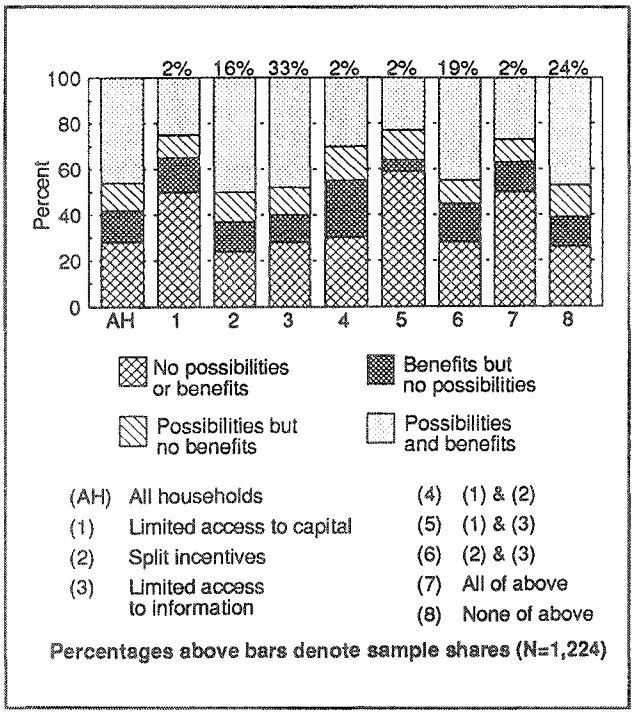

Figure 1. Barrier and Attitude Groupings

These barrier groupings are broken down into 4 attitude groups based on the household's level of agreement (i.e., agreement or disagreement) to the two following statements: (1) "It is not possible to conserve energy in my house/flat," and (2) "I/We do not see any benefits [to be derived] from making changes to conserve energy in my house/flat."

Twenty-eight percent of the households felt that there is neither the possibility to conserve energy nor are there benefits to be derived from making changes to conserving energy in their homes. The share of these households is significantly higher among the households in the following barrier groupings: the "limited access to information" (only), the "limited access to capital" and "limited access to information", and all of the barriers. Around 14 percent of the households felt that there is no possibility of conserving energy in their homes, but they saw benefits from conserving energy. Slightly fewer of the households, 12 percent, felt there are possibilities, but no benefits from making changes. This attitude is fairly consistent among households in the different barrier groupings. The most prevalent attitudes, reported by 46 percent of the households, are that it is possible to conserve energy and there are benefits. While 47 percent of the "barrier free" households have these attitudes, they were reported by only 25 percent of the households facing the "limited access to capital" barrier.

Barriers, Attitudes, and the Performance of Energy Conservation Measures

One may ask if the presence of barriers and the households' underlying attitudes towards energy conservation have influenced the performance of structural, technical, and behavior-oriented economically viable energy conservation measures. The types of structural and technical measures examined in this paper are: installation of wall, attic, and floor insulation, installation of double- or triple-pane windows, installation of weather-stripping, installation of a thermostat(s), and installation of night setback controls. The behavior-oriented energy conservation measures explored are: lowering indoor temperatures, using less warm water, and turning off lamps not being used.[6,7]

Figure 2 shows the performance levels for each of the conservation measures for all households, and by the different attitude groups within each barrier grouping. This figure illustrates several important findings. First, the levels at which the individual activities have been performed vary among the barrier groupings and the

