# Visualizing energy consumption activities as a tool for developing effective policy


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**Abstract:**

Analyzing and understanding energy consumption from the household activity perspective is vital for developing policy that promotes sustainable everyday life. Doing so entails learning how to connect policy with household activities and everyday life.

We use a time-geographic visualization to analyze several dimensions of everyday life as a totality. From household members' time diaries, we can analyze and learn about when, where and what energy-related activities occur in the household, involving what household members are engaged and in what wider social context activities are performed. We discuss the importance of relating policy analysis to everyday household activities to make policy relevant to households. Time diaries reveal differences and interdependencies in activity patterns between household members and between individuals in a population classified by factors such as gender, age and household composition. The diaries provide data to visualize activity patterns and identify individual households' use of electric appliances and need for light and heating. To capture electricity use as it occurs, we developed the VISUAL-TimePAcTS/energy use software to track the relationship between activities, appliance use and electricity consumption. This tool helps deepen discussions of the consequences of everyday household doings for energy consumption and climate change. Time diaries also help households reflect on daily life in relation to energy consumption, giving households feedback that is direct and relevant since it refers to self-reported activities. This is the starting point for discussions of how activities can change.

Time geographic visualizations of diaries complement policy research by recognizing the diversity of everyday life of households. Instead of analyzing how habits, incremental decisions and non-decisions are made by grassroots bureaucrats, we suggest broadening the perspective to include how individuals' everyday activities and restrictions influence policy formation.

**Keywords**

Policy, household, time diary, visualization, energy, feedback, time geography.

## Introduction

Historically, households have not been a major target of environmental policy, which has traditionally targeted public authorities and private industry. However, in line with the increased importance of energy efficiency in relation to climate change, households have become a more important player (Spaargaren and Mol, 2008; Dietz *et a.,l* 2009). Policy aiming to promote energy efficiency in these household sectors must relate to and rely on how individuals act in response to policy, *i.e*., in the daily choices and routines of their lives.

In general, households in Sweden use 60 % of their energy for heating and hot water. The other 40 % is used for lighting and other appliances (Lindén, 2007). Taken as a whole, the latter 40% is divided between refrigerator and freezer (19%), cooking (9%), washing and drying (6%); dishing (6%), TV, video and radio (10%), computers (14%), other appliances (12%), and lighting (24%). Many trends are not so beneficial in the perspective of energy reduction. There is an increase in single households, bigger living areas, more appliances in the households and several appliances of the same sort like the common trend with two or three TVs in one household. All these aspects contribute to an increase in energy consumption in households (Ellegård, 2010).

Lack of action in households is regarded as a main obstacle to realizing high ecological goals in critical areas, such as housing, transportation and tourism (Spaargaren and Mol, 2008). Household behaviour is now regarded as more decisive than it previously was, and policy is needed that is adjusted to the special characteristics of the household sector. However, as a sector, it is at the same time heterogeneous and diffuse; and regarding climate, all households produce small amounts of greenhouse gases. Unlike industrial companies, households are not organized as actor groups and their understanding of the externalities of their lifestyle is

limited, so they often question direct interventions by authorities. In addition, citizens who are highly aware of and interested in environmental issues may also question such policy (Spaargaren and Mol, 2008; Palm, 2010).

This article examines how to integrate policy making and household everyday projects, especially in relation to energy efficiency and climate change. We discuss how policy directed toward households can be developed and improved by integrating knowledge from everyday life research in general and time geography in particular.

## Theoretical perspectives on public policy making

Public policy can be defined as the course of action or inaction taken by the state in relation to a specific issue. As an academic perspective, policy analysis refers not only to the end result, but more broadly to the decision-making and analysis of governmental issues. Policy analysis can be divided into two major fields. Analysis *of* policy is analytical and descriptive. Analysis *for* policy is prescriptive, and it is involved with formulating policies and proposals (Parsson, 1995). When analyzing policy processes from a theoretical viewpoint, the object is public decision making, including all stages from initiation to implementation and evaluation. From this process perspective, policy is not so much about single decisions or actions, and policy is assumed to steadily change and develop (Hill, 1997; Parsson, 1995): 'Policy is created when people act in confined situations and it cannot be directly derived from public documents' (Bostedt 1991, p 42, our translation).

The intention with policy instruments in the energy area is to influence processes in a way that leads to more efficient or careful use of resources and lead to a more ecologically sustainable behaviour. The instruments promoting such a development can be different and

have in earlier research also been labeled differently. Bemelmans-Videc *et a.,l* (2007) discuss in terms of *carrots*, *sticks*, and *sermons*. Sticks include regulation that the addressee is forced to follow. The carrot is economical instrument that make a measure either cheaper or more expensive to do. The sermons are informative instruments that try to influence the addressee through persuasion or giving fact in a subject. The most effective way to influence citizens is, though, to combine these three.

