

Consumer behaviour in Swedish households: routines and habits in everyday life

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1. This manuscript was submitted for peer review by Anna Green who unfortunately died in Feb 2007. The paper has been revised by Kajsa Ellegård.

Keywords

everyday life, electric appliance use, activity-patterns, households, electricity use

Abstract

Life at home is increasingly influenced by flexible work and school hours, and an overall increase in mobility, creating new types of activity-patterns in daily life that affect electricity use. This paper presents preliminary results from an investigation of the complex interplay between household members and their appliances, asking: Who uses different types of equipment, for what purposes, and how do they coordinate appliance use in everyday life? Knowing an average householder's electricity use is insufficient, since individual variations might be big. Fifteen households were included in a qualitative study and data collected through in-depth interviews and time-diaries. Households were chosen among 400 households in a quantitative study measuring electricity use in Sweden. This paper addresses the behavioural aspects of this measurement study. The main findings are that household members' appliance use at home, especially ICT devices, is individualized. More appliances per home make it possible for individual members to simultaneously use the same kind of equipment without disturbing each other. Many ICT appliances are always turned on because the lead time to start up is experienced as too long. Internal variations in work and school hours also make ICT-appliances serve as companionship when home alone. Better understanding of household appliance use may provide policy makers with insights about who to direct policy measures towards. If household members *buying* appliances are not the same as the ones *using* them, energy savings arguments must

reach users not buyers otherwise users will not be aware of the energy consumption they generate.

In an international perspective, per capita electricity use in Sweden is high. The Swedish Energy Agency has been commissioned by the Swedish Government to measure the electricity use in about 400 households to see how much electricity different types of equipment, active or in standby, use in Swedish homes. To get a deeper understanding, the commission is widened to gain knowledge about household behaviour. It is not enough to know the electricity use of an average household member, since the individual variation might be big. Who uses different types of electric equipment, for what purposes and how do they coordinate the use of appliances in their everyday life? This paper is about the behavioural part of the measuring study made by the Swedish Energy Agency. It will increase the understanding of electricity use in households and serve policy makers with insights about who to direct policy measures towards. If the household member who *buys* the appliance is not the same as the one who *uses* it, arguments on energy savings must reach the user since the real users otherwise will not be aware of the energy consumption generated by their equipment. Concepts are needed to communicate what kinds of use of appliances are used in what kind of household contexts. Little is known about the use of electric appliances in households looked upon as situations of interplay between household members. Life at home is increasingly influenced by a more flexible labour market, flexible school attendance, and an overall increase in mobility, creating new types of activity patterns in daily life. This influences life at home and, of course, the use of electric appliances. This paper presents some preliminary results from the investigation of the complex interplay between

household members in the home and related electricity use. About 15 households of various size, age and type of dwelling were chosen from the total of 400 in the quantitative study measuring electricity use, for qualitative research through in-depth interviews and time diaries. The main findings are that the household members' use of electrical appliances at home, especially ICT devices, is individualized. More appliances in each home make it possible for individual household members to simultaneously use the same kind of equipment without disturbing each other. Much information, communication and entertainment appliances are always turned on because the lead time to start up is experienced as too long. Internal variations in work and school hours also make ICT-appliances serve as companionship when being alone at home.

Introduction

In our homes we have a lot of electrical appliances to help us in our daily lives, or to provide entertainment and relaxation: for example appliances for preparing food or washing clothes, for seeking information on the internet or watching television. In a broader perspective the increased number of appliances, whose aim is to give us a comfortable life and higher living standards create problems due to their consumption of electricity. At an EU-level there is an explicit ambition to decrease the energy use in the member countries, and one area that is pointed out is the citizens' use of energy and electricity. If the citizens in the EU change their behaviour, about 20 % energy is supposed to be saved. For example, we could switch to low energy lights bulbs, more energy efficient white goods, and use better insulation (European Commission, 2005). But to be able to decrease the electricity consumption significantly we need more knowledge not only about how, when and why households use energy, but also about how the household members in the same household cooperate or negotiate who should use the various appliances (see for example Abrahamse et al 2005; Aune 1998; Boardman 2004; Chappells and Shove 2005). Ingelstam points out that even if some studies show that technology can be an important means for energy savings, they do not pay enough attention to the fact that household behaviour is very complex (Ingelstam 2001: 271ff). Type of household, for example, concerning age and income, and household lifestyles are used to explain patterns of behaviour and energy consumption (Carlsson-Kanyama and Lindén, 2002:4).

According to Ellegård and Widén there is abundant knowledge about electricity use for average household members, but not enough attention has been paid to the complex interactions between different household members, and between individuals and technology (Ellegård and Widén, 2006). Furthermore, research is called for concerning how people reason about energy in everyday decision-making. Previous research, for example in an article by Gram-Hanssen, Kofod and Narveig Peterson, points out that "further research is needed on the specific daily practice that generates energy use" (2004:7-74ff).

