THE SECRET SUCCESS OF THE REDUCTION IN THE NORWEGIAN ELECTRICITY CONSUMPTION

Nina Heidenstrøm, Eivind Stø, Pål Strandbakken, Harald Throne-Holst

National Institute of Consumer Research (SIFO), Norway
P.O. Box 4682 Nydalen, 0405 Oslo
Eivind Stø: eivind.sto@sifo.no, +47 22 04 35 40

Abstract

Largely unnoticed by the media and the public, the electricity consumption of Norwegian households has stopped growing and even decreased since 1990. The project, financed by the Norwegian Research Council, aims at defining what factors that might explain this rather unanticipated development. This paper is, however, restricted to accounting for the validation of the existing data and a preliminary list of possible explanations. Such a validation has to take into account if the breaking of the curve really hides a shift of medium; that a decrease in electricity consumption is explained by a corresponding increase elsewhere, or if it follows simply from a reduced average household size, and thus counteracted by an increase in the number of households. The paper concludes that the witnessed reduction in electricity consumption is real.

Keywords

Energy, electricity, consumer behaviour, saving, households

1. Introduction

This paper is the first contribution from a new research project on energy consumption in Norway, financed by the Norwegian Research Council. The aim of our project is to contribute to the scientific and political understanding of why and when policy and economic measures manage to change consumer behaviour and practices. Our point of departure is the fact that electricity consumption in Norwegian households has been reduced significantly during the last two decades, and this information has not caused any headlines neither in the scientific nor the political discourse. It seems that we all have been locked into the paradigm of pessimism: “Nothing works and change will be too small and too late”. Instead of

concentrating on why measures don't work, we will shift our focus her from fiascos to successes.
Our main research questions in this project are:

- To what degree is it possible to explain the decline in electricity consumption by institutional or individual explanations?
- Has the institutional and individual factors strengthened each other and made it easier to reach the goals, or is there a mismatch between these two components?
- It is possible to identify what kind of economic, social and political measures that works and what kind of measures that obviously have not had any positive effect on the goal to reduce energy consumption?

However, we will have a sharper focus in this paper. We will report from the first step in the project where our main focus is to validate the existing data. Since this decline has created little attention, both at the political level and within the research community, could the data mask underlying trends like specific rebound effects or societal changes that indicate alternative results? Are we really breaking the curve?

Thus, we have to validate the main precondition of the project. We are particularly concerned with two factors. First, could the decline in electricity consumption alternatively be explained by a corresponding increase in other energy sources? Secondly, could the decline in energy consumption per households be a result of decline in households' size, and therefore could be expected to be counteracted by increased number of households? Before we can look for individual and institutional explanations for the decline in electricity consumption, we have to go deeper into the data behind our "breaking the curve" assumption.

2. Background and theoretical contribution

Within most consumption areas we have witnessed a continuing increase the last decades. Houses are getting bigger, we have larger and more cars, air travel is increasing and meat consumption per capita has never been higher. Despite technological innovations within all these sectors, the aggregated environmental impact of consumption is still increasing. Within sectors relevant for the electrical consumption in households we have also witnessed an alarming increase. Electrical household appliances are numerous in most families, the

stand-by solution on TVs and PCs are energy consuming and terrace-heaters [1] are increasingly popular among Norwegians.

The idea of comfort has been blamed for the perceived increase in domestic energy use (Shove 2003). It is supposed to be hard for an individual to renounce on a level of comfort he has grown used to. But he will probably not object to having the previous level of comfort delivered with less energy or less environmental impact? This utilizes the idea of a certain *service level*, where the given level of consumption is maintained, even when the use of resources and the environmental loads are reduced (Vittersø, Strandbakken and Stø 1998). However, when we look at energy consumption in Norway we have registered a significant decline the last decades, and this has also been the case for electricity. Since 1990 we have seen a slight decline in electricity consumption, after an increase from 1960 to 1985. This is the starting point for the study; our use of electricity has not increased.

