



WP3: Specifications of the empirical studies

D 15 from the BARENERGY project

(Grant agreement no.: **213558**)

"Appliances: Shifting for renewable, refurbishment, purchase and use"

by

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1. General introduction of the WP3

The BARENERGY Project is developed within the seventh Framework Programme of the European Union, Theme 5: Energy. The objective of the BARENERGY Project (BARriers for ENERGY changes among end consumers and households) is to develop methods to identify the relevance and strength of various barriers for energy behaviours changes among end consumers and households, and to discuss how activities from political authorities, energy producers and NGOs can overcome these barriers.

The Work Package 3 consists in “specifications of the empirical studies”.

1.1. Objectives of the WP3

The objective of WP3 is to collect the most relevant results provided by social sciences which have already shed some light on these barriers and levers in the field of energy-related behavioural changes so as to propose some “analysis dimensions” (“empirical specifications”) for the three next WP (WP4-5-6, empirical studies).

To do so, the teams taking part in WP3 carried out a collaborative review of empirical case studies on energy-related behaviours, barriers and levers toward reducing the energy consumption, and the initiatives already taken to reach this objective.

This empirical state-of-the-art document will serve as a base for the next work packages (qualitative stakeholder interviews, quantitative survey and consumer focus groups), in that it helps designing protocols for empirical studies, by defining some assumptions, asking appropriate questions, giving specific results for each country, suggesting which people to meet and identifying sample groups.

The state of art is defined as follows:

- on the 6 countries of the contributory teams (France, Hungary, Netherlands, Norway, UK and Switzerland).
- as regards the three following fields/topics: PP1: Domestic energy use (in particular heating and cooling of accommodations) ; PP2 : Household appliances (energy efficiency, turn down and shift off); PP3: Fuel consumption of cars (energy efficiency, drive less or more economically and renewable resources).
- more specifically, focusing the attention on the three following behavioural dimensions: energy saving within households (turn down/switch off), improvement of energy efficiency within households (purchase and use of energy-efficient appliances), changes to more sustainable and renewable energy technologies (shift energy carrier). => USE – PURCHASE – SHIFT
- and focusing on the end-users behaviours (domestic consumers and households)
- integrating data from several social science disciplines, to have the best overall analysis on the energy-related behaviours
- analysing the behaviours into three items: energy-related behaviours in general (practices and representations of energies in each country), the energy-saving behaviours (who already saves energy, why, what kind of, with which current limits?), and the behaviours linked to specific initiatives (local trials), to understand if they have led to any behavioural changes.

This state of the art provides some specifications for the implementation of the empirical studies, for instance:

- Identify the barriers and drivers to assess their strength and relevance in the empirical studies
- Propose some “windows of opportunity”, in the life-cycle to be tested in the empirical studies
- Identify some social and demographic characteristics, some lifestyles that support or slow down the behavioural changes and to investigate in the studies (strategic groups)
- Investigate the “gender questions”
- Identify the stakeholders that households relate to the energy savings

To do so, we proposed a collaborative work divided up into four stages:

- Each contributory team makes the review of the scientific literature it considers the most important and the most relevant for its country and makes a summary (one-page document) [April-May, 2008],
- The Leading team of the WP3 studies and analyses these documents and proposes a general outline for each position paper [May-June, 2008];
- The contributory teams meet for a mid-course workshop to debate on the outline, on the first results and validates the state progress [June 26th, 2008];
- The leading team writes down the three position papers, asking contributions to the contributory teams [July, 2008], and then subject these documents to the latter for rereading, comments and validation [August, 2008].

It was decided to work in a collaborative way between teams, to make the review of the documents. As a matter of fact, the objective is not to get an exhaustive state of the art per country, but rather a variety of approaches and of study purposes, to provide action points for the teams involved in the studies/surveys. The contributory teams have focused on disciplinary competences, and therefore covers a large social sciences research field. Moreover, for language reasons and to prevent the "duplications", we decided that each country made the review in a priority way of the literature of its own country.

We thus analysed 125 "one-page documents", proceeding from 7 partners. [Refer to the references table in annex]¹.

1.2. Objectives of each position paper

Work package 3 is divided up into three "deliverables":

- Domestic energy use (D14)
- Household appliances (D15)
- Fuel consumption of cars (D16)

Deliverables D14 and D15 are complementary: in the project, it is specified that the first one concerns "the energy use in the built environment" (heating, cooling and renewable energies), and that the second one concerns the "use and purchase of appliances". We will see that the analysis of the documents led us to change the boundaries of this sharing-out: D14 concerns the main and general barriers and drivers towards energy-related behavioural change; D15 concerns the barriers and drivers per activity.

D16 concerns "fuel consumption of cars" (purchase, use of cars and change to renewable energy resources).

The three deliverables are focused on behaviours, to understand:

- What factors determine energy-related behaviours in Europe,
- What are the barriers preventing a behavioural change towards a reduction of household energy consumption,
- What are the drivers to promote energy reductions.

However, these behaviours are embedded in the political, economic, social, and material institutions, and we try to understand how this institution-individual interaction comes in variety of forms. [Refer to WP2, D11, *Theoretical and methodological clarifications*].

¹ These documents are mentioned in square brackets, with the name of the author, the publication date, and the team code. Moreover, we used additional references, which are not directly in the purpose of the request, but they help to specify it. The latter are mentioned in parenthesis. All the bibliographical references are at the end of this document.

