Energy awareness services - scientific background and European best practices.

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Energy awareness services – scientific background and European best practices

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Keywords

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Abstract

In order to fight climate change, all potentials for lowering energy consumption have to be exploited. Tackling global warming is not only a technological problem - replacing conventional energy sources by renewable energy sources and promoting energy efficiency in traffic, industries and buildings – but also a problem of human behaviour. Human behaviour consists to a considerable degree of day-to-day routines and social practices which are not favourable to a sustainable use of energy. The Beware project[1], co-funded by the Executive Agency for Competitiveness and Innovation EACI, aims at providing residents and housing companies with "energy awareness services" enabling them to reduce the household-related energy consumption. Thus, in collaboration with housing associations and other relevant stakeholders of the housing sector the project consortium systematically gathers, evaluates and disseminates energy awareness services.

In this paper we will first provide a statistical overview on household energy consumption and the behaviour-related energy saving potential in the EU member states. Subsequently we will discuss prominent studies on strategies to influence residents. We will distinguish two meta categories as suggested by Abrahamse et al. (2005). *Antecedent strategies* are defined as all kind of measures pursued before the energy-related behaviour they aim to modify. This classification refers to intervention measures such as information material (e.g. flyers or events) or goal-setting for a household's energy saving. In contrast, consequence strategies such as feed back action and incentive schemes (e.g. favourable tariffs or credits) intend to influence users by opposing previous energy-related behaviour to alternative, more sustainable consumption patterns. Empirical studies indicate that general information alone, diffused by flyers, brochures, exhibitions, events, or campaigns is not very likely to modify consumer habits, whereas feed-back measures combined with individual consultation seem to be a promising approach to shape human behaviour. Depending on the chosen strategies savings from 10 to 20% of the gas and electricity consumption can be achieved

Given this background, this paper presents a selection of best practice cases found in the BewareE research process. These include web tools, exhibitions and special events, personalized energy advice, training forums, energy monitoring, low cost incentives as well as targeted consulting measures for housing companies. Many of them contain elements of both, antecedent and consequence strategies, whereas others represent a "transcendent" distinct category of services that we would like to call "empowerment services". These services cannot-be categorized by their temporal intervention but by their particular approach of user involvement which gives people an active role in conceiving and implementing energy saving measures.

Introduction

In order to fight climate change, all potentials for lowering energy consumption have to be exploited. Tackling global warming is not only a technological problem - replacing convention-

1. "BewareE -Energy Services: Reducing the Energy Consumption of Residents by Behavioural Change".

al energy sources by renewable energy sources and promoting energy efficiency in traffic, industries and buildings – but also a problem of human behaviour and people's appropriation of technical devices. Human behaviour consists to a considerable degree of day-to-day routines and social practices which are not favourable to a sustainable use of energy. The BewareE project, co-funded by the Executive Agency for Competitiveness and Innovation (EACI), aims at providing residents and housing companies with "energy awareness services" enabling them to reduce the household-related energy consumption. Thus, in collaboration with housing associations and other relevant stakeholders of the housing sector the project consortium systematically gathers, evaluates and disseminates energy awareness services.

In this paper we will first provide a statistical overview on household energy consumption and the behaviour-related energy saving potential in the EU member states. Second, we will discuss prominent studies on strategies to influence residents. Finally, we will present a selection of best practice services found in the BewareE research activities. These include web tools, exhibitions and special events, personalized energy advice, training forums, energy monitoring, low cost incentives, empowerment measures as well as targeted consulting measures for housing companies.

Household energy consumption in Europe

In 2006 European households – the target group of the BewareE project – consumed around 26% of total energy consumption (end energy, excluding transport; Eurostat 2008), ranging from 14% (Lithuania) to 36% (Latvia) in 2006. There are strong differences in the share of household energy consumption. While the residential sector in Germany (31%), France (28%), and the United Kingdom (28%) accounts for a final energy consumption well above EU average, Italy 23% and Spain 15% are at the bottom end (IEA 2008).This variety derives from a combination of factors such as climate conditions and the energy consumption in other sectors, mainly industrial production. For instance, following the closure of some energy-intensive industries in Hungary and Germany, the total final consumption of energy decreased sharply in the early 1990s, leading to a higher percentage of household energy consumption.

Data on the distribution of household energy consumption reveal that space heating is clearly the most important use of household energy, accounting for more than half of total residential energy consumption in most IEA countries. In all countries, large-sized homes and a decreasing number of people per dwelling put an upward pressure on demand for space heating, even though to an uneven degree. Historically, the distribution of households' energy consumption for space heating, water heating, lighting and cooking was rather stable in the period from 1990 to 2004, whereas the energy use for appliances was increasing (Lautsten 2008). While appliances accounted for less than 15% of residential energy use in 1990, their share had increased to almost 20% in most European countries in 2004. Furthermore, energetic modernisation of buildings during the last two decades resulted in a slow decrease of heat demand, thus compensating to a certain degree the rising demand for electrical energy needed for running electrical equipment.

Statistics also help to understand the potential of behaviour-related-energy savings, which can be illustrated by the German example. In contrast to most EU countries Germany displays a rather low energy consumption for running electrical appliances (12%, see figure 3). At first sight this is surprising because German households are "over-equipped" with TV's, washing machines, dryers, computers and many other electrical products. However, Germans seem to become more and more conscious about their energy consumption, leading to a growing share of efficient appliances in the German market. According to Bertoldi and Bogdan (2007), nearly 80% of all sold refrigerators in Germany are classified as A or A+ (and A++) and around 95% of the washing machines as A or A+ (which is the best value in Europe, together with Belgium).