A number of studies have focused on fiascos, on the discrepancies between attitudes and consumer behaviour, between knowledge and attitudes, and between knowledge and behaviour (Alwitt & Berger 1992, van Raiij 1995, Beckmann 2005, Belk, Devinney, Eckhardt 2005, Stø, Throne-Holst, Vittersø, Strandbakken 2008, Szmigin, Carrigan, McEachern 2009). This has also been the case in Norwegian studies (Strandbakken 1993, Lavik 1997). From a political point of view it is more relevant to concentrate on the successful initiatives and measures, in order to learn from the positive processes and experiences. From a more theoretical point of view we take a critical look at the role of consumers and households in electricity consumption.

We are inspired by the work of Jänicke and Weidner (1995) who gives a critical evaluation of 24 “success” cases from 12 OECD countries. However, the consumers do not play a crucial part in many of the cases sited in the book. The importance of consumers and consumption is increasingly been recognised in the national, European and global environmental policy. The time has come to take a closer look at the environmental potential for change in

[1] Terrace-heaters are used by many restaurants because it allows guests to smoke outside on cold days. The heaters are also becoming increasingly popular in private homes; it makes short summers longer, and gives a higher level of comfort. The popularity of terrace-heaters might actually be related to a change in norms for smoking, especially indoor smoking. If this is so, we see how this unanticipated side effect of a change of norms and behaviour ends as a driver for increased energy use in households and restaurants. The rather irrelevant “outdoor heating” technology suddenly becomes useful and important.

consumer lifestyles, attitudes and behaviour in modern societies. Consumers and households are not only a problem. When they are mobilised as actors in the electricity market, they are also a natural part of the solution (Stø, Throne-Holst, Vittersø 2005).

This path leads us to use “windows of opportunity”, a concept developed by Ørjan Svane (2002). It denotes the consumers` possibilities for energy savings when they are in a transition process; moving, refurbishing or building a new house. During such a transition it is easier to implement changes that will affect the household energy use. The window of opportunity is part of the consumer’s consciousness, but it is not always demonstrated by their actions. The discrepancy between attitude and action are further affected by economy, cultural norms and knowledge. How can this influence Norwegian households’ use of electricity?

The main theoretical and empirical innovation in this project is to combine the institutional and individual perspectives on consumer behaviour related to energy consumption in general and electricity more specific. An initial attempt to integrate both approaches has been made in the study if trust in food in Europe (Kjærnes, Harvey, Ward 2007), and in a study of energy consumption in the UK project RESOLVE (Jackson 2004a, 2004b). In this project we will not only study both individual and institutional factors, but also examine how both may interact in influencing consumer behaviour. For instance, people may be less inclined to reduce energy use when they use renewable energy sources, or environmental concern may more strongly affect behaviour in specific contexts.

Environmental behaviour takes place within institutional settings, and is as such ‘institutionalised practise’. By ‘institutionalisation’ it is generally meant that social interaction is framed by a variety of social constraints that, in turn, strongly contribute to the regularity of communication, resource allocation, preference formation and problem solving that characterise most social phenomena (Berger and Luckman 1984). Behavioural changes linked to energy use are no exception — whether successful or not. It follows that although individual capacities and liabilities undoubtedly have an impact on the environmental impact of consumption, they are not randomly influencing the course of events; rather, they have influenced from within institutionalised contexts, and their influence may differ for different contexts.

The *individual approach* focuses on consumer knowledge and information on the one hand and more psychological factors on the other. A further important element is the economic resources of households (Gatersleben, Steg, Vlek 2002). Providing information to consumers may easily result in an information overload, as many different actions contribute to total household energy use. Therefore, the information can best be tailored to the needs of an individual, for example, by only providing information on actions that are relevant to a particular household (Daamen Staats, Wilke, Engelen 2001, Abrahamse, Steg, Rothengatter, Vlek 2007). Individual-psychological factors may also play an important role in the acceptability of energy policies. They appear to be more acceptable when people value the environment, when they are aware of energy problems, and when they think they can and should contribute to possible solutions for these problems (Steg, Dreijerink, Abrahamse 2005). Barriers for change in consumer behaviour have been discussed in the EU project Barenergy. The study shows that such barriers are both a result of individual and structural factors (Barenergy Consortium 2010).

