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BeAware

Boosting Energy Awareness with Adaptive Real-time Environments

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D2.1 Users' practices and requirements

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Table of Contents

Executive Summary

This document reports the work carried out in the first 6 months of the project within WP2, consisting of a thorough revision of existing studies and data on energy use, and of the starting of the fieldwork. The content of this document is meant to inform the field studies and users' trial planned for the next months of the project, as well as to orient the design of the BeAware system through a series of requirements. The partners in the WP have been in charge of separate sections of this document, but have worked in strict coordination and have benefited from reciprocal updates and discussions occurred at least on a monthly basis, and from brainstorming sessions during the two consortium meetings occurred so far.

Regarding existing studies, the examination of the **state of the art in the psychological studies** of energy consumption has allowed to identify the features and the strategies that make a feedback effective in general and in the field of energy conservation in particular. Main responsible for this part is UNIPD. The review starts by grouping together the studies on energy use, and by describing the typical social-psychological model on which they are based; this model focuses on specific, individual intentions to produce a behavior, and on its determinants. The main lessons learnt from this literature regard the better results obtained by targeting specific attitudes and behavior instead of general ones; the non coincidence of energy efficiency increase and energy demand decrease; the drawbacks of money saving when trated as main motivator for conservation; and the role of values such as efficiency and comfort in influencing energy use. Then the review considers the studies on the relative effectivenss of different kinds of feedback. The results highlight, in synthesis, that a feedback is more effective when prolonged, continuous, historical, tailored, computerized, and associated with strategies through which users make a clear commitment. Overload of information, comparisons, advice tips combined with feedback, focus on money saving must be avoided. The literature is described in details in Chapter 1, and the main recommendations for the BeAware system are also repeated in the form of requirements in Chapter 4.

The **fieldwork** started with a series of interviews with stakeholders in energy conservation belonging to associations, governmental agencies or house appliance manufacturers in Finland and Italy, according to a protocol jointly defined by UNIPD and HIIT. The record of the interviews and the protocol are in Appendix (Chapter 6.2, 6.3). The units in charge of this part were UNIPD and HIIT. The results are condensed in Chapter 2. The stakeholders documented several activities in their territory, divided into definition of governmental policies, promotion of standards for energy saving buildings, and campaigns to increase awareness in individual consumers. They made available material and other references on existing promotional and measurement tools. They emphasized the consumers' lack of basic conformation and awareness regarding aspects such as own energy expenditure, single appliance consumption level, meaning

of appliances energy classes, lack of interest in the details of their bills, as well as several misleading beliefs on conservation behaviors. They also seemed to highlight a different sensitivity for energy saving in Finland and Italy, possibly because of the different energy price. They defined energy waste pragmatically, by reference to the lack of adoption of conservation practices or structurally with reference to the condition of the building and of the appliances.

The **data on energy use and households profile** of the two territories were BeAware will locate its trials is the topic of Chapter 3, authored by Vattenfall and Enelsì. The Chapter starts with the report from the Italian Enelsì and goes on with the one from Vattenfall, related to Sweden and Finland, showing a general similarity between the two countries in terms on energy demand, except for some documented differences. The two reports are based on common criteria in the data collection and presentation; they include a depiction of the country climate and morphology, energy policy, energy demand; description of typical household composition and ownership; explanation of the billing system and meters available to consumers, typical appliances. These data (e.g. climate, appliances, and energy cost) are useful in defining the goal to achieve in terms of energy conservation for specific areas and appliances, and the weight of specific conservation behaviors. Other data are useful in selecting the household to involve in the study (e.g. owned houses instead of rented ones), to orient the users' interviews (billing system and meter available to consumer), and, eventually, to orient the comparison between countries (larger share of electricity consumption related to heating, sauna and cars in the Northern countries; larger share of electricity consumption related to air conditioning in the Southern countries). The final recommendations and the great amount of data collected are to be considered along with the other results during the planning of the users' trials.

The work so far has opened the way to the continuation of the activity. The results of the stakeholders' interviews, the data on energy use reported in Chapter 3 and the literature collected will inform the planning of the users' interviews, by selecting the appropriate target, orienting the questions, and defining the protocol according to recent scientific and ethic standards. The examination of the current literature has also allowed to identify the gap in the psychological research on energy consumptions, where BeAware can provide its greatest contribution, using the data collected from initial fieldwork and from the trials. This gap relates to the lack of studies on the consumption habits, of the cues activating them and of the perception/interpretation/evaluation of the consequences of a behavior. Therefore, it candidates as a perfect area in which to invest the research efforts, given also the unique opportunity of BeAware to carry out longitudinal observations and to collect automated data on specific energy use.

1.Literature review

The literature review presented here aims at synthesizing the approaches and the results regarding modification of energy consumption via feedback intervention. It is based on the examination of international scientific articles dealing with this issue from a social-psychological point of view, which were collected according to the following method. Initially, a systematic search in scientific databases (PsychInfo, EBSCO, Science Direct, and IngentaConnect) was conducted, by looking for articles whose abstracts mentioned any of 4 combinations of terms ('energy conservation' + 'households', 'energy consumption' + 'households', 'energy conservation' + 'persuasion' or 'energy conservation' + 'feedback'). This resulted in 731 articles, whose content was rapidly examined to include only papers that actually studied energy behavior, that reported psychology research or empirical studies, instead of technical or engineering knowledge theoretical observations or project presentations. In addition, the references in the articles thereby collected have been used to further increase the list of relevant works examined, by pointing at journals that dedicated several issues to energy consumption and to energy behavior ("American Psychologist", "Energy", "Energy and Buildings", "Energy Economics", "Energy Policy", "Environment and Behavior", "Journal of Applied Psychology", "Journal of Environmental Psychology") or to specific articles. As a result, the collection of articles considered in this chapter was obtained.

Broadly speaking, approaches to energy conservation range from psychological (Winett, Ester, 1983) to economic (pricing policies, as those reported by Winett, Kagejl, Battalio, Winkler, 1978, by Anderson, Colwill, Kent, 1983 and by Hutton, McNeill, 1981), to structural, based on physical design of buildings and infrastructure design. Psychologically-based perspectives, in particular, start from the acknowledgment that energy conservation policies cannot rely exclusively on price rebate (Winkler, Winett, 1982), since people adapt to price change (Winett, Ester, 1983), saving money is not the only motivation to conserve energy (Stern, 1992) and energy saved in this way is subject to the so-called 'rebound effect': Haas, Auer, Biermayr (1998) in Austria found that the saving obtained with energy efficient consumption makes space heating energy demand increase, thereby diminishing the actual final saving. Similarly, Dillman, Rosa, Dillman (1983) found that energy conservation and energy consumption/demand do not overlap, since the former can increase without decreasing the latter. These studies highlight the role of inhabitants and their behaviors in obtaining the actual energy demand, which does not depend directly from the quality of the building or from the climate. In order to actually achieve energy conservation, any form of efficiency must be measured with respect of the final total energy used (Herring, 2006).

The psychological approaches inspiring the articles examined here are mainly behavioral theories (social learning theories – Bandura, 1977), aimed at showing models producing a target behavior to trigger learning by observation, and/or at reinforcing such behaviors; classic attitude theories focusing on the cognitive determinants of a certain behavior in the form of attitudes and intentions (theory of reasoned action, Fishbein, Ajzen, 1975; Festinger, dissonance theory, 1957); communication theories of persuasion (Petty, Cacioppo, 1986; Cialdini, 2001) aimed at finding the features of the communication process and the persuasive strategies (reciprocation, social proofs, etc) that maximize the change in the recipient's values, believes and behaviors; goal setting theories (Locke, Latham, 1990) and feedback intervention theory (Kluger, DeNisi, 1996) working to increase awareness, commitment and motivation in achieving a certain goal. All these approaches are interested in (a) identifying the determinants of energy saving behaviors, or (b) designing a feedback intervention that helps modify energy consumption behaviors. These two aspects are connected, since feedback is designed in order to affect specific factor that have been identified by prior models or studies. Reflecting these two aspects, the rest of this chapter is organized in two sections: the first synthesizes the factors influencing energy use in a multistage causal model of behavior; the second reports on the major findings on the use of feedback to modify energy use. In addition, based also on dissemination material obtained from associations and institutions, a list of energy conservation practices is provided.

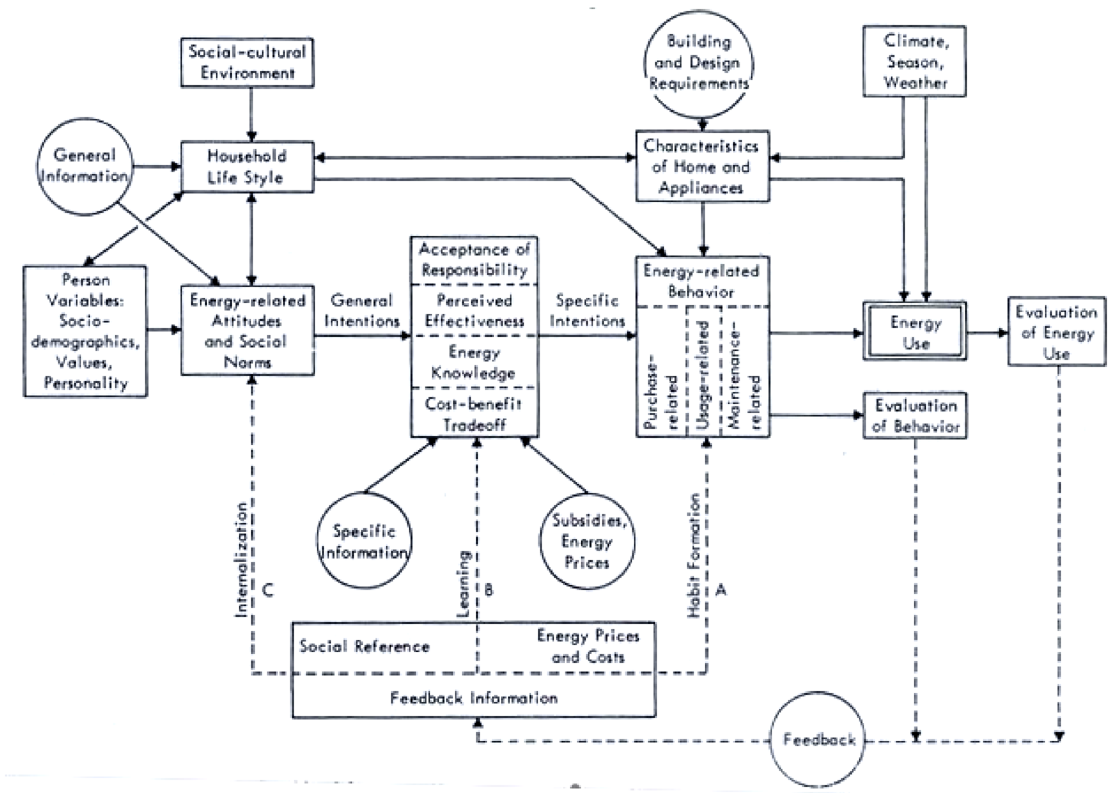
1.1. Classic determinants of energy consumption behavior

1.1.1. Factors influencing energy use

The studies on the aspects that influence energy consumption behavior largely rely on questionnaires to measure the determinants of behavior, and often also to collect data on behaviors themselves (e.g. the amount of energy saved). The orientation is to test a theoretical model and the connection between different factors, either for theoretical reasons or to find out what are the most relevant determinants in a specific case. One example of the former is Steg (2005), a study conducted in the Netherlands, where a casual chain of factors was tested (apparently with success): the chain connected values (egoistic, altruistic, ecocentric), to beliefs (worldviews, awareness of consequences, ascription of responsibility), to personal norms (sense of obligation), to behavior (in their case, the behavior under investigation was the acceptability of energy policies). An example of a study checking factor connections in a specific case is the work conducted by Black, Stern, Elworth in Massachusetts (1985), testing a model with different structural (house condition, costs) and individual factors (concern about energy, perceived personal benefits of saving energy, personal and social norms, age, education, income, people at home a various times of the day) as precursors of the reported energy saving behavior.

Figure 1.1 is a comprehensive representation of the factors that are usually taken into account by theories on energy use determinants. It must be noticed that it focuses on direct energy use, namely it does not include energy indirectly used during daily activities (e.g. by food transportation and packaging). Also, the model takes into account that the actual energy use is moderated by some external factors such as climate, season and weather. Therefore, the individual will in the model ends one step before energy use, namely in the production of energy-related behaviors, since the actual, final energy use depends on other factors on which the individual has no direct control.

Figure 1.1 A multi-factor model of residential energy consumption



(van Raaij, Verhallen, 1983, p. 41)

Focusing on energy-related behaviors, then, proximity of the different factors, and then their ability to directly influence behavior, is organized in the model by distinguishing between general and specific ones, and between contextual and individual ones: specific and individual factors are closer to the actual behavior. They include:

1) energy related attitudes and social norms regarding price, environment, energy, health, and personal comfort, are influenced:

- directly by personal variables: socio-demographics, values (person variables), personality
- indirectly by social-cultural characteristics (social-cultural environment) through households lifestyle (household lifestyle) and personal variables.

Attitudes and social norms can affect behavioral intentions only at a general level.

2) Intervening factors transforming the behavioral intentions from general to specific are acceptance of responsibility, perceived effectiveness of one's contribution, energy knowledge, expected cost-benefit trade-offs.

3) The actual behavior is influenced by the specific intentions, by the household lifestyle again, by the actual physical structure of the building (number of rooms, insulation, wind exposure…) and appliances, and indirectly by climate, season and weather. Energy related behaviors are purchase related behaviors (e.g. buying low energy appliances), usage related behaviors (thermostat, curtains, home improvement and retrofitting…) and maintenance and operating behaviors.

4) The final energy use is the result of behavior plus climate, season and weather.

In synthesis, individual factors such as acceptance of responsibility, perceived effectiveness, energy knowledge, and cost-benefit tradeoff are the closest to the actual behavior; they are directly influenced only by the household lifestyle and by the characteristics of home and appliances. All other factors, including general individual ones and contextual ones, are located in an influence chain that is generally modeled as shown in the picture.

According to the model, an intervention to promote energy saving could act on (a) the general information (information on the energy problem in our society at large, political questions, the supply of energy…) indirectly affecting general intentions, (b) the specific information (information on energy costs, the energy usage of certain behaviors, and the effects of energy-conserving behavioral change) indirectly affecting specific intentions, (c) subsidies and energy prices, (d) building, and design requirements, and (e) feedback information.

1.1.2. Main contributions from multifactor model

Emphasis on specificity

The model encourages to take into account specific values and behaviors and to verify which factors are relevant for a specific class of users under certain circumstances: people who conserve one kind of energy are not generally inclined to conserve energy (Painter, Sementik, Belk, 1983), and specific users may consider some factors as more relevant than other in influencing a sustainable energy consumption. For instance, Egmond, Jonkers, Kok (2005) in their study conducted in the Netherlands on households associations (construction and maintenance of rented houses) found that feedback from peer organizations and authority are the most important enabling[1] factors instead of experts' and customers' feedback (data are listed at p. 2380 of the article). Sexton, Brown Johnson, and Konakayama (1987) report that a monitor displaying on-peak/off-peak and total consumption did not decrease total consumption but modified the more

[1] Determinants of energy-behavior are distinguished in predisposing factors, enabling factors, reinforcing factors (Green & Kreuter, 1999).

specific behavior targeted by the feedback, namely shifting energy consumption from on-peak to off-peak periods.

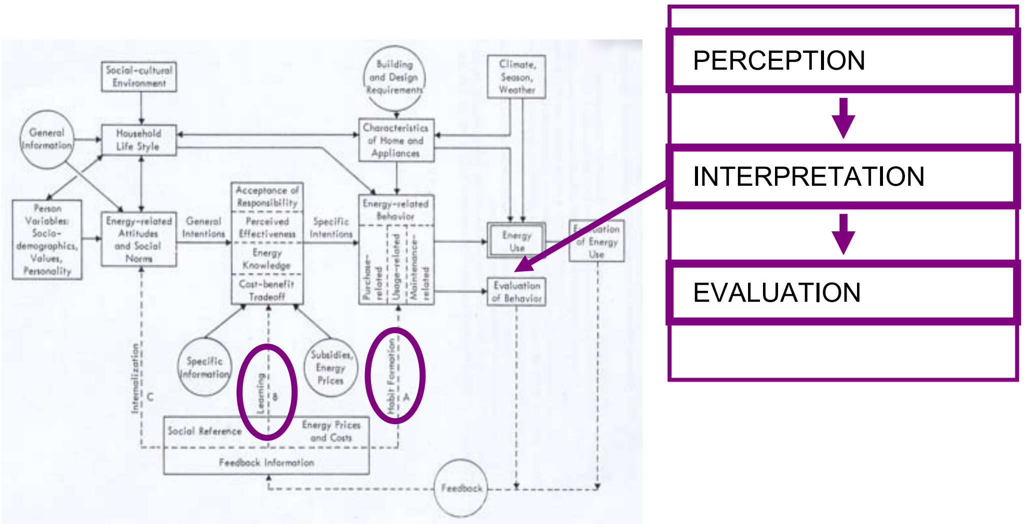
Feedback

Feedback derives from the evaluation of energy use behavior. With respect to three kinds of behavior illustrated in the model of Figure 1, the energy conservation behavior targeted by feedback interventions is the one based on consumption, and not on maintenance or purchase. Feedback is assumed to affect one or more of the following determinants of behavior:

- attitudes and social norms through social reference;
- the formation of specific intentions through learning.
- the production of specific behaviors through habits. These latter are considered as influenced especially by cost feedback (but the research is contradictory to this regard, see later in this chapter).

The ‘evaluation of behavior’ stage can be better specified in the light of the remarks model of action developed by the cognitive psychologist Donald Normal (1977), according to whom there are 7 stages of action, 4 leading to the behavior (goal, intention, action plan, execution) and 3 starting from the behavior once produced (perception, interpretation, eveluation). The latter 3 use behavior as a source of information, and it is here that BeAware feedback intervention can operate to modify the perceived users’ behavior as well as its interpretation and evaluation. This is illustrated in the figure 1.2.

Figure 1.2 Stages constituting ‘evaluation of behavior’ according to the action model of D. Norman



(adapted from van Raaij, Verhallen, 1983, p. 41)

Conservation data versus consumption data

As mentioned above, if a study is interested in measuring conservation behavior then it might be preferable not to focus on the total conservation achieved in a household, given the rebound effect (Haas, Auer, Biermayr, 1998; Dillman, Rosa, Dillman, 1983). Since the energy conserved can be re-invested in new kinds of consumption, then the total amount f energy demand can be the same in the long run. Sardianou (2007) in Greece found that intention towards no cost, easily implemented behaviors is different from intention to implement technical changes in the house. Income is connected with the latter, but not with the final energy expenditure (this also confirms that demand does not diminish if you can afford it and then that total energy consumption may not be a sensitive measure of energy conservation practices). Energy saving related purchases may not be directly connected to saving money because people are already efficient: Keirstead (2007) in UK found that energy consumption behavior after installation of photovoltaic (PV) devices does not change that much in appliance efficiency and other aspects except green electricity tariff and efficient lightening, since these people were already more energy efficient than usual already prior to the adoption of PV. Similarly Darby (2006) in a survey on participants to an energy saving competition found that those who took home alterations actually took it before the start of the competition, and saw themselves as energy conscious also thought that the competition made them 'do more'. Gudbjerg and Gram-Hanssen (2006), in the study mentioned above, also noted that there were big differences between households and the different interventions affected different families differently – and one third remained almost completely unaffected. The families who indicated interest in saving energy where the most affected and families with less interest and teenage children were the least affected.

Saving versus Curtailing

One distinction that emerges recurrently from the studies on determinants of behavior is between energy saving as efficiency on the one side, and energy saving as curtailing on the other; these two labels seem to connected energy conservation to different values, and to different income classes. Research suggest that presenting energy conservation as curtailing can be very risky in terms of duration of the effect, and in terms of amount of users with high energy conservation potential who may be motivated by it.

Neuman (1986) in a research in Southern California with English speaking households found that energy conservation is seen as blocking some values related to success (Personal Mobility, comfortable life, pleasure, personal wealth, social recognition); other values (wellbeing, security, environment, personal growth) connected to efficiency are not perceived as blocking success. Monnier (1983) in France studied self-reported energy practices in 8 households, and found that energy conservation practices were more common in households with traditional values (rural origins or middle class), familiar with a parsimonious and productive use of energy. Instead, 'modern' household liked to profit from the liberating the potential offered by technical environment and were not inclined to conserve energy. Black, Stern, Elworth (1985) in the study already mentioned above, found that energy saving investments were affected by structural factors (home ownership, number of people and personal benefits); low-cost efficiency improvements were affected by personal norms for energy efficiency plus some contextual factors (direct payment and high energy bills); and minor curtailments were influenced by personal norms for efficiency, personal norm for curtailment as amoral one, but not directly by contextual aspects. Pfaffenberger, Mayer-Renshhausen, Hohmeyer (1983) in Germany found that the energy conservation program, therefore, was taken advantage of by high-income house owners only, who could invest in house modernization. Similarly, Dillman, Rosa, Dillman (1983) in the USA found that general lifestyle cutbacks for economic crisis were connected with home adjustments but not with home conservation actions (which would be permanent), which is a luxury item. Home adjustment therefore seemed independent from income.

Household factors

The studies on determinants of energy saving behavior have also considered several aspects that relate to the nature of the household both in structural and in demographic terms. Table 1.1 lists some factors (leftmost columns 'Factor') that proved to increase energy saving behavior (listed on the 'Behavior' column), in addition to the kind of behavioral measure adopted and to the location and source of the data.

Table 1.1 Findings on household factors connected to energy conservation actions.

Factor	*Behavior*	*Kind of Data*	*Location*	*Source*
people aged 31-35 years	self-reported conservation actions	self-reported measures	Canada	Curtis, Simpson, Drever, 1984
low age	energy conservation	self-reported measures	Griece GREECE?	Sardianou (2007)
people aged 18-24 lived in cooler homes	automatically detected home temperature	behavioral observation or recording	UK	Hunt, Gidman (1982)
houses with children or elderly people were warmer	automatically detected home temperature	behavioral observation or recording	UK	Hunt, Gidman (1982)
living in households with 2-4 people	self-reported conservation actions	self-reported measures	Canada	Curtis, Simpson, Drever, 1984
number of people at home and house size (older, larger, crowded house need warmer temperature)	energy saving actions	self-reported measures	Massachussets	Black, Stern, Elworth (1985)
Big size families	energy conservation	self-reported measures	Griece	Sardianou (2007)
4 or more occupants is related to lower energy	direct measurement of energy consumption	behavioral observation or	Northern Irland	Yohanis, Mondol, Wright, Norton

consumption		recording		(2008)
Building age (homes built after 1970 were warmer for higher standards in insulation)	automatically detected home temperature	behavioral observation or recording	UK	Hunt, Gidman (1982)
occupying homes aged 16-25 years	self-reported conservation actions	self-reported measures	Canada	Curtis, Simpson, Drever, 1984
detached houses are warmer	automatically detected home temperature	behavioral observation or recording	UK	Hunt, Gidman (1982)
detached houses	energy conservation	self-reported measures	Griece	Sardianou (2007)
direct payment and high energy bills	improvements	self-reported measures	Massachussets	Black, Stern, Elworth (1985)
central heating were warmer, with smaller between-rooms differences, and people wearing cooler clothing; dwellers had higher income and owned the house	automatically detected home temperature	behavioral observation or recording	UK	Hunt, Gidman (1982)
kitchen is warmer room	automatically detected home temperature	behavioral observation or recording	UK	Hunt, Gidman (1982)
Floor area and high income related to higher energy consumption, especially late at night	direct measurement of energy consumption	behavioral observation or recording	Northern Irland	Yohanis, Mondol, Wright, Norton (2008)

The number of studies considered here is limited, but span in different countries and use different measurement systems. In these studies, recurrent households characteristics connected to low energy consumptions are: low age of inhabitants; high number of inhabitants (more, even though there as some discrepancies probably connected to variable definition, for instance with respect to the floor size), recent buildings, compounded houses (versus detached houses). Separate room heating and income are related to warmer temperatures. Therefore waste may be more easily located in households with one or more of the following characteristics: older buildings, inhabitants aged over 35, lower number of inhabitants, higher income, detached houses, central heating. The role of these and other factors is discussed more deeply in Chapter 3, on the bases of actual data on energy consumption in the areas targeted by the project, namely Italy and Sweden/Finland.

1.1.3. Main limits of the multifactor model

An important remark with respect to the multifactor model examined here is that it actually deals with energy-related behavior mostly in terms of 'intentions', while lifestyle or other aspects are mentioned but not articulated. This reflects the heavy reliance on the use of questionnaires, where intentions can be collected and studied. The understanding and modeling of users' behavior will need a further investigation both in the literature and in the field, and the adoption of different methods. The target must be the consumers' pragmatic knowledge orienting their behaviors and its relation with environmental cues. Other, less refined models such as NOA (needs-opportunity-ability, elaborated by Gatersleben and Vlek, 1998 and reported by Goldblatt, 2005 and by Schenk, Moll, Schoot Uiterkamp, 2007) try to connect the individual with the environment; they position individual variables such as needs at the same level as environmental opportunities and constraints, as pre-determinants of behavioral intentions. Models are needed where the actor's relation with the environment is central and where action and action feedback are the starting point instead of the final stage in the model. One example in this sense is the action-stage model proposed by Norman, where action is in the middle of the cycle and the stages leading to action and those following the production of action (perception/interpretation/evaluation) are given an equal explanatory status. This can be integrated with studies in the area of distributed cognition (Holland, Hutchins, Kirsh, 2000; Norman, 1977) and positioning theory (Billig, 1987; Bourdieu, 1977, 1984) in order to go deeper into habits, their reasons and constraints (Wilk, 2002).