To sum up, this example shows that behaviour (here: purchasing behaviour) has a strong impact on energy consumption, not only technologies. In the BewareE project we try to contribute to behavioural changes by disseminating energy awareness services.

Learning energy saving behaviour by energy awareness services

The effect of saving energy is less obvious than in other areas of life. For example, ignoring traffic rules may result in serious penalties, preventing us (mostly) from doing so. If we buy something in stores, we usually have to pay immediately, which makes us reflect on whether we can afford the products or not. In contrast, in most of the European countries consumers pay a monthly fixed rate for heating energy and electricity and receive only one bill per year, informing about the annual consumption. This means that residents are not really aware of the amount of energy they consume day by day.

Therefore there is a strong need for awareness raising measures stimulating behavioural changes. In this paper we will present a selection of energy services aiming at shaping the consumer behaviour. However, in order to get a clear understanding of the kind of measures we are dealing with we first want to develop a precise definition of the BewareE energy services, going beyond the existing definitions. According to the official EU definition an energy service is:

> *"the physical benefit, utility or good derived from a combination of energy with energy efficient technology and/or with action, which may include the operations, maintenance and control necessary to deliver the service, which is delivered on the basis of a contract and in normal circumstances has proven to lead to verifiable and measurable or estimable energy efficiency improvement and/or primary energy savings". (European Parliament 2006)*

This definition is very much bound to technical improvements of energy efficiency that can be precisely calculated and guaranteed in a binding "contract" between the user and the provider. However, the services the BewareE project is dealing with cover the field of human behaviour and ways of modifying it (e.g. web tools, competitions, trainings). The effect of such actions is less predictable and behavioural changes cannot be "enforced" the same way as it can be done by installing more efficient technology. Therefore we suggest using the term of energy awareness services, which we would like to define as follows:

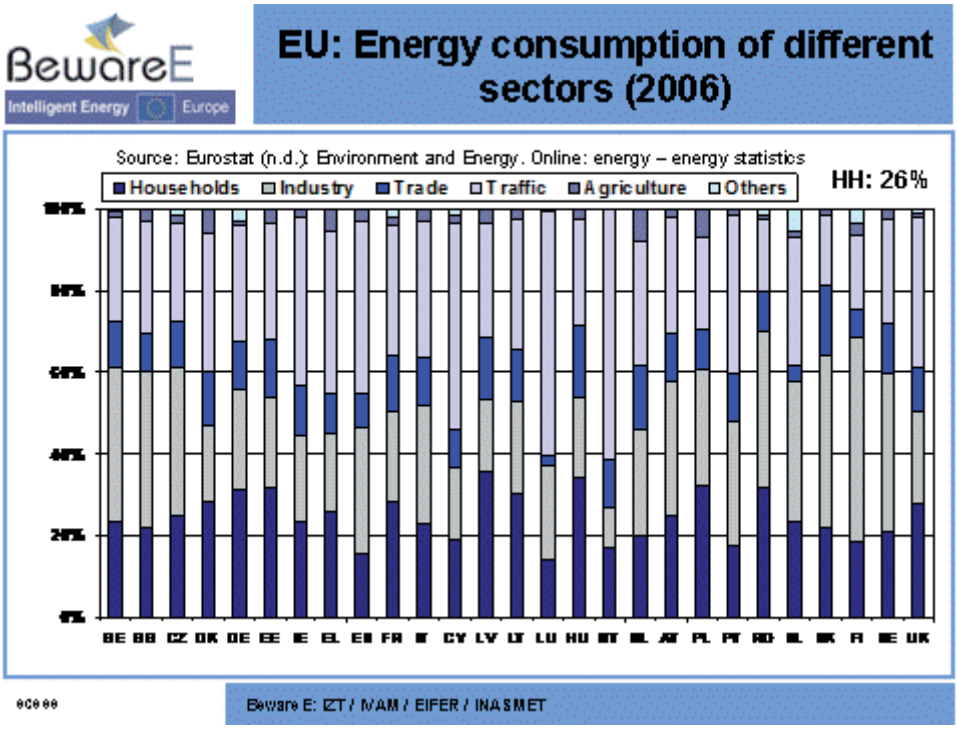

Figure 1: Consumption of final energy in Europe by different sectors. Source: Eurostat 2008