This article focuses on how to understand the use of electric devices from an everyday perspective. Three basic functions in daily life are chosen for the study of the use of electric appliances: food preparation, laundry and information/entertainment. We looked for activity patterns in how the various devices were utilized by the household members in their homes

and how they interacted with each other in their everyday life. The study is based on qualitative research and illustrates activity patterns from data collected in interviews and time-diaries. The households in the study also took part in a bigger study, where the Swedish Energy Agency measured the electricity use of about 400 households in order to see how much electricity different types of equipment (active or in standby) uses in Swedish homes (Bennich, P. and Persson, A., 2006). Since the political aim is to save energy in the household sector, suitable measures must be developed and the result from this study will serve as a basis for designing measures directed to the *users* of specific appliances in households.

This research project has to be understood in a Swedish context. In an international perspective, Sweden has a high and increasing use of electricity per capita, of which a significant amount is used for different purposes in our homes (Swedish Energy Agency 2005:10). Sweden is also a forerunner in using electronic devices in the area of information and communications technology (ICT). Hence, the research can give knowledge about how citizens in a country with a high level of living standard, including advanced use of ICT devices (devices such as mobile phones, internet, computers etc), use all the different appliances at home. This research project also will provide information about what everyday life looks like in a welfare state with a high electricity consumption. The survey made by the Swedish Energy Agency contributes information on how much electricity is used for which appliances in the participating households.

The devices addressed here are grouped into three different categories of use; appliances for preparing meals in the category "food and cold storage", appliances for "entertainment and information" and appliances for "washing and cleaning" (Carlsson-Kanyama and Lindén, 2002). Devices in the area of cooking and cold storage are often placed in the kitchen. In the area of "entertainment and information," we find e.g. TV's, computers, telephones and so on (ICT) located in children's rooms and living rooms. In the area of "washing and cleaning" devices for washing and drying clothes are used. Devices in the area of "food and cold storage" and "information and entertainment" categories are focus of this paper.

Aim

The aim of the research project, which is in progress, is to study the households' electricity use, starting from a perspective of household members' daily life at home, in order to better understand how and why different electric appliances are used and how the individuals cooperate – or not – in the use. Many daily activities involve more than one individual and it is important to increase the knowledge about the interplay between different household members when they perform their daily activities, as well as the relations between household members and technology. The objectives of this paper is to present concepts which may be useful in the analysis and present some preliminary results concerning activity patterns from the household study achieved so far.

Method

Before presenting results from our qualitative research about appliance use and daily life routines in Swedish households, we start with a short presentation of the quantitative study that forms the backdrop for the former. (Bennich, P. and Persson, A., 2006). The aim of the quantitative study made by the Swedish Energy Agency is to get better statistics on how much electricity different appliances use in Swedish homes. Statistics Sweden (SCB) does the selection of the 400 households and this process is ongoing. Participation is voluntary, and there are questions about, for example, the household's income level and the age(s) of its member(s), in order to be able to control how the study relates to Swedish averages. The sample was limited geographically to an area situated in the Lake Mälaren region in eastern Sweden, but some households were selected from the northeast and the southern parts of the country in order to get points of reference (for example there can be a big difference for lighting needs between these parts). Two-hundred of the 400 households live in apartments and 200 in detached houses.

Until now, fourteen households have been interviewed in depth for the qualitative study. The interviews were structured around open-ended questions, and were all taped and transcribed. The interviews were then thematically analysed. In eight of these fourteen households, household members above 12 years wrote time diaries during two weekdays and one weekend day. Time diaries written by household members will be used in order to relate members' activity patterns to each other and to identify significant, but sometimes hard-to-see variations. The household members also kept log books over their use of various specific appliances for cooking and information/entertainment. The results from the measurement study by the Swedish Energy Agency will be presented during 2007. At this point we will return to the households and show them graphs of individual household members' activity patterns and use of appliances and, also, statistics of their electricity consumption. When referring to various informants they are given individual designations, consisting of one letter and one number, e.g. A7 and D10, where "A" stands for apartment, "D" for detached houses, and the numbers represents the order in which the interviews took place.

If you study individuals in a household concerning their everyday life, it is of importance to define what you mean by "everyday life" and "household". According to Ellegård's definition, everyday life consists of the never-ending flow of activities being done in a continuous time period, regardless of in which place the person is located. (Ellegård, 2001:41). According to Carlsson-Kanyama and Lindén (2002:7), a household could be defined as consisting of the persons who have their everyday economy in common. This sounds reasonable, but it must be added that some individuals can be members in more than one household, for example children who live one week at a time with each of their divorced parents.

