Users and Energy Saving – Their Perspectives and Needs

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Abstract. It is becoming increasingly important to create a sustainable environment for the future. This is a problem that is recognised but it still not evident what kind of solutions that would be beneficial and useful. However, one important step is to reduce the energy consumption. In Europe, 25% of the total amount of energy being consumed is consumed by private households. Hence, if private households decrease their energy consumption this would contribute to the environment in positive ways.

The aim of this paper is to describe what kind of needs users have related to energy consumption and solutions for that. Our study have been carried out in a project called Smarties in which the objective is to develop solutions that stimulates users to decrease their energy consumption. This paper reports on the users needs related to their current energy consumption situation, the actions they want or can take, and the possible future solutions they want to se.

1 Introduction

Human life is dependent on a healthy and natural environment, which is rapidly degrading (Watson et al., 2010). It is therefore of utmost importance to work, on a worldwide scale, to create a sustainable environment for the future. Although the international determination to achieve environmental sustainability has been clearly articulated, considerable uncertainty remains at individual, organizational, societal and governmental levels about many aspects of both problems and proposed solutions related to a sustainable environment (Elliot, 2011). Creating a sustainable environment includes economical, ecological and social aspects (SKR, 2004), which makes it a complex and multifaceted task to work with.

According to Elliot (2011) there are several issues that needs to be addressed within the area of sustainability including what do we mean with environmental sustainability, what are its main challenges, what is being done about these challenges, and what needs to be done. The last issue is perhaps the most difficult one to handle and know what to do with. One thing that is certain is that public participation is of vital importance to succeed with initiatives that contributes to a sustainable society. The roles for individuals and the means of motivating them to really change their behaviour is still unclear (Elliot, 2011).

One part of the work towards a sustainable environment is to decrease energy consumption. In Europe, households' energy consumption stands for approximately 25% of the total energy consumption. Hence, an important factor when it comes to saving energy is humans and their behaviour, but knowing which approach that gives the most sustainable solution on a longer term is a complex task.

According to Caird and Roy (2008) the energy efficiency market is dominated by a techno-centric model of innovation that assumes that consumers are rational decision makers who will adopt energy saving technologies and use them effectively as soon as they become aware of the benefits these systems have both from an environmental and an economical perspective. Caird and Roy (2008) claim that several researchers suggest that people's motivation and actions related to energy use are more complex than has been acknowledged in previous studies. In addition, people have different lifestyles and needs, and generic appeals to become green can raise awareness and change social norms (Watson et al., 2010).

A lot of people are unaware of alternative paths they can take to reduce their energy consumption and as energy is invisible it is difficult for people to be aware of their

consumption. Consumers need information on their personal energy consumption so that they can make changes in their energy consumption behaviour (Watson et al., 2010). The effect of feedback on energy consumption behaviour have, according to Broms et al. (2010), recently been the focus for several researchers, and its success is well documented (Lund and Krogstie, 2011). For instance Darby (2000) concludes that the norm for saving energy in households from direct feedback ranges from 5 to 15 %. Even though this is known, there are several aspects of people and energy saving that are still unknown, for instance, what motivates users to change their behaviour on a long-term (Broms et al., 2010), what information do consumers need about the usage of the objects they own or manage to increase their energy efficiency (Watson et al., 2010), or how can energy information systems be designed (Melville, 2010).

The objective of this paper is to describe private persons needs related to energy consumption in their homes. In more detail, we will illustrate how people talk about energy saving, which actions they have taken or can consider to take to lower their energy consumption and what kind of technological support they would like to have to support them in changing their energy consumption behaviour.

The paper will start with an introduction to the area of user needs, different perspectives on user needs and how these can be understood and identified. Thereafter, the Smarties project in which the study has been carried out is presented together with the methodologies applied. Than the results from the user participation sessions are presented followed by a discussion of different type of needs related to energy saving and finally, the conclusions that can be drawn from this study is presented.

2 Users Needs

In this paper we will report on the results from a needfinding study carried out with users in a project aiming to develop energy saving services. The aim of the user involvement sessions was to gain insights into users situations and actions related to energy consumption and saving. The study will be described in more detail in the next section of this paper. Firstly an introduction to the area of user needs and motivation will be given.