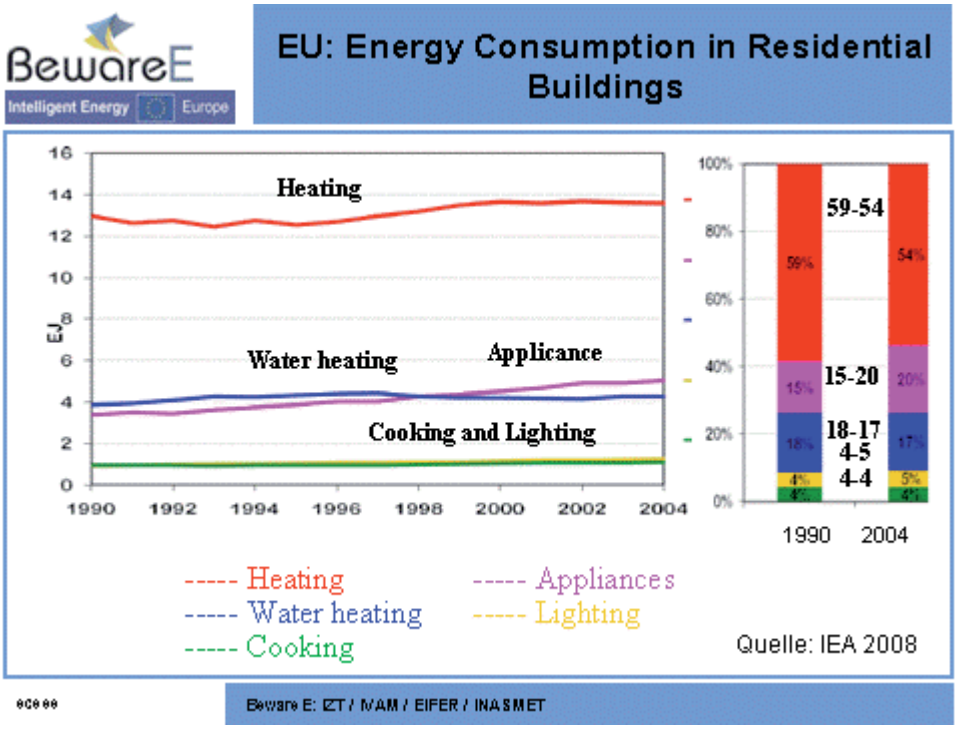

Figure 2. Consumption of end energy in residential buildings in Europe. Source: Lautsten 2008 / IEA 2008

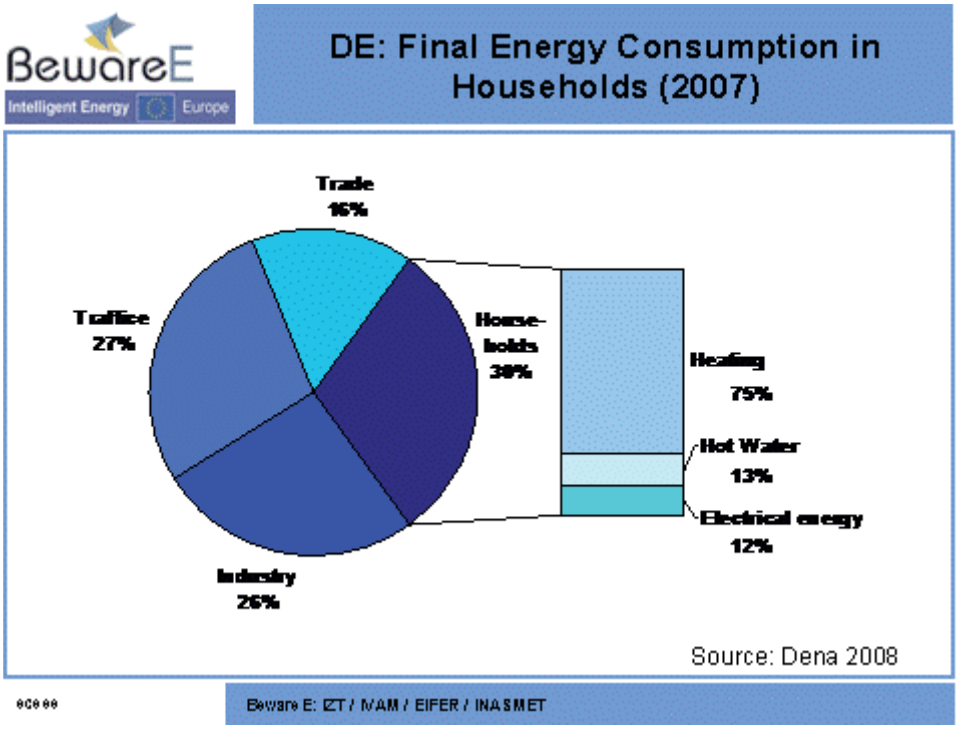

Figure 3. Consumption of end energy in Europe by different sectors. Source: Dena 2008

An energy awareness service is any kind of action or tool provided to consumers enabling them to become aware of their energy consumption and supporting them in reducing their energy consumption, e.g. by purchasing energy efficient equipments, implementing insulation measures or changing their daily routines.

How much energy can be saved by influencing the user?

In this chapter we will review literature on strategies for influencing the user behaviour. For a classification of intervention measures we would like to draw on the work of Abrahamse et al. (2005) who did a systematic assessment of empirical studies. According to the authors, two main approaches can be distinguished: antecedent and consequence strategies.

ANTECEDENT STRATEGIES

These are strategies intervening prior to the behaviour they are intended to influence. The most important antecedent strategies are providing information material, agreeing on commitments and setting goals.

- *Information strategies* comprise media campaigns, written information, websites, exhibitions or home visits. Even though this kind of measures is mostly not very cost intensive pure information strategies seem to have little effect (Abrahamse et al. 2005). Only by combining them with other measures, e.g. individual feedback, a significant reduction can be achieved. According to McMakin (2002) a reduction of 10% (gas and electricity for heating) has been saved by targeted personal information plus home visits. Winett et al. (1985[2]) claim that consumption can be cut even by 20% if information strategies are combined with a multitude of other actions.
- *Commitment strategies*: Within the commitment strategy households commit themselves to save energy (e.g. saving 5% electricity). Similarly to information strategies this kind of measures is not very costly, but studies do not indicate major effects (Pallak and Cummings 1976, Katzev and Johnson 1983).
- *Goal setting strategy*: In this stream of actions households set themselves energy saving targets. Combined with feed back, massive energy savings up to 15% (electricity) seem to be possible. However, without feedback measures and ambitious goals the strategy is barely effective (Pallak and Cummings 1976, Katzev and Johnson 1983, Becker 1978).

CONSEQUENCE STRATEGIES

These are strategies intervening after the energy-related behaviour they are intended to modify. In the context of the BewareE project feedback measures are the most important example of consequence strategies.

- *Feedback strategy*: This category of actions refers to all kind of systematic evaluation of a household's energy consumption that is presented to consumers to encourage behavioural changes. According to several studies this strategy seems to be very effective (Abrahamse et al. 2005, Seligman and Darby 1977, McCalley and Midden 2002, Brandon and

2. Some of the studies cited here are rather old and the socio-technical context has changed, which means that the results presented here have to be interpreted with caution.