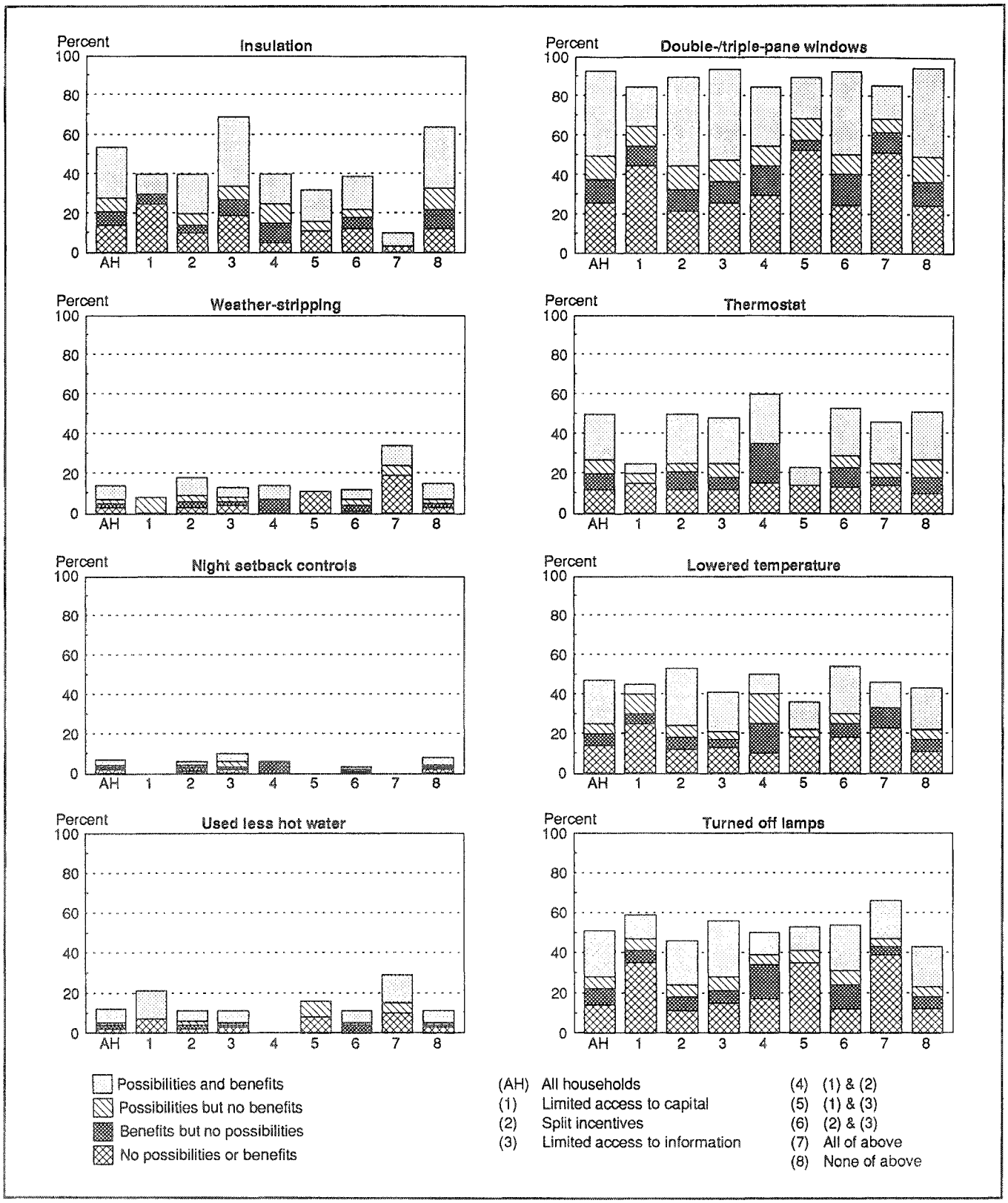

Figure 2. Performance of 8 Economically Viable Energy Conservation Measures

attitude sub-groupings. In addition, the magnitude of the variations in the performance levels among the barrier groupings (and attitude groupings) is not consistent across the measures (i.e., the presence and/or absence of barriers and attitudes have differing impacts on the individual measures). Second, many of the households, including the "barrier free" households, have not performed all economically viable conservation activities to the levels dictated by current energy prices.

The performance of the structural, and technical measures tended to be inhibited among the households which face only the "limited access to capital" barrier. However, the performance of behavioral measures, with the exception of the "lowering temperature" measure, was higher among the households in this group than among the households in the other groups.[8] In a 1986-1988 survey of consumer expenditures, it was reported that for the households in the lowest income group (incomes less than kr. 49,000), nearly 8 percent of the total expenditures per household were for electricity and heating fuels (Statistisk Sentralbyrå 1990). Therefore, while financial constrains may have inhibited the performance of technical measures, these households were more inclined to undertake behavioral measures, conceivably in an attempt to reduce their energy expenditures.