It is commonly known that it is important to understand users needs and requirements when an IT system is developed to increase the likelihood that the users will adopt and enjoy using it. It is therefore important for developers of IT systems to have a holistic understanding of the users' current situation, the actions the users perform and the aim they have with their actions. In order to facilitate the adoption of an IT-system it must support users in achieving their goals, and based on the collected knowledge gained in these inquiries, a set of systems requirements can form a starting point for the forthcoming development of the system. Preece et al (2002) refer to this process as the identifying needs process, which has the end goal to produce a set of stable systems requirements. However, the identification of needs and the establishment of requirements is not an easy, straightforward process with a defined start and end. In every phase of the development there are many things that needs to be known and clarified about the current situation. Some of the important knowledge we need about users already is known; for example, knowledge about people's short-time memory that greatly influenced how we can design IT systems to support users without overloading their memory. This knowledge is related to human characteristics in

general, which is important, but it is equally important to get to know the particularities among the group of users the system is aimed for (Jones & Marsden, 2006).

To understand a particular group of users and their situation, different data collection methods can be used to observe and probe people and their current situation. To support their activities more effectively it is important to strive for a thorough understanding of how users' capabilities, their actions, and goals, could be achieved by different means. One approach to understand users' needs is to study current and past behaviour since already established behaviour influences what is possible to implement successfully in the user's context. In addition, every implementation of a new system implies that a cultural change must occur in the user's context, and it can be resource consuming to change users' behaviour and habits (Nielsen, 2003; Preece et al., 2002; Sharp et al., 2007).

Having said that, it is easy to get the impression that getting an understanding of users' needs and their situation is a straightforward process in which users are observed and/or asked about their situation and in which the findings are obvious and can be summarised neatly into for example, personas or scenarios. This often is not the case. For instance, users can have difficulties articulating and explaining their needs (Holst & Ståhlbröst, 2006; Robertson, 2001); they also might have needs they are not aware of in their current situation which complicates their ability to express what they really need (Hyysalo, 2003; Salovaara, 2004); and even if they are aware of their needs, they might forget to express needs and requirements that they are accustomed to having in their surrounding (so-called expected requirements (Kano 1984)). Hence, expecting users to be able to express their needs and requirements explicitly might lead to important aspects are missed, according to Robertson (2001). Users also can have an idea of what they think is technologically possible to achieve and they also consider different kinds of constraints in their context. Thus, they might avoid mentioning requirements and needs they believe cannot become fulfilled based on their understanding of the constraints (Robertson, 2001). Additionally, users sometimes become used to obstacles in their environment and find alternative ways to perform their tasks, and this can influence their awareness and possibility of expressing what they need (Patnaik & Becker, 1999). To stimulate the process of gaining insights into users' situations and their needs, it is useful to give the users something to relate to. When users gain more knowledge and insights into possible solutions, they also expand their needs (Dennis et al., 2002).

One traditional view of user needs in user-centred processes is based epistemologically on the assumption of an individual user who has needs and requirements related to a particular piece of technology. According to Hyysalo (2003), this assumption includes three important limitations when it comes to understanding new technology. First, it does not take into consideration the way technologies are used together. New technology enters the life of users' contexts that already are crowded with other technologies. Hence, dividing human subjectivity into desires for characteristics of a particular piece of technology does little justice to the way people actually use technology. Second, the traditional individualistic perspective takes no notice of the interactive and social aspect of the technology use. Today many technologies are developed to support interaction and cooperation among several users spread out all around the world. Third, the standard perspective takes users'

preferences and needs as something that is given or pre-existing and, as such, can be recognised and met. While this presupposition may fit established products, it has its limitations when the technologies, as well as their users, are new (Hyysalo, 2003). In addition, the assumption that users have needs, or want new technologies, assumes that users want, or can, use technology. Following that, the desire to use technology becomes the norm of society (Nyberg, 2008). The notions of user need should be understood as an evolving relationship among the users, the communities in which they participate, and the related technological environment (Hyysalo, 2003).