Table 1. SWOT-criteria of the analysis. Source: Own table.

Criteria	SWOT-Criteria	Reasons
residents acceptance [high – medium – low]	strenght (high rating) – weakness (low rating)	High acceptance is important for spreading a service
potential market size [% of the whole country]	opportunity (high rating) – threats (low rating)	This indicator explains whether a service has mass potential or addresses just a niche population
energy reduction potential [% of total domestic energy use]	opportunity (high rating) – threats (low rating)	Savings are the condition sine qua non for a service
initial costs [€ per service unit or per household/year]	strenght (high rating) – weakness (low rating)	Obviously high costs are a serious obstacle for offering a service
development stage	strenght (high rating) – weakness (low rating)	This criterion indicates the marketability of a service

Table 2. Rating methodology for the energy services. Source: Own table.

	Value 1 (=1)	Value 2 (=2)	Value 3 (=3)
Residents acceptance	Low	Medium	high
Potential market size [%]	<10	10-50	>50
Energy reduction potential [%]	0-1	1-10	>10
Initial costs [€ per service unit or per household/year]	>1,000	100-1,000	0-100
Development stage	Idea	Pilot	mature

Lewis 1999). Savings between 4 and 18% for electricity (McCalley and Midden 2002, Midden 1983) and 18% for gas consumption (McCalley and Midden 2002, Midden 1983) could be achieved. However this type of action requires extensive staff employment.

- *Incentive strategy*: Within the incentive strategy, consumers get incentives (e.g. low priced rates, extra payment, more favourable credits) for reducing their energy waste. As long as the incentive is maintained, this kind of intervention appears to be the most effective method for saving energy. Several studies (Slavin 1981/electricity; Winett et al. 1985, McClelland and Cook 1980/gas) showed that applying this strategy up to 6% of electricity or gas can be saved.

Empirical studies indicate that general information alone, diffused by flyers, brochures, exhibitions, events, or campaigns is not very likely to modify consumer habits, whereas feed-back measures combined with individual consultation and inventive strategies (as long as the incentives are maintained) seem to be a promising approach to shape human behaviour. Depending on the chosen strategies savings from 5 to 20% of the gas and electricity consumption can be achieved.

Some words on methodology

Taking into account the findings presented above, an inventory of household energy awareness services has been created in the framework of the BewareE project. All in all, the project partners found more than 130 service examples coming from all EU member states (see www.izt.de/bewaree). 36 out of them were finally selected as best practice. In the following we will briefly describe the methodology applied in this working package.

Our selection has been based on a twofold assessment: In a **first step** the services were rated according to five indicators: potential market size, service costs, energy reduction potential, development stage and target group acceptance (see table 1). This analytical framework was conceived by the project team for systematically assessing and comparing the strengths, weaknesses, opportunities and threats of the energy services (SWOT).

The different indicators respond to varying interests of stakeholders involved in energy awareness services. For instance, the potential market size is decisive for service providers, while information on the energy reduction potential is crucial for residents in terms of ecology and household economy. Obviously initial investments are of central concern for service providers, whereas the development stage is a prerequisite for policy makers and service providers for their choice of services.

For each of the indicators three possible values were defined (see table 2). As far as possible we tried to get relevant data from the organisations operating the services. If no empirical data were available the project partners rated the services according to their personal experience and the empirical studies presented above. Finally, based on the five assessment criteria an overall value was defined. All services featuring an overall rating above a calculated threshold were included in the first best practice selection.

Subsequently, in **a second step** this group of selected best practices was analyzed considering **qualitative criteria**, more precisely, their **degree of innovativeness and their particular interest for certain European countries**. Thus, some of the services rating high were excluded as they were considered to be rather common, while other examples that appeared very innovative were included in the final selection even though they displayed a rating below the threshold. Innovativeness was not defined along an official definition but by discussing the novelty of a service idea both, internally and with relevant experts in the EU member states (phone interviews). Likewise,

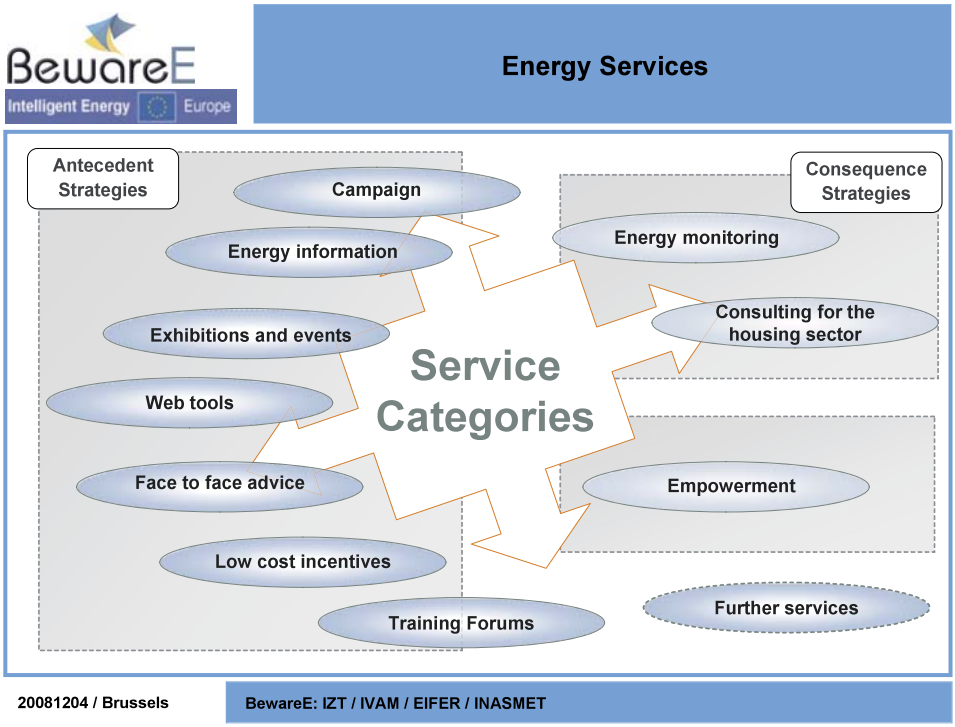

Figure 4. Categories of services in the BewareE-Project. Source: Own figure.

