Energy technology and everyday life - The domestication of Ebox in Norwegian households

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1. SYNOPSIS

Ebox is a technology for monitoring and administering electrical equipment in private houses through the Internet. The paper will analyse this technology from a user-perspective.

2. ABSTRACT

This paper will analyse a test project introducing an energy technology called Ebox, involving a selected group of private households. The Ebox is a technology developed to monitor and administer residential electrical equipment. Not only the owner of the house can monitor the technologies. Two parties are involved. The house-owner has, through the Internet, control over every technological device that is connected to an Ebox. This gives him/her the possibility to plan and administer the use of electricity, for instance indoor temperature. Because the electrical devices are accessible through the Internet, the owner of the electricity network can monitor both the details and the total amount of electricity used in a certain area. In agreement with the customer, the network owner may control a possible load factor by taking over the private energy administration for a short time. In the paper I will analyse the introduction and integration of the Ebox with the theoretical concepts of script and domestication.

3. ENERGY CONSUMPTION AND THE PROBLEM OF LOAD FACTOR

The consumption of electrical energy in Norway has multiplied many times over the last 50 years. Still, in many geographical areas, the electric power grid is the same as 50 years ago. In wintertime, when the consumption of electricity is especially high, the electricity network is in constant danger of overloading. During the resent years, several ways of managing these consumption-peaks have been tested. This paper will discuss the experiences with the Ebox – as the Ebox is a technology designed to monitor and control consumption of electricity.

In Norway electricity is still the most common source for heating in private houses and heating represents more than 50% of the total amount of the energy consumption. Thus, this is an area with a big saving potential. But even if we manage to implement alternative heating methods, flexible energy carriers or smart-houses in the future, the main part of the housing will be old and equipped with electrical panel heaters. Therefore, it is important to develop efficient, user-friendly and flexible technologies for controlling electrical heating in existing buildings. The Ebox may have such a potential.

The Ebox is a new technology for controlling several electrical devices preferably through the Internet, but it can also be operated manually. In the project that is discussed in this paper the Ebox is used to control electric room heaters (turning on/off according to temperature). Other possible areas of use could for instance be engine heaters (turning on/off according to a time schedule) and electric water heaters. More than the areas of use, it is the way it works that differentiates the Ebox from previous systems in that it is wireless and therefore not dependent of the electrical current. This leads to new ways of administering the equipment. The owner of the household may programme the Ebox over the Internet, or the owner of the electricity grid may regulate local consumption of electricity at times of capacity problems. As a technology the Ebox thus has potential for realising the interests of various actors. For the end-user it has a saving potential or it can provide increased comfort. For the owner of the electricity grid it can be one solution amongst many, to reduce the problem of overload.

Figure 1. Ebox

Between October 1999 and April 2000 Oslo Energi Enøk (the energy saving department of the electricity company Oslo Energi) in co-operation with Viken Energinett (the owner of the electrical grid in the Oslo area) and Elink (supplier of the Ebox), tested the Ebox in 17 apartments in Oslo. The purpose of the test-project was on one hand, to test the Ebox as a technology for controlling the load factor in a limited area. It had to be tested because there were several technical challenges that needed to be solved. On the other hand there was a need to know more about the customers reaction to the Ebox.

This paper will focus on the users` experiences, in other words the "non-technical" part of test-project. Central questions in the paper are; how was the Ebox introduced, interpreted and adapted through use, by the persons/families in the project? And, what opinions and experiences was developed around the bi-directional control function of the Ebox – a device designed for energy saving in the households, but which also gives the electricity utilities some degree of command over local energy-consumption. Since controlling the load factor was important, both customers with and without Internet access were in the test group to explore whether this was an efficient technology for both groups.

The aim of the paper in addition to discuss the findings, is to view the results of the Ebox project in a more general and overall perspective. Thus the analysis of the empirical material will be discussed within the theoretical tradition of Social Studies of Science and Technology (Bijker and Pinch 1987, Callon 1987, Latour 1987, Law 1988).

First, the paper will provide a sketch of other projects involving the introduction and utilisation of energy-technologies. The aim here is on the one hand to illustrate the experiences with different technologies for energy control, but more important to give an overview over the research in this field. Second, the paper will present some relevant sociological perspectives for studying diffusion and use of technology as mentioned above. In the final part of the paper the empirical data will be presented and discussed both in relation to the practical aims of the project and in relation to the theoretical framework.