Lindén *et al.,* (2006) discuss policy directed to households and identifies four groups of policy instruments that have been used in Sweden: information, economic, administrative and physical improvements. Information represents different aspects of knowledge mediation such as written information, labelling and advertisements. For this policy instrument change in behaviour takes time to observe. Economic instruments include taxing, pricing, subsidies and so on. According to Lindén *et al*. economic instruments function as catalysts for changes in the future. They motivate actors to actively watch and plan their behaviour in an efficient way. Administrative instruments such as emission limits for $CO_2$, prohibitions and legislated regulations have an immediate effect and deviant behaviour is punished with negative sanctions for example by a fine. Finally, physical improvement such as energy metres, give immediate feedback and intend to facilitate new pattern of behaviour. All these four instruments intend to motivate an actor change routines and behaviour by external means.

Jackson (2005) discusses that consumer behaviour often is related to purchasing behaviours. However, not this is always so when it comes to energy use, where it often is the users' behaviours in relation to an everyday activity like cooking that affect resource consumption. In Sweden the households are targets for different policy instruments; *e.g*., carbon dioxide and electricity taxes; subsidies for installing solar panels; energy labelling on appliances, $CO_2$ ratings for cars and so on. These policy instruments are focused on purchasing behaviours.

When it comes to influencing behaviour, providing general information has been, and still is, the viable means for the government to reach and govern households.

**Households as a target group for policy**

The major tool the EU and the government can use to reduce household energy consumption will be information. According to the EU directive on energy efficiency (EC directive 2006/32) , and to the national Energy Efficient Commission (SOU 2008:25) information and education are basic and necessary, but not sufficient preconditions for achieving more efficient energy use. According to the commission, information provision can influence knowledge, attitudes and behaviour (SOU, 2008:25, p. 89). In this perspective Lindén *et al* (2006) are discussing that it is not always so that knowledge, values and attitudes in sequential order lead to behavioural change. Behaviour performed more or less randomly can also end in change of values and/or attitudes or strengthen those already existing (compare also Biel, 2003). The use of information touches on the moral aspects of household energy behaviour, rather than strictly economic ones, as households will need to become more aware of and involved in their energy consumption (Oikonomou *et al*., 2009; Palm, 2010). Households will then need to start reflecting on their energy consumption, making time diary use suitable for combining with information provision, as concluded by Karlsson and Widén (2008) in a pilot study. We clearly need knowledge of how policy can be developed and used in households to achieve energy efficiency and sustainable everyday lives.

Energy conservation can also be improved by changing the motivations of people, for example, by increasing environmental awareness or the sense of moral obligation to reduce energy consumption (Oikonomou *et al*., 2009). In this sense we can see individuals and households that take a broader perspective than a pure egoistic, people that can abstain from

profit in the short run if that is beneficial for the society in the long run (Berglund and Matti 2006; Hirsh and Dolderman 2007). This is also discussed by Stern (2000) when he acknowledges that people's values can be egoistic, altruistic and biospheric (*i.e*. concern for the biosphere). Later studies have shown that public policy on energy savings are most accepted by the public if they have altruistic or biospheric values (De Groot and Steg, 2008).

Stern emphasizes however that the driving forces behind significant environmental behaviour are complex to understand. A general environmental attitude is influenced by specific behavioural norms such as how to act in the social sphere and which expectations other people have on a person's behaviour.

Energy use occurs when people use appliances and vehicles to perform daily activities to satisfy their needs and desires. People's habits and values differ, so they think and behave differently, resulting in large variations in activity patterns and, hence, lifestyle (Karlsson and Widén, 2008). Earlier studies have observed differences of up to 300% in overall energy consumption between otherwise comparable households (Gram-Hanssen, 2004). Household energy consumption is influenced by various social practices not linked to energy or the environment, such as cosiness or cleanliness (Shove, 2003). Several studies also discuss that even if the households had a high environmental awareness their behaviour could be very energy efficient as well as inefficient when, for example, other reasons for a specified behaviour are scored as more important (Carlsson-Kanyama *et al*., 2004; Gardner and Stern 2008; Dietz *et al.,* 2009)

This is one reason why it is important to treat individual needs and wants involved in living a convenient and sustainable everyday life as a starting point when developing policy to promote energy efficiency and conservation.

**Households as part of the policy process**

As mentioned above, the household level has attracted little attention from politicians and policy researchers. One historical explanation is that, since Plato and Aristotle developed their ideas about the state and citizenship, the private and public spheres have been distinguished. The public was taken to represent freedom, morality and intellectual values while the private sphere was seen as natural, irrational and primitive.