In synthesis:

- *the more specific the attitude, the closer to the actual behavior: all contextual values are indirect except household lifestyles and their habits;*

- *feedback intervenes on behavior perception, interpretation and evaluation and affects the next specific behaviors, awareness and habits;*

- *energy use is not a direct measure – in these surveys – of adopting energy saving behaviors: one can be energy efficient in each specific energy use but still be using a lot of energy and appliances; on the other hand, any measure of energy efficiency connected to a specific appliance must be related to the final general energy demand of the household to check if there was any rebound effect;*

- *behavioral change is available to any income, but framing it as money 'saving' may be a boomerang: it may not be appealing to high income households, who have the higher energy saving potential, and even low-income households, who might be interested in saving, may stop it abruptly when financial difficulties end. Better to frame it as efficiency or as a wellness value.*

- *the contribution to understanding actual behaviors and habits provided by studies of behavior determinants is very limited, probably because of its reliance on questionnaires a the main data collection tool. This is the main scientific potential of BeAware, to fill this study gap on actual users' practices*

1.2. Feedback on energy consumption

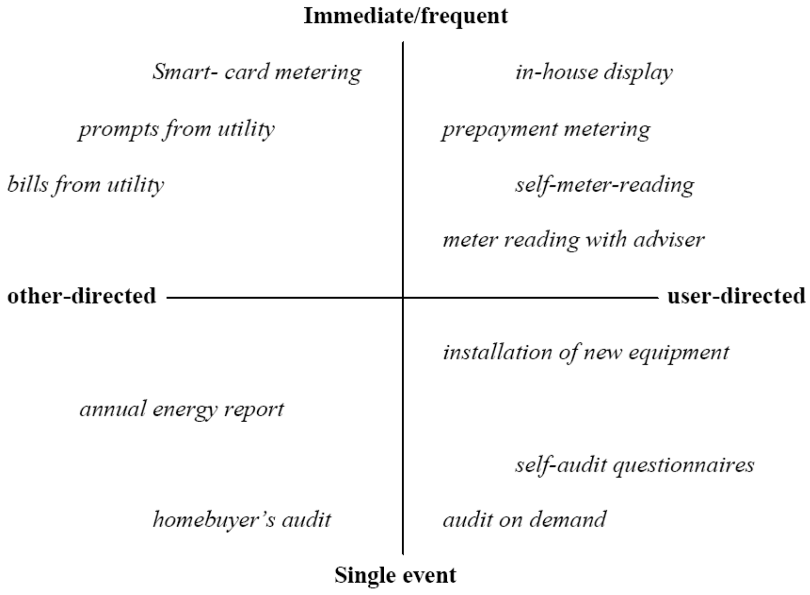
Abrahamse, Steg, Vlek, and Rothengatter (2005), adopting a taxonomy proposed by Geller in 1990, highlight that behavior can be influenced by manipulating its antecedents or by manipulating its consequences. An example of an antecedent is an appeal by a model, as in the study conducted by Luyben (1982), where a possible relation between watching a TV appeal by president Carter, and reducing gas consumption was investigated[2]. Other antecedents are commitment to change, or goal setting information. An example of a consequence of an action is the provision of a feedback or of a reward. Despite this dichotomy between antecedents and consequences, several studies, as it will be shown below, underline the importance of connecting the two strategies: a feedback is more effective if some previous commitment towards the kind of behavior covered by the feedback itself is warranted. In addition, some information might be needed prior to feedback intervention in order to be able to interpret and contextualize the meaning of the feedback once provided.

What is meant by feedback? The notion of feedback intervention was elaborated by Kluger and DiNisi (1996), as "actions taken by an external agent(s) to provide information regarding some aspect(s) of one's task performance" (p.255). In their huge, influent review, they conclude that the feedback can affect actions by operating at three different levels: task-motivation, task-learning and meta-task (self). The analysis of the results obtained by targeting either one of the three levels suggests to prefer a feedback targeting the task-learning level, and not motivation or self. Another study by Ilgen, Fisher and Traylor (1979) considers several features of a persuasive message and conclude that the feedback needs to be designed in order to provide information to the prospective actor and not on the action just carried out (Ilgen, Fisher and Taylor, 1979).

Several taxonomies of feedback are used in the field of energy conservation. The most recurrent ones can be described using a terminology reported in Darby (2006). She distinguishes between direct and indirect feedback: direct feedback consists of the data provided by meters on the amount of energy used; indirect feedback is the data on energy use processed with some algorithms and/or integrated with other data related to a prior period in the same household (historic feedback) or to other households (comparative). Finally, feedback that provides energy consumption information on separated different sources of consumption, for instance different appliances, is a disaggregated feedback. In a previous work (2000), Darby proposed a more taxonomy of feedback devices, based on two axes, the target of the feedback (other-directed versus user-directed) and the continuity of feedback provision (immediate/frequent versus single event) respectively (Figure 1.3).

Figure 1.3 - A taxonomy of feedback devices on energy consumption

[2] The results, based on self-reported thermostat setting behavior and fuel bills by the way, did not confirm the existence of a relation.



(Darby, 2001, p.6)

The rest of this section will examine first whether feedback has proven effective at all as a strategy to improve energy conservation in households; afterwards, it will consider comparison between different kinds of feedback and report on their relative effectiveness (for additional reviews see e.g. Darby, 2000, 2006; Roberts & Baker 2003).

1.2.1. Effectiveness of feedback with respect to other or no intervention

Several studies have been designed with the aim of checking whether feedback is successful at all as a strategy to modify energy use, with or without comparison with a control group or with other kinds of intervention. The results are generally positive.

Seligman, Darley (1977) compared a feedback group with a control group. They targeted residential energy consumption[3], and provided residents 4 times a week with some feedback on their daily energy consumption. Before starting the treatment, they calculated for each household a regression line allowing to predict consumption on the basis of the average temperature in the previous 24 hours. The feedback value consisted of a percentage of the actual consumption out of the predicted one. The treatment allowed a significant 10% higher reduction in energy consumption than in the control

[3] Since the study was conducted during the summer, then the authors presented the data as related to air conditioning use.

group (energy consumption would have decreased anyway because of the external climate, but to a lesser extent). [4]

More recently, Winkler, Winett (1982) reported on the results of an intervention targeting high energy use behaviors and maintaining at the same time an unaltered level of comfort; the strategy was to replace high energy use behaviors with more sustainable ones, instead of just asking users to cut energy use. Strategies included rebates and/or weekly/daily feedback, supported by videotapes where comfort was exhibited in relation to low energy consumption behaviors. An overall reduction in electricity consumption was found, and, as in Winett, Leckliter, Chinn, Stahl (1984), comfort (temperature and humidity, clothing requirement, …) revealed by meters and self-reports was maintained similar. It is unclear whether comfort was maintained unaltered or whether its threshold was lowered. Finally, budget share was a better predictor of responsiveness (the lower the former, the lower the latter) than cost.

Darby (2006) reports two initiatives from energy utilities. In one case, a new payment system was adopted, which included the adoption of new meters in households and the calculation of saving in financial terms; in the other case, a new payment system was adopted in association with prepaid cards and a display unit in the house monitoring the cost per hour (e.g. pay as you go), in initiatives in addition to the regular meter. Both initiatives are reported as successful.

Feedback has also been compared to self-monitoring. Self-monitoring proved successful on the long run in a Norwegian project. The researcher had participants reading their meters and sending the data to the utility. An energy saving of 8%, was obtained, which was still 4% 3 years later, when the rest of the population had increased 4% its energy consumption (Wilhite, 1997 reported by Darby, 2006). Previous studies that compared self-monitoring and feedback found that the former was less effective (Winett, Neale, Grier, 1979; van Houwelingen and Raaij, 1989). The persistence of the effect may be an issue however, since after one year no difference with control was found (Van Houwelingen and Raaij, 1989). The long term effects seem to be actually related – besides to the nature of the feedback - also directly to the length of the feedback period (Henryson et al, 2000 reported by Darby 2006?).

Abrahamse, Steg, Vlek, Rothengatter (2005) in their review report that continuous feedback is better than monthly feedback. A similar conclusion can be drawn from a large-scale experiment organized Oberlin College in 2005 (Petersen, Shunturov, Janda, Platt, Weinberger, 2007). In the study, two university dormitories were equipped with an automated data monitoring system with real-time web-based feedback on electricity and water consumption. In comparison, twenty dormitories allowed students to monitor the consumption of electricity and water with a similar system but in one-week

[4] This study, besides showing the effectiveness of feedback, highlights the importance of having a control group, and the possibility that some energy saving occurs even in the control group because of a Hawthorne effect. As a solution, a blind control condition can be added (as in Hutton, Mauser, Filiatrault and Ahtola, 1986), when users are totally unaware that they are participating to a study. Of course, this raises other issues related to data access and privacy.

intervals. All dormitories were enrolled in an energy saving contest with a nominal award.. All students also received information about energy saving in general, although no concrete advice. The qualitative data collected from participants highlighted several shared actions in reducing the consumption, strong incentive to save, and that students generally found the real-time information interesting. The quantitative results showed that the real-time feedback dormitories were able to cut 55% of their electricity consumption in comparison to 31% decrease for less frequent feedback. Water consumption was not remarkably reduced. Interestingly, there were clear differences between dormitories in the weekly-feedback group, showing that freshmen dormitories were much more influenced than upperclassmen houses (Petersen, Shunturov, Janda, Platt & Weinberger, 2007). The difference between student groups allows several interpretations, for instance, it supports the theory of habit formation, which argues that acquisition of habits (electricity consumption for one) is a slow and contextually dependent process. Once habits have been acquired, they are resistant to change (Wood & Neal 2007). The college freshmen are in that sense in an ideal position of acquiring and learning new habits when they entered the dormitory.

Feedback effectiveness on energy saving has been compared to information material. Abrahamse, Steg, Vlek, Rothengatter (2005) compared feedback with interventions based on information or rewards. They found that information tended to result in higher knowledge but not in behavioral change, except –sometimes - for tailored information (audits). Rewards were also successful but had a short-lived effect. Also, A Danish study (Gudbjerg, Gram-Hanssen, 2006) aimed at reducing energy stand-by consumption in electronic devices. The authors compared phases of experiment introducing different interventions; first written material, then a visit from an energy advisor, then web-accessible stand-by consumption data, and finally technical devices called "stand-by killers", which could either turn off devices automatically (master-slave and USB controlled) or by remote/timer controlled. It was found that personalized advice (visit from an energy advisor) combined with devices designed to cut stand-by consumption, had a significant and cumulative effect, especially in comparison to the first phase with just printed material delivered to participants. Wood and Newborough (2003), in UK, compared the effectiveness of feedback provided with an ECI device (Energy Consumption Indicator) attached on the appliance with the effectiveness of information on energy saving. The target behavior was energy consumption for cooking. Even though they did not provide significance tests, the better result seems to have been registered in groups with ECI, while information pack did not improve (when used in combination with feedback) nor affect (when used alone) energy saving. Hutton, Mauser, Filiatrault and Ahtola (1986) compared 4 conditions: ECI (energy consumption indicator) plus information; information; control; blind control (users were unaware that they wee participating to a study). In this research the effectiveness of feedback was weaker than in other studies. Even though integrating feedback provision with information was found as a useful strategy, the mere association of tips to the feedback does not seem to be as useful. Feedback integrated with advice tips does not seem to add any advantage in terms of effectiveness in energy saving. Apart from the study of Ueno, Inada, Saeki, Tsuji (2006), other studies showing the lack of effects are reported by Darby (Wilhite, Ling 1995 in Norway with informative billing; Haakana et al 1998a and b, in Finland using weather-adjusted comparative feedback from utility along with meter reading).

McCalley and Midden (2002) suggest that studies such as McClelland, Cook (1979-1980) or Hutton et al (1986) had no effect or weak energy saving effect after installation of an energy monitor because of the lack of information able to trigger a goal setting/commitment in the participants. Using a simulated washing machine control panel, they observed that feedback without goal setting was significantly less effective than with goal setting. No difference between self-assigned and externally assigned goal was found. The advantage of combining feedback with prior goal setting seems also confirmed by Becker (1978), in a study on electricity use. Goal setting was effective only when the goal was higher and combined with feedback (provided 3 times a week). Abrahamse, Steg, Vlek, Rothengatter (2007) carried out a complex intervention (including tailored information, goal setting, tailored feedback) through a website. Since no technology besides the generic meter was available to them, then energy related behaviors, energy saving and knowledge were collected through self-reported measures inputted through a website for both control and test groups. Control groups have a no-interventional website (see footnote 4 on Hawthorne effect). The intervention produced a significantly higher direct energy saving in the feedback than in the control group, as well as a significantly higher awareness (no difference in indirect energy saving was found). McCalley (2006) set up a study where participants were asked for data on house temperature and were given back – based on several other parameters – energy consumption data. To measure the energy conservation, the researcher measured the time taken to plan the thermostat. It was found that time increased when a specific goal was set only if also specific information was provided. In a second study the author found that an anchoring cue could influence goal setting: participants had to regulate the washing temperature with a thermostat, which pointed initially at zero degrees temperature or at a high temperature. The thermostat was set at a lower temperature, with a consequent higher saving, in the former condition.

Finally, participation to a program with feedback intervention must not lead to more expenses (and more energy consumption) compared to the saving obtained; this is common sense but happened in a study reported by Darby (2006), conducted by Puget Sound Energy from IEA DSM).

In synthesis, a feedback is generally effective, but a 'feedback plus' intervention including goal setting or other commitments seems to lead more safely to a result, possibly by enabling the user to interpret the meaning of the feedback and its implications. This 'plus' however need not be advice or tips associated to the feedback itself, but need to be provided separately from it. Also, a prolonged feedback seems to lead to a longer persistency in the effects. Participating to an energy conservation program must not lead to more expenses.

1.2.2. Relative effectiveness of different kinds of feedback

This section considers studies that contrast different kinds of feedback, while the former section considered studies comparing feedback with other kinds of interventions. Several studies considered comparative feedback, namely feedback comparing the participants with other people, which would take advantage on people's reliance on social norms and social comparison. Midden, Meter, Weenig and Zieverink (1983) compared (a) info + individual feedback (related to the consumer's own energy consumption in a previous period), (b) info + comparative feedback (related to other consumers in comparable circumstances), (c) info +comparative feedback + monetary rewards, (d) info alone, and (e) control condition. Baseline measures of each household were calculated based on actual consumption, and then corrected according to apartment position and outside temperature (as in Van Houwelingen & van Raaij, 1989). Feedback always included also rough consumption data and financial consequences of monthly increase/decrease in energy use. For electricity consumption, the two feedback kinds and the reward group differed from the control, the information group did not. For gas consumption, only individual feedback and reward differed from the control group. The scant success of comparative feedback is explained with the lack of relevance of the group with which one is compared to, or to the generation of a boomerang effect. For instance, Schultz, Nolan, Cialdini, Goldstain, Griskevicius (2007) studied the effect of normative messages on what is commonly done in the neighborhood. This risked to increase the consumption in those participants who resulted to be lower consumers than their neighbors, and was neutralized when the normative message was accompanied by an injunctive message (positive for consumption higher than the average, negative in the opposite case). Finally, in UK qualitative study with focus groups than comparative feedback (your home versus average homes or other homes in your neighborhood, Roberts 2003) was found to be less popular than historical feedback: authors registered a "strongly negative reaction to such feedback from all of the focus groups (indeed, virtually all of the participants in all of the focus groups)" (p.11). Even an historical feedback can be ineffective if the goal is set so as to stop showing success at a certain point. Abrahamse, Steg, Vlek, Rothengatter (2005) reported in their review that cumulative feedback since the beginning of the study was more effective than daily use only for high income participants: a constant increase might be too low or too slow or limited in low income households.

Kantola, Syme, Campbell (1984) used letter feedback and examined whether a comparative feedback (ratio between consumption and average consumption in the metropolitan area) would be increased by accompanying tips and by explicitly addressing the dissonance with prior commitment. They compared a dissonance comparative feedback, a comparative feedback plus tips, tips only and control during the first 2 weeks. The results showed that after 2 weeks, the effect of dissonance-based feedback differed only from the control group[5]. An extremely interesting result of the

[5] The fact that tips did not have a lesser effect than feedback might be due to the way in which 'feedback' was operationalized here: participants were given the feedback on the bases of the situation at the beginning of the observation, not on the actual consumption after the start of the study. This might have

study by Kantola, Syme, and Campbell is that self-reported behavioral change is not an actual predictor of conservation behavior (derived from reading the meter), namely that conservation and demand may not be the same and that self-reports and behavior may not be the same. This is similar to what was found by Hirst and Goeltz (1985) in a study specifically devoted to test the accuracy of respondents' self-reported data in energy research. By comparing self-reported data with utilities data, it turned out that accuracy was high (95%) for declarations on household characteristics (number and age of members, number of floors, heating, …), while was low (r=0.41) for data on floor area. Also, in comparison with utilities data or with other self-reported data collected with another technique, statements on energy conservation were inaccurate.

Regarding format, a feedback can be shown by common meters, key meters (whose data can be put on a USB pen), dedicated displays, TV or pc displays, ambient displays (alarms targeting a key behavior or a key environmental state or giving impressions of the consume without showing digits, Darby, 2006, p. 12) and informative bills, namely bills that are more frequent (e.g. bimonthly instead of annual), historic (with same period the previous years and all periods in between) and related to actual consumption not to estimates. Regarding informative bills, Arvola et al, (1994) in Finland found it effective especially for lower income households. Regarding TV versus printed material, Winett, Leckliter, Chinn, Stahl (1984) in Virginia found that a reduction in energy consumption (kW/h) and an increase in information followed an intervention with a TV program, plus questions and lasted till the follow-up test; temperature was the same, as well as comfort across groups and time. Another study using a booklet instead of just a TV program proved unable to achieve similar results. Brandon & Lewis (1999) found that computerized feedback (month energy consumption compared to previous year) inputted by consumers on the bases of meter readings is significantly different from all other kinds of written feedback used (leaflets, self versus other, self versus self, money, and environment).

Using a PC displayed or a computerized feedback, however, must not lead to the provision of too much and too complex information, just because it is easily available. Ueno, Inada, Saeki, Tsuji (2006) used a display of energy hour consumption in 18 house appliances, as well as city gas, kerosene and house temperature plus tips. Effectiveness was measured in terms of responses to tips on the interface (interface usage), which decreased after about 10 days; an energy saving seemed to occur overall, and for air conditioning, heated toilet and gas water-heater alone. However, no statistic tests are provided nor data from the group without feedback. A study by Benders reported by Darley (2006) used a very complex informative system, which registered a high level of drop-outs because of lack of time, problems with Internet connection, etc. Finally, a study on ambient feedback (light flashing when air conditioning was on and external temperature was cooler than inside) found great success rate in reducing use of energy for air conditioning; another feedback, measuring the amount of conservation/waste,

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decreased the perceived accuracy of the feedback, and its specificity. Another possible explanation is that a dissonance feedback target to closely the self, leading to a counterproductive self-consciousness that distracts fro the task (as emphasized by Kluger and DeNisi, 1996).

and contrasted to the ambient one, was not successful, since it varied too much and was then considered not credible. The variation was due to it being relative to a short time interval and not as an average to the whole period (Becker, Seligman, 1978).

In synthesis, comparative feedback is less appreciated and successful than historical feedback, whose relevance to the participant is more direct. Historical feedback should not be in the form of a cumulative feedback, especially for low-income households. The feedback needs to be calculated according to a rationale that encourages energy saving in any group of participants, without boomerang effects in some groups, and to be provided frequently. Finally, most studies adjust the feedback (when it is calculated with respect to a target) according to external factors such as weather. Computerized feedback is more effective than other methods, but should not require inspection of too much data and log-in procedure to access them.

1.3. Energy conservation practices for users' interviews

The users' interview preliminary to the trials will need to focus on the users' practices to identify what they are and the level of awareness in energy conservation. Therefore, we needed to harvest the literature as well as other dissemination material from environmentalist associations to obtain a list of conservation practices. The list is a work in progress; the initial one is the following.

SMALL INVESTMENTS		
DEVICE	**RECOMMENDED PRACTICE**	**SOURCE**[6]
Appliances	Use eco programs in the dishwasher	2, 4

6

1. Hickman, L., 2006, July 6.
2. Hickman, L., 2006, April 13.
3. Hickman, L., 2006, September 6.
4. Cianciullo, A., 2008, March 14.
5. Cianciullo, A., 2008, February 10.
6. Cianciullo, A., 2008, February 24.
7. Gualerzi, V., 2008, March 10.
8. Gualerzi, V., 2008, March 02.
9. Gualerzi, V., 2008, February 24.
10. Unescodess, 2007.
11. Hutton, R.B., Mcneill, D.L., 1981.
12. Joerges, B., Muller, H., 1983.
13. Dillman, D.A., Rosa, E.A., Dillman, J.J., 1983.
14. Painter, J., Semenik, R., Belk, R., 1983.
15. Abrahamse, W., Steg, L., Vlek C., Rothengatter, T., 2007.

	Use dishwasher and washing machine at low temperature.	10
	Use dishwasher and washing machine (and dryer) full-loaded.	2, 4, 10, 15
	Do not open fridge door and freezer door more than necessary. Do not forget them opened.	4, 10
	Defrost fridge and freezer periodically.	10, 15
	Turn off the dish washer before drying cycle is finished. Then leave dishes drying with air.	2, 10
	Control antisweat devices in refrigerator-freezers and turning off pilot lights in summer on heaters	11
Boiler	Periodically check the boiler.	10, 12
Computer	Turn down screen brightness and installing Nerogoogle as first page on internet.	8
Cooling	Close the windows and using sun curtains on the side of the house exposed to the sun.	1
	In the summer, using natural air cooling system, based on air movement and on sunscreen (adjusting drapes in winter and summer to take advantage of the sun's heat).	4, 11, 13
	Use ceiling fans rather than air conditioning systems.	1
	Control house temperature without relying on air conditioning system.	1
Dish washing	Don't use running (hot) water to rinse dishes before soaping them.	2, 11, 15
	Use only necessary soap, control dosages.	2
	Take away food fragments from dishes without water.	2
	Use two kitchen sinks, one with hot water and soap, one with cold water to rinse.	2
Lights	Switch off lights when nobody is in the room.	4, 15

Space heating	Avoid energy consumption and draughts insulating roller shutters and seal windows frames.	10
	Avoid space heating excesses.	4, 11
	Maintain a temperature equal to or less than 20°.	10
	If the house has an autonomous space heating control, then regulate temperature using the thermostat.	5, 15
	If the house has a central space heating control, then check temperature and asking to set it if is too high.	5
	Check for gaps in the attic	11
	Check for gaps in the fireplace	11
	Check for outside openings or cracks	11
	Live in multi-family rather than single-family housing.	12
	Change room use	13
	Set Thermostat at 19°C in Winter	13
	Set thermostat at 26°C in summer	13
	Close off one or more rooms during the winter	13
	Close doors between rooms	15
	Turn off thermostat when absent	15
	Lower thermostat before leaving	15
	Leave thermostat off in empty rooms	15
	Leave heat off while air co. is on	15
	Manually turn down the thermostat at night.	12
stand by	Turn off appliances' stand by leds.	4, 15
Washing Machine	Lower washing machine temperature cycle	
Water heating	Set water heater at 49°C	13

	Set water-heater thermostat on intermediate temperatures.	10, 11
	Turn off water-heater when nobody uses it.	10
LARGE INVESTMENTS		
DEVICE	**RECOMMENDED PRACTICE**	**SOURCE**
	Home energy audit	13
	Move to smaller home	14
	Move to more fuel efficient home	14
	Use of green electricity	15
Appliances	Choose appliances with low energy consumption (power class A or higher)	4, 10
Boiler	Replace the old one gasoline boiler with a new condensation one.	5
Computer	Use LCD monitors and notebooks	8
Lights	Replace incandescent light bulbs with compact led lights.	9
	Replace incandescent light bulbs with compact fluorescent lights.	4, 6, 15
Space heating	Instal thermic valves on radiators to determine heat power for each room of the house and to control temperature in each room.	5, 7, 10
	If the house has a central space heating control, then apply calculator systems to pay just for energy consumed.	5
	Renovate the space heating.	7
	To reduce heat dispersion, insulate window glasses, roofs, walls, attics.	5
	Insulate ductwork	11
	Add insulation to the attic, walls, and floors.	12, 13, 14
	Install a passive solar heating system	12

	Use a wood stove for supplemental heating	12
	Install an automatic clock thermostat set at 20°C (day) and 13°C (night).	12, 14
	Install storm door and windows	13, 14
Tv	Defer digital investments till new technologies (oled screen or others) will turn out to be more efficacious	3
	Use cathode ray tube television instead of Plasma TV.	3
Water Heating	Insulate water heater tank	11

1.4. Conclusions

This section has reviewed the literature on energy consumption and feedback intervention from a psychological perspective, to serve several purposes in the BeAware project.

A first purpose was to identify the tested features that make a feedback effective, with respect to other strategies to modify users' habits, and with respect to different types of feedback format. This information allows to formulate the starting requirements for the BeAware system, based on the state of the art knowledge in the research on energy users. The requirements are listed in Chapter 4

Another purpose was to identify what is lacking from the current literature and what scientific contribution BeAware can make to the understanding of users' consumption practices in the energy field. The study of habits, of the cues activating them and of the perception/interpretation/evaluation of the consequences of their behavior emerged as weak aspects on the current models. Therefore, it candidates as a perfect area in which to invest the research efforts, given also the unique opportunity of BeAware to automatically record specific energy consumption behaviors, instead of just the total amount of energy used, which has been rarely available to researchers so far.

A third purpose of the literature analysis was to inform the field study and the users' interviews. In order to fulfill this goal, the scientific literature as well as dissemination material from associations has been scanned to extract a list of energy conservation practices, to be used in the users' interviews. The same collection of articles will be used to define a users' interview protocol respectful of the research standard in the field, and inclusive of strategies to address privacy issues. Generally, the recommendations are to targeted specific attitudes and behavior in order for the program to work and to allow participants to learn. This requires a prior investigation of the attitudes and habits in the group of users selected as participants in the BeAware program. In addition, the program needs to integrate two separate phases, an informative one aimed at contextualizing the feedback and allowing goal setting or commitment, followed by the actual training phase with a long period of feedback provision.