Statistics

From the 400 households whose electricity use is being measured by the Swedish Energy Agency, preliminary results from 53 detached houses and 77 apartments out of the 200 of each type are presented below (Bennich, P., private communication).

Table 1. Average household electricity use in Sweden in 2006/07 (Bennich, P., private communication) compared to the Danish average (Gram-Hansen et al 2004).

Type of housing	Number of households in the survey of Swedish Energy Agency	Swedish Average Elect. Use (kWh/year)	Danish Average Elect. Use (kWh/year)
Detached houses	53 (will be 200)	5 100	4 042
Apartments	77 (will be 200)	3 000	1 934

Table 2. Electricity use by appliance category in detached houses and apartments from Swedish Energy Agency survey (Bennich, P., private communication).

Appliance category	Detached houses [kWh/yr]	Apartments [kWh/yr]
Cold appliances	1 020	720
Lighting	1 275	630
Cooking	510	390
Dishwasher	306	120
Washing and drying	306	210
Audio site	102	60
TV	255	150
DVD, VCR etc	153	60
Computer site	459	270
Others	357	60
Not monitored	357	330
<i>Total electricity use</i>	<i>5 100</i>	<i>3 000</i>

The preliminary results are compared with the total average figure from Denmark (Gram-Hansen et al 2004).

The figures show that the average Danish household uses less energy than the average Swedish household irrespective of type of dwelling. It must be underlined that the Swedish figures are preliminary, based just over 25 % of all the households that are to be measured and that they should be adjusted for seasonal variations. Table 2 shows the electricity use by appliance. Note that the figures relate to an average household in the two dwelling types.

Lighting constitutes the largest single category and cold appliances the second largest for households in detached houses, whereas the opposite holds for apartments. However, the number of lighting sources is strongly dependent on number of rooms, and thus lighting can be the largest category for large apartments as well. The combined category consisting of information and entertainment (audio, TV, DVD, VCR, computer site) constitute the third largest category in both types of dwellings. Altogether, these three categories constitute more than 60 % of the total electrical use.

It is also interesting to know how many appliances of various kinds there are in the households. Some preliminary results are presented by Krantz et al (2007 forthcoming). For example, 53 % of the 130 households have more than one television set. Notable is that as much as 13 % of the households have three TV's. 61 % of the households have one computer, 22 % have two computers, while 8 % have 3 or more. There are only 9 % of the households without any computer. Also, the number of freezers is counted in the 53 households living in detached houses. It is shown that 60 % of them have one freezer, while the rest (40 %) have two or more freezers.

The number of appliances is an important input to the discussion of how the household members develop strategies for using the appliances, and consequently also for the electricity use in the household. A suggestion is that conflicts regarding who should use the device in some cases are solved by buying another, more modern one.

Possibilities and restrictions concerning the use of electricity at home

In a Danish study of 50 000 households, the influence of different background variables on the use of electricity were studied – for example income, the number of household members, their ages and level of education. The most important variable was shown to be the number of household members: electricity usage increased for every additional member (Gram-Hanssen et al, 2004:7-77). Two other variables with some explanatory power were income and living area. According to the study, 30-40 % of the differences in electricity usage in the three different types of houses studied could be explained by these three variables (Gram-Hansen, Kofod, Peterson, 2004:7-78). It is pointed out, however, that 60-70 % *cannot* be explained by these three variables. Perhaps a time geographic approach can help us to find further explanations. According to time geography we must take into account the fact that the individual has to adapt his or her everyday life to different resources and restrictions in his/her daily context. Together the resources and restrictions form the space of possibilities within which the individual may act. Ellegård points out that organisations have legitimacy and power to restrict individuals' space of possibilities by rules, regulations and laws (Ellegård, 2001:41). She exemplifies with, among other things, school hours, bus schedules, work hours and availability of day-care and its schedules. When studying electricity use in households it is important to notice that this kind of regulations outside the home can serve as resources at the same time as they represent constraints on what can be done at home. They also serve as restrictions on how much time household members may stay at home – which of course influence the energy use of the household. What is not so obvious, however, is that even though we know that an average Swede spends about 65 % of the day at home on weekdays, we do not have much knowledge about whether the home is empty during the rest of the time since someone else in the household might have other schedules to follow (Ellegård 2003). We will present how some electric appliances serve as resources for one individual household member and how other household members' use of appliances then appear to impose restrictions. We hope that our study will contribute to new knowledge and deeper understanding of why electricity usage varies significantly between different households.