In developing policies directed towards households, households must be given a place in the policy process, something that is not obvious in either theory or practice. Classically, the study of policy processes has applied a top–down perspective, in which implementation is regarded as a rational process, structured from above. In theory, implementation is assigned to public administration, which is regarded as a tool of the government and is therefore assumed not to influence the implementation. The process is governed by control, direct intervention and regulation. In the 1970s, Pressman and Wildawsky (1973) developed their bottom–up perspective to serve as a counterbalance. They claimed that the implementation process itself helps form policy and solve political problems. According to their perspective, public and private actors participate in policy formation and policy change, so the process cannot be specified beforehand. Later research into grassroots bureaucrats, i.e. the officials that often have influence over how policy is put into practice for example social workers, teachers, nurses, has demonstrated that both action and decisions influence policy formation (Lipsky, 1980). In Lipsky's (1980) bottom–up perspective, the focus of policy analysis is grassroots bureaucrats and their freedom of action to form the final policy outcome. From this perspective, Lundquist (1987) discusses three conditions to be fulfilled in successful implementation: the actor must understand the decision, s/he must be able to realize it, and, finally, s/he must have the will to realize it. This means that a decision must be clear in order

to be understood and an actor must have enough resources (*e.g.*, time, personnel, and economic resources) to implement it.

Traditionally, public policy implementation has not been researched at the household level, attention instead being directed towards how grassroots bureaucrats behave in the implementation phase and how the grassroots influence the content and consequences of policy. From this perspective, households are represented by interest organizations that are structured more like professional than private organizations.

Current policy research is turning its attention to the household level, giving everyday life a more prominent role in trying to deal with environmental problems; accordingly, environmental policy directed towards households should be developed. In earlier policy research focusing on the state and administration, it is obvious that the actors expected to realize policy are crucial. Similar to professionals who implement a given policy, households must also understand the policy, and be willing and have opportunities to implement it. At the same time, researchers must develop new analysis methods that take account of household-level actors. Political scientists have not been analyzing household implementation partly because they lack methods and models for doing this. Time geography and everyday life research can address this lack, contributing to and developing policy analysis.

Developing policy calls for basic knowledge of the formal and informal institutions and resources that help individual household members fulfil their everyday life projects, or hinder that fulfilment. How do rules, regulations and resources structure everyday projects at the household level and in everyday life as a whole?

**Contribution of time geography to policy analysis**

The time-geographical approach developed by Hägerstrand (1970, 1985, 1993, 2009) is regarded as an "all-ecology" by its founder (Hägerstrand, 2009). Resources used by human populations result in ecological footprints and what is used today restrict the opportunities for coming generations (Hägerstrand, 1993). To analyse individuals' contribution to resource use time geography offers concepts and especially its way of handling individuals is fruitful. In time geography individual indivisibility is emphasised, and the individual is regarded as continuant from birth (composition) to death (destruction) (Hägerstrand, 2009). Time geography assumes that time may serve as a measuring device for all existence and thereby things that seemingly are not connected still coexist in time and space and can be described and analysed together because of their time-space coordination.

Time geographers early recognised the importance of individuals' daily activities to analyse and understand society (Mårtensson, 1974) and to find out how people can arrange their daily projects depending on the location of the home and their opportunities to transport themselves (Lenntorp, 1976; Ellegård, Hägerstrand and Lenntorp 1977). Time geography has developed in several directions, predominantly however along the path set by Lenntorp (1976) on transportation in daily life (not least by Kwan, 1998, 2004). Miller has suggested analytical formulations for time-space relations (Miller, 2005). There has been critique against time geography for being unable to take aggregates into its analyses and for being traditional, masculine and deterministic (Rose, 1993). The kind of critique appeared in seminars at an early stage and was handled by Hägerstrand (Hägerstrand, 1974) and much later in his last book (Hägerstrand, 2009) and several Ph.D. theses are presented showing that time geography is nondeterministic and that subjectivity has its room in it (Westermark, 2003; Nordell, 2002). Today the time geographic methods – preferably time geographic diary and biographical methods - are imported to fields like social work (Andersson-Collins, 2009; Enoksson, 2009),

psychiatry (Sunnqvist, 2009) and occupational therapy (Erlandsson, 2003; Liedberg, 2004; Magnus, 2009).

Time geography is a useful approach when studying households and their members' actions, since it emphasizes a bottom–up perspective on everyday life. Since the time-geographical diary method can be used to capture, not just what household members say, but also how they behave, since diarists note what they do, where they are, who they are with, and the household appliances used in accomplishing daily activities – they serve as good starting points for getting a grip on household energy behaviour. Concepts introduced by Hägerstrand in 1985 – project and pocket of local order – are useful for the purpose. The home is considered as a pocket of local order, governed by household members according to an order that helps the individuals' achieve the goals of their individual projects and their common household organisational projects (Ellegård, 2001). Time geography is a contextual approach and four of its contextual concepts are relevant for discussing energy use in daily life: the *everyday activity context* which stands for the sequence of activities that the individual performs in the course of the day; the *project context*, which stands for the activities that appears in the everyday activity contexts that taken together helps help one or more individuals to fulfil their projects goals; the *social context*, which tells what other individuals are engaged when the diarist performs an activity; and finally the *geographical context*, which shows where the activities are performed.