The studies reviewed here have been carried out in several different countries in the United States, Europe and Australia. A closer examination of country difference that inspires BeAware intervention is the one that derives from chapter 3.

2. Results from fieldwork: stakeholders' interviews

The fieldwork in BeAware starts with a series of interviews with stakeholders in the field of energy consumption awareness, namely people who because of their position, work and commitments are assumed to possess wide experience in increasing energy awareness. Since the project's trials will take place both in Finland and in Italy, then the stakeholder group needs to include representatives of both countries. The interviews are planned to obtain information on their strategies and successfulness, as well as a taste of the representation they have of consumers' reasons and preoccupations.

The insights gathered from these interviews, integrated with the data on energy consumption and with the literature analysis, will inform the subsequent phase of the fieldwork, which will involve consumers with no specific/official engagement in energy saving work.

This section starts with a description of the interview method, and then summarizes separately the main insights obtained from the Italian and the Finnish group. The notes taken from the interviews are reported in Appendix to this document. The final paragraph describes the themes and recommendations common to both groups.

2.1. Method

A semi-structured interview protocol was defined collaboratively by UNIPD and HIIT, and then followed by both units in carrying out the interviews in Italy and Finland, respectively. The protocol was meant to warrant the collection of information a common set of issues, but with enough flexibility to be steered towards issues most relevant to the particular informant. The detailed protocol of the interview is attached as an appendix of this document.

The informants were recruited from three broad categories:

- Producers having some low-energy consumption product or concept, and a research & development department that has done some work on such products' usability, marketability and acceptability (i.e. energy providers and appliances' manufacturers)
- Local/national governmental agencies working with citizens on energy saving practices
- Non-profit associations working on environmental issues and with some initiatives in their agenda about energy consumption in households.

At least one interview per category in both countries was scheduled. The detailed interview protocol can be found in deliverable Appendix. The interview started with the permission to record the conversation/telephone call, and then continued with the presentation of the BeAware consortium, and the exchange of contact information so that the different people could keep in contact also after the interviews. After this preliminary part, the series of questions foreseen by the protocol was asked, with no pre-determined order. After the interview, on the bases of the recordings, the interviewer inserted organized the information gathered within some broad categories, expressing the kind of information expected from these interviews.

The categories were:

- The reason why the stakeholder was contacted
- Relevant initiatives in which h/she was involved
- The ideas behind the abovementioned initiatives
- Relevant facts emerged during the interview
- Definition of energy use/waste
- Main energy-consumption aspects a consumer is not aware of
- Any need to contact again the stakeholder for information missing at the time of the interview
- Future Investigations inspired by the interview
- Aspect of consumption containing the biggest saving potential
- Miscellaneous Observations

The resulting records of the interviews can be found from the appendixes of this deliverable. In the following paragraphs, the composition of the interviewees' group and the main insights gathered in each country are reported, based on the interviews' notes.

2.2. Italian interviews

2.2.1. Informants' group

Four interviews were carried out by UNIPD between June and September 2008, with five people. One interview was conducted in the UNIPD premises, face-to-face, the other four were carried out by phone. All interviews were recorded. The five stakeholders included:

non-profit associations:

a. one of the largest national associations (Legambiente) having the preservation of the Italian environment as its main mission. The association has great familiarity with institutions and with its members through several initiatives such as energy info points. The manager of one info point in Padova was contacted.

b. the member of a project 'Prorinnovabili' aimed at spreading ecological sustainability with local administrators (promoting regulation for sustainable buildings) organization promoting energy efficiency (Main Director).

governmental body:

c. a member of the city council in Bologna, with ecologist issues on the top of his list during the electoral campaign, and a long experience in environmental initiatives.

home-appliance industry:

d. two people, the Usability Manager and the Communication Manager of an international manufacturer of electronic appliances for the home. The manufacturer is committed in continuously improving the ecologicity of its products by minding the users' habits as much as the products' functioning and material

2.2.2. Insights

Some themes that emerged from the interviews and are insightful for the progression of the fieldwork in BeAware are listed below.

Definition of energy waste and use

Stakeholders referred to energy waste as

(a) that part of energy that is bought without actually being used. Therefore saving energy would mean keep on using as much energy as is needed but not leaving any of it unexploited. This is contrasted to the idea that energy saving consists of depriving oneself of the energy that is necessary in everyday life.

(b) that part of energy that is used inappropriately, both for lack of knowledge and for bad tools. The latter relates to buildings that are not properly insulated, or appliances that are obsolete energy-wise, and the former relates to lack of knowledge of direct and indirect energy consumption as well as on the ways to save it.

Interventions tried by the stakeholders seem to move along three main lines:

- increasing consumers' awareness and knowledge, to let them know about practices and tricks allowing to save energy, and to estimate the energy value of their habits and tools;

- supporting or inviting investments to buy better appliances, insulate buildings, install photovoltaic systems, install heat-valves on each radiator;

- promoting policies and regulations that praise energy savings behaviors and investments.

Savings potential

- better energy consumption habits
- house insulation and refurbishing
- use of low energy consuming appliances

Project and research related insights

When asked about the main information that citizens lack about direct and indirect energy consumptions, stakeholders' answer that consumers' knowledge barely consists of the bill they pay. Details such as the amount of kWh spent, or the cost of a kWh escape them. Apparently, this is information they do not care about or they do not use. In addition, people lack basic tips on the 'correct' use of appliances (e.g. meaning of appliances power class, …), or even use wrong ones (i.e. keeping on switching on and off certain devices to avoid wasting). Besides direct energy use, they lack information about the long term impact of the behaviors. For instance, having the house technically checked seems able to let them see the house as a system that uses energy and that can be modified to avoid waste. Finally, people do not know about technologies, products and processes (e.g. energy re-use, when the energy generated by on appliance is used to feed another one)

Dissemination activities

Activities adopted by stakeholders include:

a. energy info points teaching how to read energy bills and providing a technical check up of the house;

b. policies with penalties and rewards to encourage the adoption of quality standards;

c. informative campaigns promoting a closer link between local administration's energy policies and citizens;

d. participative projects;

e. informative campaigns in school;

f. accurate information on the use of appliances, explaining also the meaning of appliances' energy label;

g. web 2.0 technologies to involve consumers within an energy saving discourse;

h. adoption of energy saving policies within the promoting organizations itself, as a model to the others.

Stakeholders seem to think that saving money on the bill is the first reason for saving energy. The alternative seems to be having "green" values and an environmentalist ideology.

2.3. Finnish interviews

2.3.1. Informants' group

Four interviews were carried out in Helsinki, Finland during early August 2008. We first contacted four potential informants, who all agreed to be interviewed. Three interviews were conducted on site, one over telephone, because the informant was working outside the region. The interviews were done in two weeks, bit delayed due to the end of summer holiday season. The informants' group consisted of:

- Non-profit organization promoting sustainable energy (campaign director)
- Non-profit governmental research organization investigating energy efficiency (researcher)
- Energy producer and retail company (customer advisor)
- Home appliance producer (managing director)

2.3.2. Insights

National psyche

In Finland, there have been repeated initiatives in research and dissemination related to energy awareness starting from the 70's. However, the energy prices and political will during the last decades have de facto made energy preservation a less exciting and popular topic, even though there are lot of on going activities in the area.

Definitions of energy waste and use

- Variable use: Waste occurs when devices are turned on, but are not used.
- Meta-level of use: Neglecting the maintenance and proper use of home appliances. Having unnecessary cold or warm temperatures in buildings.
- The production energy: Buying equipment that is not needed or replacing functional devices with new ones, possible even with the aim of saving energy.

Savings potential

- Flats: Computers and home entertainment system. Invisible consumption and number of devices
- Detached houses: Heating and air-conditionings
- All: correct use and maintenance habits of kitchen and washing equipment

Prevailing attitudes

All informants thought that it is typical that consumers don't see the cumulative effect of their consumption. Consumers don't think that their choices are making a change on global scale and they more steered by money and comfort considerations.

Information lacked

- People do not understand the energy transmission network and how energy is produced, delivered and priced.
- Stakeholder's believe that people do not really understand how much energy is consumed by their devices or what is the real impact of their conservation acts. The perception of the consumed energy can be based on superficial, misleading cues (e.g. washing time of a device). Also the energy ratings for home appliances can be misleading because the efficiency may change considerably based on the how the device is really used.
- People can not see the large scale effects of their consumption decisions. Personal comfort is more important than small-scale savings or cumulative ecological effect, which people are unaware of.
- Consumer can not be aware of invisible consumption (stand-by) and also the consumption of new devices (IT equipment, digital set-top boxes) may be unknown.

Project and research related insights

- Extensive exploration of national initiatives and research projects related to energy awareness. Several relevant past projects and few on-going ones discovered. There are elaborate reports on the consumption practices and opportunities for preservation available in Finnish.
- Historical view of the development of energy awareness in Finland over the years. The energy crisis in 70's introduced a series of interventions and active research across organizations which has sustained until today, but clearly decreased in volume.
- Establishing contacts to researchers working on energy and related topics in national projects, with the experience from several relevant research projects (e.g. LINKKI-project, parts I and II)
- Contacts to civic organizations consisting of potential BeAware technology pilot users and focus groups
- Insight into present problems in households. The rapid introduction of new technologies, entertainment and IT, poses new challenges for consumers to regulate their consumption. Stand-by consumption and cumulative effect of multiple devices.

About Finnish consumers

- People are primarily motivated by financial savings. People usually become aware and act upon their practices only after they receive signal that their consumption has increased considerably (from a compensatory payment for an estimated bill)

- Probes into perceived attitudes of Finnish consumers. People are in favor of going green, but not motivated to change their habits. Cheap energy is not encouraging people to preserve energy. Green values as intrinsic values maybe just emerging among young generations.

Dissemination activities:

As mentioned across different stakeholders

- Energy info points in public spaces (special occasions, fairs, etc.)
- Permanent energy info point in company premises, incl. email and phone service
- Public campaigns, incl. Energy saving week (first full week in October)
- Internet (web) services and promotion,
- Material for primary school (low grades) environmental education
- Energy lectures for school classes at company premises
- Dedicated periodic print magazine for energy subscribers
- Including consumption information into company product manuals
- Disseminating research information to national associations and press

2.4. Conclusions

In this section are summarized the convergent themes emerging from the interviews in Italy and Finland. The limited number of informants across two culturally different regions cannot provide generalizable conclusions; instead, the informants' expertise and involvement in different kinds of initiatives make these interview an important contribution to corroborate the conclusions of other sections of this deliverable.

Across stakeholder groups

The stakeholders from different segments in Italy and Finland seemed to hold quite similar opinions. Among producers working in the same area, the Finnish producer did not seem very enthusiastic about investing into 'green features' although he acknowledged that there is some kind of 'green pull' on the market. This might reflect the prevailing Finnish consumption attitudes supported by the relatively cheap energy prices (see Chapter 3). The Italian ones, representatives of a multinational company, report instead of a strong commitment to adopt energy saving policies internally, as well as in researching and designing energy saving products.

Project and research related insights

One of the main outcomes of stakeholder interviews was establishing connections to national organizations and people working with energy behavior issues. Interviews document that there exists lots of activities related to increase energy saving both in the commercial and governmental sectors. They also confirm that interventions occurs at the same three levels around which the whole scientific literature on energy consumption behavior rotates, namely governmental policies, building with energy saving characteristics, and participation to saving programs. (For instance, in Finland, a researcher working in a governmental research institute was able to pinpoint several findings and research reports that have been previously published but only nationally). Stakeholders recommend to adopt solutions that are participative, involving citizens since the early phases of the design, or providing information that is tailored to the person receiving it (e.g. energy diagnosis of their own house), in addition to generic rules. Finally, both in Finland and in Italy stakeholders seem to think that saving money is the primary motivation to save energy, and both seem to think of a 'green' ideology' as the only optional motivation. This seem to suggest that saving energy should not be connected to ideology as a motivation, but also suggests to analyze more carefully what 'saving money' means (see literature review on the different between efficiency and sacrifice).

Definitions of energy waste and use

Informants in South and North converged in using an indirect, intuitive definition of energy waste, as consisting of buying energy without using or needing it. In addition, waste is connected to improper use electric appliances are used (possibly connected to the issue below about lack of knowledge). Finally, especially Finnish informants were also concerned about the energy invested in the production of appliances and the lifecycle of domestic products. This means that energy waste is very contextualized to the habits and needs of a family, both because it cannot be defined in absolute terms and because it is embedded in the structure of these habits, be they proper or improper. Also, no informant referred to moral or ideological definitions of waste, nor to the existence of algorithms of parameters. The current tools available are in the form of audits, which can calculate the saving potential for a certain household upon insertion of a (rich) number of information on the household itself.

Information lacked

Stakeholders globally had a quite pessimistic view about the awareness of a typical consumer about the energy consumption. Most informants were sceptical about how well people understood the relation of their electricity bill and the equipment they are using. The large scale effects and the energy transmission network were also often considered as unknown to many. This would suggests to check the awareness level with the kind of participants that will be involved in the trials and to add an awareness intervention connected to BeAware feedback intervention, or participants will not be able to actually contextualize and use the information provided to obtain energy conservation. It also suggests that providing detailed, factual information of the kind consumers would not use should be avoided; they would probably use information more related to their behavior, in order to exploit it while acting. Consumers seem also to act in a scenario void of the concept of energy consumption/use as a description of their activities, with certain implications on the short and on the long run and with certain better options available to them.

3. Potential areas for energy conservation

3.1. Italy

3.1.1. Country description

Geography

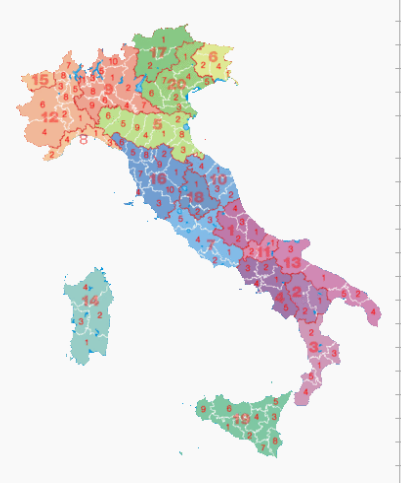
Italy is located in southern Europe, surrounded on the west by the Tyrrhenian Sea and on the east by the Adriatic Sea, and composed by the long, boot-shaped Italian Peninsula, the land between the peninsula and the Alps, and a number of islands including Sicily (9,926 sq mi; 25,708 km²) and Sardinia (9,301 sq mi; 24,090 km²). Its total area is 301 230 km², of which 294 020 km² is land and 7 210 km² is water.

Land borders with neighbouring countries total 1 932.2 kms, split predominantly between Switzerland (740 km), France (488 km), Austria (430 km) and Slovenia (232 km). San Marino (39 km) and the Vatican City (3.2 km), both entirely surrounded by Italy, account for the remainder.

Italy is subdivided into 20 regions (regioni, singular regione). Five of these regions have a special autonomous status that enables them to enact legislation on some of their local matters, and are marked by an asterisk. It is further divided into 109 provinces (province) and 8,101 municipalities (comuni).

Figure 3.1 The Italian Region (Capital, Area)

Regions of Italy



	Region	Capital	Area (km²)
1	Abruzzo	L'Aquila	10,794
2	Basilicata	Potenza	9,992
3	Calabria	Catanzaro	15,080
4	Campania	Naples	13,595
5	Emilia-Romagna	Bologna	22,124
6	Friuli-Venezia Giulia*	Trieste	7,855
7	Lazio	Rome	17,207
8	Liguria	Genoa	5,421
9	Lombardy	Milan	23,861
10	Marche	Ancona	9,694
11	Molise	Campobasso	4,438
12	Piedmont	Turin	25,399
13	Apulia	Bari	19,362
14	Sardinia*	Cagliari	24,090
15	Aosta Valley*	Aosta	3,263
16	Tuscany	Florence	22,997
17	Trentino-Alto Adige*	Trento	13,607
18	Umbria	Perugia	8,456
19	Sicily*	Palermo	25,708
20	Veneto	Venice	18,391

Source: Istat (Statistic Data 2007)

In October 2007, the Italian population surpassed 59.5 millions. Italy currently has the fourth largest population in the European Union, and the 23rd largest population worldwide. Population density is 196.1 persons per kilometre, the fifth highest in the European Union. The highest density is in Northern Italy, as one third of the country contains almost half of the Italian population. The inhabitants live mainly in three different areas: North (East, West), Centre, South and islands (see 3.1.5). The major metropolitan areas are listed in table 1.3.

Table 3.1

METROPOLITAN AREA	INHABITANTS (IN MILLIONS)
Milan	7.4
Rome	3.8
Naples	3.1
Turin	2.4

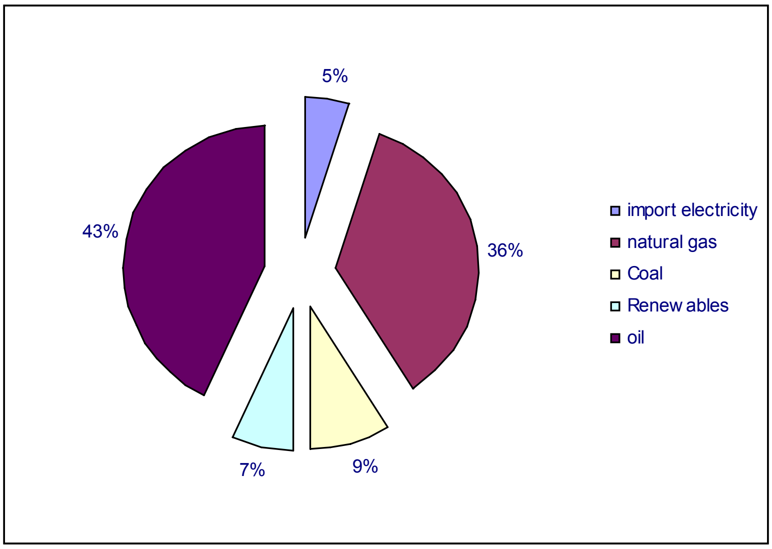
Sorce: Istat (Statistic Data 2007)

Energy Policy

With respect to the average of the 27 European Union countries, consumption of primary energy in Italy is characterized by greater use of oil and natural gas, a structural import (about 5% of primary), a reduced contribution of coal (9% of primary energy consumption) and a lack of generation power. The share of renewable energy is slightly higher than the average of OECD countries mainly due to significant contribution of hydro source.

The demand for primary energy was 194.5 Mtoe in 2007, suffering from a decline of about one percentage point in comparison with 2006. The use of energy sources in 2007 was characterized by a sharp contraction of consumption oil (-3.1%) not compensated by any growth in the consumption of other primary sources (Figure 3.2). Demand for oil products remains prevalent in comparison with other sources, covering 43% of the total consumption of primary energy, supported almost exclusively by energy needs in the transport sector.

Figure 3.2 Availability of energy sources, Italy 2007 (percentage)



Source: TERNA (2007)

Figure 3.3. Information on the electric generation in Italy

Electricity generation type	Number of plants	MW
Hydro Power	2.135	21.476
Thermal Power	1.087	72.951
Photovoltaic and Wind Power	7.850	2.801
Total installed capacity (31/12/ 2007)		**97.227**

Source: Terna 2007

Renewable energy will continue to increase over time, above all in the electricity sector. The 2007 renewable energy electricity gross production (about 50 TWh), represented 16,4 % of total gross production, and 15,1 % of total electricity demand (Table 3.3).

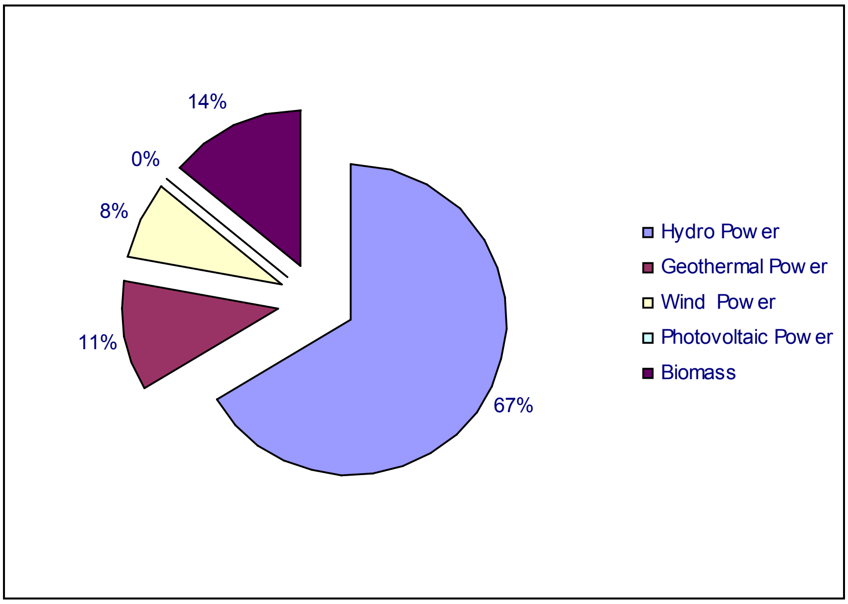
The main tool to support renewable energy will remain the "Green certificate" market-based mechanism. In parallel, the feed-in tariff scheme for photovoltaic systems and the recent legislation on energy efficiency in the building sector will contribute to accelerate the increase of renewable components in the energy mix. Another market-based mechanism named "White Certificates", is used to support energy efficiency and energy saving measures to reduce consumption to the end-use. Capital incentives are also available, but the adoption of market-based mechanisms at a national level leaves them mainly a regional and local measure.

Table 3.3. Production of renewable energy in Italy

Production of renewable energy in Italy	GWh
Hydro Power	32.815
Geothermal Power	5.569
Wind Power	4.034
Photovoltaic Power	39
Biomass	6.954
Total installed capacity (2007)	**49.411**

Source GSE 2007

Figure 3.3. Production of renewable energy in Italy (percentage)



Source GSE 2007

The “Gestore dei Servizi Elettrici (GSE Spa)” plays a central role in promoting, incentivating and developing renewable energy sources in Italy. The company has a single shareholder, i.e. the Ministry of Economy and Finance, which exercises its shareholder rights together with the Ministry of Economic Development. GSE is the parent of two companies: “Acquirente Unico (AU)” and “Gestore del Mercato Elettrico (GME)”.

Temperature during the year

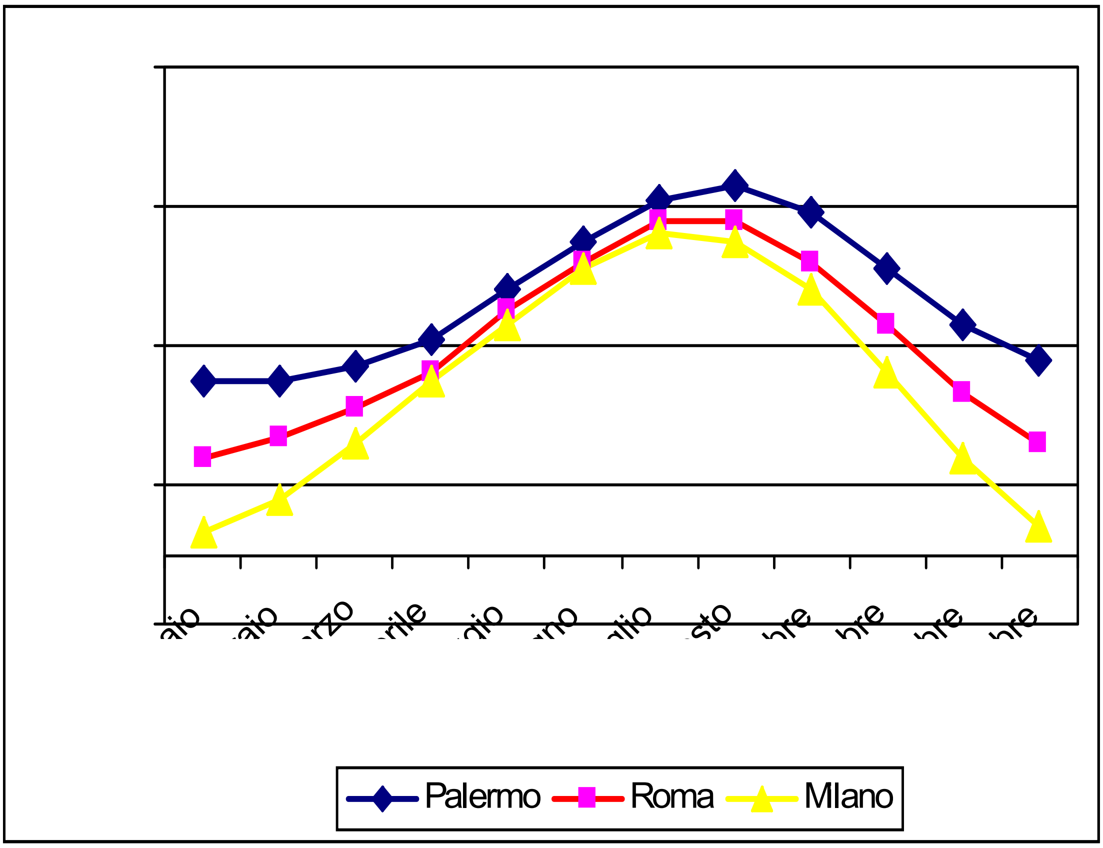
Room heating is regulated by Italian law (No. 10/1991 "Regulations for the Implementation of the National Energy Plan with Regard to the Rational Use of Energy, Energy Savings and the Development of Renewable Energy Sources.") It is a framework law to introduce regulations aimed at the efficient use of energy sources in all end-use sectors, including the specific reduction of energy consumption in production processes, especially in buildings and heating plants. Law 10/1991, as implemented by Presidential Decree 412/1992 and numerous other decrees and circulars, sets out energy efficiency measures such as building standards, including numerous energy efficiency regulations for buildings; rules for the design, installation and operation of thermal systems in buildings; and technical and construction criteria for new public and private buildings, as well as restorations.