4. CONTROL OF LOAD FACTOR IN THE HOUSEHOLD SECTOR

There have been several parallel projects that test ways of controlling he load factor in private households in Norway, but they typically focus on controlling water heaters or controlling energy-consumption by switching circuits[1]. None of these projects actively involve the customers; they just have to agree to participate. Until now it has been rather unproblematic to get people to participate in such experiments. However, there is little existing knowledge about how the consumers perceive such interference when they have participated over a period. The

Norwegian Gallup Institute's survey on attitudes towards consumption control, for the first quarter of 2000, shows that Norwegian households have become more critical towards such control:

> "At present, 28% of the households in the country are positive towards local utility companies that turn off water heaters and heating cables when no one is at home. At the end of 1998 the attitude was far more positive. At that time, 36% of the households answered that they were positive towards such arrangements."[2]

Most electrical panel heaters today is equipped with thermostats so most people are in fact regulating their energy consumption in one way or another. It is possible to connect timers or more advanced controlling devices to the ovens and thus achieve a more rational use of electric power. However, fewer such devices have been sold than one would anticipate in relation to price and saving potential. Since there is little knowledge about how such technologies are understood and used, it is difficult to explain the lack of interest. Not much research has been done on energy-consumption technologies in private households, and there is a need for more detailed investigations. One exception is a project done by SINTEF Energy Research where 15 users tested energy control with TV-screens as interfaces. The report concluded that the users were satisfied with the technology, but it does not contain a detailed assessment. Thus, little is known about how the technology was integrated into the households. Furthermore, this test involved only persons who had professional knowledge of energy-technology.[3] And consumption-control by the Electricity Company was not an option in that system.

What is special about the Ebox project is as mentioned the double function of the technology. The Ebox is a device for regulating indoor temperature as many other similar technologies, but in addition it provides a possibility to supervise the private consumption in order to control the load factor. Thus there are two crucial topics that has to be investigated. One is to study how the technology is put into use within different households and thus learn more about the design, the experience with Internet as interface, and how it works more generally. Knowledge about the integration of the Ebox, in this context, may also illustrate the new possibilities of communication between for instance homeowner and network owner that appears with the Internet. However, if the Ebox is to be a potential technology to solve a more general load factor problem in the future, the network owner has to know how the customers experience and look upon this form of "control". This is also important to study closer.

The customers in this project are recruited to the project. They have, in other words, not purchased the Ebox as an ordinary customer. Many of them are neither connected to nor interested in using the Internet. So this project may also shed light on whether the Ebox-technology, independent of the Internet, can function as a tool for controlling consumption while still providing the customers with some advantages.

Method

The Ebox project involves 17 apartments in a housing co-operative in Oslo. Contact with the inhabitants was initiated by a letter from Oslo Energi Enøk (OEE), which contained a brief description of the project and a date for a more specific inquiry.

The project group later arranged a meeting where the participants were briefed on the use of the Ebox. The devices were also programmed to each participants preferred room temperature and timing. The project group visited the inhabitants that did not attend the meeting. After these initiatives 17 of the 20 households in the co-operative decided to participate in the project.

Interviews were done 6 months after the Ebox had been distributed among the participants. 16 of the participants were interviewed (1 refused). For various reasons, only 14 of the 16 households had used the Ebox. The open-ended interviews were done in the homes, and lasted approximately 1 hour.[4]

The 14 units represent a small test group with large variations. We find couples with adult children, couples with small children, single parents, single pensioners, and couples without children. Some of these are skilled in the use of computers and the Internet, while others are unskilled and without access. The large variation has the advantage that we may expect different experiences with the Ebox. This besides the fact that the test group is so small makes it meaningless to present an overview based on numbers and figures. The analysis will focus on variations, but also try to group the users according to how they regard and use the Ebox.

As mentioned in the introduction, I wish to analyse the concrete findings in the frame of "Social Studies of Science and Technology". Before presenting the empirical material, I will therefore give a brief presentation of this theoretical tradition with a special focus on technology use.

5. TECHNOLOGICAL INNOVATIONS – FROM PRODUCER TO USER

Within European- and American social science, technology studies exists as a particular area of research. This area may be labelled Social Studies of Science and Technology (SST). It covers various methodological approaches (e.g. historical, sociological and anthropological), treats different aspects of society (from innovation to consumption), and commands a range of explanatory models (Williams and Edge 1996). What unites the SST-tradition is a view of science and technology as cultural products – shaped by, and shaping, the society they exist within. SST is a theoretical tradition that avoids technological determinism – the mindset where technology is perceived as an independent cause of changes in society.