In the following sections we present the preliminary results from our validation, trying to create an image of the situation: Do Norwegian households use the same amount (or less?) electricity now than in 1990? And how is this possible when families have more electrical appliances and bigger houses to warm up? We will also present two main groups of potential explanations for the decline, namely *structural explanations* and *cultural and normative explanations.*

3. Are we breaking the curve? A validation of the existing data

The conventional understanding of consumption tends to be that everything grows, perpetually (Durning 1992). This is supposed to hold for consumption in general and most certainly for energy consumption. Nevertheless, statistics from SSB[2] shows that Norwegian households use less energy today than before. In 2008 the energy consumption per household was 21 000 kWh, compared to 23 500 kWh in 2002. The aggregated energy use for stationary purposes increased (only) 1.6 % per year from 1960 to 2003. But if we look at the energy consumption each year during the same period, we find relatively large fluctuations, especially in the composition of the energy use. The aim of the projects first part is to determine whether reduced energy use is caused by long term, 'robust' changes, rather

[2] Statistics Norway: www.ssb.no, http://www.ssb.no/english/subjects/01/03/10/husenergi_en/

than by yearly variations. We know that the number of households has increased; hence aggregated domestic energy use increases as well. This leads us to investigate the factors behind the decline, and also whether some factors are more explanatory than others.

Figure 1: Average energy consumption per household 1990 – 2008

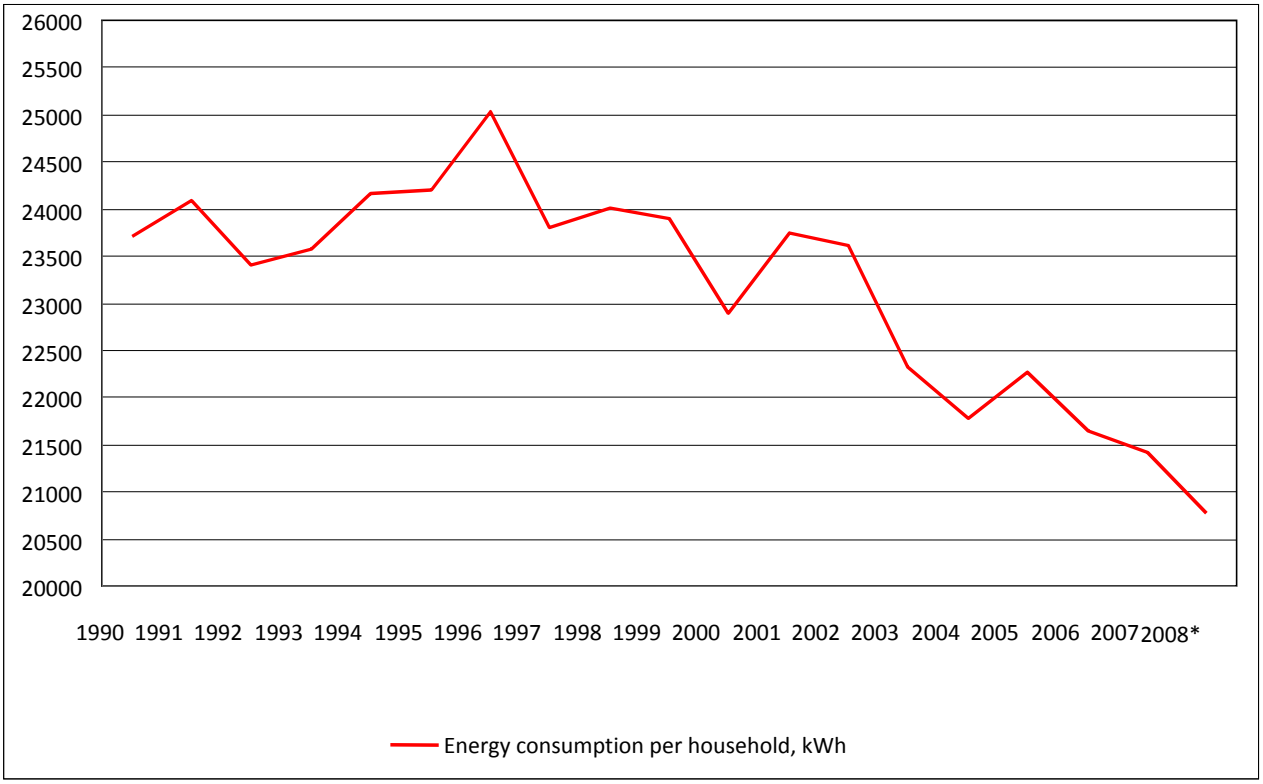
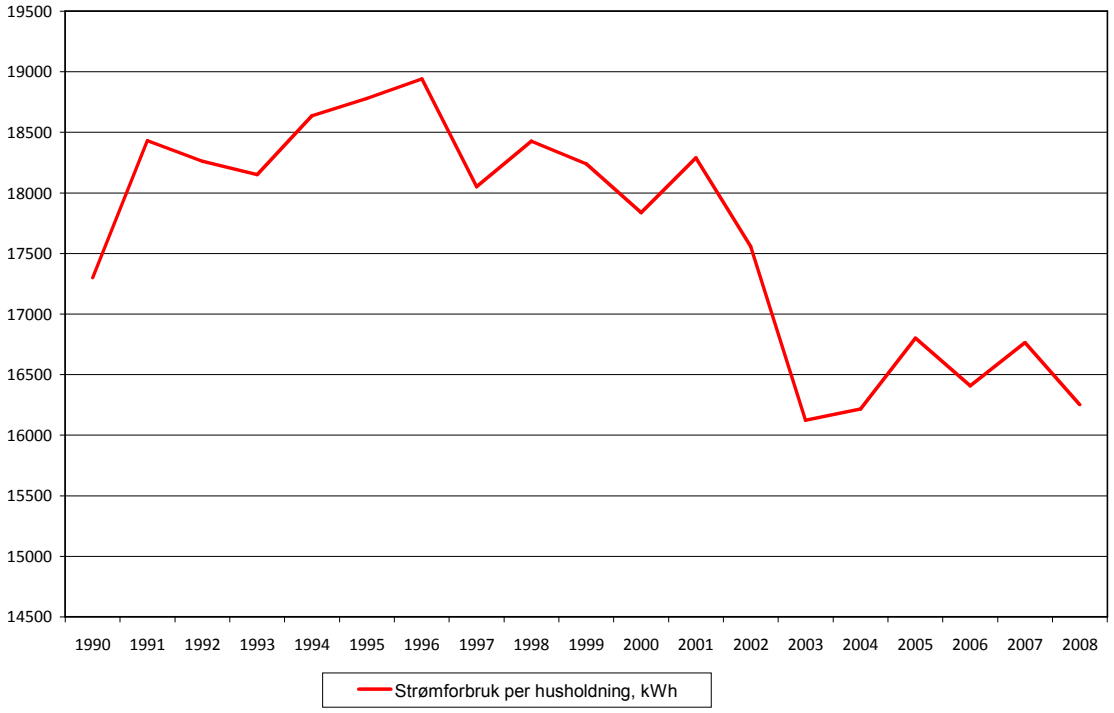