Table 3.4 - Average outdoor temperature in three cities in South, Centre and North Italy

MONTH	Palermo (South)			Roma (Centre)			Milano (Nord)		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
January	10	15	**12,5**	2	12	**7**	-2	5	**1,5**
February	10	15	**12,5**	3	14	**8,5**	0	8	**4**
March	11	16	**13,5**	5	16	**10,5**	3	13	**8**
April	13	18	**15,5**	7	19	**13**	7	18	**12,5**
May	16	22	**19**	11	24	**17,5**	11	22	**16,5**
June	20	25	**22,5**	14	28	**21**	15	26	**20,5**
July	23	28	**25,5**	17	31	**24**	17	29	**23**
August	24	29	**26,5**	17	31	**24**	17	28	**22,5**
September	22	27	**24,5**	14	28	**21**	14	24	**19**
October	18	23	**20,5**	10	23	**16,5**	8	18	**13**
November	14	19	**16,5**	6	17	**11,5**	4	10	**7**
Dicember	12	16	**14**	3	13	**8**	-1	5	**2**

Source: Eurometeo

Figure 3.4. Monthly average outdoor temperature in three cities in South, Centre and North Italy, from January ('Gennaio') to December ('Dicembre')



Source Eurometeo

3.1.2. Energy demand and household profile

Obtaining some data on the trend in the Domestic Italian electricity sector (DIES) is not an easy task by relying on the available statistics. Most of the information provided by Istat (Italian institute of statistic) aggregates electricity, gas and water. Given the wider weight of electricity within this cluster, this datum can be used anyway to track general trends. In the domestic sector, such datum is not enough because during the last years the sector of the natural gas has exhibited different dynamics than the electric energy sector. Many Italian switched from electric energy to natural gas as energetic vector for the production of warm water and space heating.

In order to obviate the informative deficiencies, we tried to cross the aggregated information available, with Enel's analysis of the domestic energy market, to provide a description of the tendencies of the field.

Demographic balance of resident population

ISTAT in collaboration with the Population Register offices ('anagrafi') of the Italian municipalities ('Comuni') operates a monthly data collection "Movement and calculation of resident population" resulting in the Demographic balance of yearly resident population. Resident population is defined as the Italian and foreign citizens usually living on the national territory, even if temporarily absent. Each person having usual residence has to register, by law, in the population register of the municipality where s/he usually lives. The legal population is being determined on the base of the Population Census. The data on 31st of December 2007 is reported in table 3.5.

Table 3.5 - Resident Italian Population (2007)

Italy	Males	Females	Total
Resident population at 31 Dicembre	28.949.747	30.669.543	59.619.290
Number of Household	24.282.485		
Average number of household members	2,4		

Source ISTAT

The morphology of the Italian country (long and narrow) and the various social and economic differences results in 5 macro categories (North- East, North-West, Centre, South and Islands.).

Table 3.6 - Resident Italian Population per different areas (2007)

North-West	Males	Females	Total
Resident population on 31st December	7.671.983	8.107.490	15.779.473
Number of households	6.931.523		
Average number of household members	2,3		

North-East	Males	Females	Total
Resident population on 31st December	5.534.422	5.803.048	11.337.470
Number of households	4.787.448		

Average number of household members	2,3

Central	Maschi	Femmine	Totale
Resident population on 31st Dicember	5.628.728	6.046.850	11.675.578
Number of households	4.776.212		
Average number of household members	2,4		

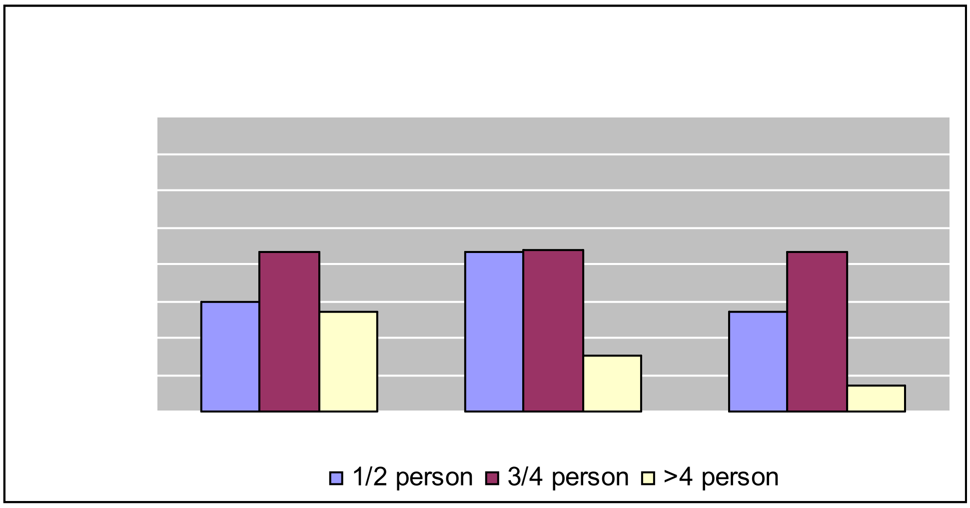
South	Males	Females	Total
Resident population on 31st Dicember	6.867.019	7.264.450	14.131.469
Number of household	5.174.432		
Average number of household members	2,7		

Islands	Males	Females	Total
Resident population on 31st Dicember	3.247.595	3.447.705	6.695.300
Number of households	2.612.870		
Average number of household members	2,6		

Source ISTAT

The first two areas (North-West and North-East) are similar by average number of household members and the energy profile. The last two (South and Islands) have the same average number of household members and the energetic profiles are similar. We can then group these areas in three clusters: North, Centre, South/Islands.

Figure 3.5. Evolution of italian households



Source: Eurisko 2008

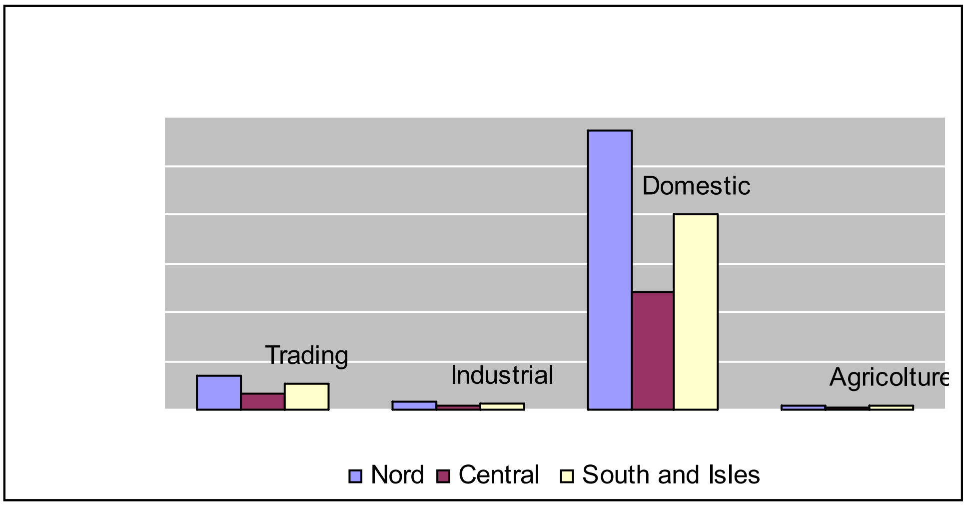
Electric Energy users

Table 3.7 - Electric Energy users

Electric energy users (Thousands of units) - 2007			
Italy	North	Centre	South and Islands
3938,1	1773,7	838,4	1326
928,6	455,1	211,7	261,7
30228	14257,2	5985,7	9985,2
534,9	178,6	101,8	254,4
35629,6	16664,6	7137,6	11827,3

Source: TERNA 2008

Figure 3.6. Electric energy users



Source: Terna 2007

Energy demand

Table 3.8 - Everage consumption per customer

CUSTOMER	N.	AVERAGE CONSUMPTION PER CUSTOMER (kWh)
Residential Sector	31.475.407	
Electrical power installed <= 3,3 kW	24.357.991	2.300
Electrical power installed > 3,3 kW	948.236	4.600
Second House	6.163.180	1.380

Source: GME - 2007

Average number of components per household

Table 3.9 -Average number of components per household

Areas	Number of components per household	Energy Consumption per household (kWh)
North	2,3	2647,3
Centre	2,4	2851,2
South and islands	2,65	2851,4
Italy	2,4	2716,8

Source: ISTAT - 2007

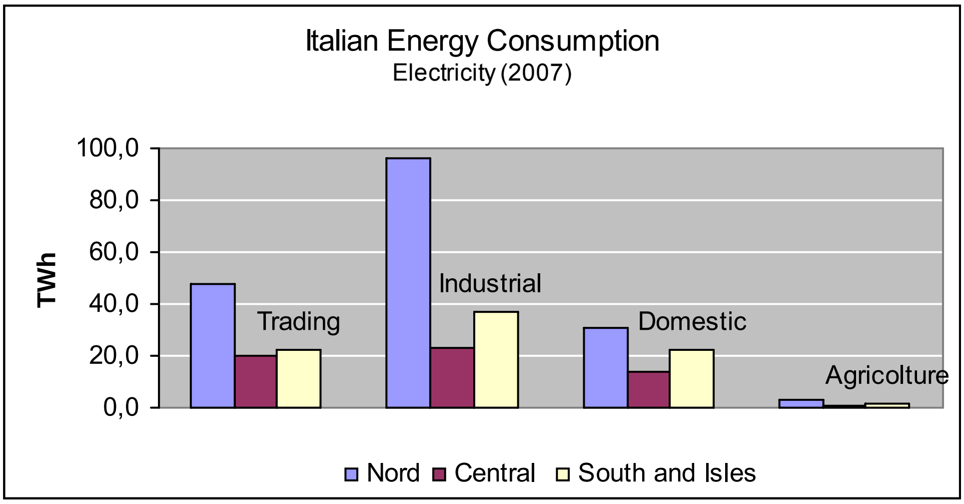
Energy Consumption (Electricity)

Table 3.10 - Energy Consumption (Electricity)

Energy Consumption - Electricity (TWh) 2007				
Sector	Italy	North	Centre	South and Islands
Trading	90,3	47,5	20,3	22,4
Industrial	155,8	96,0	23,2	36,6
Domestic	67,2	31,0	13,8	22,4
Agricolture	5,7	3,0	0,8	1,8
Total	319,0	177,6	58,1	83,2

Source: TERNA - 2007

Figure 3.6. The Italian Energy Consumption (Electricity)



Source: TERNA 2007

Energy Consumption per inhabitant (Electricity)

Table 3.11 - Energy Consumption per inhabitant (Electricity) kWh/ab

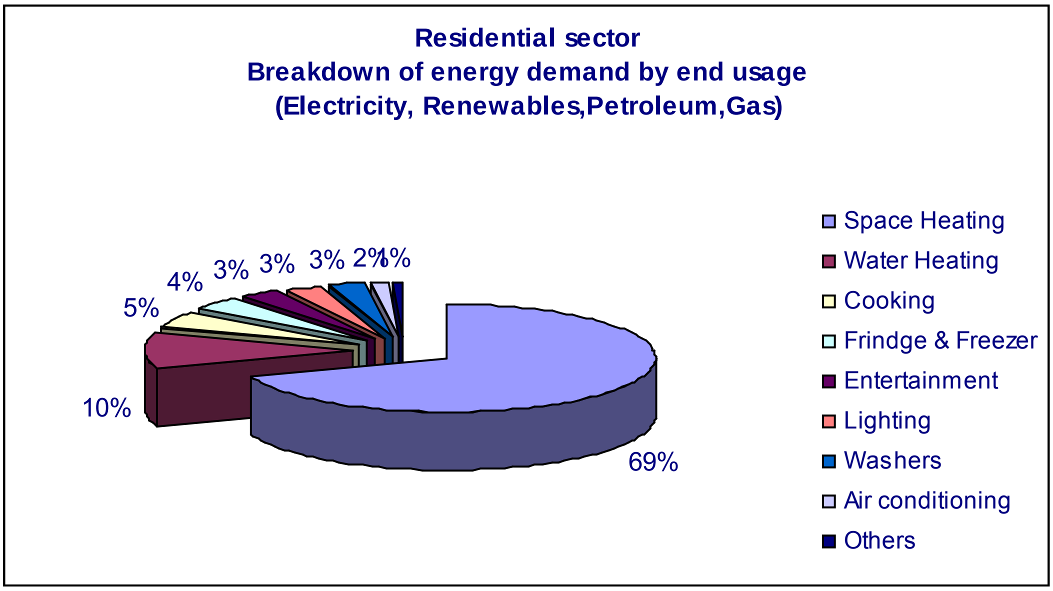
Energy Electric Consumption per inhabitant kWh/ab (2007)			
Region	**Total**	**Domestic**	**%**
North	**6585**	**1151**	**17,5%**
Piemonte	6185	1112	18,0%
Valle d'Aosta	7830	1463	18,7%
Lombardia	7029	1159	16,5%
Trentino Alto Adige	6276	1145	18,2%
Veneto	6543	1117	17,1%
Friuli Venezia Giulia	8394	1128	13,4%
Liguria	4019	1159	28,8%
Emilia Romagna	6530	1210	18,5%
Centre	**5009**	**1188**	**23,7%**
Toscana	5701	1174	20,6%
Umbria	7066	1090	15,4%
Marche	5030	1032	20,5%
Lazio	4218	1257	29,8%
South and Islands	**4002**	**1076**	**26,9%**
Abruzzo	5229	1014	19,4%
Molise	4752	916	19,3%

Campania	2995	990	33,1%
Puglia	4445	1031	23,2%
Basilicata	4959	875	17,6%
Calabria	2752	1082	39,3%
Sicilia	3798	1176	31,0%
Sardegna	7099	1330	18,7%
Italy	**5372**	**1132**	**21,1%**

Source: TERNA - 2007

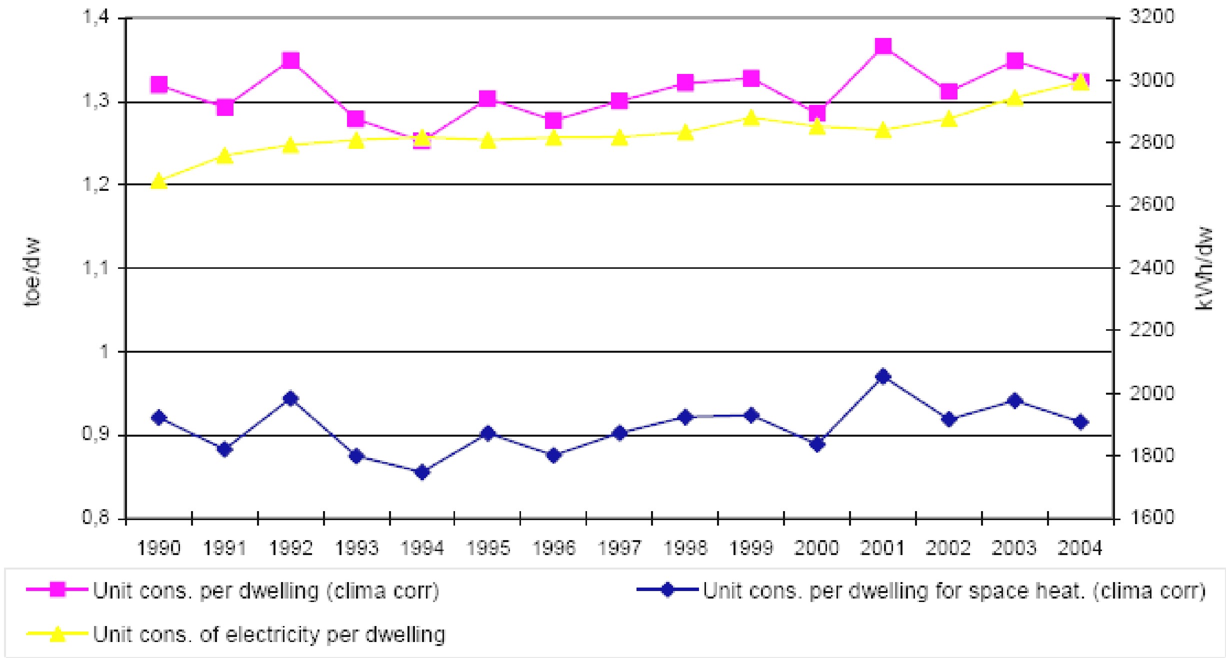
An analysis conducted by Enel obtained the breakdown for the Residential Sector illustrated in table 3.7. As previously mentioned, the statistics combine different energy sources (Electricity, Renewable, Petroleum, Gas)

Figure 3.7. Breakdown of energy demand by end usage – Residential Sector



Source: Enel 2005

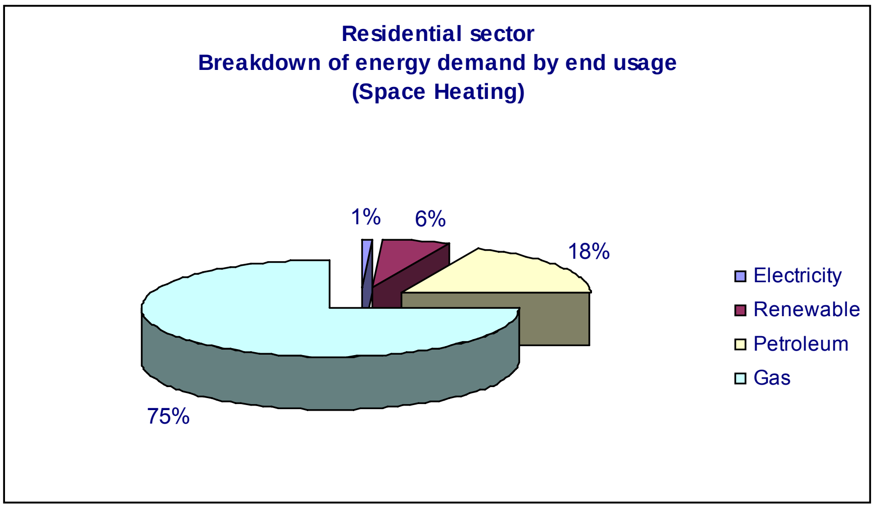
Figure 3.8. Unit consumption of households per dwelling



Source Enea 2006

From the preceding Figure 3.9 we have extrapolated the breakdown of energy demand by end use. Considering the low use of electric energy for space heating (6% Italian customers) and the low quota of electric energy used by the Country we have held opportune to exclude space heating from the chart related to energy demand by end use.

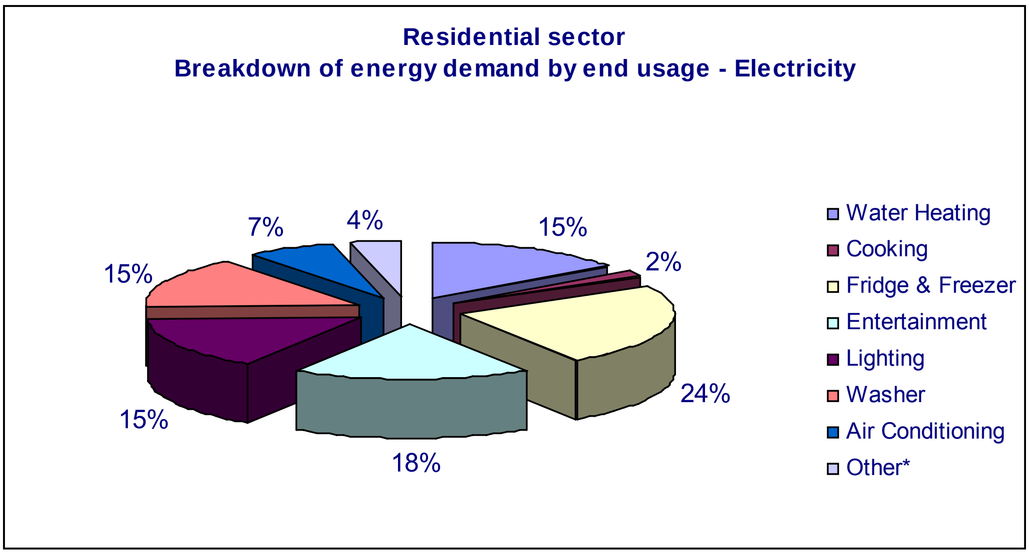
Figure 3.9. Unit consumption of households per dwelling



Source Enel 2005

Then breakdown of energy demand by end use is described by the following chart.

Figure 3.10. Breakdown of energy demand by end usage – Residential Sector (Electricity)



** Other: electric ovens, small electrical appliances; Source: Enel 2005*

Table 3.12. Energy demand by end usage in terms of the principal Italian electric appliances

	kWh
Cooking	58,01
Frindge & Freezer	812,15
Entertainment	618,78
Lighting	522,10
Washers	522,10
Air conditioning	309,39
Others	135,36
Total	2977,90

** Other: electric ovens, small electrical appliances; Source: Enel (2005)*

3.1.3. Billing system and information available to consumers

The retail market is divided into two segments, one supplying clients on the captive market (which includes all household clients and eligible non-household clients who have chosen to continue to purchase electricity at regulated tariffs) and the other supplying clients on the free market (which includes those non domestic clients who have chosen to change supplier). Starting from 1st July 2007, all users are free to choose their contractual counterpart and to negotiate the supply conditions, while retaining the right to remain within the captive market.

In 2006, captive market consumption, on the basis of the preliminary data supplied to the Authority by the distributors, fell by over 9% from the previous year, settling at 138.5 TWh of energy, of which 61.6 TWh correspond to withdrawals by household users and 76,9 TWh to non-household use.

The captive market continues to have an extremely high market share, 86.3% in 2006, rising from the 85.5% of previous year.

On 31st December 2006, there were 7.6 million eligible and thus potentially free clients who withdrew, during the year, 221.5 TWh of energy (net of consumption by users benefiting from special tariff regimes); with respect to the previous year , the volume of energy withdrawn by the same clients fell by approximately 1.7 TWh. Average withdrawal by client showed a slight increase compared to the previous year settling at 29,187 kWh/year.

There were 700,000 clients, on 31st December 2006, who procured effectively on the free market, with total withdrawals of 149.7 TWh, corresponding to 67.7% of the potential market.

Sales to the clients of the free market show a lower level of concentration with respect to sales on the captive market.

Considering overall free market sales, there were 4 groups with market share of 5% or more: the Edison Group (15.8%), the Enel Group (14.8%), the Eni Group (7.8%) and the Sorgenia Group (5.5%).

The non Italian companies (considering those with at least one foreign shareholder, whatever equity percentage they hold), sold a total of 24.9 TWh, that is approximately 16% of the entire free market.

Conduct with respect to liberalisation

Within its annual survey of the electricity sector conducted in spring 2007, the Authority collected some switching data from grid operators. According to the survey over 450,000 users (or withdrawal points) switched from the captive to the free market in 2006, representing approximately 64% of free market users on 31 December of the same year. Approximately 52% of these ex captive clients, switched to the free market choosing an operator connected with the distributor of the captive market. On the other hand just over 16,000 clients (withdrawal points) switched back from the free to the captive market.

Table 3.13 – Type of Customers

Type of customers	2007		
Residential Sector	**before 1 July (*)**	**after 1 july (*)**	Totale N° of customer
electrical power installed < o = a 3,3 Kw	13.739.910,14	**10.618.081,00**	24.357.991,14
electrical power installed > 3,3 Kw	534.883,14	413.352,96	948.236,09
Second houses	3.479.924,73	2.689.255,04	6.169.179,77
Total	17.754.718,00	13.720.689,00	31.475.407,00

number of customers calculates to pro dieÓ

Source: GME (Gestore del Mercato Elettrico - Market Operator)

Final electricity tariffs

The electricity prices paid in July 2006 by the standards consumer defined by Eurostat and their breakdown are illustrated in table 3.14.

The tensions which characterised the international fuel markets and the consequent rise in the electricity price recorded on the major European exchanges since 2004 are reflected in a significant rise in generation costs for the different user categories.

Another significant aspect is the increased incidence on electricity tariffs of the general charges component. For all classes of user, in fact, there was an increase in these charges of over 80% with respect to 2005, particularly substantial for households.

Electricity tariffs

Table 3.14 – Standard Consumer

July 2006

Standard consumer (Eurostat definition)	Dc	Ib	Ig
Wholesale price of electricity or generation cost	86.80	94.98	82.80
Transmission tariff (excluding general charges)	69.40	3.60	3.49
Distribution tariff (excluding general charges)		40.21	5.83
Estimated margin to recover sales marketing costs		1.23	0.003
Grid losses	10.30	5.02	4.37
General charges	14.20	16.62	15.80
TOTAL (€/MWh)	180.70	161.66	112.30

Notes:

- The distribution tariff also includes the component to cover metering costs and equalisation of transport costs and the component to cover improvement costs of quality of service.
- The costs of ancillary generation costs and generation cost equalisation are included in the wholesale price of electricity.
- General charges include: *stranded costs*, incentives for renewable resources and other residual costs not connected with production and grid services.

Source: AEEG.

Dc*: annual electricity consumption in households of 3 500 kWh among which 1 300 kWh overnight (standard dwelling of 90m²);* ***Ib****: annual electricity consumption in industry of 50 MWh, maximum demand of 50kW and annual load of 1 000 hours;* ***Ig****: annual electricity consumption in industry of 24 000 MWh, maximum demand of 4 000kW and annual load of 6 000 hours.*

In table 3.15 below is described the structure of the Italian electricity market.