When striving to understand users and their needs there are usually two different perspectives on how this can be achieved. One is the locating perspective assuming that needs and requirements are something that actually exists and they only needs to be identified. With this view follows that needs can be expressed by someone and that the needs are stable and recognisable. In some cases, this is true; users might be very aware and familiar with their needs related to an IT-solution, but often this is not the case. The other perspective is the constructing view (Imaz, 2006; Sharp et al., 2007). This perspective is more sensitive to users' needs and it represents the view that needs and requirements can be generated, or constructed, from understanding and interpreting data about the users, their activities and goals. Following this line of thought, needs are emergent; they are socially constructed by the interactions between users and developers in the development process (Flynn & Jazi, 1998).

Included in the constructivist perspective is the view that the outcome of any study is not a description of how things really and truly are, nor are they representations of how the reality functions. In this perspective, there is no reality except the one that people co-create as they try to make sense of their world. With that perspective, the findings from any constructivist study are not facts in some ultimate sense; rather the findings are being created through an interactive process, and the outcome from this process are constructions that represent the reality of that specific case (Guba & Lincoln, 1989).

2.1 Identifying Needs

In the following section, a presentation is given of the perspective on needs inspired by market research and the product development areas. From our perspective, these are relevant since these areas grapple with similar issues as the IT-systems development area regarding involvement of customers.

A need also can be expressed as a perceived lack of something. Therefore, the process of finding needs can be viewed as a paradoxical activity, since what is sought actually is a circumstance whereby something is missing (Faste, 1987; van Kleef et al., 2005).

Other definitions of customer needs can be found in Patnaik's article "*Systems Logics: Organizing Your Offerings to Solve People's Big Needs"* (Patnaik, 2004), in which he states that people have differing types of needs from immediate to more far-reaching. The challenge is to be able to distinguish among these needs and rigorously map out effective solutions. Patnaik also argue that not all needs are created equally; people face different challenges in their daily lives with all their different problems, the goals they want to achieve, and their ambitions.

Patnaik clusters customer needs into four different types: Qualifier Needs, Activity Needs, Context Needs, and Common Needs, see table 1 below.

	Qualifier Needs	**Activity Needs**	**Context Needs**	**Common Needs**
Stem From	Are a results of problems with existing solutions	Result from specific activities a person perform	Result from the situation in which people live, work, operate, are goal-oriented	Needs of nearly everyone
Existence	The same need exists for everyone using the same solutions in similar ways	Needs are the same for all who want to do the same thing	The same need exist for people operating in the same context	Most fundamental and universal need
Usually Solved By	Disappear if current solution is redesigned	Disappear if current solution are made obsolete	Changes in the context or change context	Met by more immediate needs
Awareness	People are aware of them	People are aware of them	People may not perceive or immediately articulate the needs	People are aware of them
Described By	Can be describe in terms of changes	Described in terms of existing product or service solutions	As long as context and conditions remains the same the needs will continue	
Satisfied By	New Features New Offerings	New Offerings New Families	New Families Systems of Solutions	Systems of Solutions

Table 1: Types of Needs and their Characteristics based on Patnaik (2004)

Some human needs are a result of a current situation and will disappear when the current situation changes. Some needs are created by a solution to other needs and the most universal needs are related to long-lasting problems that cannot be fixed by a single solution. Following that line of thought, needs can be characterised by their relation to current solutions, situations, and behaviour (Patnaik, 2004). The differentiation of people's needs provides a way for companies to act on insights they have about their customers. Qualifier Needs suggest immediate actions a company can take to improve their current offerings. To meet those needs, a company may have to modify an existing product or service. Activity Needs may require a company to create a completely new offering. Context Needs provide focus for a firm's activities, showing where different offerings might provide complementary effects, and Common Needs indicate areas for long-term strategic actions.

This framework, Patnaik (2004) argues, captures vital customer information often lost in current research methods. Typically, product developers seek information they can act on and usually end up with a list of qualifier needs that only leads to incremental improvements of their current products. Common Needs and Context Needs often are disregarded or go unexplored because firms do not have a strategy for using them.