Figure 2: Average electricity consumption per household 1990-2008



Electricity is the main stationary energy source in Norwegian households, accounting for three quarters of the total stationary energy consumption, or approx. 16 200 kWh in 2008, as shown in figure 2. In the period 1990-2008 the electricity consumption in households (excluding cabins) was about 17 500 kWh, on average. A popular hypothesis is that after a considerable rise in electricity prices during the winter 2002/2003, there was a market decline, as the sharp fall in figure 2 shows. Firewood[3] is the second most important energy source in Norwegian households and accounted for about 18 % of the total energy consumption in 2006, with approx. 3850 kWh. The use of oil and kerosene accounted for about 6, 5 % of consumption. Gas and district heating is used in a relatively small extent in Norway and amounted to barely 1 % of consumption in 2006.

[3] Firewood is carbon neutral bio energy

Norwegian households use most of their electricity for heating. Norway produces hydro-electricity, which is considered to be a clean and renewable energy form and thus an important element in understanding Norway's energy consumption, especially in regards to how consumers speak about energy and electricity. If our electricity is already clean, would consumers at all consider changing to other alternative energy forms? This might partly explain the low amount of district heating in Norway. About 75 % of Norwegian households can choose between different energy sources (the most common combination is electricity and firewood), but some, especially in new dwellings, have no alternative heating sources and can only use electricity. This is also related to the relatively low electricity prices in Norway, compared to other European countries.

One of the questions we will examine in this study is, as mentioned, why the media and the policy makers have not discussed this decline, but have continued to focus on the negative implications of consumerism in general. If we are breaking the curve and reducing our electricity consumption, is this not a good incentive for further action?