2. Objectives of the Deliverable D15

Two types of energy behaviours can be distinguished. First, energy behaviours in general, which we have described in D14. Second, energy behaviours related to equipment, activities and appliances, which we will discuss in this deliverable (i.e., D15). The analysis of the documents related to the behaviours in general shows an important limit of the definition of "energy behaviours": there is no homogeneous and coherent behaviour in terms of energy at the households level. As a consequence, the barriers and the drivers must also be examined at a specific level.

We thus distinguish various specific "energy behaviours" rather than energy use in general. Several searchers agree that energy consumption is not a goal but a "mean" to do activities for households. These activities refer to practices, behavioural determinants, constraints, and symbolic notations that overcome the energy use.

First, we will show the distinctions that people do into different types of energy behaviours. Then, we will discuss the social functions of energy behaviours and we will study which issues are underrepresented.

3. The distinction into different types of energy behaviours: examples and data

We will focus here on the energy-related domestic practices. However, the distinction into different behavioural categories is valid and effective in the domain of mobility behaviour as well (see D16).

Analysis of different energy behaviours shows that not all energy behaviours are equivalent, neither all negotiable, indicating that they do not have the same meanings, do not refer to the same social networks, to the same symbolic notations, agency and constraints. For example:

The answers (concerning the motivations to make energy savings) can vary according to the fields of energy consumption concerned. [Moreau, Wibrin, 2005/EDF-15]

Therefore, we are first discuss which and how these mechanisms distinct different types of energy behaviours.

3.1. Hierarchical organisation between energy behaviours

Activities are organised into a hierarchy depending on their importance to both their social life and in relation to their supposed difficulty to change this behaviour (for instance related to the decrease in the life comfort):

Quantitative data: analysis of people's propensity to do some efforts to protect the environment. 93% people agree to use low-consumption bulbs, 75% with the fact of not heating more than 19 C°, 44% with the fact of renouncing to use their car everyday. 87% declare paying attention to electricity consumption when they buy a new electrical appliance. [Peretti-Watel, Hammer, 2007/EDF-11]

Investments in energy savings are only granted when they are linked to another advantage (renewed comfort, patrimonial value of the dwelling, etc.):

The actions already undertaken are generally related to insulation or actions which have a low cost. If people are mainly in favour of change, they are less convinced when the actions have a high cost or require a loss of comfort. [Moreau, Wibrin, 2005/EDF-15]

Thus, the studies separating different types of behaviours show that people perceive different types of difficulties to change behaviours and are not always willing to change specific energy-related behaviours, especially when it is related with high behavioural costs (in terms of money, comfort or convenience (refer for example to [Bartiaux et al., 2006/EDF-15], [Peretti-Watel, Hammer, 2007/EDF-11])).

For example, an English study showed that people make priorities in the measures for sustainable energy consumption:

The remaining measures for sustainable energy consumption under consideration in this

research, and participant responses were (in priority order):

- buying/installing energy efficient products/appliances- A-rated appliances were a popular concept and there was an expectation on manufacturers to only supply such goods;
- installing micro-generation- participants were supportive in principal of this, but there remain significant barriers to uptake related to a lack of knowledge about micro-generation and an unwillingness on the cost front; suggestions to overcome such barriers included: community micro-generation schemes; micro-renewable to be installed in new builds; government and local authority buildings to install micro-generation);
- switching to a green tariff- this proved a distinctly unpopular 'priority' amongst participants, mainly due to a significant gap in knowledge, unwillingness to pay extra and distrust of the concept. [Brook, 2007/CSE-04]

📁 Proposal for the surveys/studies: organise energy behaviours into a hierarchy from the most acceptable to the less acceptable and from the easiest to the most difficult.

3.2. Choice of energy behaviours in a list

Each person or household thus does not carry out all the energy-saving behaviours. He or she "selects" some energy-saving options above others depending on his/her constraints, his/her resources; his/her agency, from a list of "acceptable" actions. One action possibility is to act moderately in several domains:

Basic energy saving practices are present in households and are based on four principles: financial principle; anti-waste principle; environmental principle; a principle which criticises excessive consumption. Heating: standard practice is: 16-19°C when away, 20-21°C when the children are at home and 19°C at night. Young children are considered to need more heating at night. Heating goes up when the grandparents visit. Lighting: low-energy light bulbs, lights are switched off when rooms are left, wattage of the light bulbs, but light left on for children at night. Halogen: they know it consumes a lot of energy, may be kept for social occasions (guests, etc.). Cooking: few actions, practices mentioned (pressure cooker to cook faster; turning hotplates off before cooking is complete, etc.) Electrical appliances: multi-socket on/off switch to turn off night lights, tour of the house to turn off appliances in the evening or when leaving the house in the morning, giving up of driers to dry clothes 'naturally'. Energy labels in purchasing criteria but not as a priority. However, people don't accept to decrease the number of appliances at home. [Moussaoui, 2007/EDF-12]

Social groups can have different degrees of energy-saving involvement (Barr, Gilg and Ford, 2005):

- 'Committed environmentalists' were the most likely to purchase energy efficient bulbs and look for efficient appliances. They were also, by way of contextualisation, the most likely to engage in other environmental practices such as composting, waste reuse and a range of green consumer practices (+reduce heat in unused rooms, reduce the hot water temperature, clothes rather than turning up their heating, switch off lights, wait for a full load before using the washing machine); [Small household size; member of a community organisation]
- "Mainstream environmentalists": very similar respect to their purchase behaviours. But smaller level of composting [Small household size]
- "occasional environmentalists": less reductions in energy saving behaviours compared to the previous group (they do not keep their heating low neither put on more clothing to keep warm);
- "Non-environmentalists": rarely look for energy efficient products and are only likely to participate in energy saving behaviours that require minimal effort or no reduction in comfort (switching off lights in unoccupied rooms) [younger people, males, big household size, low income]

Thus each group defines acceptable actions and balances between these practices and its daily constraints, to develop what its members are able to do.