the particular interest of one service for certain regions was based on our research experience. Thus, some services might be completely outdated in some western European countries, but very relevant for Eastern European Countries who tend to lag behind in their development.

Classifying BewareE energy awareness services

In order to group the 136 identified energy services 12 service categories were defined along the main characteristics of the services. These categories of energy services are described below. In general most of the categories can be associated either to antecedent or consequence strategies (see figure 4). However, some of the services go beyond this positioning in time and can be distinguished from the other services by their particular approach of user activation. This category of services is not particular for its content – flyers, websites, smart metering devices, seminars etc. – but for its philosophy of giving users an active role in the detection of energy wasting, as well as in the conception and in the implementation of energy saving measures. By stimulating discussions and giving people a feeling of agency this kind of approach might lead to what Giddens (1984) (followed in the field of energy consumption by Bartiaux (2008) and Bartiaux et al. (2006)) calls "discursive consciousness". We will call this kind of services "empowerment services" (see definition below).

Campaign: These energy services are promotion activities carried out by mail, email, television, radio etc. that aim at improving energy efficiency in households. Campaigns are addressed to a great number of households and can even be organized nation-wide. Usually their messages are not focused on a particular group or a specific type of house.

Energy information: 'Energy information' services give specific information through diverse media about how to reduce energy consumption in households. This information is addressed to particular households' situations but there is no face to face contact between energy service suppliers and households.

Exhibitions and events: This category of services consists of the organization of exhibitions and events where households can get general information on energy efficiency. They are normally addressed to a large number of households of a district town or region. This category includes a diversity of events such as awareness weeks, exhibitions, street theatre and poster exhibitions.

Web tools: This category includes all services that provide information and advice to consumers available on internet. In some cases savings by implementing the suggested measures are calculated, while other websites present comparative data related to the Kyoto objectives. They are usually launched by electricity companies, NGOs or environmental agencies.

Face to face advice: This category includes all kind of services with an energy expert offering tenants personalised, targeted advice on energy saving. Thus they imply a live communication chain between service supplier and consumer.

Low cost incentives: These services combine energy information with small gifts in order to stimulate behavioural changes related to energy consumption. For instance, the inventory includes two examples of "climate boxes" that contains small appliances such as low consumption bulbs and insulation stripes showing how energy can be saved without decreasing the comfort level.

Training Forums: This category includes all kind of training activities targeting any kind of actors that are able to shape household energy consumption, e.g. architects, constructors,

Figure 5. Qualifying energy ambassadors. Source: NGO Prioriterre-Conseil.

installers, home owners, associations, building managers, or even children.

Empowerment: This type of services is based on the idea of giving residents the skills and competencies to become actors in the detection of energy wasting, as well as in the conception and in the implementation of energy saving measures rather than being only passive recipients of information. For instance the inventory contains one example of tenants training other tenants and another one on the creation of a resident environmental board in social housing dwellings.

Consulting for the housing sector: This category refers to services that are addressing housing organizations rather than residents. For instance two services are related to the benchmarking of energy consumption and costs per building block, which enables building managers to compare the energy balances of several building and find energy leaks.

Energy monitoring: 'Energy monitoring' services are services that make households' energy consumption and related costs transparent. These services imply giving direct real time feedback on the energy consumption, relying usually on ICT devices, such as smart metering. In many cases the technical complexity requires collaboration between energy companies, energy or environmental agencies, housing companies, public administration bodies, NGOs or technology companies.

Best practice examples taken from the BewareE project

In this chapter we present a selection of best practices that exemplifies the whole range of energy services identified during the BewareE project. Many of those services contain elements from all, the consequence, antecedent and empowerment approaches. For instance, the Motiva Oy service (see first example below) on the one hand renders neighbours skilled agents in their buildings by training them for being energy experts (empowerment); on the other hand as experts they are monitoring the energy consumption in their social housing dwellings and initiate action if necessary (consequence strategy); and finally, the energy experts spread information material among their neighbours (antecedent strategy).

EMPOWERMENT: MOTIVA OY / FINLAND

Within the Finish "Energy Expert Training" project tenants/residents are trained to be active experts on energy issues in the buildings they live. The Energy Expert Concept was developed by Motiva Oy and the Centre for Energy Efficiency in cooperation with the social housing organisation VVO. The first energy experts were trained in 1995. The energy experts monitor sudden changes in the electricity and heating energy consumption, provide information and training material via extranet and advice other residents on energy saving measures. Basic training is given in a three days course, but experts receive also further training, and regularly exchange with other experts. The courses are organised in collaboration with regional energy offices (government organisations) and housing organisations. VVO counts on around 500 energy experts among its tenants. Since 1994, altogether 3,000 energy experts have been trained in Finland by Motiva. In average energy experts have helped to save 5% in heating, 10% in electricity consumption and 20% in water usage. (www.energiaesteri.fi)