Research on innovation in the 1960s and 70s perceived the process of innovation, with few exceptions, as a linear process from knowledge, through production, to a more or less unproblematic phase of diffusion. Users were not studied, and it was assumed that a product was used in accordance with its design, and that this use had the anticipated consequences. In a manner of speaking: the consequences were inherent in the product. The new starting point taken by the constructivist sociology of technology, one branch of the SST tradition, in the 1980s, showed that studying actors and processes within the field of science and technology gave a new insight into the relations between power, knowledge and technology in society. The empirical research took into account conflicts between relevant actors on various levels and the role of engineers and scientists in a changing society (Bijker and Pinch 1987, Callon 1987, Latour 1987, Law 1988).

The constructivist approach originally focused mainly on innovation and design as an activity of scientists and engineers, but as the amount of empirical studies increased during the 1980s, the end-user also became an object of interest (f.ex. Latour 1988, Berg 1996, Lie and Sørensen 1996). These studies, which combine a technology/constructivist approach with elements of cultural studies, have shown that further development of the product takes place when it is put into use. In other words, the consumers do not relate passively to the products they buy, but may be active in both procurement and use (McCracken 1988, Fiske 1989, Keat *et al.* 1994, Berg 1996, Lie and Sørensen 1996). In these studies *domestication* has been developed as a useful analytical concept to describe the processes of negotiations that occur when a technology is integrated into a household (Silverstone *et al*. 1992, Lie and Sørensen 1996). Domestication is on the one hand an analytical perspective that reminds us to include the "social innovation" in a study of technology in society. On the other hand it is a practical concept linking the practical, symbolic and cognitive processes that takes place when a product is integrated into a household. In other words, people actually domesticate a technology – they place it, learn to use it, fit it into their routines and give it meaning - or they reject it. These activities may vary from person to person, from group to group. Thus the discussion is *not* about effects of technology, but of the development of different user patterns in "negotiation" with the technology. An illustrating example here is the mobile telephone. In the years since the mobile phone became available to "the average user", the users have "reinvented" different and various user patterns and symbolic meanings. Youths have for instance proved to be an innovative group in regard to text messages. The meaning and use of a technology is in other words partly in the hand of the users. In this project the Ebox is new and the experiences of the users may be more limited. In order to learn and be able to improve the technology, it is however important to study the early integration process as well.

The concept of domestication captures, however, more than the practical actions and symbolic meanings that surround a technology. By studying both participants and processes, it is possible to achieve insight into the possible changes that takes place in relation to the technology. According to Sørensen:

> "What is constructed through domestication may be understood as micro-networks of humans, artefacts, knowledge and institutions " (Sørensen *et al.* 2000:241)

This may be central in relation to domestication of the Ebox. The network that the Ebox is a part of is as interesting as the concrete use of the device. The network consists in addition to the Ebox, the users, specific patterns of use and the symbolic meaning, also the electricity network owner and the saving department of the

Electricity Company. The Ebox provides the possibility of new communication possibilities between these groups, through the Internet. How is this new channel of communication being used?

Another important concept within the sociology of technology is *script* (Akrich 1992). This is a semiotic approach and is related to the design of the concrete technology. As Akrich puts it:

> "Designers thus define actors with specific tastes, competencies, motives, aspirations, political predjudies and the rest, and they assume that morality, technology, science and economy will evolve in particular ways. A large part of the work of innovators is that of *inscribing* this vision of (or prediction about) the world in the technical content of the new object" (Akrich 1992:208).

The script describes how a potential pattern of behaviour is tied to the design of the technology. A strong script suggests a certain kind of use, while a weaker script suggests a larger degree of flexibility. A washing machine is for example provided with a quite strong script. You choose a specific program and the machine takes care of the laundry. In relation to the Ebox, it is interesting to see how easy it is to use, what patterns of behaviour that are possible, and to what extent the producer/designer has managed to strongly prefigure the forms of use.