3.3. Routine/reflexivity

Routines are often considered as barriers to change energy-saving behaviours:

"There were relatively low levels of green purchasing which reflects a lack of willingness to engage in activities that required conscious and deliberate thought" (Barr, Gilg and Ford, 2005)

However, routines are not always barriers. They can correspond to habitual energy-saving practices. Their advantage is to be very stable because they were learned during childhood [Moussaoui, 2007/EDF-12] or because they correspond to strong constraints (e.g., "fuel poor people"² who develop strong energy-saving practices).

In the Deliverable D14, we saw that public policies generally centre around using an awareness/sensitization model, that is, utilizing individual's reflexivity and individual responsibility to change behaviours:

"Compared to the earlier waves of consumer activism and consumer policies, the new feature of the problematisation of consumption in the 1990s is the focus on the choices and responsibilities of the individual consumer to her or himself" (Halkier, 2001)

Routines can be considered as drivers as well. As a matter of fact, routines and reflexivity are two parts of energy-saving behaviours. Routines are not always "bad" habits, and reflexivity concerning environment is not sufficient to develop practices.

It would be interesting to have a wider vision of behavioural practices making part of "energy behaviours" drawing up a wider list of what is usually retained in surveys/studies.

3.4. The appliances are socially differentiated

Households use appliances in a different way depending on their life cycle (purchase, use and waste) and depending on the life cycle of the individuals within each household (e.g. children, teenagers, adults, seniors). Moreover, appliances are classified according to living spaces and to the symbolic notations.

3.4.1. The purchasing moment

The appliances are often socially differentiated during the purchase. For example, some appliances are categorised as "basic", indispensable to buy, whereas some others are considered as more "superficial" and are comfort products:

Purchasing of energy-powered objects: basic for moving in (cooker, fridge, washing machine, iron) or comfort (small electrical appliances, dishwasher and optional appliances) [Desjeux et al., 1996/EDF-13]

Thus, whereas basic products will be bought by most households, comfort products will be bought depending on the financial, personal and situational situations. In terms of the amount of purchase, it is interesting to understand what is negotiable or not, to understand where there is energy-saving potential.

Which appliances are perceived to be basic/superficial differ across cultures, countries, e.g., depending on welfare, climate. To be tested?

Another distinction between purchased appliances is related to the people's definition of what is "small" and what is a "big" appliance, in particular in regard to their energy consumption:

Purchasing of 'small' electric objects: 'The purchasing of some electric objects is not considered as essential' (p. 51) but rather as a luxury, for personal pleasure. That is why there are 'tricks' to buy the object without feeling guilty: justification of its usefulness (the coffee maker is old, the machine is obsolete, not good enough, a new one could make life easier), altruism (for one's children or partner), aesthetics (create atmosphere with a new light fixture, etc.). Or wait for the ritual celebrations (Mother's Day, Christmas, birthdays, etc.). Or unexpected occasions:

² Is considered as "fuel poor" a household who needs to spend more than 10% of its income on total fuel use.

inheritance. Qualities sought when making the purchase: visual/aesthetic, practical (functions), comfort. As a general rule, attention is not given to the electricity consumption of small appliances, unlike large appliances' (p. 54) [at the time of purchasing]. [Desjeux et al., 1996/EDF-13]

Some energy-consuming appliances are related to rituals, in particular during particular moments of the year:

Mother's Day for small electrical appliances / Father's Day for "do-it-yourself". 'The purchasing of electrical objects is part of the social reproduction of the division between the sexes in the area of housework and it refreshes the sexual boundaries which exist at home.' (p. 20) + passing down from the eldest to the youngest, particularly when forming a young household. [Desjeux et al., 1996/EDF-13]

📁 These examples of categories (small/big, daily/occasional, habitual/ritual, etc.) found in a French study in 1996 could be developed in each country and updated in the focus groups survey, and maybe in the questionnaire.

3.4.2. From purchase to use

Energy savings can be due to purchasing energy efficient appliances, but can be due to energy-saving practices as well (switch off, etc.). But purchase and practices (appliance's use) are not mechanically related. People can be aware concerning energy consumption of the appliance during the purchase, and not during the use, or inversely:

There is "a conceptual division between purchase related energy saving behaviours (such as buying low energy light bulbs) and habitual actions (such as turning off lights)." (Barr, Gilg, Ford, 2005)

The authors relate these behaviour differences to the routine/reflexivity distinction:

"In the case of energy saving, the data pointed two distinct lifestyle contexts, in which activities that were undertaken with minimal thought (habits) can be contrasted with those that may reflect considerable deliberation (purchase decision)". (Barr, Gilg, Ford, 2005)

An appliance may have different meanings depending of its stage in the consumption process: in particular, at the moment of purchase and at the moment of use. Thus, there is sometimes a "rebound effect" when the efficient appliance is often used (refer to 3.9.). Some people are aware concerning energy consumption when purchasing, but not when using an appliance:

One obvious way to reduce energy use is to promote the adoption of energy-efficient appliances. Various psychological factors are important in this respect. Energy efficient appliances will be more readily adopted when they meet important needs, wants and preferences. It is important to consider possible side effects of energy-efficient appliances as rebound effects may occur. This happens when people use efficient appliances more often, because they are energy efficient. [Steg, 2008/RUG-04]

📁 Ask questions concerning energy efficient appliances in the different stages of the consumption process: purchase, use and recycling.