When this happens, companies lose the opportunity to create more valuable, profitable, and strategically powerful solutions for their customers (Patnaik, 2004).

3 The Smarties Project

In this paper, we are reporting on the results from an on-going project called Smarties. This is a project carried out in collaboration between Iceland, Sweden, Norway, Denmark and Lithuania. The project started in 2010 and will end in December 2012. The overall objective of the project is to exchange, analyse and disseminate Smart City Living Lab pilot initiatives in the area of Energy saving towards successful implementation of a Nordic transnational best-practice Smart City Living Lab pilot. The projects focus on energy saving solutions for individual households, in private houses and in transportation. In doing so, user needs and ideas are the key drivers, and the project aims to use existing knowledge on user-driven innovation methodologies and available technical solutions among partner networks, in order to:

1. increase the knowledge of Living Lab key characteristics and their indicators
2. innovate on technical energy solutions that are tested in real life settings
3. create higher visibility and innovation capacity among Nordic Living Lab actors and their partners and stakeholders by cross-border collaboration, shared Living Lab knowledge and development of joint Living Lab resources.

These objectives are achieved by bringing together main Nordic Living Lab actors and their research-partners in the area of Smart City Living Lab Research Development and Innovation-processes together with their co-partners from industry and public authorities.

3.1 Methodology Used

In this project, an iterative and cross-border collaborative process has been applied. The process started with a baseline definition and best-practice sharing phase in which all Living Lab partners have been involved and shared their experiences with the objective to provide a research-based baseline for a Living Lab approach through different existing Smart City Living Lab pilots. This phase served to bring existing knowledge, evidence-based methods and approaches for Living Lab activities, and user needs, together with innovative ideas and solutions among different partners.

In the project, three iterative phases following the FormIT Living Lab methodology has been applied (Ståhlbröst & Bergvall-Kåreborn, 2008, 2011). The first phase focuses on Needfinding and idea generation (which is reported on in this paper), the second on concept development and beta-test, and the third is the test of the final system. The first phase has been carried out through needfinding and idea generation sessions with users where they have talked about their needs and problems related to energy consumption and saving, and they gave ideas and suggestions on innovative energy saving solutions. This process has been carried out in all countries using a common approach . The results from these sessions were gathered and distributed among the project partners who then developed two energy-saving service scenarios that were presented and discussed in workshops in which a diversity of actors within the energy area participated. The objective of the workshops was to encourage them to collaborate and develop ideas for innovative energy services inspired by the results

from the user involvement sessions. The results from the user involvement sessions were summaries in short cartoons and series strips in which the essence of the users expressions were explained and put into context. The actors involved were experts in energy saving solutions and they reflected on their involvement on the most applicable solution for them. The energy market actors could then apply for funding from the Smarties project to develop an energy solution that will be tested cross-border. In detail, the activities in the project are: (1) Needfinding and idea-generation, (2) Concept development, (3) Development of solution suggestions, (4) Solution implementation, (5) Pre-pilot and (6) Trans-national pilot. In this paper, the focus is on the needfinding and idea generation process.

3.2 Session methodology

In the needfinding sessions, 9 users interested in energy saving were invited through the five Living Labs involved in the project. It was 8 men and 1 women and their age spanned from 25-65 years of age. The sessions lasted between 1-1.5 hours and they were semi-structured. For these sessions a question form and a powerpoint presentation were developed to ensure that the same aspects were covered in the discussions. The session started with a short presentation of the project and its aim, we described the process of the session and a short presentation round of all participants was done. In the next part of the session, question areas were discussed among the participants. The question areas focused on aspects such as , their energy usage today, how they use IT-tools and their perspective on energy saving. Thereafter some stimuli were shown in terms of pictures of different energy saving solutions and a film on how to save energy followed by a discussion on how they would like to save energy and the users view on services they would like to use to stimulate them to save more energy. Then the session ended with a slogan competition combined with a picture for a badge where the participants could win a surf pad e.g. an Ipad.