Here I will use the concept of domestication to analyse the practical experiences of the users as well as the symbolic meaning they attribute to the Ebox and the process of use. How the Ebox is presented through design, as the physical object and as interface through Internet, will be explored in the light of the concept of script. The starting point of this analysis is in other words that the consequences of a new technology can not be taken for granted. Although a pattern of behaviour is inscribed in the technological artefact, research show that the user domesticates (develops, and to a certain degree changes) the product. It is not given that the Ebox will be used and understood in the way the producer, or in our case the network owner, plans. Thus we can not predict whether and how the Ebox will contribute to new patterns of heating or if new communication possibilities between the users, the network owner and energy saving department, will be developed. Exploring the script and processes of domestication will provide knowledge to assist the ongoing process of distributing the Ebox. The analysis will also highlight the importance of integrating these aspects when studying technological innovation.

6. DOMESTICATING THE EBOX – NEGOTIATING PRACTICE AND MEANING

The Ebox is as mentioned in the introduction, a part of a larger control system in order to measure and control the load factor in a certain district. The tests and development of the different technical parts are reported separately.[5] [6]

As presented in the introduction of this paper the main questions to be explored are; how was the Ebox interpreted and adapted through use, by the persons/families in the project? What opinions and experiences developed around the bi-directional control function of the Ebox – a device designed for energy saving in the households, but which also gives the electricity utilities some degree of command over local energy-consumption? Is the Ebox an efficient or interesting technology for both groups with and without Internet? I also wanted to look into the new communication possibilities that is a part of Ebox technology.

The concepts of *domestication* and *script* are chosen as analytical perspectives in order to perceive and understand the integration and use of the Ebox as a process with practical and symbolic content, the meaning of design, and the possible network that is constructed on the basis of the Internet connection. Analysing the interviews the following dimensions proved to be a fruitful approach to the theoretical concepts as well as to the more practical aim of the project: *design/function/control*, *patterns of use*, *motivation* and *communication*.

The Script - Design, Function and Control

Techno-sociological literature often stresses the point that producers lack knowledge about the users (Lie and Sørensen 1996). The result of this "ignorance" might be that potential users do not buy a product, or that they do not use it because they do not see it as user friendly, not functional in relation to their needs, or not fitting into a specific context. With energy saving products, this often seems to be the case. The design of the energy-saving showerheads was for instance criticised by consumers for being both uncomfortable and ugly (Aune 1998). Technologies for temperature control have appeared as complicated and not user-friendly. These technologies have changed during the last years. Energy-saving showerheads now come in various colours and designs, and

devices for controlling electrical heating have become user-friendlier. But one has to keep in mind that once established it is very difficult to change a bad image of a product. Therefore it seems important in phase of development/testing - to weed out unpopular and not user-friendly features before it is released into the marked.

Apparently, the Ebox is a simple and user friendly technology that will give the user various advantages. By design it was primarily meant for users with Internet access. It also has some features for manual control, but this is limited to a little switch that controls temperature. The script is primarily addressing “modern”, professional people that travel, have flexible working hours and may programme it through Internet access at work. Otherwise, it is necessary to have access to the web at home. The Ebox is marketed as a device that makes it possible to for example prolong vacations. Furthermore, it has flexible functions whereby it is possible to programme different temperatures according to the hours of the day, days of the week and weekends. People that spend the day at home, travel little or do not use the Internet may get the same service from a conventional temperature control unit. However, in this project it was arranged for full user privileges also for those without Internet access. The user could call a user support hotline and give instructions for how they wanted it to be programmed.

Few of the users held any particular opinions about the physical design of the Ebox, but a common view was that it was not an item they would use for decoration. Most wanted to place it out of view. However, this was not considered an important feature of the technology. The functional design was more important, and two functional problems were pointed out. The first problem was that the thermostat did not control the temperature accurately. The reason was, as is often the case with thermostats, that it was situated too close to the heating source. The temperature was set quite high (23 at daytime/19 at night time), so no one was unpleasantly cold, but it was a source of irritation that the programmed temperature was different from the actual temperature. “It makes me more irritated than positive” as one of the informants said. The fact that the technology did not function perfectly made him more negative to the possible advantages as well.

The second problem was connected to appearance. The Ebox has a display that shows both programmed and actual temperature. Since the Ebox has to be placed in the contact between the electricity source and the oven, the display was depended on the construction of the plug, and thus some of them had to be read transversely. A flexible display would have solved this.