FRAMEWORKS AND RESOURCES ON A SOCIETAL LEVEL

Several different technical infrastructure systems are connected to our homes, making it possible for us to install a wide variety of appliances for different purposes. These infrastructures are to some extent resources, but can also impose restrictions, limiting our use. For example, electricity makes it possible to watch TV, thus being a resource, while a limited supply of channels or airing hours represents a limitation, potentially making the TV unused. We can distinguish between the following types of in-

frastructures: Flowing, Transportation, and Information/communication. Examples of Flowing infrastructures are systems for electricity, water and sewage. Transportation infrastructures, e.g. busses, roads and trains, are not directly connected to the households, but make it possible to move to or from their homes, and since the distances travelled have increased significantly this might influence how much time we can spend at home. Information/communication infrastructures are dependent on electricity supply, and consist of information and communication services, e.g. the use of telephones and TV-sets. The supply in these areas have drastically increased in the last few years, in part due to deregulations, leading to increased competition between different actors on the market and an increase in supply of different services. The number of TV-channels have increased, many being on the air around the clock. New types of technology, e.g. mobile phones converging with cameras, music players and internet access and mp3-players, have made a more mobile life style possible.

Organisational structures for employment, day-care and education influence when people can be at home. Sweden has well developed systems for day-care and schooling, presupposing that both parents are working outside the home. It is not uncommon for employers to provide laptops enabling people to work from home, or that day-care centres offer breakfast to children. Organisation of certain services, e.g. in the field of banking and contacts with public authorities, has had the effect that some services might be demanded from the home, using computers.

HOUSEHOLD STRUCTURES

Household members' participation in organised activities outside the home together influences their electricity usage. The most common type of household in Sweden, constituting about 47 % of all households (Carlsson-Kanyama and Lindén 2002) has one member.

Households often have a *variable structure*, meaning that the number of resident members changes over time, both in the short and the long term. It is not uncommon in Sweden that children of divorced parents alternate between living with each parent on a weekly basis, thus being members of two households – thus having two homes. It is also common that a household splits its time between different houses on a yearly basis, for example moving to a summer house during vacations. This means that households are not static, and that their different members use electricity in several places.

Another important issue concerns the structure of appliances. In Sweden, white goods (fridge, washing machine etc.) are installed when buying or renting a residence. Other appliances are bought by the households, e.g. radio, TV, microwave ovens. The appliances can be divided in two groups:

- *Permanently used appliances* which are active all the time, e.g. the refrigerator, freezer and alarm clock.
- *Intermittently used appliances* which are used to a varying degree, at different times, hence, they can be active or not used at all depending on the household's needs.

CHANGING STOCK OF ELECTRIC DEVICES IN HOUSEHOLDS

Kanyama and Lindén (2002) refer to a study where it is pointed out that electricity use is dependent on three important factors: the number of appliances, their performance, and how they are used. In the statistics section above, some figures on household ownership of some appliances were presented. The most striking thing is that households have several appliances for information and entertainment. The ownership of more than one TV and computer per household is in part due to a higher living standard, in part to decreased prices of electric appliances. In two interviews it was pointed out that TVs have become inexpensive (D6, A7). In many households there are several devices for handling the same function, e.g. porridge can be made on the stove as well as in the microwave. This is also the case in the area of information and entertainment, where households with two or more members often have several TVs and computers (D1, A2, D6). Mp3-players and mobile phones are examples of devices where every single household member can have their own.

But household members do not only have an increased number of intermittently used appliances. In the interviews it was sometimes noticed that the number of permanent appliances also has increased. Some informants told us that when old appliances were exchanged for newer ones, old (but still working) white goods were kept and used. Two of the households interviewed said that when they bought new white goods (fridge and freezer with A-labels), one household moved the old fridge to a storeroom in their house (D4), and in another the old freezer was moved to the living room (A10).

Further, there are examples of how intermittently used appliances are left on all the time, thus having the same connection to the electricity network as permanently used appliances. One man always had his computer on in order to shorten the lead-time for using it (A14). In another household the broadband cable modem, with its blinking lights, were left on around the clock, since the owner did not know what would happen if he disconnected it (A13).

The use of appliances runs in cycles, influenced by economy, interests, and the households' phase of life. One man told that he used to play a lot of computer games (D8), and hence left the computer on most of the day. Households with children point out that when the children were infants they used to launder every day, which is not necessary now when the children are of school age (A2, A10). In some households the women told that they used to bake more than today (D4, D12). But now it is less economy in baking yourself, and the feeling of being pressed for time leads to a decreased home baking (A10).

It is also of importance that a lot of appliances are rapidly replaced since they become outdated, e.g. the computer. Modern appliances, often with more functions and better performance, replace them. Electric kettles replace the percolator, the mobile phone is replaced with a multifunctional mobile audiovisual gadget and the video recorder is replaced by a DVD-player. In one household an unused record player was shown and referred to as an antique by the owner (A13).