3.4.3. Appliances define territories at home

We saw that the tendency is in favour of an accumulation of equipment (increasing number of energy-consuming equipment). However, all the home spaces are not concerned in the same proportions. Some rooms "accumulate" more appliances than other rooms. "Highly energy-consuming" rooms and "low energy-consuming" rooms are socially and culturally defined:

'All of these appliances, one of whose main characteristics is to have multiplied since the 1960s, are going to enter the home and organise it according to a hierarchy that divides the house into areas (sitting room, dining room, kitchen, bathroom and bedroom) - whether through direct or indirect lighting - and darker areas such as the corridor and the cellar; into areas with a high density of electrical equipment (kitchen, sitting room and bathroom) and areas without or with little of such equipment (bedroom); and high electricity consumption areas linked to the heating, cleaning and cooking functions (kitchen, bathroom and sitting room).' (pp. 56-57) [Desjeux et al., 1996/EDF-13]

These spaces are linked to social identities, like gender or generation:

Electrical appliances, once bought, are going to form part of a social space which corresponds to the large gender and generation divisions in the home (children rooms vs adults spaces, kitchen vs “do-it-yourself” space, etc.). [Desjeux et al., 1996/EDF-13]

3.4.4. Life stages

Accumulation and energy consumption of appliances partly depend on the life stages, for instance becoming an adult is accompanied by consuming more energy than during childhood:

Becoming an adult: a young household is formed, electrical appliances given as gifts, second-hand equipment is given. Arrival of children: organisation of the home is altered. Retirement, growing old: change of home and/or equipment. [Desjeux et al., 1996/EDF-13]

3.4.5. Perceptions of energy consumptions of appliances

There are also social perceptions of which appliances consumes "a lot" or "a little", and people often rely on these perceptions when wanting to reduce energy consumption:

Management of spending and consumption: some objects are considered as big consumers: heating, telephone, hotplates, iron, oven. + intensive use (coffee maker and washing machine) + those that we use badly (fridge, when the door is left open). + halogen lights. Distrust towards newly acquired equipment. 'The management of the home's light is very often considered as a symbol in the fight against waste.' (p. 107). [Desjeux et al., 1996/EDF-13]

People don't have lots of information concerning the consumption of each appliance (because of global invoices). Thus, some households make energy-savings efforts but reduce use of “low-energy-consuming” appliances. So there is a gap between efforts and results in terms of efficiency.

☞ The distinction of energy behaviours may thus be carried out depending on the "native" categories it is important to make appear. Some were provided here as an example, but we would have to define their relevance (quantitative survey) and to find some others (focus groups).

4. Understanding the barriers and the drivers of energy use based on domestic activities and social functions

To understand the barriers and the drivers of activities, we will disaggregate energy behaviours. First, we analyse energy behaviours requiring building structures changes and "heavy" investments or refurbishments (including changing for renewable energies). Then, we are going to discuss activities in the accommodation related to purchases and uses of appliances.

4.1. Insulating and refurbishing

The drivers and barriers related to insulating and refurbishing concern household's decisions and adoption but behaviours of renovation channels actors (craftsmen, fitters, etc.) as well.

4.1.1. The decision process of a “big” investment

Willingness to pay for energy-efficient improvements seems to be present, sometimes even when the investment exceeds possible savings. An assumption is that the accommodation takes an additional patrimonial value. However, willingness to pay may be limited to specific groups:

The paper gives some detailed insight into the willingness to pay for improvements in energy efficiency by modelling renters' and house buyers' choices of housing with regard to different energy efficiency standards of windows and façade as well as to the presence of an air renewal system. The results show a significant willingness to pay (WTP) for energy-efficiency attributes of rental apartments and of traded houses. The willingness to pay varies between 3% of the price for an enhanced insulated façade (in comparison to a standard insulation) and 8% to 13% of the price for a ventilation system in new buildings or insulated windows in old buildings (in

comparison to old windows) respectively. The WTP is generally higher than the costs of implementing these attributes. However, it has to be kept in mind that due to a possible overrepresentation in the sample of environmentally sensitive people, the WTP values presented in this study should be used with caution. [Banfi, Farsi, Filippini, Jakob, 2008/UNISG-07]

For households, energy savings are not a priority in refurbishment decisions. For example, a quantitative survey among Swiss people shows that the energy savings criterion is neither primordial nor a priority in renovations:

The results that are based on about 1000 single family houses and apartment buildings each confirm the assumed lack of renewal of the Swiss residential buildings. The majority of the measures on the building envelope include only refurbishments like painting or renewal of the roof covering that doesn't improve the energy efficiency of the building. The common main factor of all construction elements that triggers refurbishment is the end life time, other factors are specific on the construction element and the measure (changing attic to apartments, noise protection, energy saving / environmental protection etc.). [Ott et al., 2005/UNISG-13]