Experiences with Controlling – Manually and through the Internet

Most of the participants had the Ebox programmed when it was given to them. Six of the informants had the possibility of controlling the box through the Internet. Only three of the informants had, however, used the Internet to change the settings. They found the design of the homepage satisfactory and had no problems in understanding the instructions. Still one of them got into problems. He thought that the problems were due to lack of, or old, software. For this reason, he had operated the box manually for 14 days, which he found a bit unpractical. One informant told in the interview that he had experienced problems at his first attempt at programming the box and did not try again. Another said that she had not had the need to change the settings of the controls, and therefore had not accessed the programming web page. The possibility of the Internet access did not in other words necessarily lead to an interest. Three of the informants had been in touch with the support hotline in order to change the pre-programmed settings. Most of the participants had changed the temperature on the Ebox manually once or more. This had proved to be quite unproblematic, but some complained about the switch being too small. Later it became evident that used correctly, it really was no problem. However, this is an example of a design problem that is unnecessary and possible to solve.

All together the script of the Ebox, connected to the physical artefact as well as to the Internet page, can be understood as quite strong. You have three ways to operate it, manually, by telephone and through the Internet. The user has an opportunity to switch on/off or to regulate the temperature and the only option you have is to choose the device that shall be controlled. The Ebox as such did in other words not invite to various user patterns. But as emphasised, we can not predict a user-pattern or the consequences of a certain technology just by examining the design or the looking at the intentions of the producers. We also need to examine the process where the product is integrated into the users everyday life.

Developing patterns of use

As mentioned, all the users got a briefing on the use of the Ebox at an information meeting, or at home. It was then programmed according to the requests of each household and then ready to plug in. After a while, it was clear that not all of the participants had obtained a temperature they were comfortable with, so it took some weeks before all of the devices were finally adjusted and put into use.

After 6 months, the Ebox had contributed to some changes in the heating habits of a half of the users. Earlier, the panel heater was set to the same level day and night. After the project, they let the Ebox lower the temperature during the night and, in some cases, during daytime. Some had even changed other habits. One of the users said:

> "Now I turn off all the lights when I go to bed (…) before many lights where on" And her husband added: "We have been arguing about this for years (…) I think there has been to many lights on."

This group did not initially reflect much on heating routines or energy consumption. For them, the introduction of the Ebox led to a higher degree of consciousness around their heating routines. The Ebox provided them with a means to save energy without decreasing their level of comfort. The informants in this group said that they did not think much about the presence of the Ebox as long as it worked satisfactory. Even though not all were fully familiar with the device, it was becoming a part of the daily life. The Ebox was, as we may see it, almost domesticated.

As earlier investigations have shown, patterns of energy consumption show great variation (Gaunt 1985, Ljones and Doorman 1991, Aune 1998). Some does not care much, but there are also groups that are highly conscious about their energy use. This last group was also found in this project. For them, the Ebox substituted earlier technology (timers) or manual control. The introduction of the Ebox did not necessarily lead to a decrease in energy consumption, but some profited with regard to comfort. One of the users said:

> "If you're away from home you cannot remotely programme a conventional timer. The great advantage of the Ebox is that you can programme it through the Internet if you re-decide when to come home."

In addition, with a pre-programmed timed temperature increase there was no need to sit in the kitchen until the living room had a comfortable temperature. One of the informants said that she forgot some good habits. The autumn after the test period, she started to heat without the Ebox, but now she forgot to turn off the oven during night. Thus, the living room was way too hot in the morning. The Ebox had been integrated into her daily routines as she had delegated the temperature control to the technology. Another informant that also was used to manually control the temperature before the project started did not think that the Ebox helped her. She felt comfortable with a cold living room in the morning, and was used to being in the kitchen while the living room was heated up. To her, the Ebox was a device she very well could do without. She had not, after _ year domesticated it as it was not at all integrated it into her daily routines.

Motivation

The motivation for using the Ebox is linked to its functions as (1) a device for private control of the cost of energy consumption, and (2) a device that enables the network owner to control the consumption peaks. The different members of the test group claimed varying motivations in relation to these. One part of the group was highly motivated and found it interesting to participate in the project as such. They wanted to test the technology and followed the project closely. They also thought that the Ebox worked well. Another part of the test group was sceptical. They considered it a duty to participate, and loyally used the device. To some of these the Ebox was a foreign body and not integrated into the household. Others used it actively even when they were not satisfied with its functions. A third group was mostly indifferent. They were not particularly conscious about energy consumption, and were prepared to pay the costs of electricity whatever they might be. The Ebox was installed, but they did not pay much attention to it and had not tried to adjust it.