Using appliances

Gram-Hanssen et al. point out that it probably is a big difference between what you, as an individual, think that you are doing, and what you actually are doing in practice (Gram-Hanssen et al, 2004). In their article they refer to a man who put emphasis on turning off the lamps; he even said he returned home just in order to turn off a lamp left on – but the same man had several computers on all the time. In a study concerning whether people change their behaviour when moving to an area with an explicit environmental friendly profile, interviews show that environmental friendly living is associated with recycling and separation at source, rather than with energy issues (Green 2006). Several informants say that they try to act environmentally sound, e.g. through recycling, but during the same interviews they can talk about their interests in going abroad for vacation and in sports cars (Green 2006). This indicates that households trying to live environmentally friendly to some extent adapted to it, mainly through what can be seen as symbolic actions. However, the rest of their lives were not changed.

In the interviews our initial question was about why the informants took part in the study, and what they knew about their energy consumption.

The interviews showed that many households have a rather vague idea on how much electricity they use, and what it costs. But they want to know this, explaining why some of them agreed to take part in the study. Either they want to confirm that they use little electricity (A2), or that they use a lot (D11 and D1). To answer question on cost and usage, many brought out the folder in which they keep their bills. But they still cannot give precise answers, because bills can be hard to understand, and consequently do not serve well as an instrument for energy-saving behaviour. Some households, however, have good insights in their use of electricity, and can give rather precise numbers on cost and usage, which they sometimes can verify by presenting the correct numbers (D11). In the interviews the informants can make comments on how they view their use of electricity and how large it is. Four types of reasoning on this are distinguished:

- We/I use very little electricity, for example due to environmental reasons. Other households' motive for low usage was that they did not let appliances be in standby, or because they were not at home very much.
- We/I use what is needed. Some actions are taken to save electricity, like turning off lamps. But other actions are not very adapted to saving electricity, like e.g. taking a bubble bath.
- We/I use much, or more than is needed. What savings can we do?
- We/I use much, or more than is needed, but are willing to pay for this comfort.

Important activities in order to save energy that were mentioned in the interviews, are e.g. to turn off the lights, or not leaving appliances on in standby mode. One woman said that the sheer number of appliances was to blame for high energy usage, and she thought about how to decrease this number (A10). Two households, with members in their sixties, said that they never leave appliances on in standby due to the risk of fire.

One environmentally conscious informant said she wanted to throw out all appliances, since she connected the number of appliances with wastefulness.

Several households discussed the problem that certain ICT-devices are used far too much; parents especially points out that their children use the computers more than is good for them, and that they should be doing other things instead of hanging about the computer (A13, A2, D7, A10).

Behavioural patterns concerning use of appliances

An obvious pattern in the interviewed households, whether a person lives there alone or not, is that intermittently used appliances for entertainment and information often are owned and used by single individuals. In part this is due to economic factors; a combination of falling prices on appliances and an income increase has led to an increasing number of appliances for personal use. Other factors include changes in the structure of our working and social lives. For example, as a consequence of more flexible working hours, we use communal appliances at different hours, and not together for a common purpose. Twenty years ago, in households with several members, there was usually only one TV and one radio, and household members had to watch or listen together. These appliances served as a common information node for the household members use. Likewise there was only one phone. Today different members often use different TV sets and mobile phones at the same time to do similar things. We observe an increase in the number of simultaneously active appliances; e.g. the kids who have their own computers and TVs in their rooms. Further, a lot of appliances, especially in the area of “food and storage” (the microwave for example), have become easier to use.

BEHAVIOURAL PATTERNS AND ORGANISATION IN HOUSEHOLD

What patterns of actual use of appliances, and organisation of common activities, are found in households with two or more members? Here we will examine some patterns, based on established household activity patterns. Earlier research have emphasised gains through cooperation in households with several members, e.g. when cooking. But according to our findings this can to some extent be put into question, since individual use seems to be increasing also in multi-member households.

The use of appliances in multi-member households shows patterns that can be categorised in the following way:

- Communal use: when two or more members use an appliance together (e.g. watching TV together).
- Use for common goals: when the use of appliances serves several members (e.g. cooking the family dinner).
- Serial use: when the same appliance is used at different times by different members (e.g. the percolator).
- Parallel use: when different appliances of the same type are being used at the same time in different parts of the house (e.g. different computers being used at the same time by different household members).

These patterns are different ways to use the appliances as common resources in the household and to handle the restrictions

emanating from different purposes with using the appliances. There seems to be a tendency towards less communal use and more individual use.