The performance levels for households encountering only the "split incentive" barrier differed among the individual measures. Fewer of these households installed insulation, double- or triple-pane windows, and night setback controls than households in other groups. This type of barrier did not impede the installation of thermostat controls. These households tended to maintain lower room temperatures and used less hot water, but fewer of these households turned off lamps than households in other groups, with the exception of the "barrier free" group. Nearly 75 percent of the households in this group live in apartment buildings, but they own their units, and they pay directly for their energy use. Therefore, while the presence of this barrier may impede the performance of some of structural or technical measures, it may not hinder the installation of measures like weather-stripping (which is something that can be installed by an individual household) or the behavioral measures.

The performance of the structural and behavioral measures (with the exception of "lowered temperatures") was not dampened by a lack of information. One explanation for relatively high performance levels of structural measures is that many of these households could have moved into the dwellings after these measures had been undertaken and are not directly accountable for the improvements. (Nearly 30 percent of these households live in homes built after 1981.) While 85 percent of the households in this group stated that turning off lamps was an effective way of saving energy, only 7 percent felt that reducing indoor temperatures was effective. This could partially explain the lower performance levels for the temperature measure.

Multiple barriers had varying effects on the individual measures. The most significant finding is that less than 10 percent of the households encountering all of the barriers had installed insulation. While the presence of all of the barriers somewhat suppressed the households' performance of the other structurally related measures (with the exception of weather-stripping), it furthered the performance of the behavioral measures. These households reported using less hot water and turned off lamps more often than households in the other groups.

"Barrier free" households tended to install more of the structural and technical measures (with the exception of weather-stripping), but they tended to perform fewer of the behavioral measures. A greater proportion of the households in this group live in newer homes (more than 30 percent live in homes built after 1981) and 43 percent of these households reported incomes of more than kr. 300,000 ($43,480). Therefore, many of these households may not be accountable for the performance of the structurally or technically oriented measures, but instead the completion of these measures could be attributed to changes in building practices. In addition, expenditures for electricity and heating fuels represented only 4 percent of the highest income groups' (incomes over kr. 300,000) total expenditures (Statistisk Sentralbyrå 1990). As a consequence, these higher income households may not be as economically motivated to make behavioral changes, as the lower income households.

The relationship between the barrier groupings and the attitudes, and the performance of measures is varied. Differences in attitudes do not tend to effect the installation of double- or triple-pane windows, or any of the behavioral measures. However, these differences do tend to effect the installation of insulation (especially, among the households facing all of the barriers), thermostats, night setback controls, and weather-stripping. A rather surprising finding is there are only small differences in the performance levels among the households in the various defined attitude groups in the "barrier free" household group.

Hidden Barriers

In the previous section, it was shown that the barriers of: (1) limited access to capital, (2) split incentives, (3) limited access to information, and combinations of

these barriers, affect the performance of economically viable energy conservation measures. In some instances, differences in the households' attitudes towards energy conservation, and the benefits to be derived from making changes to conserve energy, also interact with the presence of one or more of the above types of barriers to influence the levels of performance. However, these types of barriers and attitudes, alone, cannot serve as indicators of the households' inabilities to undertake economically viable energy conservation measures.

Even though each of the energy conservation measures is cost effective, there are large variations in the performance levels of these measures that cannot be explained by the barrier and attitude groupings used. These variations ranged from a low of less than 7 percent (installation of night setback controls) to a high of more than 90 percent (installation of double- or triple-pane windows). Many of the more expensive measures have been performed at higher levels than the less expensive or "free" measures.[9] However, this study did not distinguish between households which actually invested in a structural or technical measure and those which moved into a home where the measure had already been performed (e.g., when the home was built). If one were able to separate these households, the performance levels for actual investors may be significantly lower. If a comparison was made of the performance levels among the measures for the households that were actual investors, there may be less variation among the levels. At the same time, the hidden barrier(s) would be larger.