Table 3.15– Italian electric market

a) Basic component tarif		
Fixed price	€/cliente anno	4,127300
Charge	€/kW anno	4,498100
Energy price:		
At 900 kWh	€/kWh	0,107220
From 901 kWh to 1800 kWh	€/kWh	0,120850
From1801 kWh to 2640 kWh	€/kWh	0,152910
From 2640 kWh to 3540 kWh	€/kWh	0,236340
from 3541 kWh to 4440 kWh	€/kWh	0,244310
More of 4440 kWh	€/kWh	0,160260

b) A e UC e MCT Component use		
Fixed component	€/kW/anno	0,415200
to 1800 kWh consumed	€/kWh	0,010300
from 1801 to 3540 kWh consumed	€/kWh	0,035530
More of 3540 kWh consumed	€/kWh	0,02305

Source: Enel 2007

a) Component use		
Fixed component	€/cliente anno	4,127300
Charge	€/kW anno	4,498100
Energy price	€/kWh	0,103

b) A e UC e MCT Component use

Fixed component	€/kW/anno	0,415200
to 1800 kWh consumed	€/kWh	0,010300
from 1801 to 3540 kWh consumed	€/kWh	0,035530
More of 3540 kWh consumed	€/kWh	0,02305

Source: Enel 2007

All prices are tax free.

Comparison between two energy prices

Table 3.16 – Comparison between two energy price

Annual energy consume (kWh)	A Economic amount no tax Free market (euro)	B Economic amount no tax Captive market (euro)	A-B Save among fre and captive market	A-B/Bx100 (%)
1200	176,81	164,43	12,38	7,53%
2700	445,58	417,72	27,86	6,67%
3500	671,33	635,22	36,11	5,68%
4500	944,15	897,72	46,43	5,17%
7500	1575,03	1447,65	127,38	8,80%

Source: Enel 2007

For BeAware purposes we decided to use the free market green energy price, referred to Annual energy consumption of 3500 kWh: **0,23 €/kWh** (tax included) .

Type of meters

Availability of Automatic Meter Reader Information

Enel's Meter system is called Telegestore. It ia an Automatic Meter Reader. The Telegestore system gives customers information about:

- energy consumption
- total monthly consumption

The Telegestore gives Enel (or other distribution company) a Remote Management System for the Entire Energy Distribution Process.

Through Telegestore' Remote Management, the distribution company can make:

- Contract Activation
- Contract management
- Contract termination
- Bad payers management

The last one reduced drastically the number of bad payers.

Telegestore is fully operational on 30 Mln Enel's Customers

Information available to customers from bills and from other sources

Enel Energia's customers have the ability to get information about their consumption through their invoice. Customers receive bills every 2 months.

Figure 3.11. Energy Bill

L'ENERGIA CHE TI ASCOLTA.

DATI CLIENTE

Numero cliente: 838 995 047
Partita IVA: 01298521210
ENEL DISTRIBUZIONE

CONTATTI UTILI

SERVIZIO CLIENTI
800 900 800 Numero verde
199 50 50 55 da cellulare numero non gratuito
lunedì-venerdì 8-22; sabato 8-14
www.prontoenel.it
QuiEnel, scopri quello più vicino su www.prontoenel.it
Casella Postale 1100 - 85100 Potenza
per informazioni e reclami scritti

SEGNALAZIONE GUASTI
803 500 Numero verde
da rete fissa e da cellulare tutti i giorni 24 ore su 24

GINKO e GIASBO

Via Lupin III

BOLLETTA PER LA FORNITURA DI **ENERGIA ELETTRICA**
N. fattura 610010670110514 del 04/05/2007
Mese **aprile 2007**
Attenzione: per questa bolletta non c'è niente da pagare

Le sue bollette precedenti già scadute ci risultano pagate. Grazie

DATI FORNITURA

Le abbiamo fornito energia in
SS Sannitica 87 SN GRADIL - 81100 SAN LEUCIO
Codice POD: IT001E83899504(7)
Numero di presa: 6100106701105

TIPOLOGIA CONTRATTO:
Uso Diverso dall'Abitazione
con Opzione Tariffaria base M1
- tensione di fornitura 380 V - Media Tensione
- potenza contrattualmente impegnata 10 kW (chilowatt)
- potenza disponibile 11 kW (chilowatt)

RIEPILOGO LETTURE
Abbiamo calcolato questa bolletta di conguaglio tenendo conto delle letture:

65484 del 08/09/2006 (effettiva)
65725 del 23/11/2006 (finale effettiva a chiusura del contratto)

CONSUMO EFFETTIVO PER 76 GIORNI:
241 kWh (chilowattora)

Nelle bollette precedenti abbiamo già addebitato in acconto:
241 kWh (chilowattora)

DATI CONSUMI

Totale energia elettrica fornita	10,71
Acconti bollette precedenti per quote energia	-30,50
Totale imposte	3,49
Acconti bollette precedenti per imposte	-3,48
Totale energia elettrica fornita e imposte	**-19,78**
Totale proventi e oneri diversi soggetti IVA	**-0,03**
Importo IVA 20% (su imponibile di euro -19,81)	**-3,96**
Totale altri proventi e oneri	**-90,04**
TOTALE DELLA BOLLETTA	**-113,81**

Sul retro del foglio trova il dettaglio importi della bolletta.

Source Enel 2005

Figure 3.12. Details of energy bill

DETTAGLIO IMPORTI BOLLETTA

	Unita di misura	Corrispettivi unitari euro	Quantità	Totale euro
CORRISPETTIVI PER L'USO DELLE RETI E IL SERVIZIO DI MISURA (A)				
Quota fissa				
mesi luglio - agosto 2007	cliente/mese	7,425300	mesi 2	14,85
Quota potenza				
mesi luglio - agosto 2007	kW di potenza impegnata/mese	2,157500	kW 15,0 mesi 2	64,73
Quota componente tariffaria A6				
mesi luglio - agosto 2007	kW di potenza soggetta/mese	0,286800	kW 13,5 mesi 2	7,74
Quota energia				
dal 01/06/2007 al 30/06/2007	kWh	0,036800	kWh 2.637	97,04
dal 01/07/2007 al 31/07/2007	kWh	0,034700	kWh 2.724	94,52
dal 01/08/2007 al 03/08/2007	kWh	0,034700	kWh 263	9,13
Totale				*200,69*
Riduzione quota energia				
dal 01/06/2007 al 30/06/2007	kWh	-0,005500	kWh 1.651	-9,08
dal 01/07/2007 al 31/07/2007	kWh	-0,005500	kWh 1.705	-9,38
dal 01/08/2007 al 03/08/2007	kWh	-0,005500	kWh 164	-0,90
Totale				*-19,36*
TOTALE (A)				**268,65**
CORRISPETTIVI PER ACQUISTO, VENDITA, DISPACCIAMENTO E SBILANCIAMENTO (B)				
Quota fissa				
mesi luglio - agosto 2007	cliente/mese	0,273500	mesi 2	0,55
Quota energia				
dal 01/06/2007 al 30/06/2007	kWh	0,091300	kWh 2.637	240,76
dal 01/07/2007 al 31/07/2007	kWh	0,091600	kWh 2.724	249,52
dal 01/08/2007 al 03/08/2007	kWh	0,091600	kWh 263	24,09
Totale				*514,37*
TOTALE (B)				**514,92**

Source: Enel 2005

Residential Customers are not able to receive WEB information about monthly consumption by Enel Energia. That service is available only to Business Customers.

Figure 3.13. Telegestore

Source: Enel

Figure 3.14.

Error! Objects cannot be created from editing field codes.

Enel

The Italian Electricity System Authority AEEG has published the resolution 292/06, according to which all Italian electricity customers will be equipped with AMMs (Automatic Meter Management System) by 2011

3.1.4. Characteristics of appliances in Italy

Dishwashers: A dishwasher is a mechanical device for cleaning dishes and eating utensils. Dishwashers are common in 47% of family [Niche consulting 2007]. In Italian flats, dishwashers are connected only to cold water pipe.

Washing machines: A washer machine, or washer, is a machine designed to clean laundry, such as clothing, towels and sheets. They are common in 90% of family [Niche consulting 2007].

Cold appliances : A refrigerator (often called a "fridge" for short) is a cooling appliance comprising a thermally insulated compartment and a heat pump - a mechanism to transfer heat from it to the external environment, cooling the contents to a temperature below ambient. Refrigerators are extensively used to store foods which deteriorate at ambient temperatures; spoilage from bacterial growth and other processes is much slower at low temperatures. Domestic freezers can be included as a compartment in a refrigerator, sharing the same mechanism or with a separate mechanism, or can be standalone units. Domestic freezers are generally upright units, resembling refrigerators, or chests, resembling upright units laid on their backs. Many modern freezers come with an icemaker. They are common in 95% of family [Niche consulting 2007].

Air Conditioning: The term air conditioning refers to the cooling and dehumidification of indoor air for thermal comfort. In a broader sense, the term can refer to any form of cooling, heating, ventilation or disinfection that modifies the condition of air. They are common in 28% of family [source Niche consulting 2007].

Heat water boilers – 74,5% of Italian families use natural gas to heat water. 5% of Italian Family use removable to make Heat Water and 20,5% Family use electric to make Heat Water.

Natural Gas is available in a lot of houses. Natural gas is not available in Sardinia.

Table 3.17 - Distribution of Heat water boilers in Italy

	Methane Customers	LPG Customers	e.e. customers	others Customers	Total
Abruzzo	547.000	130.276	15.051	60.202	752.528
Basilicata	180.000	102.456	6.277	25.107	313.840
Calabria	353.000	658.368	89.899	22.475	1.123.742
Campania	1.180.000	1.025.011	49.000	196.001	2.450.012
Emiliaromagna	2.069.000	92.246	48.028	192.111	2.401.385
Friuli Venezia Giulia	446.000	171.673	13.726	54.904	686.303
Lazio	2.094.000	564.215	59.071	236.286	2.953.572
Liguria	838.000	187.519	22.789	91.157	1.139.466
Lombardia	4.475.000	41.295	100.362	401.448	5.018.105
Marche	613.000	118.161	16.248	64.992	812.402
Molise	110.000	57.749	3.728	14.911	186.388
Piemonte	1.928.000	385.064	51.401	205.606	2.570.071
Puglia	1.042.000	818.797	165.404	41.351	2.067.553
Sardegna		789.358	70.165	17.541	877.065
Sicilia	851.000	199.437	1.111.564	464.091	2.626.092
Toscana	1.460.000	358.345	40.408	161.631	2.020.383
Trentino Alto Adige	236.000	225.076	10.246	40.985	512.307
Umbria	319.000	82.755	8.928	35.712	446.394
Valle d'Aosta	18.000	82.275	2.228	8.913	111.416
Veneto	1.941.000	224.745	48.128	192.511	2.406.383
Total	20.700.000	6.314.820	1.932.652	2.527.935	31.475.407

Source: Enel

Table 3.18 Breakdown of usage of natural gas by end usage

[C]	10,8%
[WH]	0,6%
[C] + [WH]	11,2%
[MF SH] + [S SH]	4,2%
[S SH] + [C] + [WH]	61,1%
[S SH] + [C]	7,6%
[S SH] + [WH]	1,6%
[MF SH] + [WH]	0,4%
More	2,5%
Total	100%

Legend: Cooking [C], Water Heating [WH],
multi flats Space Heating [MF SH], Single Space Heating [S SH]

Lighting

The domestic lighting industry has a significant weight on energy consumption in Italy. The annual electricity use is more than 7 billion kilowatt hours, equivalent to about 13% of total electricity consumption in the domestic sector.

The compact fluorescent lamps, the so-called low consumption lamps, have a much higher light (4 to 10 times) to the common incandescent lamps, an average life of 10,000 hours compared to 1000 hours of incandescent and low consumption. Although the cost of fluorescent bulbs is higher, the high efficiency allows a reduction of electricity consumption up to 70%.

Replacing the common incandescent lamp bulbs with low consumption is therefore very beneficial. A 25-watt fluorescent lamp provides the same amount of light as an incandescent bulb of 100 watts. Replacing a 100-150 watt lamp (1,000 hours of life) traditionally present in frequently used rooms such as kitchen or living room (2,000 hours a year-on) with a compact fluorescent lamp of 25 watts (8,000 hours of life), leads to a savings over 4 years of more than 100.00 euros.

Our goal is to use lighting with lower energy consumption. It is also important to determine the proper distribution of light sources and the right amount of light. The main activities carried out in a specific environment determine the particular kind of light required. The central chandelier is not a beneficial solution in terms of energy: it is better to distribute the lamps according to where the activities are located. In general, the best solution is to create a soft light throughout the environment and act with more intense light sources in areas for specific activities like lunch, reading, studying. Scale, cellars, garages, where the light is on for a long time, should have fluorescent lighting and time- based switchers. In areas outside terraces, gardens, parking, access roads, however, it is more convenient to install sodium lamps. We can install lights, lamps, headlamps, with control systems or setting.

Interventions to reduce the Stand-by and consumption vacuum

Stand-by characterizes all the states of operation in which the equipment is not achieving the primary service for which it designed but expects to do so. In the past, this operation mode was limited to electronic devices (such as television, hi-fi, video recorder), but today several devices – including predominantly mechanical one - are equipped with a circuit Electronic control (for example washing machines, dishwashers or refrigerators). The reduction in consumption with Stand-by is possible with the introduction of technological. These improvements have often no additional cost because they are simply part of an improved electronic control architecture, and have no connection with the services of the unit. The failure to introduce these solutions on a large scale is due probably to scarce knowledge in the public that these opportunities exist, and the consequent lack of motivation in this sense for producers.

Microware ovens: Microwave ovens work with powerful high-frequency radiation (microwave radiation). This radiation is absorbed by food and transformed into heat. They are common in 45% of family [source Niche consulting 2007]. The are mainly used for thawing frozen food.

Recommendations on areas of energy saving

The Italian Action Plan for energy efficiency, presented in September 2007, describes the guidelines that the government has already taken to meet the target envisaged by the Directive 2006/32/EC (indicative targets, mechanisms, incentives and institutional, financial and legal, necessary to eliminate barriers and imperfections on the market that impede the efficient end-use energy): 9.6% energy savings by 2016 (about 11 Mtoe).

Proposed Measures acting on the main technologies available to implement effective intervention on end-use energy efficiency, create a synergy between the need for reducing energy dependence, increasing security of supply and reducing emissions of greenhouse gases which affects the competitiveness and technological innovation of the whole production system. Table 3.18 briefly describes the proposed measures and the corresponding assessments in terms of lower consumption in 2010 and 2016.

Table 3.19 - Italian proposed measures and the corresponding assessments in terms of lower consumption in 2010 and 2016.

efficiency measures to achieve the objective in the domestic sector	Annual energy savings expected in 2010 (GWh)
Building insulation opaque residential areas before 1870	3489
Replacing simple window with double glazing	233
Replacing incandescent light (GLS) lamp with compact fluorescent (CFL)	1600
Replacing dishwashers with Class A equipment	305
Replacing refrigerators and air conditioners with Class A equipment	1210
Washing machines with Class A equipment	31
Replacement of electric water heater with more efficient one	700
Efficient use of air conditioning	180
Use efficient heating systems	8150
Thermal vents and wood-fired boilers	1100

Source: ENEA (ENERGY AND ENVIRONMENT REPORT 2007)

3.1.5. Recommendations on areas for energy saving

Enel is Italy's largest power company, and Europe's second listed utility by installed capacity. It produces, distributes and sells electricity and gas across Europe, North and Latin America. Further to the acquisition of the Spanish utility Endesa, together with partner Acciona, Enel has now a presence in 22 countries with 75,500 MW of generating capacity (on 31st December 2007) and serves more than 50 million power and gas customers. Listed on the Milan stock exchange since 1999, Enel has the largest number of shareholders of any Italian company, at some 1.7 million retail and institutional investors.

The territorial extension of the Enel allows to make test in every area of the country. It is necessary however to fit the demands of the test with the comparability. Then, in order to get a good comparison to Finland and Sweden and address same kinds of consumers, it is recommended to chose households in city areas.

User selection

In 2006, 73.3 percent of resident households (17.3 million out of 23.6) and 74.7 percent of individuals (43.6 million) lives in owned homes.

Another 9.1 % of households (2.1 million) 8, 7 % of individuals receive housing in usufruct or free use. The remaining 17.7 % of households (4.2 million) and 16.6 % of individuals (9.7 million) rent their house.

From a territorial point of view, the share of households owning is higher, and increases, in the North and even more in the Centre of the Country, where correspondingly there is also the largest decline in the share of renters. It is decreasing, and the bottom of almost 5% percentage points in the South, where the amount of families receiving a house in use or free use increaseas.

Regarding household types, the share of renters is particularly high for Single people (especially younger than 35 years: 39.5 percent), who are positioned on the extreme of the age range (elderly and old). On the contrary, owners are more frequently couples without children, and on average have greater economic power.

According to section 3.1.14 and the breakdown of energy usage (witch don't include Space Heating) the recommendation on Enel's behalf is to include during the first trial period household consisting of

- Two apartments in North area (multi flats apartments) (Milano, Padova)
- Two apartments in Centre area (multi flats apartments) (Roma)
- Two apartments in South and isles areas (multi flats apartments) (Palermo)

Long term strategy

In accordance with EU Directive 32/CE/2006, Italy submitted its National Energy Efficiency Action Plan in July 2007. The plan considers measures already undertaken under the budgetary law of 2007 and other measures, such as application of energy efficiency standards in buildings and the promotion of high efficiency CHP plants. The proposed measures aim to achieve an energy saving target of 9.6% by 2016, comprising 118,464 GWh. The industrial, residential, tertiary and transport sectors are addressed.

In the residential sector, that could be measures by be-aware may include:

- thermal insulation of opaque surfaces of pre-1980 residential buildings;
- replacement of single glazing by double glazing;
- replacement of incandescent lamps (GLS) by fluorescent (CFL);
- replacement of dishwashers with class A appliances;
- replacement of refrigerators and freezers with class A+ and A++ appliances;
- replacement of clothes washing machines with superlative class A appliances;

- replacement with efficient electric water heaters.

3.2. Sweden/Finland

3.2.1. Country description

Geography

Sweden and Finland are situated in the northern part of Europe and are rather sparsely populated in comparison with the southern parts of Europe. Geographically, the two countries are neighbors and they have had a shared history. Though there are differences between the countries, there are big similarities in many areas. For instance, both countries areas consists to 50 % of forest, the climate is approximately the same in the two countries etc.

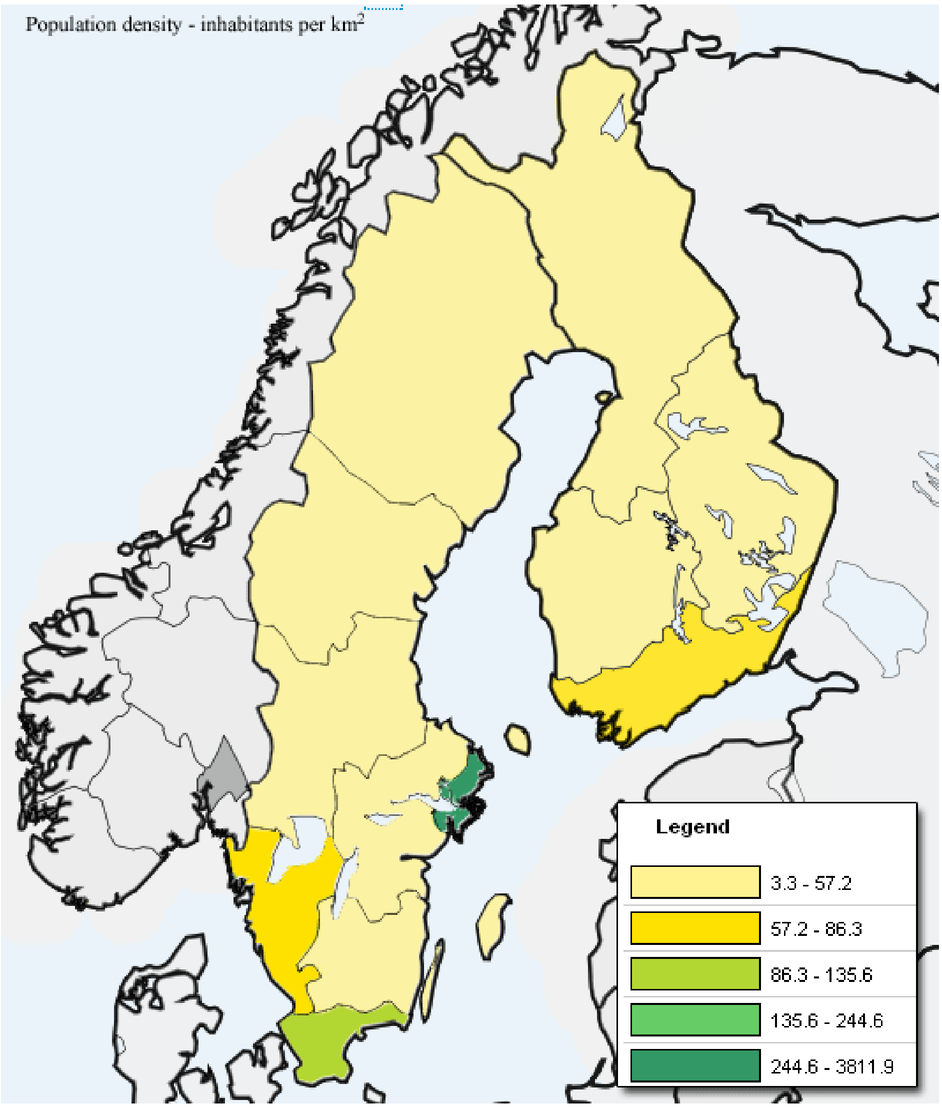
Sweden is a fairly big country with an area of 449 964 km^2 and a total number of inhabitants of approximately 9 200 000. Finland has an area of 338 145 km^2 and approximately 5 300 000 inhabitants.

The inhabitants of Sweden are mainly living in three different areas[7]: The Stockholm area, The Gothenburg area and The Malmo area, the inhabitants of Finland live mainly in the southern part of Finland including the Helsinki area.

Figure 3.15 - The density of inhabitants in Sweden/Finland.[8]

[7] http://www.h.scb.se/scb/bor/scbboju/cgi-bin/bj_mapp.exe

[8] www.ec.europa.eu/**eurostat**



Source: Eurostat

Energy policy

Sweden[9]

The International Energy Agency (IEA) has in 2008 published a country review on Sweden's energy policy called *Energy Policies of IEA Countries – Sweden*. The report states that

> "[Sweden] is in constant compliance with IEA oil security requirements; it is likely to meet its target under the Kyoto Protocol thanks to its ambitious climate policy; and it is intensifying efforts to improve energy efficiency and increase the use of renewable energy, both from an already high level."

The report also states

[9] *Energy Policies of IEA Countries – Sweden*, IEA, 2008, ISBN: 978-92-64-04333-6

> "By international comparison, Sweden's energy policy is sound and sustainable. The IEA congratulates the Swedish government for the continued outstanding progress during the last four years."

Finland[10]

In 2007, the IEA published *Energy Policies of IEA Countries – Finland*. The situation in Finland differs from the situation in Sweden. The report states:

> "Finland, like most IEA countries, also faces the challenge of rising greenhouse gas emissions, the level of which is much above its Kyoto Protocol target for the coming compliance period, and the country will struggle to meet its commitment."

The report also states

> "While Finland's energy policies are generally advanced, balanced and sound, scope exists for further improvement – as in all countries. Three areas can be given particular attention. The first is supply security. […] The remaining two key areas are energy efficiency and R&D, […]– arenas where longer-term policies can benefit the country's energy situation."

It seems like Finland has a more interesting energy policy from a BeAware-point of view.

Sources of energy

The electricity generation in Sweden and Finland is relatively environmental friendly. In Sweden over 50% of the installed electricity generation capacity is based on renewable energy sources and in Finland around 20% (in both countries mainly hydro power, see Table 3.9).

Table 3.19 - Installed capacity in Dec 31, 2006 by generation type, MW

Electricity generation type	Sweden	Finland	Total
Hydro power	16180	3044	19224
Nuclear power	8965	2671	11636
Other thermal power	8094	10743	30860
Wind power	580	86	666
Total installed capacity in 31.12.2006	**33819**	**16544**	**50363**
Increase since 31.12.2001	2098	-283	1815

[10] *Energy Policies of IEA Countries – Finland*, IEA, 2007, ISBN: 978-92-64-03071-8

Source: Swedish Competition Authority

According to EU standards, measuring a country renewable energy production should be based also on its self-sufficiency. This is important to consider when viewing Figure 3.16. One should read that:

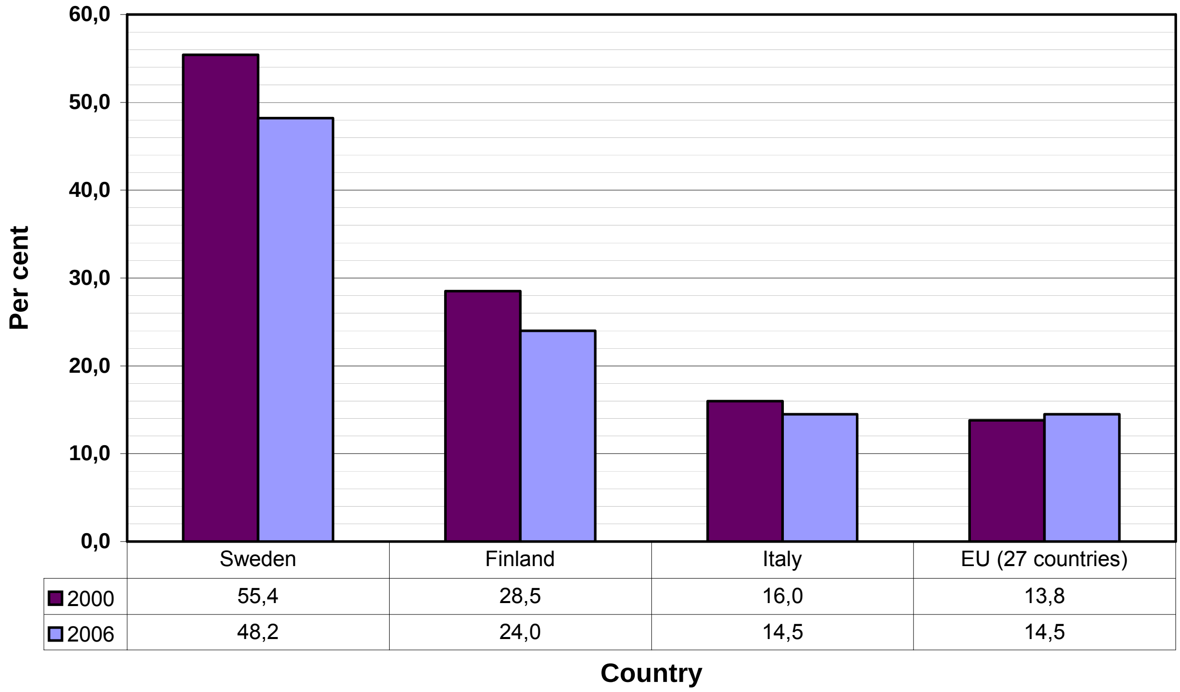
> "During 2006 Finland produced energy with renewable sources that covered 24% of the country's energy demand, compared to year 2000 that's a decrease by 4,5 percentage points."