In the annual report from the Norwegian environmental organisation "The future in our hands", the subject of decline in electricity consumption has been mentioned by the author several times as the most positive feature of the development in household energy use since 1990 (Hille 2004, 2009). Hille claims that the changes in electricity consumption are caused primarily by two factors. First, there is supposedly, a limit to growth to certain forms of domestic energy use. There is no improved comfort in increasing indoor temperature beyond i.e. 25 C. Further, a higher use of hot water is constrained when there is no perceived extra welfare in additional baths. When, or if, these two practices stabilize, better insulation will reduce energy use. Second, the electricity prices is Norway have increased since 2000. An increase will not only lead to less energy use, but also to greater awareness concerning environmental subjects such as energy, and encourage alternative energy sources (e.g. heat pumps, photovoltaics). The energy use per person in 2008 is about 3-4 % lower than in 1990, which leads us to believe that the decline is relatively stable.

The validation of the existing data so far shows that the decline in Norwegian households' use of electricity is not due to fluctuating electricity prices, but seems to be an ongoing and stable development. During the project's validation period we have also met with several stakeholders [4]. Their perception of the existing data material is consistent with our perspective. Households are stabilising their electricity use. Their main concern in this project is to examine conducted environmental measures and to evaluate their short and long term effects.

Thus, we have to look further into potential explanations for the changes in electricity use. A list of the most feasible ones is given in the next section.

4. Possible explanations

The amount of electricity used in households is determined by factors such as household size, dwelling size and the amount of electrical appliances, but also by how we use our dwellings and gadgets.

Our aim in this project is to study the possible causes for the decline in energy and electricity use in Norwegian households, and to discuss their relative influence on the reduction. Below, we present a number of possible explanations related to electricity use, with particular emphasis on their long term effects. The rebound effect will be discussed briefly. There are two main groups of explanations that we would like to emphasize in this paper, namely (1) *structural explanations* and (2) *cultural and normative explanations.*

[4] Stakeholders:
Enova SF is owned by the Ministry of Petroleum and Energy. It was established to take a leading role in promoting environmentally friendly restructuring of energy consumption and energy generation in Norway. Enova's goal is to make it easier for public and private enterprises to choose simple, energy efficient and environmentally correct solutions.
The Norwegian Water Resources and Energy Directorate (NVE) is a directorate under the Ministry of Petroleum and Energy. NVE's mandate is to ensure an integrated and environmentally sound management of the country's water resources promote efficient energy markets and cost-effective energy systems and contribute to efficient energy use. The directorate plays a central role in the national flood contingency planning and bears overall responsibility for maintaining national power supplies.

The first group contains explanations in relation to the housing unit itself, and to the composition of the family unit.

Smaller families

The Norwegian population has grown from 3.5 millions in 1960 to 4.5 millions in 2001. The average household in 1960 consisted of 3.3 persons. In 2001 this number was down to 2.3. Smaller household units use less energy, but the number of households has increased during the same time period which means that the aggregated energy use is higher in 2001 than in 1960. The number of households has increased from 1.7 million in 1990 to 2.1 million in 2008. The electricity use per person has decreased less than per household. At the same time, the dwelling size has gone from 36m^2 per person in 1980 to 52m^2 per person in 2002. Even though there are fewer people in each household, we have a larger area to heat. A further study of these data will show how much of the decline is caused by smaller but a higher number of households.

Type of dwelling and insulation

There are substantial differences in electricity use between farm houses, detached and semi detached houses and apartments in blocks of flats. In 1960 20 % of the Norwegian population lived on farms, compared to only 7 % in 2001. The number of villas has increased, but the number of apartments has remained relatively stable throughout the period. Statistics from SSB shows that households in (older) villas are more likely to implement energy saving measures than those in apartments. This may be linked to the "windows of opportunity" concept, mentioned earlier because living in apartments limits the freedom to execute such changes. When consumers find that the ability to make changes is greater than the obstacles, it is easier to carry out necessary measures e.g. related to energy saving. It may be that the transition from farms to villas have had an effect on the consumer, giving a greater amount of opportunities for energy saving. New technical regulations will also have an effect on energy use. From 2007 30 cm of insulation in new buildings is required, which is believed to reduce the energy use for heating by up to 25 %.