It is clear that in many instances, the presence of the hidden barrier(s) is significant. The impact of this barrier is as large, or larger than the impacts of the other barriers with respect to the performance of certain measures. Furthermore, this barrier could explain the large variations in the performance levels among the measures. However, because of data limitations, this barrier cannot be identified.[10] (This issue will be discussed in the next section.)

In spite of these data limitations, there is evidence that some of the components of the "non-economic consumer rationality barrier" influence performance levels. For example, in their 1982/3 study of 60 households in Santa Cruz, California, Wilk and Wilhite (1985) reported that almost none of the households who bought solar panels or greenhouses checked their energy bills afterwards to determine whether they had saved money. The households' primary motivation was the approval of relatives and neighbors. The authors also found that many households found weather-stripping to be "non-glamorous" and had instead invested in more expensive measures (Wilk and Wilhite 1985). These factors could explain, in part, Norwegian households' lack of interest in weather-stripping their homes and why households have not performed lower cost or "free" measures, before performing more expensive ones.

There is evidence that real, and perceived health concerns can also influence the performance of certain measures. In an article entitled, "Nordmenn blir syke av ENØK (Norwegians Become Sick From Saving *Energy)", that recently appeared in a major Norwegian newspaper, researchers attributed large increases in the number of allergies, and asthma cases to increases in the levels of insulation found in Norwegian homes (Dagbladet 1992). There has also been an ongoing debate on the links between Legionnaire's disease and the use of low-flow showerheads. (See, for example, Aftenposten 1992a; Aftenposten 1992b.)

Attitudes towards the environment may not influence the households' performance of energy conservation activities. In 1990, the Central Bureau of Statistics conducted a nationwide interview survey on the population's attitudes towards environmental problems. While the majority of the Norwegians surveyed were very concerned about international environmental issues (69 percent were very concerned about depletion of the ozone layer and 65 percent were very concerned about global climate change), fewer Norwegians were very concerned about local and national environmental problems, such as air pollution (39 percent), and water pollution (42 percent) (Statistisk Sentralbyrå 1991b). Wilhite and Ling (1991) substantiate these findings. In their ethnographic studies of 18 families living in Oslo, the respondents often reported that they had no control over environmental problems, since other countries are responsible for these problems (Wilhite and Ling 1991).

Conclusions and Future Work

While there exist many studies that describe the types of non-price barriers that impede the performance of economically viable energy conservation measures, this is the first study that has attempted to measure the degree in which non-price market barriers have affected Norwegian households' performance of certain measures. This study has yielded interesting results, but there is clearly a need for more rigorous analyses. These analyses should focus on further exploring the barriers described in this paper and attempt to identify, and subsequently, measure the effects of the hidden barrier(s). The types of measures examined should be more explicitly defined, and extended to include other economically viable measures. These analyses necessitate data, which are currently unavailable.

Careful thought should be given to the method(s) by which data are collected.

The "limited access to capital barrier" was somewhat arbitrarily set because of data limitations (i.e., the availability of only gross income per household). Future analyses should attempt to more accurately estimate this threshold level.

The sample used in this paper contained very few households who pay their energy costs either indirectly or not at all. The effects of the "split incentive" barrier on these households (as opposed to those who pay) is different. Households who do not pay their energy costs may not perform structural or behavioral measures, while households in the later category may be more inclined to perform behavioral-oriented measures since it may be their only way to reduce energy costs. Therefore, in future studies it is important to delineate between these two groups.

The proxy used for the "limited access to information" barrier attempted to measure the household's knowledge of their energy use. While this proxy may have captured households who have a lack of knowledge, the source of these deficiencies remains unknown (e.g, do the households have too much or too little information?).