Two things could, considering the factors, cause this;

- one is that the consumption has risen during this period and renewable energy production hasn't been able to keep up (very likely)
- the other would be that the production of renewable energy has decreased (less likely).

Notable is that this table will change a lot during the next couple of years, especially in Finland where new nuclear power plants are under construction.

Figure 3.16 - Production of renewable energy against total consumption

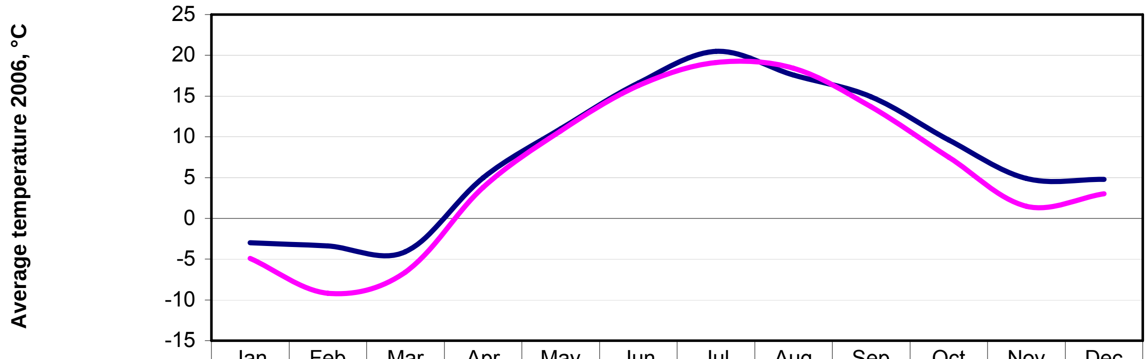


Source: Eurostat

Temperature during the year

Room heating is usually needed during the period when the outdoor temperature is under 10 ºC, which is from October to April, but the major consumption is during the coldest months when the average temperature is around zero and below (November/December to February/March). As Figure 3. shows, the temperature in both regions is very similar, and statements regarding need and demand of heating related appliances can be considered to be valid for both countries even if statistics for only one of them are available. The climate in Sweden and Finland is much colder than in Italy and therefore there isn't as much need for the inhabitants of Sweden and Finland to cool their homes with AC, compared to those living in the southern parts of Europe.

Figure 3.17 - Average outdoor temperature 2006

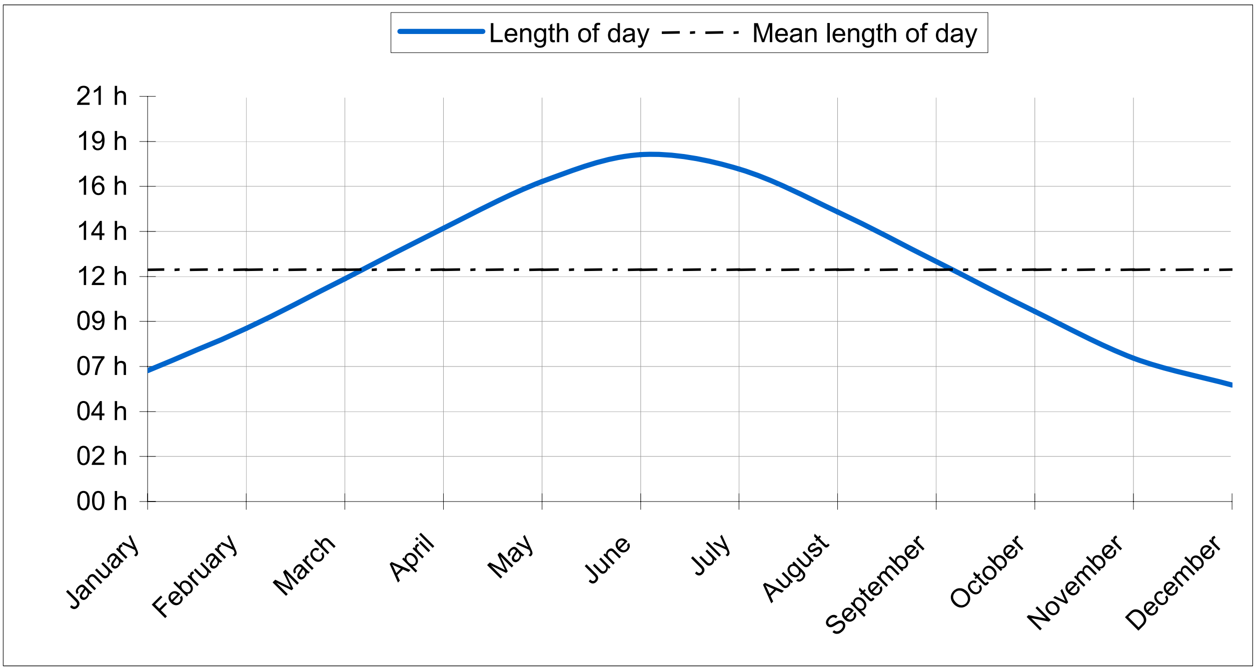


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Stockholm	-3	-3,4	-4,1	5	11	16,6	20,5	17,6	14,9	9,6	4,9	4,8
Helsinki	-4,9	-9,2	-6,6	3,8	10,7	16,3	19,1	18,4	13,7	7,5	1,5	3

Source: SMHI (Stockholm) and vantaa.fi (Helsinki)

Light during the year

Figure 3.18 - Length of day in Stockholm



Source: http://www.timeanddate.com

Due to the fact that the countries are very close to each other geographically, and that Helsinki and Stockholm are situated on almost the same latitude, the light conditions during the year can be assumed to be the same in both capitols.

3.2.2. Energy demand

Table 3.10 - Electricity consumption (including losses) in 2001 and 2006, GWh

	Sweden	Finland	Total
Production in 2001	150512	81604	232116
Production in 2006	146366	90111	236477
Increase in production	**-4146**	**8507**	**4361**

Source: Swedish Competition Authority

It is important to note that the values in the table above are not corrected for differences in temperature between the years and thus a comparison between the years might not give the exact increase in consumption compared to a “normal” year.

Availability of “Green” energy

In Sweden it is more and more common that energy companies offer their customers to buy environment friendly energy (from here on referred to as “green energy”). Some companies even have as a niche to only sell green energy to their customers. This is a relatively new phenomenon and there have not been any studies (that the project is aware of) that could be used as a statistical basis for knowing how common it is for customers to actively make a green energy choice. Therefore Vattenfall’s customers will be used to give a hint, as to how common this could be. From But as Figure 3. showed almost 50% of the electricity consumed in Sweden was produced by national, renewable energy and therefore there has not yet been any keen competition for green electricity.

Table 3. one can see that of all the customers in Sweden 12 323 – or 3,35% – has made an active choice. Furthermore you can see from Figure 3. that over 60% has chosen to actively support hydropower, and that 25% has actively chosen to support nuclear power. But as Figure 3. showed almost 50% of the electricity consumed in Sweden was produced by national, renewable energy and therefore there has not yet been any keen competition for green electricity.

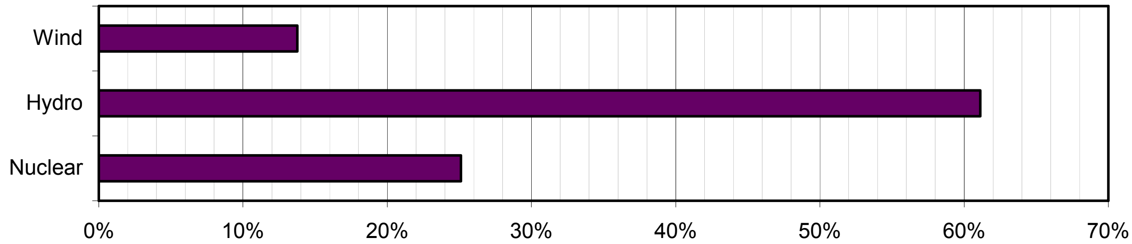
Table 3.21 -Active choice of electricity production type within Vattenfall Sweden

	No. of customers	Percent
Nuclear	3 095	0,59%
Hydro	7 532	1,43%
Wind	1 696	0,32%

No active choice	512 751	97,65%
Total:	525 074	100,00%

Source: Vattenfall

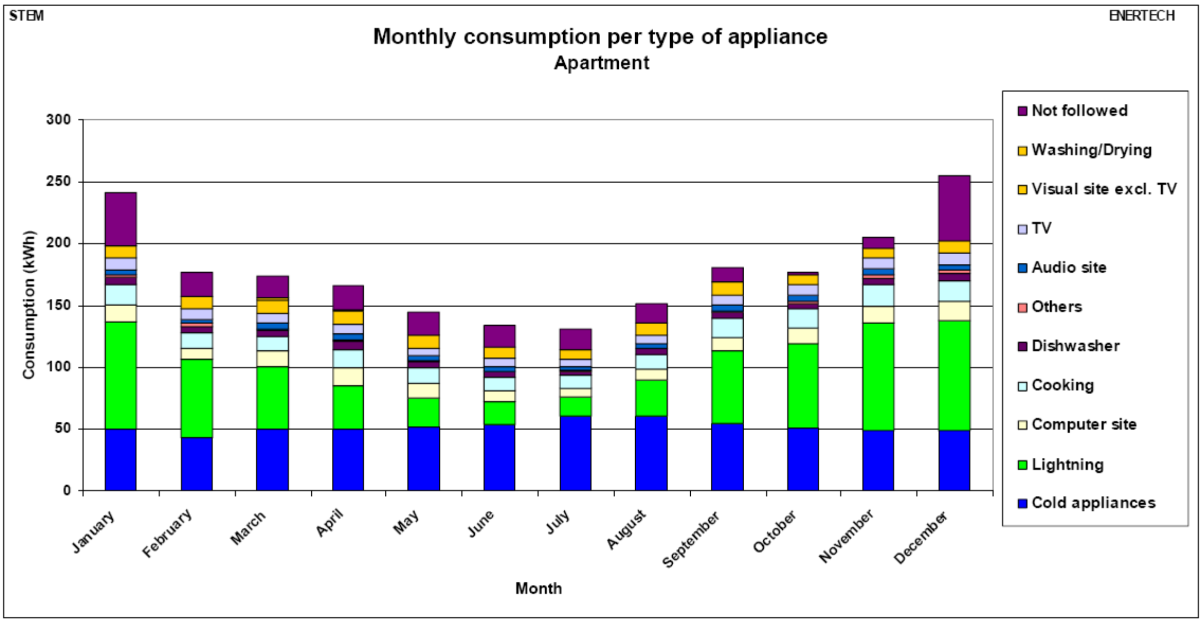
Figure 3.19 Production type chosen when actively making a choice



Source & Scope: Vattenfall

Demand by month during the year

Figure 3.20 – Monthly household consumption in apartments (excl. heating) in Sweden

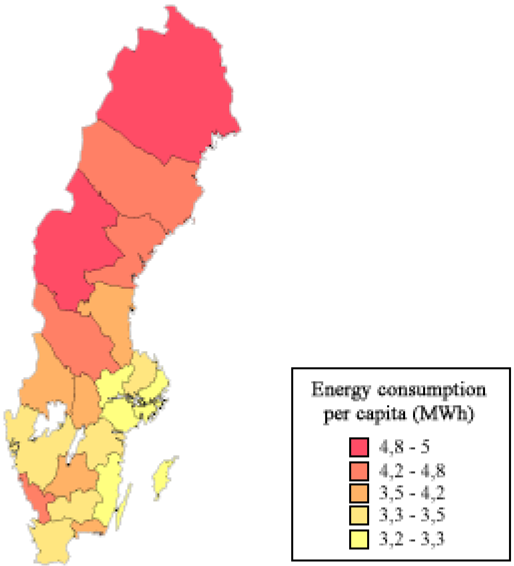


Source: Energimyndigheten

Household electricity is a lot less season depending comparing to the heating electricity, but as seen in Figure 3. it is still varying over the year. The largest change in consumption is the lightning, considering that the length of day differs from 6 hours in December to 18 hours (Stockholm, Sweden) in June that is self-explanatory. The second largest difference (excluding “not-followed”) is cold appliances, but as temperatures in apartments are usually kept at 20°C the only difference is during the summer when inside temperature rises above 20°C.

Demand per geographical area

Figure 3.22 - Electricity consumption per geographical area in Sweden 2006



Source: SCB

The main conclusion to draw from this picture is that in the parts of the countries where the climate is colder and the days during winter are shorter, the energy demand is higher. This conclusion should be applied also in Finland, which means that in the north of Finland, where the climate is colder and days are shorter than in the south of Finland, the energy demand should be higher.

Demand by type of household

The energy consumption in the Nordic countries varies from an average of 1200-2000 kWh/year in a small apartment with a single person up to about 5000-7000 kWh/year for a medium house with four persons.

In the Figure 3.:

- the four first cases include households without electric heating:
- The first three cases are flats where space heating is normally included in the rental charge.

- Case four represent customers with district heating.
- Only case five include electrical heating.

There is a recent study in Finland discussing this subject and similar studies have been done in Sweden. A comparison between Sweden and Finland shows large similarities but the total consumption in the Finnish households seems to have a larger span (1200-7000 kWh/year) than Sweden (2000-5100 kWh/year).

Figure 3.23 - Small dwelling heating in Sweden

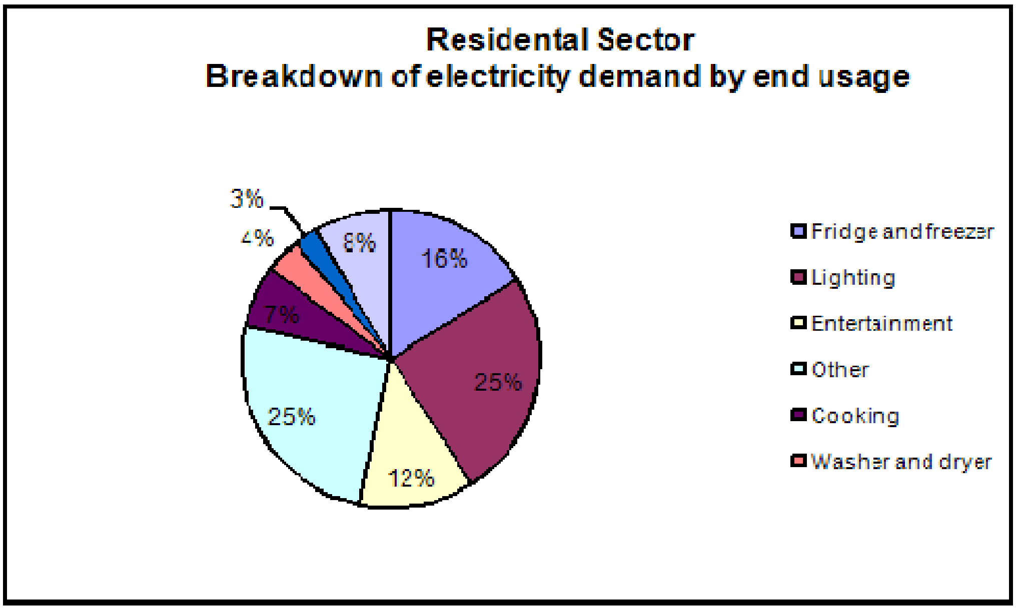
CASE	DESCRIPTION	CONSUMPTION FINLAND	SIMILAR SWEDISH HOUSEHOLDS	SWEDISH COMPARISON
1	small apartment, area 45 m^2, one person in household, high level of housing	2500 kWh/year.	3000 kWh/year	Avarage apartment
2	small apartment, area 45 m^2, one person in household, low level of housing (for instance no dishwasher)	1200 kWh/year.	2035 kWh/year	the avarage apartment with one person in household
3	bigger apartment, area 75m^2, three persons in household	2600 - 3000 kWh/year.	3900 kWh/year	the avarage apartment with two adults and two children in household
4	a single-family house, distric heating, area 120 m^2, 4 persons in household	7000 kWh. Increased pretty much. Earlier research (1993) it was 5900 kWh!	5100 kWh/year	the avarage single-family house, distric heating, area 120 m2, 4 persons in household
5	a single-family house, electric heating, area 120 m^2, 4 persons in household	18 000 kWh/year.	19000 kWh/year	- a single-family house, electric heating, area 120 m2, 4 persons in household

Scope: Statistics based on general data from the whole country.
Source: Rouhiainen and Korhonen (2008) Kotitalouksien sähkönkäyttö 2006. Adato Energia Inc.

Demand by process/appliance in the house (heating excluded)

FINLAND

Figure 3.24 - Breakdown of electricity demand by end usage



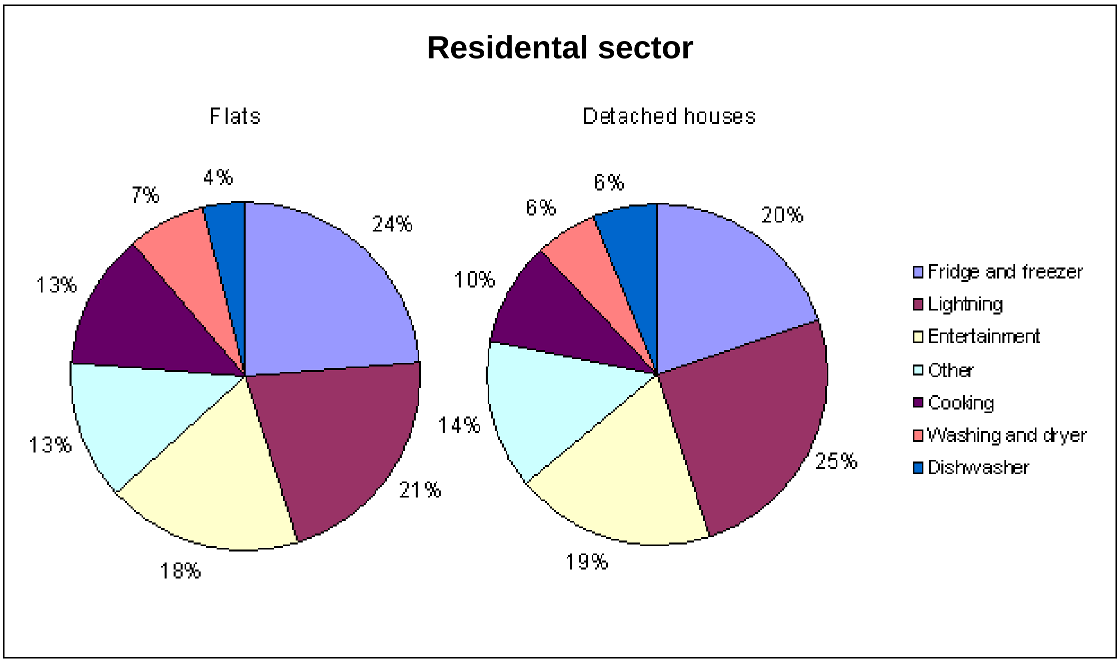
Source: Rouhiainen and Korhonen (2008) Kotitalouksien sähkönkäyttö 2006. Adato Energia Inc.

The Finnish statistics doesn't divide flats and houses (like the Swedish statistics below) so this is the total average for both housing types (heating excluded). As one can see, the single most energy-consuming product in the Finnish household is the lighting. That consumes a quarter of all household electricity. Fridge, freezer and cooking consume almost another quarter of the electricity.

All electronics, like TV, DVD, PC, stereo and radio is aggregated into one group called entertainment. In Finland the sauna is more popular than in other countries and therefore consumes a significant amount of energy (8%).

SWEDEN

Figure 3.25 - Breakdown of electricity demand by end usage and household type



Source: Energimyndigheten

Detached houses and flats show great similarities. Cold appliances and cooking is a bit higher in flats but that can be explained since they usually have about the same amount of appliances in both flats and houses but since houses had a larger total consumption, the percentage differ. On the other hand, lightning is larger in houses, probably because they use outdoor lightning. The Swedish consumption is very similar to the Finnish even though it has some other detail groupings.

3.2.3. Household profile

Average number of occupants

Table 3.22 - Occupancy in Sweden and Finland

	Sweden	Finland
Nr of households (1000s)	4345	2477
Nr of adults (1000s)	6672	4037
Nr of children (1000s)	2087	1263

Occupants per household	2,0	2,1
Children per household	0,5	0,5

Source: 1: SCB – Boende och boendeutgifter 2006, 2: http://www.tilastokeskus.fi/til/asuolo/index_en.html

The average number of occupants in households is very similar in Sweden and Finland. As shown in the table above, both ”Occupants per household” and ”Children per household” are very similar.

Type of occupancy and percentage[11]

Table 3.23 - Statistics on household types/size in Sweden and Finland

Sweden

Household type	Nr of thousands
Single person household	1928
Cohabitation without children	1122
Single person household with children	246
Cohabitation with children	836
Other households	213
Total	4345

Finland

Household type	Nr of thousands
Single person household	1000
Household of two persons	812
Households of three or more	665
Total	2477

Even though the statistics for the different countries are a bit different in the categories, the figures and tables above show that the distribution of the different kinds of household are rather similar in the two countries. For instance, in Sweden, 44 % of the households are single-households, in Finland, the percentage is 40%. As single households are common in both countries they represent an interesting target for the BeAware-system pilot.

[11] Source: SCB – Boende och boendeutgifter 2006 / Tilastokeskus

Figure 3.1 – Swedish household type/size statistics

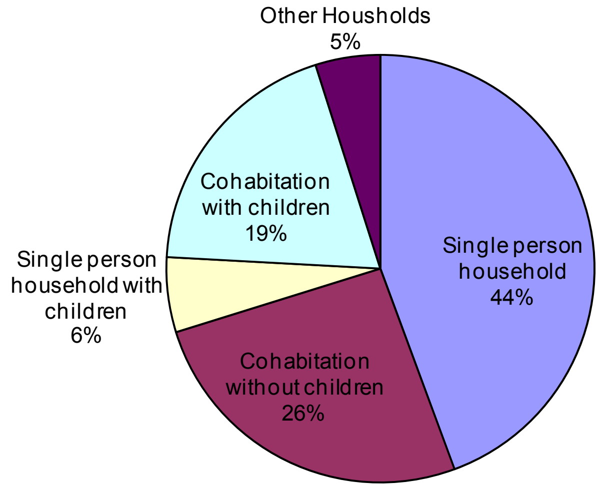
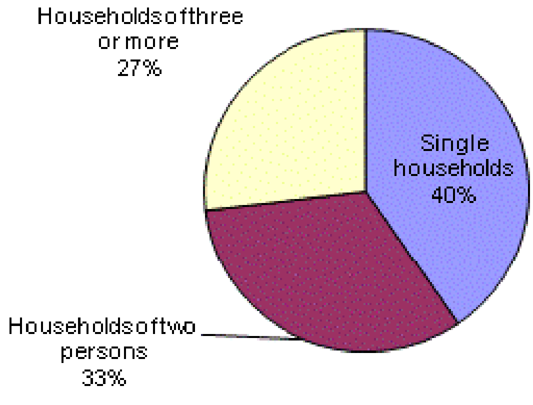
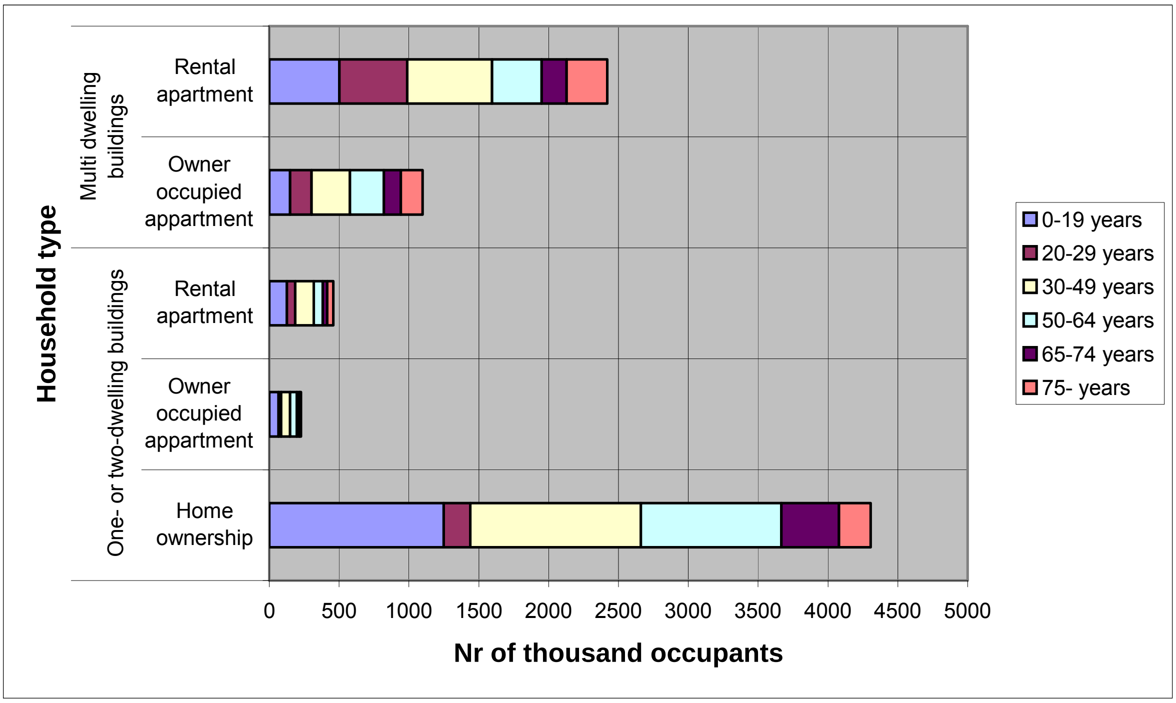


Figure 3.2 – Finnish household type/size statistics



Ownership

Figure 3.28 - Distribution of inhabitants in Sweden per household type and age

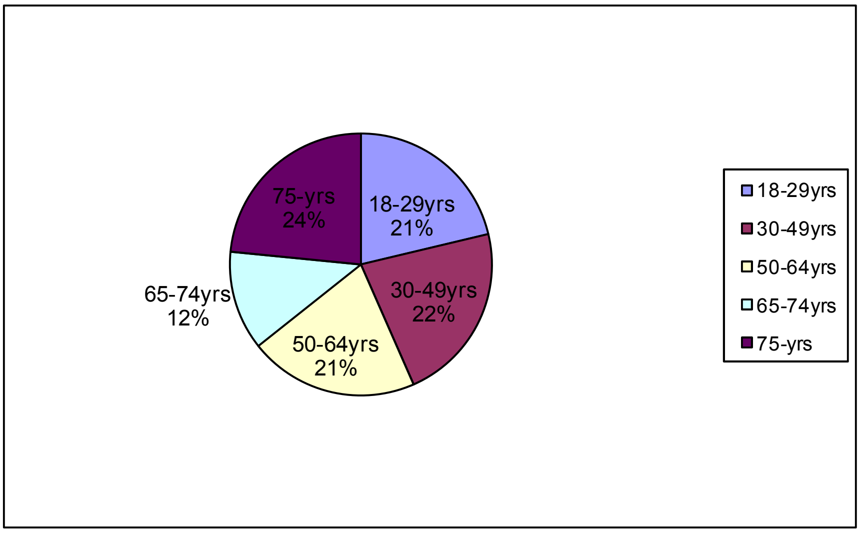


Source: SCB – Boende och boendeutgifter 2006

The statistics are from Swedish households, due to the so far shown similarities between the countries; the assumption is that the situation is similar in Finland. The types of residences in Finland are: 1 006 698 houses, 344 252 row-houses, 1 074 479 apartments and 51 076 of other types.