EMPOWERMENT: NGO PRIORITERRE-CONSEIL GENERAL DE HAUTE-SAVOIE / FRANCE

In the context of growing "fuel poverty", NGO Prioriterre proposed its Energy Ambassadors service to the district authority "Conseil Général de Haute-Savoie". The aim of this initiative

is to help families with low incomes to manage their energy bills. More precisely, energy ambassadors help families to save money and energy by the following actions: First, training on energy and housing is offered to social workers (vocational training and at school education). Second, a telephone service was launched for social workers and volunteers, who are in contact with people in difficulties. It aims at responding any question concerning energy or water. Third, a written manual (the 'ant's guide') was developed and distributed, targeting social workers and volunteers. It provides information on helping families in difficulties to manage their energy consumption. Fourth, home visits are offered to families. However, visits can only have a positive impact, if families feel a real need of the service and make an appointment. Following these visits families can draw on personalized advices. Energy savings have not been evaluated yet, but this service demands a lot of time and money. However, the aim of the project is mainly social and it is a very innovative example of coordination between an NGO and a local administration to help low income families to reduce energy costs (www.prioriterre.org).

EMPOWERMENT – RESIDENTS PARTICIPATION IN REFURBISHMENT ACTIONS / FRANCE

For the building of 61 dwellings in the "Grand Tissage" area (Bourgoin Jallieu), French social housing operator Opac 38 (Grenoble) adopted a comprehensive environmental strategy, including both the technical and the user side. With regard to the technical aspects, buildings were very well insulated with 37.5 cm large clay brick walls. In addition, the buildings were equipped with solar thermal and photovoltaic installations and low-energy bulbs. Concerning the users, the project is exceptional for its inclusive approach: At all stages residents have been consulted and informed to make sure that residents accept the technical devices and handle them in an appropriate way. In the conception phase a representative of a tenants union joined the planning team. Later on an Environmental Performance Committee (Comité de Gestion HQE) was launched, composed of representatives of the residents association "Friends of Grand Tissu", the Union of tenants organisations (Fédération d'Associations Représentatives des Locataires), OPAC 38's technical administrators as well as the building company, the technical designer and the maintenance companies. This board assures that all actors, tenants, building administrators and maintenance companies, consider the objectives of sustainable housing and act in a coordinated way. This presence of a resident association and the involvement of all the partners was decisive for analysing problems and furthermore enabled good relations with tenants for all relevant aspects (e.g. quality of the building, treatment of the reclamations, etc.). As they were mportant actors themselves instead of merely receivers of information, residents were willing to cooperate and committed to reduce their energy consumption. Compared to the rest of OPAC 38 estate, the energy costs of the Grand Tissage buildings for the year 2007 were 44% below average for heating and 29% below average for hot water. (www.opac38.fr)

CONSULTING FOR THE HOUSING SECTOR: OPERATING COSTS BENCHMARKING / GERMANY

In cooperation with the Berlin-Brandenburg housing association (BBU) the private company WohnCom in Berlin developed a benchmarking concept in order to supervise the operating costs. The concept is based on the compilation of consumption data of residential buildings, depending on the building structure. Due to the cooperation of numerous housing companies a comprehensive database could be created which includes thousands of dwellings and facilitates detailed comparisons. The aim of benchmarking is comparing key figures for different residential buildings and regions to spot "weak points" in resource consumption. Benchmarking results could be used by all owners of multifamily buildings paying an annual contribution. In Berlin and Brandenburg operation costs have been reduced between 0.15 and 0.35 Euro/m^2 living space per month since 1995/96. Therefore, despite the significant increase of fees within the last decade, housing companies have been able to reduce the burden of living costs by implementing saving measures and changing consumption behaviour of residents (www.wohncom.de).

ENERGY MONITORING: VOLKSWOHNUNG GMBH – KARLSRUHE / GERMANY

In the course of the refurbishment of 375 building units the housing company „Volkswohung GmbH – Karlsruhe" installed special thermostats and measuring equipment in 21 of its dwellings in order to analyze heat consumption and residents' ventilation patterns. The daily energy consumption was illustrated on a simple display showing three types of "smileys". Thus the company enabled its residents to get a better understanding of their energy consumption. The results were quite impressive: Compared to other dwellings not equipped with display the sample group used around 7% less energy. The transparency of this energy monitoring example shows that personalised, direct feedback is a promising strategy of inducing behavioural changes. Furthermore, one important lesson is that retrofitting measures alone do not reach the full potential of energy savings, but additionally, behavioural changes can contribute considerably to reduce the carbon footprint (www.volkswohnung-karlsruhe.de).

ENERGY MONITORING: ECOFAMILIAS PROJECT / PORTUGAL

Eco EDP and Quercus NGO (Associaçao Nacional de Conservaçao da Natureza) give direct assessment to Portuguese families in order to change behaviours to make a more rational use of energy. Thus, these two organisations started a programme to study the consumption habits and energy needs of Portuguese families, from October 2005 to January 2007. The main objective was to encourage families to make better decisions as to effective energy consumption through individual and direct assessment – without decreasing their level of comfort. In the first phase of the project, this was done through diagnostics of energy demand in 30 families over a period of 8 months and another 8 months of intervention, designed to change the habits that influence energy use. "Eco-Familias Program 225" is taking place from 2007 to 2008. The project also aims at disseminating the results all around the country in order to make other families aware of the importance of energy saving. The total savings of the 206 families is estimated as