4 Results from the sessions

In the following our analysis of the interviews are presented. These results are the first analysis where we have clustered the results into five themes. These themes are ICT usage, Current situation, Actions, Future solutions and Needs.

4.1 ICT Usage

The participants involved in this study were all mature ICT users who use computers on a daily basis both in professional and private use. They have the mobile phones available always and most of them use smart phones and some of them have also started to use surf pads. For these participants, the computers are mainly used for work-related tasks such as writing documents, drawing, mail and so forth and to search for information. One of the participants reflected on how dependent he had become of computers and smart phones, "*When your computer is broken and you are without computers for a few days you start realizing how dependent you are. It is almost scary"*. The usage of devices also differs at home where some people carry their surf pad around to search for information when they, for instance, sit in their sofa watching TV. The laptop, or stationary computer, is usually in another room and

is not carried around in the same way due to its weight and size. Here the surf pad is much more useful, they state.

4.2 Current situation related to energy

Most of the participants in this study are not very interested in energy saving, they state that it is mainly during winter they keep track of their energy and electricity consumption. In the northern parts of Europe, energy is mostly used for heating up the houses during winter while very little during the summer. In the city, in which this investigation took place, the cost for electricity and energy is rather low since the houses are heated with district heating produced from surplus gas from a large plant in the area and the electricity comes from water power. This somewhat demotivates the users from changing their energy consumption behaviour since they think that they have both low prices and it is an environmental friendly production. Also when the users live in an apartment, the energy consumption for heating is included in the rent, hence the users states that they do not have any incentive or enough insights on how to change their consumption behaviour. In their current situation, the users express a difficulty to know how much energy the devices in their home consumes when they are used or in standby mode. Currently, they only know their consumption in kWh on a monthly basis.Hence, most users have a basic understanding of their electricity and energy consumption from a high-level perspective, but they have less understanding of, for instance, the costs for heating warm water or the cost for using a washing machine.,

4.3 Actions

This theme refers to the actions the users have taken to save energy, or the actions they think that they could take to lower their energy consumption. Related to this theme almost all of the users involved in this study have changed their light bulbs to low energy or halogen lamps. However, installing these has decreased their motivation to turn the lamps of, hence it is difficult to know if they are actually lowering their consumption. Among the private house owners some have installed heat pumps and triple-glazed windows to lower their energy consumption and most of the users have installed district-heating systems in their homes.

The users are also looking forward to the hourly measurement of their consumption mandated from 2016 since this will make it easier for them to keep track of their consumption and to acknowledge if they deviate from their normal consumption. The users also talk about solutions that are common in public buildings such as motion detectors for the light, doors that open and closes automatic and sensors that feel how much heating or cooling that is needed in a building related to how many people there are in that building at the moment. These are all solutions the users could consider installing in their houses, but the motion detector is the most appealing solution if they were cheap and easy to install, especially in spaces that are not used so frequently.

Other actions the users in this study have taken to save energy are that they have changed their dish-washers to energy graded appliances, they have it a bit colder in the rooms they are not using frequently and they have isolated their houses. They also think that they could turn off their computers during night, they could take shorter showers and they could turn off all devices that have stand-by mode. These

are all actions that would not decrease their comfort level in their homes, even so they have not implemented them yet.

4.4 Future Solutions

In this theme we have chosen to gather all the solutions the users have expressed in the focus-groups. Some of these solutions are possible to implement today, and some of them are of more future oriented character. We call them future solutions because they represent solutions the users view as futuristic.

The users stated that for them it is not most important to save energy, but to consume the right type of energy. The future climate is the most important incentive from an overarching perspective, or at least is should be, the amount of money that can be saved is not as important even if it might trigger behaviour changes to some extent. The users expressed that they would like to have a solution that split their consumption into more detailed information. For instance, they want to see how much electricity their devices consume, they want to see the cost for heating warm water and they want to see how much energy that is used for heating their homes.

The users also said that they want to have an energy visualisation tool in their mobile phone. They want this solution to be web-based and easy to understand both for children and adults. To increase the understanding of the consumption one approach to visualise the consumption, or the savings, could be to express it in monetary terms.