Electrical appliances (and the rebound effect)

Overall, electrical appliances for domestic use have become more energy efficient through the years. For white goods, like cold appliances, improvements have been considerable.

Here, the European Energy label, together with other labels like the Energy Star and Energy Efficiency Recommended[5], seems to have pushed producers, retailers and consumers in the direction of energy efficiency. The market has changed considerably; inefficient appliances (D-G) have largely disappeared in the market, and As and Bs tend to dominate. All this has happened during the last 10 to 15 years.

The aggregate effect of these improvements is, however, not one dimensional, due to patterns of exchange, the number of appliances, their size and the ways the consumers use them (Strandbakken 2009, Throne-Holst 2003, Throne-Holst, Strandbakken, Stø 2007). Improved appliances probably contribute to a decrease in domestic energy use, but not as much as we might have expected. The rebound effect implies that the amounts of energy you can save by buying new and more energy efficient appliances will be reduced because of an increased use and more appliances per household. How the rebound effect will influence energy saving is not necessarily clear. How conscious is the consumer concerning his amount of saved energy? Could it be a part of a "moral accounting"?

Electricity prices

Electricity prices in Norway have been relatively low compared with other European countries, but we have seen a doubling over the last ten years[6]. During this time period, there have been wide fluctuations in prices due to some extremely cold winters. This has definitely made the consumers more aware both of the prices, but also their own use of electricity. High prices give an incentive for saving in every day life, and to invest in more efficient technology. As mentioned earlier, electricity is the main energy source for heating; quite a number of new buildings have no other options. These dwellers have been called "electricity hostages". This creates difficulties for consumers wanting to use alternative energy, but it also makes it hard to raise electricity prices significantly as an environmental measure. However, there is reason to believe that much of the alleged passivity of Norwegian consumers on the energy saving field is due to low electricity prices over time. Electricity has ever since our independence in 1905 been a highly politicized issue in Norway (Olsen 2000:323). In significant parts of the last century electricity was viewed as a central symbol of progress (Furre, 1993:239).

[5] See energylabels.co.uk
[6] In 2000 the average price was 0, 05 €/kWh, and in 2006 0, 11 €/kWh.

Heat pumps

Statistics from 2006 shows that approx 8 % of Norwegian households own a heat pump. But it is the daily use of the pump that determines whether it is possible to save energy. There is no clear energy (or economic) gains by using a heat pump because the pumps are increasingly being used for both heating and cooling. Therefore, it is possible that the pumps are being bought and used during warm summers as well as cold winters. But, if used correctly, there still is a substantial potential energy gain from domestic heat pumps. In Norway the pumps are also used as a replacement for wood burning due to the evenly distributed heat and the less amount of work. In addition, there have been subsidies for the instalment of certain types of heat pumps, on the condition that they replace solutions based on fossil fuels (oil furnaces etc.). It seems, however, as if most Norwegians have bought the cheap and "un-subsidised" air-to-air pumps (Bjørnstad, Grande, Sand, Wendelborg 2005). Another aspect to the general cause-and-effect debate over this technology concerns the degree of comfort; the heat pump can give a higher comfort level for the same amount of money, but no energy is saved. Thus, a possible rebound effect occurs. The use of heat pumps among private households is, however, under researched.

Climate change

We know electricity use is higher in cold years than in warmer. In 2009 the temperature in Norway was 1 degree Celsius above the normal rate for 1961-1990. By looking at average temperature scientists might calculate the effect of global warming and its future consequences. The debate is extremely complex with numerous aspects, but is important to consider in this project. Temperature change can be relevant as a cause for households electricity use, but to what extent can 1 degree difference influence our every day use? Will it have practical implications? And how is the relationship between local and global measurements? These questions must be discussed before giving a sensible consideration of the importance of global warming in energy reduction.

The second groups of possible explanations is seen in relation to the public discourse on electricity and energy consumption and use, but also our habits, motivations and incentives for action.