For "big" investments (i.e. in terms of financial cost, time, types of refurbishment, etc.), the financial incentives supported by public policies are an important driver in the decision-making:

From a policy point of view, the government can reduce these barriers by supporting the communication and information for decision makers namely consumers, investors and financial institutions. In addition to an enhancement in communication, the governments could grant additional financial resources to the house owners who want to invest in energy-efficiency measures to overcome financial barriers. Some Swiss financial institutions award credits with lower interest rates for Minergie labelled buildings. It should be considered that government intervention could speed up process of the cost reduction (learning curve) of measures improving energy efficiency in buildings. [Banfi, Farsi, Filippini, Jakob, 2008/UNISG-07]

In terms of renovation decision process, the majority of the Swiss households decided first of the renovations and then have recourse to a craftsman or to an adviser:

As far as decisions about measures related to the building envelope are concerned, 50% of house owners choose the measures on their own and then hire a contractor, 30% of house owners ask a company to suggest measures and few house owners hire an architect or energy consulting company. Further, house owners normally consider companies that already worked on the house before (60%). In 30% of all cases, building owners consider companies recommended by relatives or friends and in 13% trade fairs are determining the choice of the company. [Ott et al., 2005/UNISG-13]

The craftsman thus plays a weak prescription role regarding the types of work carried out.

A survey among a representative Belgium sample shows the characteristics of the people who agree to insulate their house. The criterion to increase comfort (compared to the current low temperature) seems important:

- Acceptance to change some behaviours: To improve the insulation: "Respondents who agree (completely or rather) with the proposition of improving the insulation are more numerous to estimate, earlier in the survey, that the temperature of their living-room during a winter day is about 18°-20° while the dwellers who say that they have already applied this measure are often estimating the same temperature at 21°-22°." (p. 127)

Socio-economic characteristics of the respondents who state that they completely agree to improve the insulation of their dwelling:

- the vast majority (76%) is among the middle-aged respondents (30-69 years old), however the youngest respondents (less than 30 years old) are proportionally more numerous to state that they completely agree with this proposition.
- they are living in pair (74%) with or without children
- the household income is also highly and significantly associated with the intention to improve the insulation of their dwelling
- significant relationship between this intention of improving the insulation and the dwelling type: dwellers living either in an apartment or in a 3-façades house are quite likelier to express their intention to improve the insulation. [Bartiaux et al., 2006/EDF-15]

Although there are incentives stimulating energy-efficient refurbishment, some barriers appear during the decision-making renovation process:

There are many incentives to improve the energy performance of one's home: desire for comfort and to make savings, funding and tax credit offers, media pressure, environmental worries and

concerns as a citizen. However, the barriers are strong: competition with other budget priorities: leisure, car; work funding offers from banks are not constant; difficulty, which is sometimes accentuated by the range of information available on the Internet, to identify the solution suited to one's constraints and one's home from among a very wide range of offers; difficulty in gaining access to artisans and companies; difficulty in understanding the words used by professionals; for buy-to-let landlords and tenants, a difficulty in starting a win-win process; very rare use of a professional project manager who rarely encounters the financial conditions expected by his profession in low-budget projects; slowness of joint ownership decision-making processes.' (p. 97) [Lagandre, 2007/EDF-43]

Finally, especially middle to high income households choose energy-efficient renovation and insulation actions. Also, house owners invest more in energy efficiency than renters. There is a paradox: people who have low agency, in financial terms and in terms of action means, need more energy-efficient renovation in their dwelling:

'For fuel poor households, whose income is insufficient and homes very difficult to heat, which is often the case in those households considered as squalid, improving energy performance makes even greater sense.' [...] 'Environmental issues in the home, far from being a concern specific to the well-off, in fact concerns the poorest even more: homes which lose a great deal of energy and are expensive to heat, lead-based paint poisoning of children from families who have recently immigrated, homes exposed to sources of noise deserted by the middle classes.' (p. 98) 'problems of a lack of comfort' in social housing. [Lagandre, 2007/EDF-43]

Households are thus "trapped" between social and family priorities on the one hand, and comfort in the other hand. These may be either barriers for renovation (e.g., budget dedicated to other priorities) or drivers (e.g., renovation allowing to improve comfort of accommodation). Lifestyles of inhabitants are important to "personalise" the appropriate moment to carry out some renovations, the content of these renovations, and to guarantee the inhabitants' satisfaction. For example, in a renovation project in "passive houses" where the energy aspects are a priority for designers, the inhabitants' point of view was taken into consideration but energy considerations proved not to have priority. "The energy aspects can be found in the list but they do not benefit from the highest priority". [Hermelink, 2005/CEU-02]

The inhabitants require "brightness", "bigger kitchen", say that there is a "lack of balconies". This was reinterpreted by the designers (who could not financially build balconies) in a "green roof" which led to a "recreational value" to the project. Finally, while the designers focused their attention on the winter temperature, the inhabitants perceived the summer temperature "worse than in winter". "For the concept phases of the refurbishment this was a completely new aspect. Usually the focus is on winter, because of the energy aspect. In this case it became obvious, that planning for comfortable conditions in summer needed even more weight than providing for ultra-low-energy demand in winter." [Hermelink, 2005/CEU-02]

This example shows that what can be considered as a barrier for renovation in the first place (e.g., comfort), may become a driver for projects.