To capture and analyze peoples' everyday activity context from their diaries, the VISUAL-TimePAcTS,[1] software was developed (Ellegård and Vrotsou, 2006; Ellegård and Cooper, 2004). We later refined this software to capture, in real time, the electricity used by activities. This updated software, VISUAL-TimePAcTS/energy use, tracks the relationship between

[1] VISUAL-TimePAcTS: VISUAL = visualization, P = place, Ac = activity, T = technology, S = social companionship; time is, of course, time.

activities, appliance use and electricity consumption (Ellegård *et al*., 2010). A model for recording electricity use has been developed by Widén (2009). Both software programs handle several levels of aggregation, *i.e*., individual, household, group and population, though they both use the individual as a basis for analysis.

Though the software visualizes individuals' everyday activities in a systematic and standardized way, individual diarists can usually still easily recognize their own daily lives when the graphic output is presented to them (Nordell, 2002; Westermark, 2003). In addition, the software can visualize several household members' activity sequences in the same graphic output (Ellegård *et al*., 2010). The activity sequences describing everyday life of household members might be used as starting point for interviews discussing how and why household energy consumption has its present form. The graphics derived from diaries permit household members to reflect jointly on how and why their activities are interrelated and why their activity patterns look so different – or similar – over the course of a day and week.

Time geography also helps us focus on the resources individuals control and on the restrictions on their opportunities to make good use of their resources. A main time-geographical concept used in analyzing the resources needed and used for individual (and household) everyday activities is that of project. A project is defined as a set of activities arranged to achieve a certain goal (Hägerstrand, 1985; Ellegård 1999; 2001). Projects appear at different levels (i.e., the individual, household and organizational levels) and may have different time horizons. The overall project assumed to be shared by everybody is to 'live life' as well as possible given the resources at hand. In this context, a short-term project might be to 'cook a meal.' This project can be realized by one or more individuals performing certain necessary activities, including preparing to realize the project by assembling resources in time and space (*e.g*., ingredients, knowledge, tools, appliances, water and electricity). From

visualization of the everyday activity context and activity sequences of the individuals involved, the project context is identified and can be analysed in depth.

Individuals striving to achieve their project goals will approach restrictions that limit their possibility of success. The time-geographic concept referring to restrictions is constraint (Hägerstrand, 1970; Mårtensson, 1979) which also is closely related to the time-space prism (Lenntorp, 1976). Three types of constraints hinder individuals from performing activities planned in order to achieve a project goal: *authority constraints*, *i.e*., what the performer is allowed to do and by whom during the period allotted and at the place where the activity is planned to be performed; *capacity constraints*, *i.e*., whether the performer has the required abilities and commands the resources needed to perform the planned activities; and *coupling constraints*, *i.e*., whether the resources and people required can be marshalled at the right place during the time allotted for the activity. Analyzing coupling constraints can reveal shortcomings in the organization and logistics of a project in relation to the structures supplied by the local environment.

**To start in everyday life activity patterns**

The development of household-relevant policy should take as its starting point the time-geographical opportunities to research projects, to visualize daily activities and discuss the constraints encountered. The challenge is to capture the unique and complex, intertwined everyday life activity pattern of each household, while demonstrating that there are basic patterns common to many people and that many habitual behaviours resemble each other. From this, it is possible to group individuals and households in clusters. The combination of uniqueness and similarity can be revealed by using a software program (Vrotsou, 2010).

When developing the software and demonstrating how it works, we used a database consisting of the time diaries of 463 individuals from 179 households, for one week day and one weekend day per person.[2] The software helps visualize peoples' activities performed as a sequence in the course of the day, from midnight to the following midnight, just as they are written in the diary. The sequential visualization of activities explains why people find it easy to recognize their days from the software output (Ellegård and Nordell, 1997), making it a good way to begin discussion of how to change a household's everyday activity patterns. Discussion starts with the sequence of today's activities (*i.e.*, the visualization of the diaries); from there, it can be judged whether it is possible to change the activity sequence and still reach the project goal, who in that case will perform the activities, and whether the activities can be performed more sustainably.