Knowledge

Spreading information via campaigns, advertisements, TV-commercials and the internet may lead consumers to act. Information can be considered as a window of opportunity itself, as

an encouragement or motivation. In Norway, ENOVA (see footnote 4) runs several campaigns and offer an information website with expert consulting. Norwegian consumers have a high degree of trust in the government; therefore, measures implemented by state agencies may lead to actions, and certainly put green politics on the agenda (Stø & Strandbakken in Rubik & Frankl 2005). Regarding knowledge, at least the reverse argument is relevant: lack of knowledge will be a serious barrier to changed consumer practice. Even if increased access to knowledge of opportunities is not sufficient to inaugurate change, it might still be a necessary precondition for behavioural change to occur (Barenergy Consortium 2010).

Discursive changes

How consumers speak about ecology and saving is highly relevant to understand the stabilisation in electricity use. Leading narratives are created, replaced and changed within the environmental discourse. One example is the transition from speaking about nature to seeing the importance of consumerism in relation to the debate. Another possible discourse is saving. It is legitimate to discuss your economic savings trough changed consumer behaviour, where a more eco friendly life style might be the positive, but often unintended consequence. This may eventually lead to a greater awareness concerning energy saving and the environment.

Myths

Do myths about energy saving have an impact on consumer behaviour? Strandbakken (2006) finds that respondents in focus groups are critical towards energy labels because consumers tend to believe that producers can buy the label for their product, making it less trustworthy and of low value to consumers. Another example is unleaded petrol. When it entered the market in 1985, Norwegian consumers were sceptic because the lead would lubricate the engine in older cars, the new petrol would not. In this case consumers were dependent upon reliable information to understand the new product (Throne-Holst 2000). Myths (or urban legends) like these makes behavioural changes difficult. Breaking a habit or a routine, whether it's buying the same brand, product or service, is time-consuming. But has something changed? Is information more reliable and more available? Is it making consumers realise the benefits of energy saving?

5. Concluding remarks

In the paper we have accounted for some of the changes in Norwegian households' energy and electricity use. Our main finding is that a decrease in households' energy use over the last two decades indeed is real. This is to a certain extent related to a decrease in household size and an increase in number of households; on the aggregated level private consumers use more electricity, but each household does not. Further, we have presented a number of possible explanations for this decline, and our next task is to assess their relative importance. Both individual and structural factors seem relevant, and we are especially concerned with the relationship between the individual and institutional approaches in understanding changes in consumer behaviour and social practices.

In the environmental political discourse, however, and even in the scientific community these findings have received little attention. Critics tend to focus constantly on an image of perpetual growth and excessive consumption of everything. If the decline in energy and electricity use actually were to be put on the political agenda, there might be unintended consequences. How will consumers react to such a sudden and unexpected positive message? Will they stop saving energy and go back to spending more? Or will it be an incentive for further action? Such questions are highly relevant in all of the phases in the project, from interviews with stakeholders to publishing our empirical results and analysis.

A key concept in relation to the decline in electricity use this is *comfort.* High indoor temperature during winter months, hot baths, long showers and a number electrical appliances increase domestic energy use. The idea of comfort is rooted in the modern Norwegian consumer partly because the electricity prices are low and we can afford to spend more. But this kind of comfort probably also has an upper level, beyond which increased comfort (higher indoor temperature, more baths, bigger dwellings) becomes rather meaningless. When a household reaches this level the energy use will not increase much, which makes the effectiveness of technological improvements more visible. Effective appliances might also be regarded as a way of reaching the desired level of comfort in a less energy intensive and thus more environmentally friendly way.

Our focus so far has been on the validation of the data, the further development of the project aims at explaining why energy/electricity use has declined. Here we would like to consider the historical context; what actually happened between 1990 and the present, as well as into the comparative landscape; if a similar development has not taken place in other

comparable countries (i.e. like Sweden, Finland and Germany), this should be explained. For this next project phase, we intend to produce more empirical results, first we plan to conduct a consumer survey and then to follow it up by feeding its results into focus groups and stakeholder interviews. By using focus groups it will be possible to distinguish between stable households and those in a transition process, and thus consider consumer options during a window of opportunity. Stakeholder interviews will focus on their activity on energy saving policy and programmes, their potential conflicting interest with other actors and their explanation on the reduction of electricity consumption in Norway.

In a time of potentially very serious climate change, the occurrence of a decrease in domestic energy use in a rich nation like Norway is both politically relevant and academically challenging. Does it happen earlier in this country than others, or is it only happening here?

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