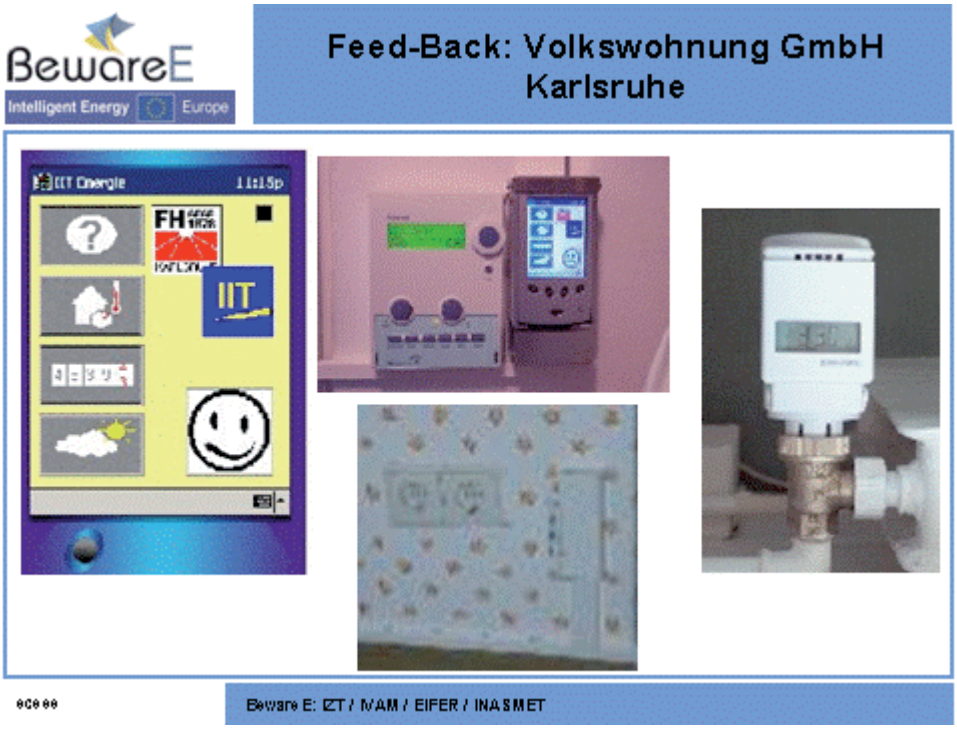

Figure 6. Display and electronical thermostat. Source: Volkswohnung Karlsruhe GmbH.

around 71,600 kWh per year (10% of the total electricity consumption) which is equivalent to around 34,000 kg of CO_2. The study has shown that it is possible to get a significant reduction in energy consumption thanks to small behavioural changes. If every Portuguese household did so, it would be possible to achieve around 1% reduction of emissions and would thus help to fulfil the conditions of Kyoto Protocol (www.ecocasa.org).

ENERGY MONITORING: ENERGY LETTER / SWEDEN

The Energy Letter concept was introduced by a Swedish energy supplier to provide homeowners with a statistical breakdown of their water and electricity consumption. Considerable energy savings were achieved without investments. The households send their meter readings to the energy supplier, which analyses the data and provides insight in the customers' energy consumption habits. The results are rapidly returned to the customer in the form of an energy letter. The energy letter contains suggestions on how the customer might cut his electricity consumption. The Energy Letter scheme provided a "natural" channel of information between "small" customers and the power company. The service does not exist anymore but there are similar, Internet based services provided by the energy supplier. However it was a perfect starting project to raise awareness about energy reduction measures in households and during the first year, the pilot group reduced its electricity consumption by 6% (www.umeaenergy.se).

WEB TOOL: UNION FENOSA'S VIRTUAL FOREST / SPAIN

The project "Virtual Forest" aims at guiding households towards a more efficient use of energy by inviting them to fill out an on-line questionnaire on their consumption habits and, at the same time, receive advice on possible actions for reducing energy consumption. The promoter of the "Virtual Forest", the Spanish electricity company Unión Fenosa, donates 1 Euro to a reforestation project in Brazil for each participant who responds to the on-line enquiry and also plants half a tree in Second Life. The funds for reforestation are managed by the NGO AccioNatura. If the participant in the on-line enquiry submits his or her e-mail account, he or she receives a comparative evaluation of the present energy use in the household as well as practical recommendations for improving. It takes only a few minutes to complete the on-line inquiry (in Spanish, English, Portuguese and Catalan) at http://www.bosquevirtual.com/index_en.aspx. After 6 months, 55,000 people have reduced their CO2 emissions and saved up to 25% of their electricity costs. That means that, according to Union Fenosa estimations, 2,600,000 kg of CO_2 have been avoided additionally to the abatement effect that can be achieved thanks to the 316 reforested hectares in Brazil. (http://www.bosquevirtual.com/)

FACE TO FACE ADVICES: BOILER INSPECTORS / ITALY

Italian Local Administrations are providing energy advice through boiler inspectors. According to Law 10/91 article 31, Italian municipalities with more than 40,000 inhabitants in their territory and provincial administrations in the remaining national territory have to submit all the boilers to inspection at least once every two years. During the check, the boiler inspector is obliged to: verify the state of maintenance of all installed boilers and guarantee for an energy efficiency not exceeding a maximum value; verify the presence of automatic temperature regulation and safety equipment; check that the boiler conforms to legal requirements for heating plant; inform the end users about energy savings, safety rules and the achievement of a good comfort level. The estimated number of boilers to be inspected is 11 million. There are indications that the boiler inspection programme has increased citizens' awareness of the