Communal use and use for common goals

Coordination gains when using appliance in a household with two or more members can be obtained in different ways. One is when several members use the same appliance together at the same time (i.e. *communal use*), and applies mainly to the “information and communication” category, for example when we are watching TV as a way to relax and be together. During weekdays this takes place after school and work, e.g. parents with children who relax together on the sofa, or parents watching TV after putting smaller kids to bed (D8, A7, D11). In households with older children the TV is turned on after dinner and washing the dishes are completed (D1, A5, A2). The time spent in front of the TV also presents an opportunity for conversation, for example about the events of the day. For example, in one time diary, a man aged 60, writes about sitting in front of the TV, talking with his wife (A5). In an interview with this household, the wife says that her husband watches the TV, while she is sitting in the armchair next to him, prefers to knit or do embroidery. Time in front of the TV thus constitutes an undemanding way to be together after a long days of work. But the TV can also assist in taking care of the children. The father in a household with several children pointed out that the two youngest children were placed in front of the TV while he cooked or used the computer after work (D11).

Listening to music is normally initiated individually, but when one household member puts on a CD, maybe as background music, others have to listen whether they want it or not. For example, during one interview with a family with children, there was music playing in the background all the time, while we were sitting in the family’s TV-sofa. Also computers can be used for a communal purpose, but this is rare compared to watching TV, unless the computer is used to show a movie. Communal use of computers includes showing someone something on the Internet (A7) or when discussing a programme or some computer malfunction (A3) or to follow the stock market (D6).

In the categories “food and storage” and “washing and cleaning” many appliances can be used either by one or more persons and cooperation gains are obtained when the purpose of the use is to serve several household members. Appliances in these fields are not used primarily for pleasure, but to indirectly add pleasure to life, such as the common goal to make good food and a clean house. For that sake appliances that facilitate household chores are used. When women were housewives being at home, they took care of such chores. One informant told us how his father always went home for lunch, since his mother were at home and prepared food for both of them (A14). Today it is uncommon that someone is at home all day, except when on parental leave or after retirement. So how do we handle projects for common goals today, when both women and men work outside the home [or participate in the labour market]?

The use of appliances for common goals can be handled by a single individual in a multimember household, e.g. by one person cooking or washing for the whole family, or be done in cooperation, e.g. by cooking together or by taking turns. But despite the fact that women of today also work outside of home

they still have the main responsibility for washing and cooking. Several of the interviewed women with flexible working hours mention that they do the household washing, for example during a free morning (D4). The men of the households are responsible for other chores, e.g. they tend the garden, care for the car or do practical handiwork (D8, D12). In many households there is a pattern of seeing the household chores as a shared project with a common goal. Different members in the household take care of different parts to achieve the common goals, (e.g. concerning cooking, washing and cleaning), or cooperate. For example, one person can do the shopping and put on the potatoes, and the other finish the cooking (D8), or one person loads the washing machine, and the other hangs the laundry out to dry (A7 and D11). In one family with teenage daughters the mother said that she and the oldest daughter were responsible for the family laundry (D11).

Individual use for individual goals – serial use

Another pattern in households with several members is individualisation of the use of devices, i.e. that different members in the household use the same devices at different times of the day for their individual purposes. We call this *serial use*. Two reasons for serial use is different working hours and the plentitude of devices in our homes, where one person can sit in front of the television and another by the computer, and after a while they can change places. In serial use the appliances are used for individual demand. To some extent social use is a strategy to overcome conflicts arising when more than one household member wants to use the appliance. Below we will give some examples of serial use in the areas of "food and cold storage" and "entertainment and information".

Serial use in the area of "food and cold storage" – eat on demand

Far from all meals are eaten together by all household members in multimember households (Mestdag and Vandeweyer, 2005; Falk, 1994; Whit 1995). Some meals are prepared by one household member for just him- or herself, and coordination advantages decrease accordingly. Household members prepare food and want to "eat on demand", which means that some kitchen appliances are used at different times by different household members. Devices are then used for individual needs, and the appliances are used serially. One reason is that some new devices that are easy to handle have been developed, for example the microwave oven and the electric kettle. In particular, breakfast on weekdays seems to be a source for serial use of kitchen appliances. The reason for preparing this meal individually depends on different individual needs; some household members have to eat their breakfast early to get to work in time, while others can sleep longer in the morning. Consequently an important restriction is that different household members start work and school at different hours. A father of two sons points out that when school begins varies between eight and eleven o'clock (A2). The consequence is that for example the electric kettle can be used many times during the morning. One time diary from a household of four persons revealed that the breakfast meal almost never was eaten together with someone else during the weekdays (A2). But it is important to have in mind that for example sandwiches and orange juice as breakfast can be eaten

without any other than the use of electricity for permanently used appliances (D8, D12).