The users also say that they want to be able to both monitor and control their energy consumption. For instance, they would like to remotely turn on and off devices in their homes or control the heating in their summer cabins. They also want to have continuous feedback on their consumption and through some type of intelligent system get suggestions on actions that could be taken to decrease their consumption. Including in these solutions the users also expressed a desire to have a solution that alarms them when something is wrong in their house.

Solutions that would motivate the users to lower their energy consumption are games. Related to that, the users said that they might consider to compete with other similar houses on energy saving. They also suggested that they could participate in a "neighbour feud", in this feud both apartments and houses could participate. Also those renting apartments could compete against each other and the winner would get a lower rent for a month.

From a more overarching perspective, the users expressed that they wanted to know which energy provider that produces green energy. For instance, they want a solution that makes it possible for them to select the energy providers they want to get their energy from. In this solution, the users wants to see where their energy come from, the prices etc. They also suggested that the government could give advantageous loans for energy investments for private persons with very low interest so that these investments would pay off faster.

5 Different Types of Needs Related to Energy Saving

In this section we will discuss different types of needs stemming from what the users have expressed in this study. These needs have been generated, or constructed, from the users expressions and our interpretation of them, and they will be discussed in

relation to common, qualifier, activity, and context needs based on Patnaik's (2004) clusters.

A *common need* is characterized by that nearly all people experience the same need (Patnaik, 2004). A common need that can be identified in this study on a general level is that users want to have immediate access to energy and electricity when their need emerge. These common needs are usually met by more immediate needs, which in this situation can be that the users want to use their electronic devices whenever they want to, or have warm houses regardless of season. These needs are satisfied by systems of solutions such as the power grid and different types of energy sources such as wind power, hydropower and nuclear power.

The second cluster of needs is the *qualifier needs*. These needs are a result of problems with existing solution (Patnaik, 2004). The qualifier needs that have been observed in our study are the users needs to monitor and control their energy consumption. With todays solutions it is difficult to monitor the energy consumption instantaneous. Several existing solutions can provide feedback on the instantaneous electricity consumption for the household as a whole, but few solutions support the monitoring of the energy consumers in more detail. In addition, some solutions give feedback on individual energy consumers, but they do not provide an overarching perspective. Hence to gain understanding from both a holistic and detailed view, a combination of several diverse solutions are needed which makes it difficult for the users to install and use it. From a control perspective the same situation exist with dispersed solutions. There are solutions that remotely can turn off and on devices, and there are solutions that support control of different appliances through a timing device. Hence, these solutions to not support control over the energy consumption from an overarching perspective and existing holistic solutions such as smart home solutions are experienced as too expensive to be installed in older houses.

By monitoring the energy consumption, the users want to increase their understanding about their consumption. Currently, energy is an invisible resource; it is the actions the energy enables that are visible. Thus, it is hard to gain a deeper understanding of energy consumption for people in general. With current solutions the consumption is like a black box, the users receive a bill and a sum of consumed kWh at the end of the month without knowing which device or activity that has consumed what. This makes it very hard for the users to understand their consumption and to alter their behaviour into becoming more energy efficient.

Another qualifier need that has been generated in this study is that the users want to contribute to the environment by lowering their consumption and they want to consume the right type of energy. These needs could be met by introducing new families of systems such as a the system suggested by the users where they want to be able to choose their energy provider based on how "green" they are in combination with their price.

An *activity need* is generated as a result from specific activities a person performs (Patnaik, 2004). These needs are the same for all who want to do the same thing. Related to that, this study shows that users have a need to get direct feedback on their energy saving activities. If the user changes, for example, light bulbs s/he wants to receive feedback on how much energy (and money) that has been saved for a defined time frame. Another activity need that has been generated based on this study is that most people constantly use their mobile phones, hence they wants to be able to