How did the participants perceive the utilities' new power for controlling their private energy consumption? A bit oversimplified, we may say that the group divided into two parts. One part was motivated by collective responsibility, the other part by individualistic interests. The collective aspects were related to energy-/environmental interests in general, and were not tied to the functions of the Ebox. This group mentioned the protection of undeveloped waterfalls and access to energy sources. At the same time, they also expressed concern for avoiding digging in the area as a consequence of the need for new electricity cables. The group with

the collective view did not expect any rewards, for instance reduced electricity costs, for using the Ebox. Nor were they prepared to pay for it, being aware of the fact that using the Ebox favoured the utilities as much as them. An upgraded cable-net would cost the network owner a lot of money. All the informants knew that it was possible to disconnect the Ebox if they did not like the intervention of the utilities, but this was not an option in this group. Then the point of the project would be lost. As one of the participants stated:

> "No, if I had seen that the Power Company regulated my consumption I wouldn't have disconnected it. If they used the Ebox to control consumption, it would be because the level of consumption was to high, even if it wasn't my fault."

The more individually oriented group meant that they should be given some kind of reward for letting the utility control their energy consumption. They used the argument that the owner of the electricity grid would save money by not having to invest in new cables (as a consequence of electricity saving), and that they as customers also should profit from this. They thought that the Ebox should be free, and that they should be offered reduced prices for access to the electrical grid. They also mentioned the responsibility of big customers with much higher consumption than ordinary households. One of the informants said:

> "I'm willing to cut down on my consumption if the lads that run these projects are willing to concern themselves a bit more with waste in the public sector (…). If I leave the lights on at work nobody cares, but when I come home they want me to start saving (…). I don't know how much waste there is in homes, but we're not wasting any. Every time I run the tumble dryer I get a bad conscience."

The various users' stated motivation was connected to controlling the electricity consumption and to save money or get reduced prices for access to the grid. Some also mentioned avoiding waste as a matter of principle as a motivation.

This short presentation show that effects of the Ebox can not be taken for granted. The expectations from the producer side were that the Ebox would provide increased comfort at the same cost as before or even better; reduced consumption and better comfort. Half a year of testing is however not enough time to measure exact increase or a decrease in the consumption over time. To some of the users that previously did not practice any temperature regulation, the introduction of the Ebox will most likely lead to lower costs with the same comfort as earlier. When studying the daily routines in this test-group, it is nevertheless obvious that the advantages depend on earlier heating habits. The informants that had been regulating the temperature manually or with a timer may even experience increased energy consumption. This is not due to the technology itself, but more to the way it is presented through information and design. The script "tells" you so to speak, that you do not to have to wake up to a cold kitchen or living room. The purpose of the Ebox is to start heating a few hours before you get up. Thus some of the users did perceive improved comfort as an advantage. But there also was a group of users that did not see any advantages to the Ebox and preferred to control electricity consumption manually. It is also clear that the motivation for using the Ebox differs from person to person. While some have a more collective engagement, others are mainly concerned with their personal gains.

Analysing the domestication of a technology means viewing the practical as well as the symbolic aspects of the process of integration and use. The symbolic aspects of the Ebox as it could be viewed through the script from an analytical point of view, connotes as mentioned previously to "modern", professional people that travel, have flexible working hours and Internet competence. But a symbolic value of an artefact is something that develops over time. In this group the Ebox represented a new and unknown technology and the information towards the users stressed the energy-saving potential, the comfort potential and the possibilities for control over the load factor.

In addition the motivation behind attending the project provides the Ebox with symbolic meaning. From this angle it represents environmental engagement, a position towards unnecessary waste and a positive attitude towards sharing the responsibility for the energy problems. At the same time it also represents individual control and technology interest. Surprisingly, none of the informants in this project focussed on the "network-control" part of the Ebox.

"Connecting people" – the network around the Ebox

During the test period it was mainly the contact with the energy saving department (OEE) that was established. Through meetings and diverse personal contacts all of the users got to know the project and some of the persons working on it. All of the participants remembered having received information and knew what the project was about. The information provided by OEE stressed that the project included advantages both for the customers and the utility. During the first half-year no Internet based communication channels between the energy saving department, utility and customer were established. The user support hotline was the communication channel the customers could use. This hotline was not much used. One reason might be that there were not many problems with the Eboxes, but it was also noted that some of the users did not like to "trouble" the user support people. One of the informants even said that she preferred to wear more clothes before calling the support people at a period when her Ebox did not function well and her apartment was a bit cold. She did not want to "bother them".