Age of occupants in single person households

Figure 3.29 - Age of occupants in single person households Sweden



Source: SCB – Boende och boendeutgifter 2006

The pie-diagram is based on Swedish data, due to problems finding the same data for the Finnish situation. However, considering the so far found similarities between the countries, the assumption that the situation is fairly the same in Finland seems likely.

3.2.4. Billing system and information available to comsumers

Market (liberalization)[12]

Finland

The electricity market in Finland has been 100% liberalised since 1997.

The electricity companies set the tariffs and other conditions themselves. Network tariffs and retail tariffs have to be published. The Energy Market Authority (regulator) may intervene and ensure adjustments to ensure compliance with the electricity market legislation.

Until the end of 2004 the regulator had no power to provide network system operators in advance with any common or binding rules concerning methodology or revenue level. The regulator monitored the tariffs afterwards on a case-by-case basis (ex-post regulation).

The Electricity Market Act was changed at the end of 2004 and the regulatory framework was changed partially towards ex-ante regulation from the beginning of 2005. Since then the regulator has had power to confirm in advance by means of a decision the methodology for the reasonable pricing of network services.

The methodology has been confirmed for a certain regulatory period. The first regulatory period has a length of three years covering years 2005-2007. The following regulatory periods have a length of four years. The regulator supervises thereafter at the end of each regulatory period whether the network system operators have followed the confirmed methodology (whether the pricing has been reasonable). The regulator also confirms ex-ante terms and conditions of network services.

The network system operators have an obligation to inform the regulator about the changes in their tariffs.

*See footnote 12

[12] Source (copied text):
Eurostat - http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-ER-07-001/EN/KS-ER-07-001-EN.PDF

Sweden

The electricity market was reformed on 1 January 1996. Competition was introduced for production and trade of electricity. Companies that perform transmission of electricity (local or regional monopolies) must be legally separated from companies producing, trading and selling electricity. All consumers were eligible in the new market if the consumption of electricity was measured by the hour. In November 1999 this requirement was abolished. Since then all consumers have the possibility to change electricity supplier without incurring costs.

The Energy Markets Inspectorate supervises the price of transmission of electricity. The Swedish

Parliament decided on certain changes to the electricity act in the spring of 2002. One of the changes was an amendment to the criteria for reasonable network charge. According to the new regulations, reasonableness assessment should be based on the performance of the network company.

**See footnote 12*

Tariffs

According to statistics from Eurostat[13] the average price for electricity per MWh in Sweden is 108,8€ and in Finland 87,7€ excluding taxes.

Availability of Automatic Meter Readers and Information

The central most important question is how many households will have an Automatic Meter Reader (AMR) collecting information about their energy consumption in the nearest future. This is important for both sales and distribution companies as the added benefit of having a better knowledge of their customers' energy consumptions. This enables them to help their customers with energy efficiency work as well as giving them a better, more detailed, feedback (for instance on their invoices). In Sweden there is a legislation[14] that stresses the schedule of the AMR rollout; as this legislation says that all meter readers must be read at least once a month. This will result in that every household in Sweden will have an AMR before 1 June 2009 (with a few exceptions). Vattenfall Distribution has, as of 2008-07-27[15] installed AMR's on all of their customers. At the time this project will run, every Vattenfall customer will be billed according to actual consumption with AMR.

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[13] Calculation based on *Households - Dc (Annual consumption: 3 500 kWh of which night 1 300)*.

[14] http://www.energimarknadsinspektionen.se/upload/F%C3%B6reskrifter/54541_01-24_Stemfs%205.pdf (swedish) (acc 2008-09-29)

[15] http://eldistribution.vattenfall.se/arkiv/nyheter_iframe_start.asp?ref=795 (acc 2008-09-29)

In Finland it has been estimated that in 2005, about 7 % and in December 2007 about 20 % of the 3,1 million small-scale customers (fuses max 3 x 63 A) had an AMR-meter. In addition, it has been evaluated that in 2010 the share would be 47%.

Also a Finnish energy organization Energiateollisuus has launched a recommendation that in the beginning of 2009 all new installed meters should be remotely read. The same recommendation included an aim that in the beginning of 2014 at least 80 % of the customers of each local electricity utility should have an AMR meter representing 95 % of the supplied energy of the utility.

One- or two dwelling buildings usually have the AMR installed inside the house or outside it in an electricity box accessible by the owners at any time. However, they are often placed in the basement, so it takes an effort for the customer to actually go down there and check The common place for multi dwelling buildings to have the meters is in a locked electricity central room in the basement of the building that isn't accessibly by the occupants of the flats.

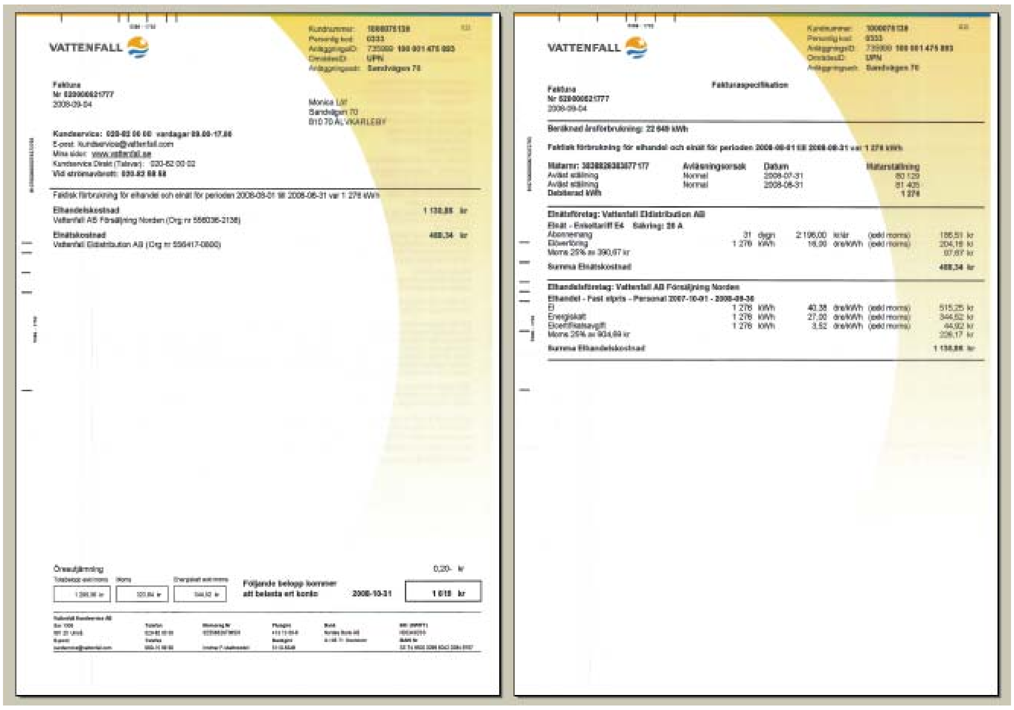
On the other hand, having access to the AMR doesn't help much in terms of energy saving, as they usually only show the current meter reading. So without comprehensive work of the consumers they won't receive any helpful information about the consumption of the household.

The AMRs do however save a lot of information about the consumption that is available for the network owner. For instance are consumption statistics down to hourly values, power outage information down to milliseconds, and voltage fluctuations all available in the meter.

Information available to customers from bills and from other sources

Vattenfalls' customers have the ability to get information about their consumption through their invoice and Vattenfalls' "Mina Sidor" which is a customer web portal.

Figure 3.3 - Example of a Vattenfall AB invoice



Source: Vattenfall

Figure 3.4 - Screenshot from a customers web portal Mina sidor ("My Pages")

Source: Vattenfall

Today the information given to them on the invoice is their total monthly consumption and their costs. Since nearly all customers now have AMR meters they get billed after their actual consumption for the previous month. Earlier the invoice was only based on an estimation and once a year the meter was read manually and the exact yearly cost was calculated which sometimes ended up with an extra high or low) invoice once a year.

They customers can get additional information online such as the previous months consumption, prognosis of future consumption and access to invoice-copies to see the costs. There is a lot of on-going activities within Vattenfall that will look into in which ways the customers' web portal could be improved in the future.

Figure 3.32 - Screenshot from Vattenfall's energy guide web service

Source: http://energialaskuri.vattenfall.fi/ or http://energiguiden.vattenfall.se/

Vattenfall has also launched an Energy-guide on both the Swedish and the Finnish web sites. The tool, available for all visitors (not only customers), offer a calculation of the recommended electricity consumption for a household like yours and also you can then find a number of suggestions how to reduce your consumption. You can both choose a ready-made profile or make your own detailed profile well adapted to your actual household to get a better match.

Figure 3.33 - Screenshot from Vattenfalls web service "Lev Energismart"

Source: Vattenfall.se

Vattenfall has recently launched a whole energy saving concept on Vattenfall national homepage in Sweden. The service is called *Lev Energismart* ("Smart Energy Living") and includes both energy experts, nationwide TV and energy saving tools and competitions as well as issues regarding global energy saving.

The *energy experts* are four senior energy experts in Vattenfall that both blog and are available for questions by e-mail.

Vattenfall has also recently started to broadcast a 5-minute program on nationwide TV in the Sunday morning talk-show in TV4 every week. The program is called ***Många Bäckar Små*** ("many a mickle makes a muckle" = many small contributions make a help). The program visits a private household in Sweden and helps them out with different energy saving questions. The programs are available on the TV4-website after broadcast. (link to one of the programs:
http://www.tv4.se/1.283438?videoId=1.646852&renderingdepartment=2.20509)

There is also a competition *Utmana dina vanor* ("Challenge your habits") running on the web until Nov, 30 2008 where you should agree to save on something, like changing to they map where in Sweden you live with your saving challenge.

Common agreements

Vattenfalls' customers have can choose to get their invoice in three intervals; monthly, every other month, and quarterly. Vattenfalls' customers most commonly get one invoice every other month (with an average of five (5) invoices per year).

Amount of customers using a direct debit

Table 3.23 - E-invoice and direct debit customers within Vattenfall Sweden

Payment type	2008-07-01	Per cent
Customers with E-invoice	37 036	**7,05%**
Customers with direct debit	36 878	**7,02%**
Customers with regular invoice	451 160	**85,92%**
Total	525 074	100,00%

Source: Vattenfall

Studies[16] have raised the concern of customers' abilities to take in information on their invoice; this especially regarding customers who have direct debit or E-invoices, as they don't need to see their invoice to pay their bill. Looking at Vattenfalls' customer base in Sweden as an example one can notice that there are almost equal amounts of E-invoice customers as there are direct debit customers; these sum up to about 14% of the total clientele. That means that almost 86% of the customers have to look at the invoice before being able to pay it. There is however no way of knowing how many of those customers actually study the invoice or how many would read any extra information other than what they should pay. But it gives a hint of what penetration power information on invoices might have.

3.2.5. Characteristics of appliances in the Nordic countries

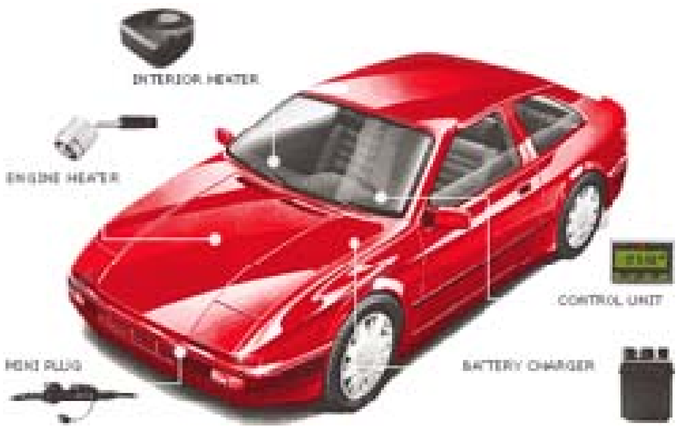
Car heaters are commonly used during the cold period. You are recommended to use a car heater when the outdoor temperature is below +10 °C (in order to minimise petrol consumption) Most people only use is when the temperature is near or below zero. The heaters are recommended to be connected for different lengths of time depending on the outdoor temperature. Today most people only have a simple timer that can be preset to fixed times.

Many have both an engine heater (500 W) and a compartment heater (500-2000 W) both running for the same time. More advanced systems with a control unit etc is available but still not so widespread (expensive).

[16] http://www.cse.org.uk/pdf/pub1014.pdf (acc 2008-09-29)

If you live in a flat you usually rent this at a fixed fee (not part of your electricity bill). If you have a house you pay it on your electricity bill.

Figure 3.24 - Different car appliances



Source: www.defa.com

Dishwashers are common in all houses and in many newer/larger flats. You usually connect your dishwasher to your cold water pipe and use the heater in dishwasher to heat the water but others connect it to the heat water pipe.

Washing machines are standard in all houses and common in many flats. Nearly all flats have access to a central laundry room in the cellar but many install their own in the bathroom. The central laundry room is part of your rental fee at no extra cost but often need to be pre-booked which people don't find convenient.

Tumble dryers or drying cupboards are also common in houses since it is rather difficult to dry laundry outdoor during a large part of the year. They are however not commonly used in flats, but are available to the tenants in the central washing room.

Cold appliances usually include one full-height fridge and freezer in a house and larger flats and a combined full-height fridge/freezer in other flats.

Air condition is not very common in private households in Sweden. Many heat pumps can be used for cooling in the summer, but it is not known to what extent this is used.

Hot water boilers are usually heated by the same source as your residential heating system. This could either be through district heating or another waterborne system (could of course be a electrical heating furnace). But if you have a house with direct electrical heating (or air-air heat pump) you need to heat your water boiler with electricity this is then possible to keep track of with a BeAware system (usually has it's own fuse)

Heating systems can vary a lot in houses. Many people are changing from older oil furnaces etc to heat pump systems. These people now get higher electric consumption than before (the heat pump need electricity to run). Houses can also have a fire place as extra heating and for comfort (also useful if there is a longer power outage during the cold period)

Gas is not available in Sweden and Finland except some very limited city areas.

Sauna stoves are used both in Sweden and in Finland. But the use in Finland is much more extensive. The sauna is usually electric heated but can also be wood heated in houses. In Finland nearly all houses and flats have a sauna and it is used frequent. In Sweden it is not at all that frequent in houses and rather unusual in flats. The power of an electric sauna for single households is usually 4-8 kW (4000-8000 W). It is usually equipped with a timer so you can preset a starting time.

Outdoor lightning is very common during a large portion of the year both for comfort and safety. Many use some kind of twilight sensor for the most frequent used outdoor lightning. Another thing used sometimes in houses in the summer evenings are the **infrared heaters**. They are usually consuming about 1kW each (1-2 units are most common).

Indoor lightning is used both for practical reasons of course but also very much for comfort at least during the darker period of the year (September-April) with an extra peak during Advent and Christmas time. It rather common to have window lamps on even if you are not at home. If you are away for a longer time (like holiday) many people use timers on a number of lamps that will go and off at different times during the period so that it will look like you are at home.

TV/Video is standard in all households. You usually have a full-size TV in your living room and many also have one extra smaller TV (sleeping room or children-room). During the last few years more and more people are changing from 28-32 inch TV with picture tube to a 32-42 inch LCD (or plasma) TV. Most houses in Sweden also need a separate **digital box/satellite box** since the TV broadcast now is fully digital. The main TV is usually equipped with a **DVD player** or a **home cinema** system.

Gaming consoles (like Xbox, Playstation) are rather common among younger people and families with children but usually turn on and off just for the time you use it. Handheld gaming consoles like Nintendo DS and PSP uses battery and chargers and are most common among children.

PC with broadband is very common in all households. Families with children might have both two and three computers (the children have the PC in their rooms). There is a mix of standard computers and laptops but the trends seems to go more to laptops (and mobile broadband) since the price differences between them are less today. If you use a laptop you usually carry it around and don't have fixed place for your charger. Your broadband router is usually on day and night. If you have more than one computer you usually have a **local network** too in the flat or house, that usually include a hub that also on day and night too.

Mobil phones (cell phones) are personal equipment used by nearly all people from the age of 10-12. Since chargers are very specific for different mobiles the family usually need to have a number of charger, one for each mobile.

Microwave ovens are almost standard in all households and are mainly used for thawing frozen food, cooking ready made food (3-7 minutes) and heating beverages like baby bottles and hot chocolate (1 minute).

Stoves are nearly always electric and of similar types everywhere. Trends are moving towards induction stoves. Nearly all households also have an electrical **oven**.

Outlets/wall sockets are usually placed rather low near the floor (between 200 mm-300 mm between the floor and the centre of the socket, 200 mm according to current Swedish standards) next to the windows, which mean that they are usually covered behind a curtain or furniture and not possible to view easily (important if the BeAware project like to used wall socket light indicators).

Electric floor heating is used in rooms with clinker/stone floor. This is becoming rather popular in bathrooms and halls. You usually need to have the heating on all the year around in the bathroom for good comfort. There is always a thermostat that you can adjust so the consumption is probably rather low in the summer. If you have a waterborne heating system you can have this as floor heating too. Bathrooms can also have electrical **towel dryers**; they are usually on most of the time.

Lawnmowers are usually petrol-driven but many also use battery charged lawn movers nowadays when the battery capacity are getting better and they are also silent and often regarded more environmental friendly too. Lawn movers are used during the summer period, mainly from June to August, approximately once every week.

3.2.6. Recommendations on areas of energy saving

Saving potential

The saving potential varies a lot. The potential goes from simple actions that can save energy and money directly to other areas that need larger investment to carry out. One should also take into consideration that some areas are not so relevant if you rent your flat because you don’t want to do any investments. There is also the situation where you rent a flat with electricity cost as part of your rental fee, in that case you don’t get the feedback in money saving if you save energy. The same situation goes for washing & drying in flats if you use the central laundry room.

Table 3.24 - Potential energy saving areas

Area	Action	Saving potential
All customers-easy action	Change to low energy bulbs	High

	Use power off instead of stand by function	Low
	Defrost your freezer	Low
	Use saucepans with the appropriate size on your stove	Low
	Boil water in electric kettles instead of in a saucepan	High
All users but no immediate benefit for some	Wash in lower temperatures	Medium
	Dry your washing outside instead of using tumble dryer	Medium
All customers – behavioural change	Vacuum clean behind the fridge and freezer	Medium
Houses	Car heaters with better timers	Low
Houses-large investments	Increase isolation on roof, floor and walls. Change to better windows	High
	Buy new fridge and freezer	High
	Buy an induction stove instead of ordinary stove with cast iron plates	High

Source: Energy experts Vattenfall

The BeAware project should primarily focus on savings that don't need any investments. The most obvious and easiest saving potential that doesn't need any real behavioural change and is common for all customers are changing to low energy light bulbs, defrost your freezer and use power off instead of standby on TV, PC and chargers (however, the concept of energy waste is rather complex, since most of these appliances generates heat when they are "wasting energy"). Other rather easy changes are regarding washing and drying but that has no real incentive for many customers in flats since they don't get a reduction on their electricity bill if they use central laundry room. Then there are car heaters and sauna stoves that are both specific for the Nordic countries but mostly only relevant in houses (in Finland saunas are common in flats too). Both these appliances usually don't get so much attention regarding the consumption level since people find them necessary. They do use quite a lot of electricity so even minor changes will make a difference.

Area for selection

Sweden and Finland show very similar consumption patterns regarding energy consumption.

Vattenfall AB is a Swedish energy company with presence in Sweden, Germany, Poland, Denmark and Finland. The BeAware project focuses on comparing and changing the energy usage habits of people in the southern and the northern parts of Europe. Translated to Vattenfall's market this means mainly Sweden and Finland.

Due to the fact that the countries show big similarities, it does not really matter in which country the pilot sites are situated. The profile of the customer seems more important than where they are situated. Hence, practical issues will decide where the pilots will take place. However, in order to get good comparison with Italy, and in order to try the systems on the "general customer", it is recommended to choose households in city areas, such as Stockholm or Helsinki.

User selection

In order to maximize the output of the BeAware project, the selection of end users for the pilot on is very important. A number of factors need to be taken into account when selecting them.

For instance, a person who owns the house or flat that he or she lives in is would probably be more engaged in making the home energy efficient than someone who rents. If you rent an apartment you might neither have the commitment nor the possibility to for example change the freezer in order to save energy.

In the BeAware project, it is recommended to exclude heating since the infrastructure for heating is very different in the two trial regions. In Italy, the primary energy source for heating is gas. In the northern countries on the other hand electricity and wood are the primary energy sources for heating. Including heating would make the comparison between the regions very complex, without adding any value to the final conclusions.

Given the information regarding the definition of a household and the energy usage of different types of households, it seems logical to try the pilot on people from Case 1, a single household, small apartment with a high level of housing. In this customer segment, there should be some saving potential, and also some "early adopters", persons with a high interest of new technology who are interested in trying the system. Another customer segment to try the pilot on is Case 3, a bigger apartment with three persons in the household. Also, Case 4, a single-family house with four persons in the household and district heating. (see table 1.10)

The recommendation from Vattenfall's behalf is therefore: the household to try the BeAware system during the first trial period should consist of:

Two small apartments, single households, in a city area, with high level of housing.

Two bigger apartments, three or four persons in the household, in a city area.

Two single-family houses, ca four persons in the household, district heating, in a city area.

Long term strategy

In order to be able to distinguish what is a" BeAware effect" and what is a general effect of higher energy prices (or other parameters effecting the average energy consumption), it is of great importance that the project also measures a number of reference households. These households should not be aware of the fact that their consumption is being monitored. This can be done with the AMR-meters which exists both is Sweden/Finland and Italy. It is of great importance that the reference households are as similar as possible to the households used as trial sites in the BeAware-project in order to be able to draw any conclusions regarding the BeAware project's effect on energy consumption.

During the second trial, new households with the same characteristics as the ones described above, should be identified and used. However, the first trial group should be able to keep their equipment and be a second reference group.

3.3. Joint conclusions Vattenfall and ENEL

The Nordic region and Italy have many regional differences that make it difficult to fully compare the results from the pilots between the different countries. The most significant differences are:

Differences in the climate. The Nordic has much colder winters than Italy and also more varied lengths of days during the year. The climate in the north of Italy (Milano region) shows similarities with Nordic (Sweden most similar).

Differences in appliances. In Italy there is a large consumption of electricity used for air condition systems. In the Nordic car heaters are very common. Finland is special since it have the sauna used more frequent than anywhere else.

Differences in energy production Finland, Sweden and Italy. Finland and Italy have more CO^2 emissions.

Vattenfall and Enel.si has therefore come to a joint recommendation in order to get the most out of the pilot evaluation. The recommendation is the following:

Basic household criteria for all pilot households in both Nordic and Italy should be:

Only include early adopters

All households shall have high level of housing

The selected households should have appliances in all categories that are common in all countries (fridge/freezer, lightning, cooking, entertainment, washer & dryer and dishwasher)

Extra appliance in Italian households: air condition system

Extra appliances in Finnish/Swedish households: Sauna and car-heater (for house)

Exclude houses with electric heating

Reference households must be identified before start in order to be able to measure the consumption changes that comes from the BeAware-system compared to changes that comes from other influences (eg. climate, general awareness changes, prices).

Select maximum two different household types

Type 1: Single person in flat

Type 2: Family in house with 1-2 children (school-age/teenager).

The Nordic pilot can be handled as one region in this project. The saving potential is perhaps better in Finland than in Sweden. Sweden has already a very good awareness and also an energy production with lower CO^2 emissions.