The category of hidden barriers is significant. Future work should attempt to identify, and measure the components of this barrier. It is important to obtain more information on the household's motivations for performing (or not performing) energy conservation measures (e.g., do households undertake conservation measures in order to reduce energy use and/or costs, increase comfort, or impress their neighbors and relatives?). It is also important to obtain more information on the households' decision-making processes. The factors described in Krause and Eto (1988) (i.e., appearance, fashion, social status or the opinions of peer groups, personal obligation, convenience, health and safety, competence and interest in new technologies, and habit persistence), should be explored. Furthermore, it is important to investigate the households' preference orderings (or rankings) of economically viable conservation measures.

The economically viable energy conservation measures examined in this paper were limited to the measures contained in the survey. These measures are very broad. Future analyses should examine more specific measures such as: full versus partial insulation (of walls, attics, and floors) or weather-stripping, particular insulation levels, and the levels to which behavioral measures have been performed (e.g., before and after temperature settings). Additional measures should also be included. For example, investments in energy efficient appliances, and lamps.

Data are necessary to facilitate the analyses described above. Careful attention should be placed on the formulation of questions. For example, in the 1990 Residential Energy Use Survey, the attitude questions were formed in the negative (i.e., the statements read: "It is not possible to save energy in my house/flat", and "I/We do not see any benefits [to be derived] from making changes to save energy in my house/flat"). This could have biased the households' responses. In addition, careful consideration should be made in the choice of the survey instrument used. While mailed questionnaires are inexpensive in relation to other survey instruments, the non-response rates tend to be large, the quality of responses to technically oriented questions tend to be poor, and households may inflate their performance of conservation measures.

A better understanding of the non-price barriers that impede the performance of economically viable energy conservation measures is necessary in order to more adequately explain the discrepancy between the estimated potential level of energy use that could be achieved from the implementation these measures and the current level of energy use in this sector. In addition, the identification, and measurement of these barriers will provide policy makers with the information needed to evaluate whether these barriers constitute market failures, and then if necessary, the policy makers will be better equipped to select, and implement the appropriate policy tools.

Endnotes

1. These findings are based on an analysis of energy use in 600 dwellings before and after the completion of technically oriented conservation measures (Energidata 1989).

2. In 1990 the Central Bureau of Statistics conducted a nationwide residential energy use survey. The survey instrument was a mailed questionnaire that was sent to 4,004 households in May 1990. The questionnaire contained 51 questions pertaining to the following: Dwelling type, age of the dwelling, structural characteristics of the dwelling (size, types of walls, floor, ceiling, and windows), ownership and use of space heating equipment, ownership of thermostats, ownership of night setback controls, water heating equipment ownership, appliance ownership, lamp ownership, electricity and/or fuel use, demographic characteristics of the household members (number of

members and their ages), gross income per household, tenure in the dwelling (number of years, ownership status), reported temperature settings, reported energy conservation measures undertaken or planned in 1990, and several attitude-related questions.

The sample was drawn using the Central Bureau of Statistics's standard sampling plan (See, for example, Statistisk Sentralbyrå 1991a). The non-response rate was 48 percent (1,913 households). Forty-four households were removed from the sample because they lived in institutions. An additional 823 households were removed from the sample used in this paper because of excessive non-responses to key questions. The resulting sample of 1,224 households is not unbiased. This sample under-represents 1 person households. As a consequence, the sample also over-represents larger dwellings and under-represents low income households.

3. The terms barriers, obstacles, market failures, and market imperfections have been used somewhat interchangeably in the literature to describe the factors that may impede the normal functioning of markets. Most studies have defined a set of barriers, assumed or established they constitute market failures, and have then attempted to link these to a set of corrective policy instruments. In this paper no attempt is made to establish the defined barriers as market failures or to link these to a set of corrective policy instruments.

4. kr. 100,000 (gross income per household) was chosen as the upper boundary for households subject to the "limited access to capital" barrier. The selection of this boundary was rather arbitrary because the survey contained a question on gross income (before tax income) but not on disposable income, which would have been a more appropriate income measure in this analysis. Furthermore, there is not a simple definition of a low income household or a "poverty line" in Norway.