Figure 1 presents a visualization of all activity sequences performed by the 463 individuals in the database population. There are seven activity categories, which together consist of approximately 600 more detailed activity categories, coloured according to the legend in the figure. The individuals are ordered by gender and age. Men are displayed to the left (above the red bar at the bottom of the figure) and women to the right (above the green bar). The youngest individuals are placed to the right and the oldest to the left within each gender group, indicated by the bar just above the gender bar ranging from white, *i.e.*, 10 years old, to dark grey, *i.e.*, 97, the age of the oldest individual. The activity patterns of most people are similar in some ways: they sleep at night (green), travel (yellow) to and from school and work (both coloured red), and perform recreation/reflection activities (dark lilac) in the evening. Children's school days are shorter than the adults' working hours. The pensioners do not

[2] The diaries were collected in a pilot study conducted by Statistics Sweden in 1996. The age span of participants was from 10 to 97 years, and the study included households of various sizes from various parts of Sweden. Though this empirical material is old and much has happened concerning electricity efficiency since it was compiled, it was the sole existing data set with which to test our model. It is not difficult to change the parameters for the electricity consumed by various appliances.

work, and their midday is dominated by housework activities (pink). The overall women's activity pattern appears more 'transparent' than that of the men, since women do not do as much paid work; instead, for example, they prepare food (dark blue), take care of children (turquoise), and do housework (pink) more than do men.

Figure 2 presents just the cooking activities performed by the population of 463 individuals. Not all individuals cook, especially not the youngest ones, and more women than men cook. People cook more in the afternoon than in the morning. On the right in Figure 2 is the energy consumption graph. Since cooking is largely a women's activity, policies that strive to improve energy conservation via more efficient cooking behaviour should be directed towards women.

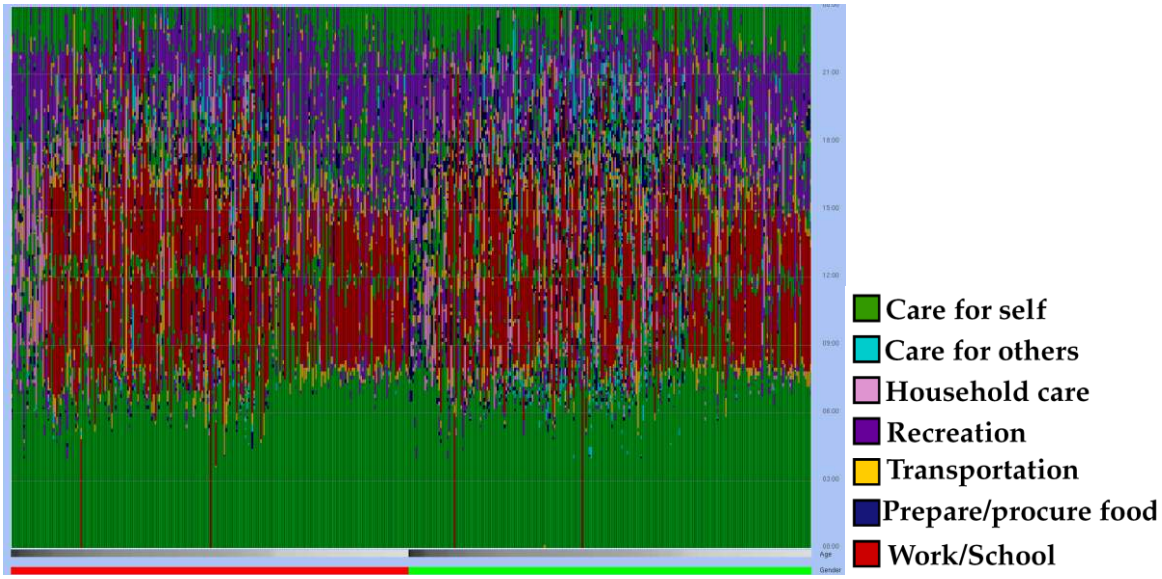


**Figure 1** The weekday activity pattern of a population based on the activity sequences 463 individuals recorded in their time diaries. Time, on the *y*-axis, should be read from bottom to top. Each individual is accordingly represented by a line, and the activities performed are coloured according to the colour legend. Activities are presented in sequence and should be read from bottom to top. The individuals are ordered along the *x*-axis according to gender (the gender bar at in the bottom of the figure is red for men and green for women), and age (the age bar just above the gender bar is white for the youngest and dark grey for the oldest individuals in each gender category). The dominance of sleep during night-time hours (green, care for oneself) and work/school

activities during daytime hours is prominent. Travel to work/school in the morning and after these activities in the afternoon is indicated by the yellow parts of the line. In the evening, reflection/recreation activities (dark lilac) dominate, the most significant of them being watching TV.

From the total picture of all activities performed by all individuals in the population, presented in Figure 1, those activities that are most interesting for the purposes of the study can be extracted. An example is shown in Figure 2, which visualizes cooking activities (in the 'procure and prepare food' activity category, coloured dark blue) together with electricity use per individual in the course of the day (the model used for calculating electricity use is presented in Widén, 2009). Electricity use for cooking peaks at approximately 1700 hrs (cooking dinner) and there are two lower peaks, for cooking lunch and breakfast. Women cook much more than men do irrespective of the meal, and the longest duration of cooking appears in the afternoon, a pattern that is especially striking among the elderly. Very few, if any, children cook.