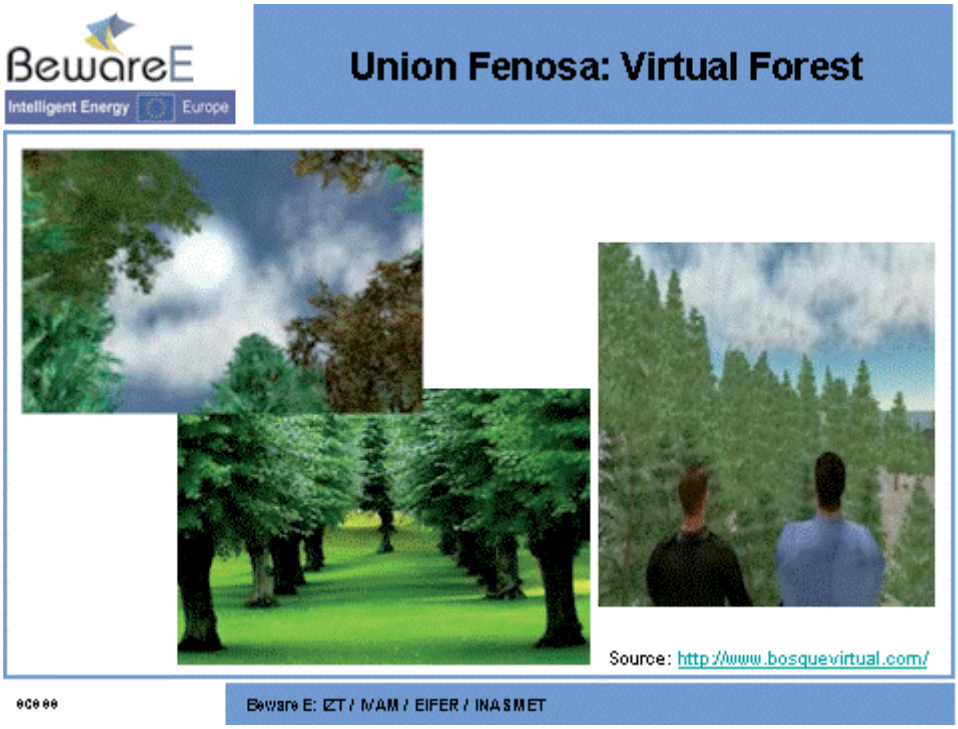

Figure 7. The virtual forest on the web. Source: Union Fenosa.

need to maintain boilers properly. For example, in the Province of Como the number of checked plants with correct maintenance increases every year. During winter 2005-2006, 83% of plants complied with the legal requirements.

Outlook

Behaviour-related energy savings can be understood as a two-fold challenge: first, trying to influence people's values, priorities of action and habits that are opposed to the aims of energy efficiency; second, informing those who are already willing to act on the possibilities of reducing their energy consumption. In this paper we presented a set of best practice services that shall help to respond to these two challenges. By implementing such energy awareness services energy consumption can be cut by around 5 to 10%. Consequence strategies such as targeted individualised feed-back and empowerment strategies creating discursive consciousness are most likely to have a significant impact on values, priorities of action and habits. In contrast we do not expect antecedence strategies alone to have a major impact on user behaviours. Nevertheless antecedent strategies such as web tools, campaigns, one-day energy events etc. are by far not useless as they provide those willing to act with important practical information. Therefore, combining antecedence with consequence strategies over a long period of time appears to be a very promising strategy.

Furthermore, most of the services require an appropriate technology but this technology has to be complemented with information and training of users on how to use it and implement energy efficiency measures. For example, energy monitoring requires not only the right measures equipment but also targeted advices. In this regard, technology is necessary to guarantee energy saving but not enough.

Finally, energy service analysis has shown that collaboration between different agents is a key factor for success service provision in order to offer a coordinated mix of tools to raise awareness: information, training, technologies, etc. Thus, successful services are often provided by energy companies, energy or environmental agencies, housing companies, Local or Regional Administration, NGOs, technology companies, etc. Furthermore, from an ambitious point of view in terms of energy saving, only big collaborative projects will help to reach energy efficiency objectives.

In 2009 the BewareE project partners will test the transferability of the found best practices and will perform an important disseminating task. To this purpose, 8 national workshops with main actors in the French, Spanish, German and Dutch housing markets will be organised in order to discuss socio-cultural, political, legal or market barriers impeding the transfer of services. In addition 20 in-house workshops will be organized with housing companies in France, Germany, the Netherlands and Spain to get "real life" feed-back on the feasibility of energy services found in the framework of the project. Based on this practical experience the BewareE project partners will develop a manual addressed to policy makers and practitioners which will present successful measures as well as important information on the transferability and implementation of the services.

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ANNEX: Ratings of services

	Value 1 (=1)	Value 2 (=2)	Value 3 (=3)
Residents acceptance	Low	Medium	high
Potential market size [%]	<10	10-50	>50
Energy reduction potential [%]	0-1	1-10	>10
Initial costs [€ per service unit or per household/year]	>1,000	100-1,000	0-100
Development stage	Idea	Pilot	mature

Source: *Own table.*

ID	Country	Service	RA	PM	ERP	IC	DS	Typ	R
55	FI	Empowerment – Motiva OY	3	2	2	3	3	BP	8,7
69	F	Empowerment – Prioriterre: Energy ambassadors for low income households	3	2	2	3	3	BP	8,7
61	F	Empowerment – OPAC 38: Resident participation in refurbishment	2	2	2	3	3	BP	8,0
9	DE	Consulting for the housing sector – Operating costs benchmarking	3	2	2	3	3	BP	8,7
11	DE	Energy monitoring – Volkswohnung: Displaying energy consumption	3	3	2	3	2	BP	8,7
106	PT	Empowerment– Evaluation of household energy use: EcoFamilias project	2	2	2	3	2	BP	7,3
33	SE	Energy information – Energy letter with personalized energy reducing advice	3	1	3	2	2	BP	7,3
86	ES	Web tools – Unión Fenosa's virtual forest	3	3	2	3	3	BP	9,3
94	IT	Face to face advice – Boiler inspectors	3	3	2	2	3	BP	9,4

Source: *Own table.*