5. This information was directly obtained from responses to the relevant questions contained in the survey.

6. The insulation and thermostat data have been reported by the households, while the weather-stripping and night setback control data have been imputed from the households' responses to questions regarding their energy conservation activities. If a household had installed weather-stripping after 1980, it was assumed that they had weather-stripping. (There are no published estimates of the effective lifetime of weather-stripping in Norwegian dwellings.) For the temperature measure, if a household maintained a temperature in the living area(s) of their dwelling which was lower than sample average, it was assumed that they at some point had lowered their temperature. It was decided that this proxy was more favorable than the use of reported responses of whether they had lowered their temperatures because of the relative nature of this question. Indeed, many households who reported having lowered their indoor temperatures maintained temperatures significantly higher than that of the sample average. The "used less warm water" and "turned off lamps" measures were based on data reported by the households on their energy conservation behavior. Unfortunately there were no questions contained in the survey on appliance efficiency or use.

7. Wilk and Wilhite (1985) reported the following: "Most of these [weather-stripping] figures are for self-reported conservation measures, which tend to produce highly inflated percentages, as those questioned respond to the perceived expectations of the researchers." As a consequence, the self-reported data used in this paper may also be highly inflated. Since there are not other Norwegian data on the performance of conservation measures, it is not possible to verify this finding.

8. Nearly 75 percent of these households do not have thermostats and may be unable to adequately regulate their indoor temperature.

9. While Energidata (1991) reported that each of the measures are cost effective, the households were not asked the costs of the installation of the measure or enough specific details on the measures (e.g., type of insulation) to obtain cost data from other sources.

10. The survey contained a very limited number of attitude and behavioral-related questions. It also did not contain questions on the lifecycle phase of the households.

Acknowledgments

The author would like to acknowledge the helpful assistance of T. Bye, R. Ling, B. Morrison, S. Svoren, H. Wilhite, and the two anonymous reviewers.

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Appendix 1

An attempt was made to quantitatively measure the households' understanding of their energy use. Households were asked if they had to save energy, to rank the five conservation measures listed in Table 1 from 1 (very effective) to 4 (ineffective). Based on the responses to this question, it was apparent the households answered for the hypothetical household, and not their own (e.g., if a household did not own a washing machine, then they could not wash their clothes with a colder-water program, and therefore, they should not have responded or the response should have been "ineffective"). In addition, there is no evidence that the households treated the individual items as being interdependent. Although an unique ranking was impossible, if the instructions were followed (i.e., there are 5 questions and 4 possible responses), very few households had a ranking in which they had the same response to two items and different responses to the remaining items.

As a consequence of the above problems (lack of individual-specific responses, independence among the individual items, and the prevalence of non-unique responses), statistical scaling techniques were deemed to be inappropriate. Therefore, a simpler system was employed. Households received a score based on their responses and non-responses to each item as shown in Table 1. A scoring system was designed to award the household with one point if they answered an item correctly and to penalize them if they answered incorrectly. The correct responses were established by assuming that the items were dependent and the last item (i.e., "watching less television") was the least effective way to save energy. An unique ranking could then be established. Correct responses could be uniquely assigned for each item based its relative importance (i.e., Lowering the indoor temperature is the most effective energy saving measure and watching less television least effective measure). The degree to which the household was penalized was determined by the deviation of the household's response from the correct answer (e.g., households who answered incorrectly to the most and least important questions were more heavily penalized). The total score is the summation of each of the five scores. Households receiving a score of less than 50 percent of the total possible points were assumed to face the "limited access to information" barrier.

Table 1. The System Used to Obtain a "Limited Access to Information" Score

Response→ / Measure↓	Very Effective	More Effective Than Ineffective	More Ineffective Than Effective	Ineffective	Missing Response
1) Reducing indoor temperatures	1	-1	-2	-3	-4
2) Taking a shower instead of a bath	-1	1	-1	-2	-3
3) Washing clothes using colder water	-2	-1	1	-1	-2
4) Turning off lamps not in use	-3	-2	-1	1	-1
5) Watching less television	-4	-3	-2	-1	1