4.1.2. The role of business channels in the adoption of energy efficient equipment

Business channels regarding manufacturing, distribution and maintenance of energy systems may include barriers to proliferation of this type of equipment.

First, the "usual markets" badly know the new equipment and lack of time to train:

In general, the building market lacks of important information as regards the energy-efficient products. As a consequence, the participants in the market have some difficulties to identify the solution effectively corresponding to the best practice. Moreover, a lot of energy-efficient solutions are characterised by an enough high complexity degree. While the well trained intermediaries (e.g. the fitters) could decrease the information deficits, a lot of other actors on the market aggravate the difficult situation in terms of information by an information or a continuous training partly insufficient? We identified in particular gaps in regard to this issue in the setting up jobs. [Kägi, Schäfli, Siegrist, Hässig, 2004/UNISG-08]

Moreover, to spread the equipment, collaboration between several actors of the action system who may have different interests is needed:

The problem of the lack of information as regards the best practice products is reinforced by the

manager-employee relationship observable in the building field in case of informational asymmetry. Concretely, this situation requires that the project owner (the manager) has to appoint an employee (that is to say an architect or a fitter) to carry out the planning and the management of the works of his project. This employee can, in some circumstances, have his own interests that do not correspond to those of the project owner. As a consequence the information is not symmetrically shared out, if the architect advises against an energy efficient measure, the project owner can only check under specific conditions if the measure is really attractive or if the employee just does not find important. [Kägi, Schäfli, Siegrist, Hässig, 2004/UNISG-08]

This becomes a problem of the entire action system:

'The 'Climate Plan' updating work undertaken in spring 2006 revealed that the main barrier to upgrading the energy performance of existing houses on the basis of "factor four"³ concerns the continuity in and the quality of communication between industry, material distributors, artisans, companies and private persons/clients of home renovations.' (p. 95) [Lagandre, 2007/EDF-43]

The business channel is thus not always well informed and it is not always in its interest to develop innovation. Moreover, innovation generates risks for these companies, related to information, cooperation, demand uncertainties, etc.:

Another reason avoiding the quick adoption of modern energy efficiency measures resides in the fact that, in general, the building market offers an unfavourable field to the advent of pilot products. Finally, the penetration of products of best practice products at a wide scale is hindered by market conditions generally difficult as regards the energy efficiency measures. A lot of problems described would lose their importance if the energy efficiency market in the building field was wider. In particular, an extension of the market of the energy efficient products would improve the information of the employees and the transparency of the market, and the energy efficiency in the building would no longer be a pioneer market. [Kägi, Schäfli, Siegrist, Hässig, 2004/UNISG-08]

But the craftsmen carrying out this type of installation have often small-sized enterprises:

'The problem in improving energy performance mostly concerns the relationship between clients who are private persons without any knowledge of the subject and who are deprived of technical assistance and artisans most of which have fewer than five employees.' (p. 95) 'From this perspective, the improvement of energy performance in homes is more directly concerned by thousands of small transactions than the usual problems affecting town planning.' (p. 95) [Lagandre, 2007/EDF-43]

Moreover, in France, there is a problem regarding the number of expert craftsmen: there are too few craftsmen to guarantee the development of a new market, already very occupied by conventional markets, and who will be soon retired. All of this does not encourage to train oneself to new equipment:

On the side of artisans, there are difficulties: insufficient (or sometimes excessive) information on new techniques and public funding. Building trades which are too divided. Competition with companies which get experts in renewable energies and with energy distributors who seek to harvest energy saving certificates. Hiring difficulties (it is foreseen that many people are going to take retirement as a result of the Baby Boom). But also capacities: role advising on technical solutions and guiding people towards complementary professionals. [Lagandre, 2007/EDF-43]

☞ Energy savings are not priority but renovations include energy efficiency improvements: arguments are mostly not based on energy saving (but on comfort, patrimonial values, etc.).

☞ Confidence in the intermediary actors is important; understand what leads to confidence, legitimacy, credibility

☞ It seems that there is an important difference between willingness to pay for and actual behaviour. To be tested?

☞ The life moment of renovations is undoubtedly significant.

³ In France, Factor 4 indicates the commitment taken in 2003 by the French President and the Prime Minister "to divide by a factor 4 the national greenhouse gas emissions (based on the level of 1990) between now and 2050".

Barriers to innovation are also in the action system.

4.2. Shifting to renewable energies

Another way to decrease one's carbon energy consumption is to change energy sources, either by, decentralised systems of energy production or by "green" offers from energy companies.