However, there are reasons to believe that Internet based technology, such as the Ebox, may be a good starting point for establishing contact between relevant actors on the supply side and the end-users. Regarded in this manner, the Ebox may function as a possible initiator for accessing the various web pages of the energy saving department and the utility, where also bills, information, and so on could be handled.

Ideal Types of the Users

To summarise and systemise the interviews I have constructed three simplified user groups, or ideal types. Ideal types is a way to systematising and simplifying some common traits in a group of informants, based on more detailed information about them. These three groups illustrated the three ways of domesticating the Ebox that I identified in this data-material.[7]

The Enthusiast

The Enthusiast thinks it is important to do an effort towards environment (like participating in the project). She has always been conscious of using electricity in a sensible way and has either controlled the indoor temperature manually or with a timer. The Enthusiast thinks that the Ebox represents something new and interesting. She does not need a "reward" for using the Ebox because she finds that the environmental argument is sufficient. She is however sceptic to pay for the Ebox, since it also represents an advantage for the utility. The Enthusiast will not experience significant changes in energy costs or temperature by using the Ebox, because consumption has been controlled earlier as well. She may however get a higher comfort-level. She does not necessarily have computer skills.

The Sceptic

The Sceptic participates in the project, but wants something in return for using the Ebox. She either wants reduced grid-access costs or other compensations. And of course she thinks that the Ebox should be free. The Sceptic has not controlled the indoor temperature earlier, but is willing to try. It is however very important that the Ebox works according to the aims and she wants to experience specific results. The Sceptic may get significant advantages by using the Ebox, if it is used and works according to the aims. Thus she may develop into a loyal user if the advantages are evident and the technology works as intended. The Sceptic has computer skills and Internet access.

The Democratic Participant

The Democratic Participant does not think that the Ebox or the project is useful as such, but she participates because the others do. After attending the project for a while she thinks that it is all right to participate, but the Ebox remains a foreign element in the house. She is not particularly concerned with new technologies and has no computer skills or Internet access. She is of course unwilling to pay for the Ebox. If she has not controlled the temperature previously she may experience reduced electricity costs.

The three ideal types illustrate that in spite of a relatively strong script the users have developed different user-patterns during the test period. Previous habits, attitudes, age, technology interest and competence appear to differentiate the users, but this test group is to small to make such conclusions. These users do however illustrate the possibilities of flexible understanding and use of a specific technology. This means for the Ebox as for other energy technologies marketed towards the household sector, that information, supervision and support must be

tailored to fit various user groups. Different users need different information and support. To get, and keep, satisfied users of the Ebox it has to work in accordance with the aims, appear logical, and the relationship with the utilities must be based on trust. With small apartments, such as in this project, it is mainly the utilities that gain advantages from the Ebox. The people live in a quite limited space and the Ebox control only one oven. Therefore, the cost reductions are limited. If people become more aware of their electricity consumption, that may have various positive consequences for their everyday life, but one should be very careful when stating anything about the cost reduction potential. Whether the users will save money, depends on earlier habits. It is not unthinkable, as discussed that some of the participants in the Ebox project will end up consuming more electric power by using the device.

7. CONCLUDING COMMENTS

The Ebox project has mainly dealt with how this device was used and integrated into a household. It has however given some ideas of the future communication possibilities between energy saving initiative, utilities and customers. In this respect, it may be useful to bear in mind theories of social learning. These theories treat processes of co-operation, and how knowledge about such processes can be developed and put into use (Sørensen 1996, Williams *et al*. 2000). Within the theory of social learning, the notion of a learning economy signifies a system where learning through projects and co-operation are systemised and made available to actors on all levels. According to Aune and Sørensen:

> "…we will examine the system as a *learning economy*. This way of thinking highlights the way that producers and users interact and exchange experiences and ideas, an interaction that may provide a basis for learning to produce as well as to use technologies more efficient and beneficial." (Aune and Sørensen 1998:2).

In this context the notion of a producer gains a broader definition. I.e. we also find producers within the realm of politics and administration. In the present study energy saving departments and utilities are the producers. Social learning takes place when knowledge about the processes at work when introducing a new technology is collected and systematised, at the same time as networks and arenas for communication of such knowledge are created. The aim of the Ebox project is to understand and solve technical problems; to understand how the users are integrating it into their household; and to see how the communication between customer, energy saving department and utilities works. When this knowledge has been established it becomes important to make it available outside the local context, so that other projects may benefit from it.