Some household members did not eat breakfast at home at all. The Swedish day care centre service make it possible for both parents to have full time jobs, and their children are offered breakfast at the day care centres. One informant said that at his workplace breakfast was served every morning, and in the same family another adult person said that he bought breakfast on his way to work, in order to be able to sleep a little bit longer before the time-consuming journey to work (D8).

Serial use in the area of "information and entertainment"

Also in the area of "information and entertainment" some appliance use is serial. The important restriction is, as above, that different household members have different work and school hours. The increasing supply of information and communication services has the consequence that devices in these areas are increasingly used day and night. About twenty years ago there were only two TV-channels in Sweden broadcasting mainly in the evenings. Daytime broadcasting and an increasing number of channels mean that the devices can be used as company for household members who spend time alone at home during the day. In one family, consisting of a single father and a twelve-year-old son, the son said he often watched television or used the computer when he came home after school in the afternoon (A3). This boy alternated between two parents living close to each other, and he used to sleep at his mother's house after spending the afternoons at his father's house. In the evenings the father could sit by himself and watch television. Another example of serial use is from a family with two adults, two children and sometimes also an adult relative also stays in the house. In the daytime, the mother could sit by the computer, for example talking to her sister using Skype. The father used the computer in the evenings when he returned from work, and the third adult person used the computer at night (D8).

In some households, serial use was a consequence of lack of interest in the appliance in question (D4, A5). For example in a household with members aged 55-65, one person was not very interested in computers, and both household members used the computer only once in a while. In some households with children, it can be a strategy adopted by parents not to have too many devices making it impossible for the children to watch too much TV or use the computer too much since the children will have to share the devices (D11 and A10).

Individual parallel use

We have mentioned that multi-member households can own several devices of the same type. It is not uncommon that these appliances are personal, which means that several household members own for example a computer (A3, A2). Different household members use their personal appliance at the same time in the same or different rooms – this is called individual parallel use. Individual parallel use of devices is most common in the area of "information and entertainment", e.g. devices like computers, televisions and mobile phones. Parallel use is a costly solution when household members do not manage to agree upon how to take turns in using ICT-devices. Household members all want to be free to use the devices instantly when they need.

When the number of appliances in a household is a restriction, i.e. when the household members compete over who is going to use it, more devices are bought. This is a strategy to solve conflicts, for example about which television program the family members have to watch, or how to share the computer. A father in a household with two boys put it this way in the interview:

Interviewer: You mean that the computers are above all used by your sons?

Dad: Yes, they are. We have two of them to avoid quarrel.

One household of three persons, a mother, a father and a son in the 20's, had three television sets. One belonged to the son, another was located in the living room for common use, and often the father and mother watched television here together. If they could not agree on what to watch, the father had to watch television in the "little room" on the third television set. But conflicts can also emerge due to individual parallel use, e.g. if parents think that their children use the computer too much (A2, A3, A13).

Individual parallel use in the area of "food and storage" exists, but it is not common. For example, in a two-person family both members had porridge for breakfast, but they cooked it in two different ways. One of them cooked it in the micro oven, and the other on the stove (D4). In the area of "washing and cleaning" it is not common with parallel use, since hardly anyone thinks it is such fun to do laundry that they would buy many of the same appliances to use them in parallel.

Low use patterns

One pattern is low frequency in using household appliances. Even though there are several appliances in a home they are not frequently in use. There are several reasons not to use ones appliances. One informant living alone, said that he did not use his TV or computer very much because he almost never was at home due to his work and leisure activities (A13). Another individual used to read the paper in peace or take a nap when coming home from work. Then no intermittently used appliances are utilized. Some informants say that they spend a lot of time at their holiday cottages (D7, D4). In such a case the household members only use the permanently active appliances in their main residence, but in addition they use both permanently active appliances and intermittently used appliances in their summer cottages.

Individual simultaneous use

It is quite common for an individual to do several things simultaneously, which means that many different appliances are used at the same time; e.g. cooking at the same time as listening to music and speaking on the mobile phone. We call this **individual simultaneous use**. This holds for a broad range of home appliances, especially in the category of "information and communication". Some appliances in this category are mobile, like the mobile phone, mp3-player and laptop. This pattern reveals a combination of "home-business" with pleasure. One informant told us that his grandmother always stood in an upright position when she talked on the phone, since making a phone call was an action of importance and important information was to be exchanged (A2). It is not likely that this grandmother

would have been cooking at the same time. Using the phone while cooking is a modern phenomenon related to the mobile phone, and it has the character of chatting with ones friends. As mentioned above, the development of devices is of importance; it is of course easier to do other things while using a mobile phone than when constricted in ones movements by a cord of half a meter. But our attitudes have changed a well. Telephone technologies are not special anymore; they have become part of everyday life. Newer devices have a wider range of functions than older ones; and there is a considerable convergence of technologies. This makes simultaneous use of different functions in one and the same device possible, e.g. using the computer to surf the Internet while at the same time using it to play a CD, or mp3-music from the hard drive, or listening to a radio channel received via broadband on the computer.