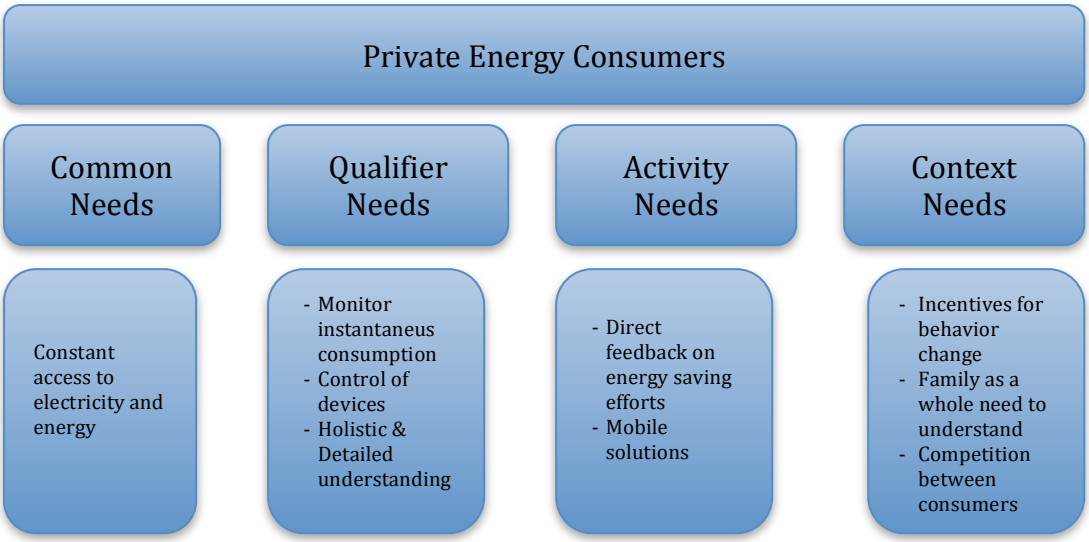
control and monitor their energy consumption independent of location. This calls for a new offering from energy providers that support the mobile access.

Finally the *context needs* that are constructed from the situation in which people live, work, and operate on a daily basis. These needs are goal oriented (Patnaik, 2004). This study was carried out in the context of private households, including both apartments and houses in the northern parts of Europe. One context need that has been generated is the need of heating in the homes. In other parts of Europe, the main part of the energy is consumed to cool down the house in the summer. Energy saving and private households also include needs related to incentives. Here the incentives can be monetary, while in, for instance, in a work place, the incentive might be to reduce the carbon footprint and become a "green workplace". Related to the private household context is also the need to have an energy solution that takers into account the family as a whole and makes it possible for both small children and adults to understand their consumption. However, the needs differ between those living in an apartment and those living in a house. People living in a house, usually get feedback on their energy saving efforts in terms of lower energy bills, while those living in apartments lack this opportunity. This calls for different solutions where for apartment owners who needs to be motivated by other means, even though they can be of monetary character with for instance lower rent for a month.

One can identify a number of threats to validity on the overall results of such an investigation. Given the use of a constructivist perspective, where needs and objectives are socially constructed evolving in the interactions between users. developers and other stakeholders, generalizability is obviously problematic. Also since the results presented here is from one stage of the investigation, we will need to follow how the perceived and actual needs evolve as solutions to parts of these aspects are implemented and experimented with. It is also too early to say to what extent the envisaged solutions will instill behavioural changes or not.

6 Conclusions

The aim of this paper was to describe private person's needs related to energy consumption in their homes. In more detail, we have illustrated peoples energy consumption situation, which actions they have taken or can consider to take to lower their energy consumption and what kind of technological support they would like to have to support them in changing their energy consumption behaviour. In this paper, we have found that energy saving is complex for the users. There are many aspects that influence their willingness to save energy, for instance, the effort it takes, the amount of money they can save, their contribution to the environment. Also, users want feedback on their energy consumption in real-time placed in a central place in their house or accessible by their mobile phone. But seeing how much they are consuming is not enough, they want to compare their consumption with others to see if they consumer more or less. Here they users stated that they would be motivated to save energy if they could compete with other people. The actual saving is also important to feed back to the users, not only in graphs but in other motivating ways. Seeing how the consumption decreases from one month to another is not enough, it makes it difficult to understand what is really a saving and what has to do with other factors such as out-door temperature, wind or activities in the home.



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