4.Requirements

Based on the work conducted so far in WP2 (literature review, insights from stakeholder interviews, and modeling workshop on users within the WP2 partners) we present a first set of requirements for BeAware feedback system. They are stated at a very general level, and need to be refined once the nature of the prototype will become clearer. They are accompanied by the source supporting them and grouped according to the system component affected, namely:

- system at large
- invisible component
  - Sensor
  - Basestation
  - Server
- visible component
  - User interface
  - Feedback properties

The template is the following:

R NUMBER	
Source of requirement	<<literature reference>>
Use case	<<the context from literature or use case from scenario>>
Description	<<short and easily comprehensible description of the requirement
Component	<<beaware component concerned by the requirement >> Invisible components: <<specify which>> [Sensor | Basestation | Server] Visible components: <<specify which>> [User interface (ambient display, web, mobile) | Feedback properties]

Detailed requirement	<<more technical and detailed description>>
Notes	

4.1. BeAware system

R 1.1	
Source of requirement	Nissinen et al. (2008) HEAT'07 final report
Use case	
Description	**Perceptually accurate and stable technology**
Component	BeAware system
Detailed requirement	Users should not perceive obvious errors or biases in the system, for instance the energy consumption information must be reliable enough to be considered realistic
Notes	

R 1.2	
Source of requirement	Darby, 2006; WP2 brainstorming session;
Description	**Energy needed by BeAware System in households must not neutralize energy saving of that household**
Component	system
R 1.2.1	
Source of requirement	Darby, 2006; WP2 brainstorming session;
Description	Energy used by BeAware System needs to be monitored
Component	system

R 1.3	
Source of requirement	WP2 brainstorming session;
Description	**BeAware System must be sustainable**
Component	system
Detailed requirement	
Notes	

R 1.4	
Source of requirement	Kluger and DiNisi, 1997; WP2 brainstorming session;
Description	**Feedback must encourage good habits not just discourage bad ones**
Component	system
Detailed requirement	
Notes	

R 1.5	
Source of requirement	WP2 brainstorming session;
Description	**BeAware System must respect privacy**
Component	system
Detailed requirement	
Notes	
R 1.5.1	
Source of requirement	
Description	Data stored or accessed must be encrypted and anonymized since the lowest level in the system (sensors)

Component	system
R 1.5.2	
Source of requirement	
Description	**Users can switch off the system**
Component	system

R 1.6	
Source of requirement	Vattenfall internal discussion
Description	**The system needs to be safe**
Component	BeAware system
Detailed Requirement	The system must ensure that safety prescriptions are fulfilled regarding safety for electrical devices. The system must not electrocute children crawling around in the apartment/house.

4.2. Invisible parts of the BeAware system: Sensors/Basestation/Server

R 2.1	
Source of requirement	It is easier to affect specific behavioral intentions than general ones (Van Raaij & Verhallen, 1983; Painter, Sementik, Belk, 1983); the feedback needs to allow learning of effects of specific behaviors (Kluger and DiNisi, 1996); too much information on different appliances might lead to overload and drop outs (Ueno, Inada, Saeki, Tsuji , 2006); the trials must run long in order to be effective (Van Raaij & Verhallen, 1983; Henryson et al., 2000; Wilhite, 1997)
Description	**Feedback must be focused**
Component	Sensors | Basestation | Server (wherever data are

	elaborated)
Detailed requirement	
Notes	

R2.2	
Source of requirement	amount of energy use and adoption of energy conservation practices are not related directly (Dillman, Rosa, Dillman, 1983; Haas, Auer, Biermayr, 1998; Dardianou, 2007; Herring, 2006); stakeholder's remark about continuous purchase of electric devices;
Description	**Keep a measure of general energy consumption in the household, to verify if there is a rebound effect**
Component	Basestation | Server (wherever data are elaborated)

R2.3	
Source of requirement	Midden, Meter, Weening, Zievering, 1983; van Houwelingen, van Raaij, 1989)
Description	**corrections to the energy use must be added in the algorithm for the production of the feedback (based on weather, appliance, region)**
Component	Sensors | Basestation | Server

4.3. Interface

R3.1	
Source of requirement	Midden, Meter, Weening, Zievering, 1983; van Houwelingen, van Raaij, 1989)
Description	**data on relevant household and geographical area must be inputted in the system to tailor**

	the feedback to the user
Component	Server

R3.2	
Source of requirement	Feedback must be remembered when used (Ilgen, Fisher & Taylor, 1979)
Description	**Feedback must orient the prospective actor**
Component	interface

R3.3	
Source of requirement	WP2 brainstorming session;
Description	**BeAware System must be ergonomic**
Component	interface
R3.3.1	
Source of requirement	WP2 brainstorming session;
Description	**BeAware System must allow interaction yet no need it**
Component	interface
R3.3.2	
Source of requirement	Users need to log in on a web site to access the feedback and rapidly droped out (Ueno, Inada, Saeki, Tsuji , 2006); Ilgen, Fisher and Taylor, 1979)
Description	**Feedback need to be accessed on the same place where it is used and without additional action**
Component	Interface
R3.3.3	
Source of	Brainstorming session

requirement	
Description	**Feedback must not be annoying**
Component	Interface
R3.3.4	
Source of requirement	Vattenfall internal discussion
Description	**The system shall not disturb the composition of the room**
Component	BeAware system
Detailed Requirement	If the plugs are too big, they will not fit behind electrical devices such as refrigerators and stoves. People will not want to rearrange the room to have space to plug in the system. They have to be small enough not to disturb.
R 3.3.5	
Source of requirement	Vattenfall internal discussion
Description	**The system must support all kind of sockets and other electrical connections**
Component	The BeAware system must be able to be plugged in into every different type of sockets. In Sweden at least, there are a number of different types of sockets for electrical devices and other ways of connecting electrical devices (stoves for example). Ungrounded and grounded sockets do not look the same.

4.4. Feedback

R4.1	
Source of requirement	too much information on different appliances might lead to overload and drop outs (Ueno, Inada, Saeki, Tsuji, 2006); advice tips are not useful (Ueno, Inada, Saeki, Tsuji, 2006;)

Description	**feedback must be one simple index/cue triggering the right conservative action**
Component	Server
R4.1.1	
Source of requirement	Effectiveness of tailored feedback and sometimes even tailored information without feedback (Abrahamse, Steg, Vlek, Rothengatter, 2007); better effect of individually tailored feedback than comparative feedback (Midden, Meter, Weenig and Zieverink, 1983)
Description	**feedback must be tailored to the user**
Component	Server – feedback information
R4.1.2	
Source of requirement	McCalley & Midden, (2002); Becker, 1978; McCalley, 2006;
Description	The feedback must be related to conservation goal of the specific household
Component	Server

R4.2	
Source of requirement	Historical feedback are more effective than comparative ones (Midde, Meter, Weeenig, Zieverink, 1983; Schultz, Nolan, Cialdini, Goldstein, Griskevicious, 2007; Roberts, 2004; Kantola, Syme, Campbell, 1984); cumulative feedback is counterproductive (Abrahamse, Steg, Vlòek, Rothengatter, 2005); a feedback value that variates to much is not perceived as credible (Becker, Seligman, 1978)
Description	**The feedback must be a historical index, not a merely cumulative calculation, and must be calculated so as not to show excessive variations**

Component	Server

R4.3	
Source of requirement	saving seems stronger than ideology according to the stakeholders but Financial saving is discouraged as a motivator with respect to efficiency (Neuman, 1986; Monnier, 1983; Pfaffenberger et al, 1983; Black, Stern and Elworth, 1985) Dillman, Rosa and Dillman, 1983; the item does ad to an idea of successful life and wellbeing to survive end of economic crisis and appeal to high-income households where there is a high energy saving potential
Description	**The feedback does not express conservation in monetary units, but as efficiency or conservation**
Component	Server

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6. Appendices

6.1. Results of WP2 internal brainstorming

The following list of requirement derives from a brainstorming session occurred at month 5 in the project in Palermo (15th Sept 2008), and involving all WP2 partners except for HIIT.

GENERAL

Zero energy consumption devices (sensors & cue/feedback especially)

Recycled-recyclable Material used for Gadgets and Devices

Zero Km devices

Low price of sensor & devices ETHICAL

Privacy during data recording, storing and delivering

Bringing privacy at the lower technical level in the feedback process (sensors)

Allowing to switch off the device

SOCIAL –CULTURAL

Product should be similar to their users

Aggregation of data when communicated to parties external to the project

Device includes data form for user inputs

Device implements works mainly as a reinforcing system that encourages good habits instead of discouraging bad ones

COGNITIVE & ERGONOMIC

The device should:

engender no cognitive overload

require no special actions in addition to the use of the appliance

allow interaction yet not need it

be aesthetically pleasant

have a "universal" design for the classes of users who are heavy consumers (elderly, children, and differently able people) [to be refined later]

not be annoying

not hint at monetary saving as motivator

connect to a community with similar values (social networking)

be rewording as a videogame, allowing upgrades to more sophisticated/interactive usage levels as an incentive

6.2. Protocol of stakeholders' interviews

Goal: to collect experience and facts orienting subsequent research with final users

Interviewee: not the final users but stakeholders in the field of energy consumption awareness in the territory where the fieldwork is planned to occur; they can be also telephone or Skype-phone conferences, provided that they are recorded

Potential Interviewees:

- Producers having some low-energy consumption product or concept, and a research & development department that has done some work on such products' usability, marketability and acceptability (i.e. energy providers and appliances' manufacturers)
- Local/national Governmental agencies working with citizens on energy saving practices
- No-profit associations working on environmental issues and with some initiatives in their agenda about energy consumption in households.

Characteristics (one or more of them):

- Working in the energy/environmental sector
- Promoting energy conservation
- Having a company policy closely bound to environmentally sustainability
- Having experiences and initiatives on sustainable energy consumption in households
- Being involved in disseminating information
- Working with energy users/consumers, households, local government or schools in environmental projects
- Coping with energy/environmental issues

	TO DO	**TO ASK**

BEFORE THE INTERVIEW	- Stakeholder selection - Collection of information about stakeholder, to focus the interview on Creation of list of questions for interview	
DURING THE INTERVIEW		- Present the BeAware consortium, goals and interviewer's contact information.
	- record the interview	- Ask for the permission to record the interview
		- Ask for personal stakeholder's information (Who the Stakeholder is, Society, Title in the Society)
	- the interviews should start from stakeholders' works and should allow stakeholders to speak about his/her experience and activities in a semi-structured form, meaning that the order and phrasing can change, and new issues can come up that weren't in the original list of questions - start with easy questions that allow the interviewees to recollect his/her memory about the experience s/he's asked about - avoid being suggestive: kind interviewees will try to comply out of courtesy and no reliable information will be collected - take personal notes during the interview and then correct them with the recording	**Issues to touch: (in non-specific order)** 1) *How stakeholder defines Use and Waste of energy* 2) *Experiences and initiatives on sustainable energy consumption in households known by stakeholder; key ideas and outcome; lessons learnt* 3) *Personal believes about sustainable energy use (?), frequent issues s/he's called to cope with,* 4) *Motivating factors to change consumption habits in the clients/users/consumers/he's contacted* 5) *Information dissemination techniques from your organization to consumers* 6) *Where is the biggest potential for saving in "typical" households* 7) *-What kind of problems or questions do consumers have with energy preservation or understanding energy consumption?* 8) *How the stakeholder works with people and with administrations about local environmental problems (projects in the territory, feedback...)* 9) *Two things about energy consumption users are not typically aware of* 10) *How does energy awareness or preservation involve your organization, What interests does your organization have in this regards ?* 11) *How do you perceive the mental model or equation of household energy consumption? (ref. stim. Material)*
		- Ask for contacting data (Telephone Number,

		Address, E-Mail, Skype Contact) and contact preferences (day of the week, etc; time at whichh stakeholders' current position will change)
AFTER THE INTERVIEW	- soon after the interview, compile a record with the information gathered through the interview, based on both your notes and the recording, and containing the following aspects: ▪ Date and time of interview, participants' names ▪ Stakeholders' Information (name, affiliation, position of interest to us) ▪ Main reason why stakeholder was contacted ▪ Definition of energy waste ▪ Facts collected during interview ▪ Experiences/initiatives around which the interview gravitated ▪ Future Updates from stakeholder to fill in potentially missing information not available at the time of interview ▪ Ideas and presuppositions inspiring initiatives: investigate the reason why stakeholder chose that particular kind of initiative ▪ Two things users are not aware of ▪ Where is the biggest savings potential? ▪ Future Investigation required after the interview ▪ Contact information Note: it is possible that not all the categories fit all stakeholders.	

6.3. Records of stakeholders'interviews

6.4. Italy

Society	Lega Ambiente - Sportello Energia	Bologna's city council
Informant's name	Lisa Zongaro	Roberto Panzacchi

Title	Energy info point manager	city councelor
Date & Time	16-06-2008	10-09-2008
Who conducted the interview	Anna Spagnolli, Teresa Tona	Teresa Tona
Why the stakeholder was contacted	an agreement among Legambiente, the local government and the company Bacino Padova2 opened an energy info point for each Padova's residential districts, like a similar the info point opened in the fifth district one year and half earlier	He's a public administrator, he joins up with local environmental political group
Initiatives	Energy diagnosis with 20 voluntary families: '-audit to see type of building and their energy consumption (technical questionnaire and engineering home check up) -consumption monitoring pre and post survey: behavioral questionnaire, about 60 questions based on the DOCET software by ENEA '-informative meetings	promoting and supporintg ESCO (society for building adjustments); traffic lights with led lamps; photovoltaic panels for public buildings; public informative campaigns addressing public administration empolyees, as a best practice organization (Bologna has 5000 municipal employees); informative campaigns in schools; project in a public park to tailor light control to citizens' needs.
Ideas behind initiatives	We tried to go beyond prejudices and information against linking a technical and "a life style" approach. We think that our work will be successful if we support our project with information about users and their life style.	Ethic interest to promote energy and environmental awareness, new technologies supporting energy saving, ecology and a healty lifestyle. Bologna's local administrator aims at boosting energy awareness involving citizens. Energy policies are efficacious only if people are engaged in them.
Facts	1)users' questions: technical advices, economical and engineering needs; 2)motivation: economic motivation (saving money on the bill), also with money investment for example in the photovoltaic sector; 3)dissemination: newspapers, activities during the "Settimana del clima" on February, website, newsletter, and dissemination by word of mouth.	1- Policies that have penalties and rewards are expected to encourage quality standards. 2- Beyond information on sustainable use of energy, people need to know how to read their consumption and savings in their bills 3- a direct link with citizens, projects with clear goals, participative ecology are needed. 4- an energy info point would be useful to teach how to read the energy bill. The energy bill is too indirect to be an effective way to disseminate a different way of thinking.
Whtais energy Use/Waste	-energy waste: if an electrical device is turned on and you are not using it, this is an energy waste. You should give what you don't need up, if you are not at home don't turn on the heating; don't turn on the heating in those rooms you don't use, install heat-valve to settle hot water influx, and to save money. You don't sacrifice anything. A lot of people think that saving energy means giving comfort up, instead saving energy means optimizing comfort you already have.	wasted energy = forgotten energy Wasted energy is the energy that people don't need but use anyway

What do people not know?	1)biomass energy 2) you should keep the heating at 16/17° Celsius for all the day and turn it up if need be; 3) about the bill: how many kw/h every two months, contract type. Everything a part of bill's amount and deadline; 4)people is not aware houses are something that need energy. They become aware only after a technical check up (by a specialist) of their house and of every consumption energy source linked with their house's structure.	1- people should not switch on, switch off energy saving lamps. They are made to remain turned on. If you turn them on and turn off four times, then the consumption is the same as four hours of light. 2- People don't understand the importance of the appliances' energetic power class. People don't know what an energetic class means and what amount of energy is linked to it
Future Reasons to Get in Touch	- ask for diagnosis data energy: users layout (about those 20 families that had a part in the survey in terms of family size and age distribution) the first week of July; -questionnaires data, both technical and behavioral ones, available from September; - ask for questionnaires used	
Future Investigations	- software DOCET dell'ENEA/software DOCET by ENEA	ESCO
Where is the biggest saving potential?		Apppiances, space heating, insulation.

Society	Prorinnovabili	Whirlpool	Whirlpool
Informant's name	Federico Brucciani	Gigliana Orlandi	Sarah Brady
Title	ProRinnovabili's Director	Usability Manager, Whirlpool Italia	Communication manager, Whirlpool Europe
Date & Time	11-09-2008	10-09-2008	10-09-2008
who conducted the interview	Teresa Tona	Teresa Tona	Teresa Tona
Why the stakeholder was contacted	He is ifamiliar with energy issues, and energy users becasue of his role in Prorinnovabili. Good knowledge on potential dissemination methods related to new media technologies.	Directs the usability department of an appliance producer committed to environmental issues.	Directs the usability department of an appliance producer committed to environmental issues.
Initiatives	Prorinnovabile, part of "Agenda 21" project in Cecina (Li) to define sustainable building regulations; partnership with Rosignano Marittimo's local administration and University of Salerno for a project about sustainable mobility.	1. Whirlpool has a commitment, since 2003, in achieving the Kyoto protocol gald to reduce gas emissions. Our strategy consisted in reducing 3% of toxic gas emissions before 2008. We succeded even if we had a higher production (40%). 2- Our initiatives on the territory are divided into three main areas: design, logistic, production. We speak about eco design when a product has a compact and efficacious package, Moreover in each factory we have a system to reuse and co-generate energy, to depurate water and to reduce the production of toxic substances. We have a commitment to encourage people to change old appliances and to recycle them.	
Ideas behind initiatives	ProRinnovabili' s mission: to contribute to spread an environmental culture, information about renewable energy and an idea of participatory ecology.	1- We try to sell products with A or AA plus energy label. All our products must have certain energy standard. 2- Local and global activities aim to maintain high energy standard in our products and to produce appliances with a low energy consumption in the future. 3- Understanding users. We are interviewing our clients to understand their believes about energy use and energy saving, what is ecological for them? what we are finding is that people are not aware. 4- Designing products that to improve people's right	

		energy use of our appliances because energy consumption is often caused by a incorrect use of the appliances.
Facts	"ProRinnovabili" website with more than 1500 articles. It aims at being a participative ecology where citizens could have a role using web 2.0 technologies. What is necessary is a change in people's way of thinking, more information and direct involvement.	1- "Green Kitchen" is a new concept. It includes a group of appliances that work together. The aim is not to have a single appliance that works alone and saves/ consumes energy or water alone, but to have appliances sharing the use of energy or water. In this way energy is saved and the consumption is reduced 2- there is a very big lack of information. People have not accurate information and they can not use appliances in the right way to save energy.
Whtais energy Use/Waste	Waste: televisions, lamps... switched on when nobody is using them. Use: when people use appliances in an aware and ecological way, just when they are needed. If there is no awareness and sparing use of appliances then there is wasted energy. Energy is wasted when people use it as if it will never end	Each person has a personal theory. Wasted energy is an energy that you don't use.
What do people not know?	People don't know that buildings are made with a very bad thermic insulation. So, first of all, people should insulate their houses and adopt sustainable energy generation system. Only when the house has a good insulation they will install photovoltaic panels or other minor solution.	In italy there is the biggest consumption of plastic bottles of mineral water in Europe. In green kitchen we have a system to use and re-use tap water. A larger consumption of tap water would reduce production of plastic for bottles of mineral water.
Future Reasons to Get in Touch	He asked to keep in touch next year because ProRinnovabili, through its website and blog, will have a part in a national dissemination project about sustainable use of energy.	
Future Investigations	None	none
Where is the biggest saving potential?	space heating, space cooling, heat insulation	a correct use of the appliances could save a lot of energy. Moreover, reducing enegy bills and consumption is possibile thanks to: new technologies that consume less energy; new products that re-cycle resources; new energy cogeneration systems that allow consumers to re-use energy, heat or water, produced by their appliances. For example, nowadays you can use heat from the wave for space heating or to create a greenhouse. The heat generated by the fridge' compressor could be used for water heating. In the end, education is very important to boost awareness in regard to a more effective use of each appliance.

6.5. Finland

Society	VaihdaVirtaa	Helsingin Energia
Informan	Riitta Savikko	Marja Einesalo

t's name		
Title	Campaign coordinator	Energy advisor
Skype		
Date & Time	14 AUG 2008; 13:00-14:00	14 AUG 2008, 15:00-16:00
interviewer	Lassi.Liikkanen@hiit.fi	Lassi.Liikkanen@hiit.fi
Why the stakeholder was contacted	One of the few non-profit organization with a clear focus in consumers and energy	Person who is constantly in touch with energy users and their questions. Good knowledge on potential dissemination methods and typical points of waste in Finnish house holds.
initiatives	Long campaign after the electricity market opened, from '99 to today. Consumers get help in switching to sustainable energy sources	Company policy is to promote efficient production and usage. They have constant dissemination procedures going on and energy awareness activities
Ideas behind initiatives	People are not aware how the energy is produced, how their energy choices can have long-rangin effects, and companies market green energy in various ways	Try to make their customers to use energy rationally, not to waste it. One part of activities targets school children, with the idea that principles of energy preservation and wise usage should be learned early on.
whtais energy Use/Waste	Motto: there is now harmless energy. Waste: when device is on or stand-by but is not being used	Waste: keeping on apparatus and lighting that are not currently needed. Buying equipment that is needed only briefly (invested energy).
What do people not know?	How energy production-delivery network functions; How the choices of millions of individuals add up in the total consumption	Do not realize how much energy is consumed by IT and new entertainment equipment AND cumulative effect of buying new devices. People can have outdated beliefs about equipment.
Future Reasons to Get in Touch	Exact statistics on how active and successful has been in the past	
Future Investigations	Look up Greenpeace energy conservation reports for Finnish industry and individuals	There is coming a report about the typical consumption of different devices in Finnish households from Motiva Ltd.
Where is the saving potential?	-	Computers and entertainment for flat residents, heating and air conditioning in one house apartments.
Misc. Observations	The organization has various dissemination tactics: school teaching material, stands at fairs, info points every now and then, seminars, and electric services (web site, Facebook	Several channels of dissemination: own periodicals, class room for visiting school kids, electric ABC, several full-time energy advisors and information office (appr. 14 000 customer interactions yearly). They also lend energy, temperature, etc. meters for customers free of charge. Also web-service for janitors to monitor water, heat, and water on-line

	The informant feels that critical attitude towards energy consumption is not welcome in Finland, as there is a strong movement promoting the construction of additional nuclear energy and keeping the energy prices low. The governmental organization that should provide neutral and informative information are keeping to quite conventional dissemination	Biggest motivator for people is money. Getting a big energy bill can turn peoples attention to find out what's consuming so much. On the other hand, small savings that require noticeable actions are more difficult to justify for customers as they don't see the bigger picture.

Society	UPO / AM Kodinkoneet Oy	Työtehoseura (TTS)
Informant's name	Timo Laatikainen	Anne Korhonen
Title	Managind director	Researcher
Skype		
Date & Time	19 AUG 10:00-10:50	21 AUG 13:30-14:30
Interviewer	Lassi.Liikkanen@hiit.fi	Lassi.Liikkanen@hiit.fi
Why the stakeholder was contacted	As one the few remaining Finnish producers of home appliances (although production happens in Italy)	Researcher at a non-profit organization that has a long record working with household energy consumption issues; research and dissemination
initiatives	Company has adopted european energy consumption standard labelling across their product line. Highest categories of energy efficiency are sought. In history, also campaign to provide consumers with consumption meters.	Several studies and publications over the years. Recently, scarce resources have forced the organization to cut off direct contacts to consumers and instead they participate in projects that have goals in preserving energy or increasing awareness.
Ideas behind initiatives	Presently, company does not believe that Finnish consumers are greatly motivated by energy efficiency as such. However, marketing and sales of home appliances is nowadays clearly dependent on energy labelling, consumers look for the A class products. However, the company has been in contact with High school age teenagers who show increased environmental awereness and thus expects a change in future in consumers' habits.	Energy efficiency or preservation are not values as such for the organization. The motivation comes from research questions (ALTHOUGH THEY DO NOT PUBLISH INTERNATIONALLY) and from government ministries that fund the research and thus also decide on what issues should be investigated at the time being.
Facts whtais energy Use/Waste	When appliances are misused, misplaced or not regularly maintained	Unnecessary cold or warm. Buying unnecessary devices or replacing functional appliances with new ones. On the other, they strongly acknowledge the personal
What do people not know?	People do neither see the connection between consumption and expenses, nor really perceive how much energy is consumed	How energy consumption of a device accumulate? What is the amount of energy consumed by a device, depending on how it is used. What is the nominal power of a device. When trying to save on one aspect, more money maybe consumed somewhere else. People don't see the consumption and the mental models are often based on superficial features
Future Reasons to Get in Touch		They have several reports published in the past about Finnish households

Where is the biggest saving potential?	Outside their own product range. Use and maintanance habits might improve, but the patterns of consumption tend to stay stable.	Electric laundry dryers (but still only 20% households have them).home entertainment systems, computers and their accessories. The increasing number of systems cumulating net consumption.
Misc. Observations	As producers, the company relies on designing for efficiency and then providing all information in owner's manual. No systematic research on how products are really used, but suspicious whether recommendations are really followed. No particular initiatives for affecting consumption patterns or improving energy efficiency on the level of interface or interaction	Consumers were previously contacted in fairs, and a phone councelling service was active. Nowadays phone service is discontinued and dissemination is intended for other organizations which then deliver the results for the consumers.
	The company thinks about energy savings at large. Producing hardware requires energy and sustainability requires reason. Consumers are primarily motivated by money (pricetag when acquiring new devices) so it should be the main item to present for the consumers	In their intervention studies during 90's, it was found that comparative feedback (information how much you consumed compared to other similar households) was more effective than mere counseling. In a longitudinal study, they found that the households that showed the greatest interest and biggest improvements initially could sustain the positive consumption over time.