Individual by turn use

Another pattern revealed is that the user alternates between two or more active appliances, e.g. he or she has both the television and the computer on at the same time; for a while he/she sits in front of the television, and then changes to the computer. From the time diaries and logbooks we can see that these devices are not turned off when they are used in this way. This can be viewed as a kind of simultaneous use of electricity, but since appliances are used alternately, and not at the same time, we prefer to distinguish this as a separate category. We call this **individual by turn use**, and it is common among the informants in the area of "information and communication". The appliances are left on are primarily due to convenience, but also based on the notion that there is no point in turning them off, since they will be used again soon. One informant said that his computer always was on (hence making it serve as a permanently used appliance), while he turned the TV on and off during the evenings when there was a program he wanted to watch. He left the computer on because he did not want any lead-time, and he wanted it to be easy to switch between using the TV and the computer. He was willing to pay for the comfort of being able to use the computer instantly (A14). Other instances of individual by turn use could be when one leaves the radio on when taking a shower after breakfast, continuing to listen afterwards.

Individual double use

In some cases several appliances need to be in use in order to enable the individual to fulfil the objective of what he or she wants to do. We call this **individual double use**. One example is when the computer is used to discuss, e.g. via Skype, a show on the TV with someone else who watches the same show. One informant told us that his sons, who both had their own TVs and computers in their rooms, held such TV-generated discussions with their friends via internet (A2). This communicative activity presupposes the use of two kinds of appliances (either TV and telephone or TV and Skype). The fundamental need for two appliances at a time distinguishes individual double use from individual simultaneous use, where it is more coincidental which devices are being used at the same time.

Discussion

The paper presents some preliminary results from a study of household behaviour that will serve as a complement to the measurement of electricity use in 400 households which is being performed by the Swedish Energy Agency during 2006/07. We have focussed on how members in households of different size and age use their electric appliances to perform activities related to cooking, laundry and information/entertainment. The study is mainly based on interviews and time diaries in 14 households.

This study focuses on the use of electricity at home, but from an energy saving point of view, it is of importance to bear in mind that some activity patterns in the home relevant for energy use are influenced by factors outside the home, like location and opening hours on work and services. The fact that all household members do not eat breakfast together at home may make preparing breakfast an activity that is split up in time, claiming for serial use of electric appliances. This results in higher electricity use, but it might be compensated by cooperation gains outside of home, e.g. when breakfast is prepared at the day-care centre for many children at a time.

Some patterns of how household members utilise two kinds of electric appliances – permanently used appliances and intermittently used appliances – are identified and the patterns are labelled serial use, parallel use and simultaneous use. The patterns are found on the household as well as on the individual level.

The patterns revealed by the use of appliances in multi-member households are categorised in four groups:

- Communal use: when two or more members use an appliance together (e.g. watching TV together).
- Use for common goals: when the use of appliances serves several members (e.g. cooking the family dinner).
- Serial use: when the same appliance is used at different times by different members (e.g. the percolator).
- Parallel use: when different appliances of the same type are being used at the same time in different parts of the house (e.g. different computers being used at the same time by different household members).

These patterns represent different ways of using the appliances as common resources in the household and how to handle the restrictions emanating from different purposes of using the appliances. There seems to be a tendency towards less communal use and more individual use.

There seems to be a trend towards individualisation, especially in the use of ICT-appliances and regardless of the number of household members. Since the 1990's there has been a substantial increase in the number of ICT-appliances in households. This increase is followed by an increased supply of services provided over the internet.

We also identify patterns of individual use depending on how the appliances are used in practice:

- Individual simultaneous use
- Individual by turn use
- Individual double use

Both individual simultaneous use and individual double use results in more electricity use, and this also goes for individual by turn use if one device is not turned off while another is being used.

Some appliances have for long been used by one individual at a time, like stove, oven and washing machine. These appliances relate to traditional home making activities. However, we can see that in some modern families the members help each other in fulfilling food preparation and laundry tasks, hence they utilize different appliances simultaneously or the same appliance by taking turns in a serial way. Hence, there might be a trend towards creating social situations at home when using other appliances than ICT-devices.

A deeper understanding of household electricity and the issues of appliance use discussed in this paper may provide policy makers with useful insights about who to direct policy measures towards. If the household member who *buys* the appliance is not the same as the one who *uses* it, arguments on energy savings must reach the user since the real users otherwise will not be aware of the energy consumption generated by their equipment. Concepts are needed to communicate what kinds of use of appliances are used in what kind of household contexts

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