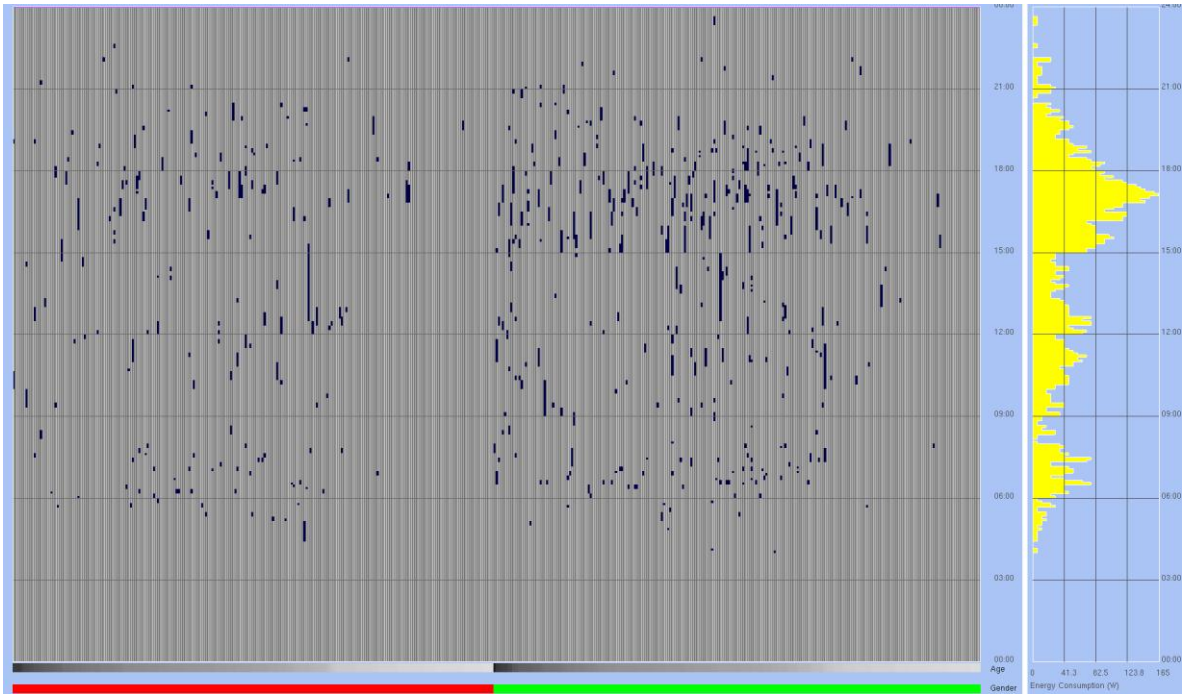


**Figure 2** The cooking activities (dark blue) extracted from the whole activity pattern presented in Fig. 1; the energy consumed by cooking is shown in the graph to the right. It is obvious that women cook more than men

do, that cooking is more common in the afternoon than in the morning, and that neither male nor female children cook.

Electricity consumption is not always directly linked to any one specific activity, as in Figure 2. Televisions, for example, are often kept turned on even while people are doing something else. This is shown in Figure 3, in which the electricity consumption graph for televisions (the middle part) is related to the activities people perform (the left part) while their televisions are on. The right part of the figure shows the number of people actually watching TV. In the daytime, televisions largely seem to be kept turned on for 'company' when people are doing other things; the same phenomenon appears again at 2100 hrs.