The Ebox can perform many functions, and the way to integrate it in the market depends both on which the most important goals are and the experiences of the domestication process. In this project, the Ebox was tested as a way of handling a local consumption problem connected to a load factor problem. In addition, the energy saving department wanted to test and gain experience with temperature-controlling technology. As stated earlier, it is important to stress that this project was special because the users had not bought the device themselves. Therefore, their motivation may be different from what would be the case with "conventional" use. In addition, the users were introduced to using the technology through written information and meetings. These circumstances make the experiences from the project different from what we would find by studying "conventional" users. In this case one most likely will experience a user group that is not always motivated by consumption-cost control or energy-use control, not always skilled in Internet use and not willing to pay for the Ebox. This should lead to initiatives from the producer, including information, motivation of customers, briefings, establishment of user-support, distribution by utilities and energy saving departments and subsidising.

This marketing situation differs from situations where the Ebox is offered as a technology for controlling the temperature only. In such a situation, the customer group that buys the Ebox will have access to the Internet and is motivated to use it. In such circumstances, more traditional marketing would be adequate.

How much time and effort that should be used to attract and motivate the customers must be seen in relation to the desired goals. In this project, the aim was to test the Ebox as a means for controlling consumption, and it was important to reach as many as possible. Is this a good strategy? The findings from this concrete project are that when trying to reach a customer group with the aim of controlling the load factor in a certain area, it would be wise to concentrate on those that have Internet access and are interested in using the device. This could include

both the ideal types Enthusiast and Sceptic, but limited to those that have Internet access at home and/or work. It would be unreasonably time consuming to include and support all possible user groups, both regarding motivation and backing. Controlling water heaters, in order to control the load factor, will be another matter. The experiences with controlling water heaters in other projects show that few feel opposed to such control. In such cases, the efforts should be concentrated on including and motivating customers, while user support would be less in demand.

If the aim is as mentioned above, the experiences show that the Ebox must be sold cheaply or given to the consumers. In order to include many users it would be wise to offer reduced prices for accessing the electricity grid. The symbolic aspects seem more important than the size of the discount given. If on the other hand, the aim is to offer the customer a new technology for controlling energy costs, other strategies could be followed. When the user buys the Ebox, the motivation is present from the outset. However, there is an upper limit on the price. By selling the Ebox cheaply, or giving it away, and giving discounts on grid-access, it is likely that an interest for energy control through the Internet could be created. This could “help” the Ebox, and similar technologies, into the market. Until now, energy-technologies have been diffused according to a market-way-of-thinking (demand oriented), and with rather poor results. The sign of a successful integration of technology in the household sector, as e.g. with computers, mobile phones, and other life-style products, is that the product has a symbolical aspect in addition to the utility-aspect. This symbolic aspect lacks in energy-technologies. They have to symbolise more than saving. Maybe the Ebox, with its relation to the Internet, can be a contribution in that direction.

Regarding the theoretical aims of the paper this empirical material provides an illustration of the importance of viewing everyday life actors and activities as a part of the technological innovation process. Insights in different domestication strategies are important to avoid deterministic perspectives towards technological development. Users are does not passively adapt to technological changes. Small changes on micro-level of society can be important both as indicators of, and as reflections on changes on a macro level. As for achieving the Norwegian political goal of reduced private energy consumption by means of new technology, this perspective will emphasise the importance of developing energy technologies in dialog with the users.

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9. END NOTES

[1] Projects in: Drammen Energinett AS and Norsk Enøk og Energi, IT & Process AS ved Energiråd Øst, Enøksenteret Sør-Trøndelag and Enfo

[2] *Norwegian Gallup's Energy Barometer* for the first quarter of 2000.

[3] H. Sæle og K. Livik: *Energy control and Internet with TV asUser Interface (Energistyring og internett med TV som brukergrensesnitt)*, Available only in Norwegian, Report SINTEF Energy-research, 1998.

[4]Gry Kongsli and Margrethe Aune did the interviews.

[5] Forthcoming report from *Oslo Energi Konsult*

[6] Results so far show that there will be a need for another year of monitoring and administering the Ebox to get an overview over the most optimal function. Even if the project is not completely finished on the technical side, the user experiences are however necessary to provide the "producers" with sufficient information for further development of the technology. Concerning the more theoretical part of the paper the empirical material is sufficient.

[7] The groups consisted of both men and women, but in the presentation I use "she".