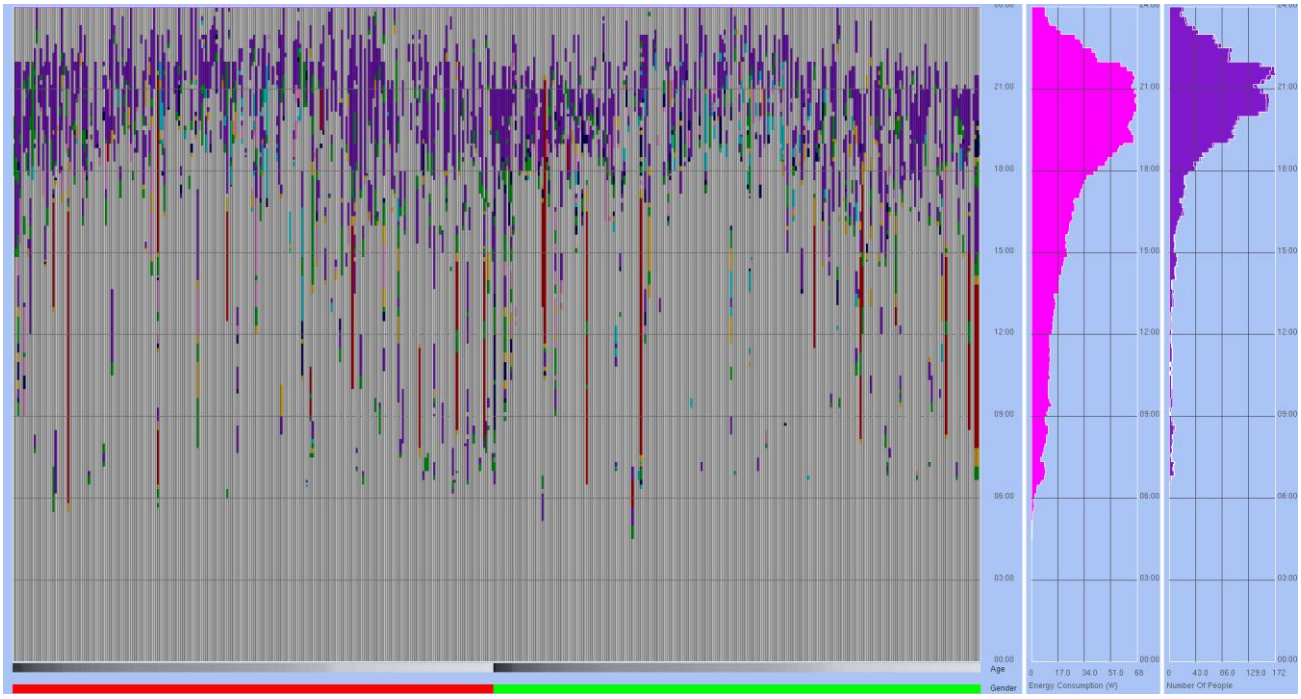


**Figure 3** The electricity consumption of the population's TV use related to peoples' activities, showing that people keep the television turned on while doing things other than watching TV (*e.g.* working, preparing food, and taking care of children). The activity colour legend is presented in Figure 1.

As shown in Figure 3, people do not always use appliances only for their intended purpose. Using television for 'company' means that more electricity is being used than would have been the case if the television were just being used for watching programs. Electricity use

resulting from having a television thus fulfils more than one purpose, *i.e.*, TV viewing and company, but household-directed policies aiming at changing energy-consumption behaviour do not take such variation into consideration. Sometimes policy implementation might fail because households, while knowing about a specific energy conservation policy, lack the requisite knowledge to put the policy into action. Other times households do not understand how to implement a policy because they lack knowledge even of its existence (Palm, 2009).

Still another explanation is that coupling constraints in everyday life hinder policy implementation. Using the software, researchers can identify constraints that make it impossible for a mother to travel more energy efficiently by public transportation instead of by car, since she must be at home to take care of the children before the father has to leave the home for his evening work (see Figure 4). Policy directed towards this mother and her household, to encourage them to increase their public transportation travel, would be wasted, at least until the children are old enough to be alone and take care of themselves for a while.

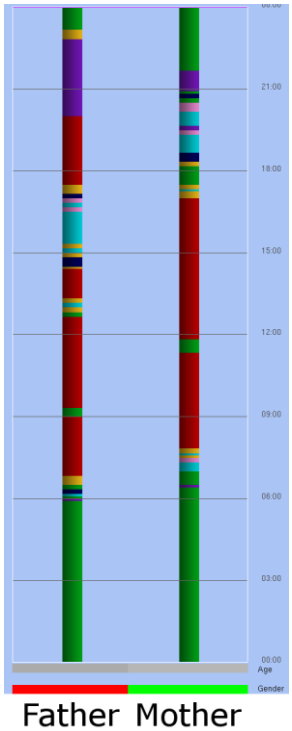

**Figure 4** The mother (right) and the father (left) in a two-child family living in a large city and having two cars. Both children are under 10 years old and both the mother and father work outside the home. This day the father must go back to work (red) at approximately 1730 hrs, so the mother has to rush home by car (yellow) after work (at approximately 1700 hrs) to be with the children. The father has picked them up at the day care centre at approximately 1500 hrs. The activity colour legend is presented in Figure 1.

Many households' daily activities consume electricity since they use electrical appliances; some electricity-dependent activities are integrated into the software and can be shown on the energy graph. In Figure 5, the electricity use in one household is displayed as it appears from the software.

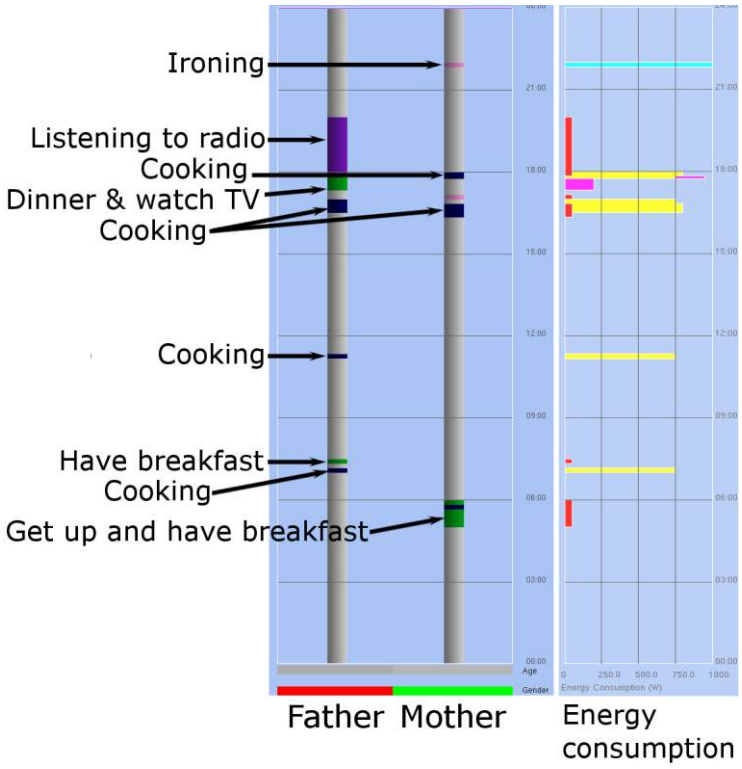


**Figure 5** Electricity consumption resulting from various activities: listening to radio (red in the energy graph), watching TV (bright lilac in the energy graph), cooking/preparing food (yellow in the energy graph), and ironing (turquoise in the energy graph. The activity colour legend is presented in Figure 1.

It is well known that it is important if household members are to start behaving in line with policies. When policies directed towards households are being developed, it is common to tailor the associated information campaigns towards an 'average Mr. Swede' (*Medelsvensson*), so the information can be expressed in terms understood by householders. The problem is that the 'average Mr. Swede' approach does not recognize and capture the complexity of everyday life; 'Mr. Swede' does not resemble anyone, so people cannot recognize themselves in him, making him uninteresting to most people.

The software may also support the further development of the 'average Mr. Swede' concept. For example, instead of tallying the average timed use for everyday activities and treating these averages as the properties of 'typical' individuals, *i.e*., Mr. and Mrs. Swede, the software can be used to cluster individuals (or households) according to the similarity of their actual activity sequences. This would allow a new kind of typicality to be formulated, one that helps people recognize themselves in one of the clusters.

Time-geographic methods for description and analysis thus complement the 'Mr. Swede' approach, taking their point of departure in the great variation of everyday life, as noted in people's time diaries. A step beyond socioeconomic and demographic groupings of individuals is taken when individuals are clustered according to their activity sequences. These new clusters may help in identifying policy measures that people find actually apply to their own everyday lives. From this point, individualized information can be developed and directed towards individual households. Such personalized information campaigns have been demonstrated to reach households better than general information campaigns.

## Conclusions

Public policy on more efficient energy consumption and on climate change mitigation needs more informed knowledge about households' everyday life activities, since these activities are parts of projects people want to realise and the activities give rise to household electricity consumption. Everyday life activities can be analyzed and understood by taking the point of departure in household projects.

In policy making the traditional way to influence energy related behaviour in households have been through general public information. The software here discussed will provide more qualified information; first by showing electricity related activities at macro level spread over the population and second giving more detailed information to individual households.

This could help policy makers to better adapt information to target groups simply by adjusting information relevant to the household level. Policy makers can use time diaries as a way to recognize and visualize the great diversity of everyday projects in the household sector. The software based on time diaries is useful for learning more about everyday projects, including activities that need energy, to the benefit of policy-makers and others who want to reach householders with tailored information about energy efficiency. However, time diaries are equally useful to households as a reflective tool when discussing families' daily lives in relation to energy consumption. The method provides direct feedback to households and the information is valid directly applicable since it emanates from their own reported activities. On this basis, it is possible to begin discussing how activities can be changed without affecting the values and routines that households believe help maintain their good life.

Household energy use is a collective rather than individualized process. The software let us focus on the coupling between members of households, which will bolster our understanding of energy consumption in everyday life. This coupling of members is increasingly being

recognized, and households will be a key unit for analysis in the future. Therefore, policy would perhaps benefit from targeting household rather than individual energy consumption.

The software has the potential to identify clusters of households or individuals with similar energy consumption patterns. It could serve as a tool for developing policy to promote energy efficiency tailored to specific groups or households with particular characteristics. Identifying clusters of households with similar activity patterns can contribute to more effective policy interventions and be used to assist in policy development.

By integrating the conceptual framework developed within time geography, the present approach will help pinpoint problems relating to how various households or household clusters use energy and help policy makers address their activity patterns and formulate suitable policy. This integration has great potential that merits further exploration.

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