4.2.1. Importance of energy sources

In Switzerland, the progressive liberalisation of the energy market results in questions on the importance of selection criteria of suppliers according to households. The "energy mix" (the ratio of different energy sources for the national production) is, beside the price and the location of the electricity production, an important criterion. On the contrary, the eco-labels proceed from secondary criteria:

The Swiss electricity market will be gradually opened and liberalized in the years to come. The study determined the importance of seven product attributes for the choice of the electricity product. It also evaluated the willingness to pay for all stimuli. The most decisive attributes are the electricity mix, the monthly electricity costs and the location of the electricity production. Customers strongly prefer renewable energy to nuclear and fossil energy. The electricity provider, the price model, eco-labelling and the duration of the contract were of secondary importance for the average private customer in this survey conducted in 2007. [Burkhalter, Känzig, Wüstenhagen, 2007/ UNISG-05]

In Hungary there is also awareness of "green offers" from energy companies, that propose a "green" label:

Electricity consumers in Europe are generally interested in considering information other than price when making decisions about electricity supply. Overall the reaction to a label was positive amongst both domestic customers and SMEs in all countries. A label showing environmental impacts in addition to fuel mix was favoured. With respect to the fuel mix, domestic and SME consumers gave high priority to the origin of imported electricity, and comparison of the fuel mix with the national or EU average. Respondents want to be informed about the origin and proportion of any imported electricity. The majority of respondents indicated that they would find comparative information on their fuel mix useful, but there was no strong opinion as to whether this should be company portfolio, country average or European average. The majority of households and SMEs would prefer to buy electricity generated from renewable sources rather than from coal, gas or nuclear. Almost 50% of households and SMEs state that they would be willing to pay up to 5% more on their electricity bill for electricity associated with a low impact on climate change and no nuclear waste. Less than 30% of respondents were unwilling to pay any extra at all. [Ardison et al., 2003/CEU-03]

Surveys would allow us to study which offers of energy resources are really adopted by households, beyond declarations of intention.

4.2.2. Awareness and adoption conditions of renewable energies (micro-power)

Globally, households seem little informed. Only the "pioneers" of adoption of renewable energies are well-informed:

'Households which turn towards renewable energies are well-informed households which are likely to look for the most reliable information possible and hold it up to the know-how of the sector's players.' (p. 107) [Roudil, 2007/EDF-42]

Households who decide to adopt a decentralised energy system have more "ecologist" or more "technophile" profiles than the average:

The new building market is a more promising route for innovative micro-power systems. However environmentally conscious consumers are very interesting also within the much larger refurbishment market. [Kaenzig, Wüstenhagen, 2006/UNISG-02]

Technical professions are significantly overrepresented among owners of solar thermal installations. [Kaenzig, Wüstenhagen, 2006/UNISG-02]

Depending on differences in techniques, products and services, the target groups differ:

For companies as well as for policy makers it is important to note that different micro-power products and services appeal to different customer segments. A targeted marketing strategy based on a careful and effective segmentation increases the probability of adoption of environmentally preferable micro-power products and services. [Wüstenhagen, Känzig, Boehnke, 2008/UNISG-03]

A survey among Belgium respondents shows that the profile of people who are "ready to do" is also specific:

Acceptance to change some behaviours: To use renewable energies

80% of the respondents of the large-scale survey declare that they fully or rather agree with the proposition of using renewable energies. However, there are several obstacles before this wish becomes a reality, the main ones being market-related and financial ones.

The respondents who state that they completely agree to use renewable energies have the following socio-economic characteristics:

- 30-69 years old and the youngest proportionally more numerous
- couples with children are also over-represented
- not significantly related to household income
- dwellers living in an apartment are quite likelier to express this wish
- the respondents fully agreeing with this proposition express more often than the total population surveyed that their motivation to save energy or would be mainly "to protect the environment" or "by a sense of collective responsibility". [Bartiaux et al., 2006/EDF-15]

Also, in the case of more efficient heating systems, the decision-moment seems important. With other words, the decision process depends on whether there is an emergency to change the heating system (breakdown, etc.) or a long-term reflection in order to eventually change the system:

Buying decision processes and criteria for heating systems differ between two typical situations, namely an emergency replacement of the existing boiler, and a more planned search for a new system (in the case of new buildings, but to some extent also in the refurbishment market). In emergency replacements customers tend to be conservative and often choose the same system as before. Concerning the influence of the available time for the decision-making process it can be taken as a working hypothesis: the more time available for the search of a new system the higher the chances that an environmentally favourable micro-power option is chosen. [Kaenzig, Wüstenhagen, 2006/UNISG-02]

In Switzerland, the business actors most solicited by households for advices are the actors considered as "independent":

Architects and fitters play a key role in influencing buying decisions, and many homeowners expressed their preference for getting independent advice in their decision process (e.g. by regional energy agencies). However architects that are not interested in sustainable development don't seem to be willing to invest additional time in the evaluation of alternative micro-power systems. For example they reported not being interested in a tool that would help them to rapidly calculate total costs. [Kaenzig, Wüstenhagen, 2006/UNISG-02]

The business actors who accept to give advices to households who want a "micro-power system" have a strong environmental awareness:

Enablers for environmentally favourable micro-power systems are environmentally active or "green" consumers, architects and installers or sometimes painters and plumbers. Consumers as well as architects and installers whose latent willingness to consider environmental aspects can be evoked could be targeted to move further on the way from niche to mass market. [Kaenzig, Wüstenhagen, 2006/UNISG-02]

A new "ecological" social standard seems to be developed, searching for visible indicators. The Boom of solar panels is partly linked to the greater social visibility (also refer to Henning, 2005) and to positive social representations of the sun:

'The survey revealed that out of all the renewable energies, solar energy for the health part is the one that households, symbolically, resort to most easily while in terms of cost amortization this choice is the one which is the most questionable.' [Roudil, 2007/EDF-42]

4.2.3. Shifting to renewable energies as a “conservation chain”

The adoption of micro-power systems includes a more global energy-saving way of life. Thus, people having adopted this technology also carry out refurbishments or energy efficiency equipment purchase:

The installation of PV could be seen as part of a ‘conservation chain’: respondents had higher rates of loft and cavity wall insulation and energy-efficient lighting prior to installing PV (compared to national figures). [Keirstead, 2007/CSE-07]

After this implementation, other practices can appear as well:

Post-installation, two significant differences within households included switching to green electricity tariffs and a further increase in energy efficient lighting. Self-assessed overall electricity savings of 5.6%, mainly due to increased awareness of consumption issues were reported post-installation. 86% of respondents had a monitoring device which displays generation information; of these, 61% were in a visible place; 51% viewed their monitors at least once a day; 73% expressed a desire for a device that displayed consumption and generation information simultaneously; 43% reported some form of load-shifting in response to their PV generation profile. Only 48% of PV installations had export meters fitted; only 29% of respondents were paid for their exported units. [Keirstead, 2007/CSE-07]

Another study showed that shifting to renewable energies can have effects on energy savings.

A UK qualitative study shows that “conversely households with micro-generation installed showed a greater awareness of their energy consumption and the presence of the technology was having a positive impact on their energy-conserving behaviour.” [Dobbyn, Thomas, 2005/CSE-03]

The practices linked to the adoption of renewable energy are various and important to study: “import, export and consumption profiles”, “peaky consumption” and the shifting the energy-intensive activities”, “reduction of consumption” or not, etc. [Bahaj, 2007/CSE-10]. The conditions of the implementation are also important: social housing or owners have different uses of renewable energy [Bahaj, 2007/CSE-10].

4.2.4. Business channels for renewable energy: a market “in progress”

Although a lot of consumers consider to take a micro-generation, there remain barriers as regards demands and offers of these technologies:

Thermal solar plants for water heating have a considerable latent market potential. At present, the most important target group are the over 600'000 owners of single-family houses. Basis of this market evaluation is a representative survey of actual and future owners of family and experts. One third of the present and two thirds of the future owners of single family house could imagine the installation of such a solar plant, present owners especially in the connection with a building or heating renewal or as substitution of an electrical heater. These investment windows should be used. However still large market barriers exist on the demand and offer side. Regarding the households, the largest barriers are knowledge deficits and misjudgement of costs, capacity and reliability. The product has thus no clear profile, whereas the solar power itself is a strong popular figure. The market barriers on the supply side are even bigger. It is exhausting to get proficient, neutral technical advisers. Most architects and installer content themselves with conventional plants. Frequently they are lacking the technical knowledge and the organization to assume the total warranty of a plant. Thus the investment windows are often missed. [Gerheuser, 2002/UNISG-06]

Moreover, there is a gap between the arguments used by actors of business channels who emphasize the supply quality and consumers’ arguments who have a cost problem:

The investigation of the German solar thermal and micro CHP (combined heat and power) markets yields some interesting results with respect to business models for distributed energy. Surveyed firms indicated that cost is a key aspect for final consumers. Whereas initial costs are more important than operating costs for mainstream customers, for green costumers operating costs are more important than initial costs. An attractive value proposition seems to be the idea of increasing the independence of residential energy supply. Regarding the communication towards final consumers, most firms currently focus on quality rather than cost in the case of solar thermal, while cost is more of an issue for micro CHP. A general conclusion than can be

drawn from the survey with respect to the value proposition is that, in addition to a strong service orientation, businesses should find a way to offer products with competitive upfront and operating costs as well as environmental benefits. [Boehnke, Wüstenhagen, 2007/UNISG-04]

Financial investments may be regarded as an important barrier for adoption, but can be solved by a "third payer", for example banks:

To overcome the "user-investor dilemma" barrier, the article suggests "contracting". In this concept, instead of the proprietary or tenant, a specialized enterprise (contractor) is responsible for the energy saving measures. The contractor does also finance these measures. A specialized contractor is probably better informed about the appropriate measures as a tenant and also disposes on bigger market power to buy the necessary services. As a consequence, contracting seems to be an advantage for all these stakeholder, proprietary, tenant and contractor. [Diekmann, 2001/UNISG-09]

Banks are new players: association with local authorities (preferential loans to invest in renewable energies, ethical saving accounts, etc.) + individual initiatives by branch managers. 'cultural shift in the attitude of the public authorities who tend to encourage a private approach while trying to steer it.' (p. 107) 'Solar energy players are aware of the need to ally themselves with banks in order to grow.' (p. 107) 'The banking sector is making itself the player which is likely to finance the continued and regular development of renewable energies.' (p. 108) [Roudil, 2007/EDF-42]

In France, the renewable energy business channels seem to go into two different directions: the industrialisation and the "activism" movement (environmental-friendly organisations):

Introduction of industrial lobbies and the development of a activism movement. 'There are two overlapping views on the spread of renewable energies. One is linked to economic imperatives associated with defending the pool of jobs that the renewable energy sector now represents for manufacturers. The risk is that the commitment towards and awareness of the environmental risks which serve as a basis for their work are pushed to the back of the public's mind. The other side of this group of players demands an ethical, socially responsible and committed approach which makes households which decide to opt for renewable energies responsible.' 'There is a risk of becoming selective and elitist.' [Roudil, 2007/EDF-42]

☞ The market of renewable energies and the actual adoption of renewable energies is still largely in development. Only "pioneer" groups adopt such technology. Households perceive some risks (financial risks, lack of knowledge, lack of confidence in the business channels, etc.). Business development also varies across different European countries. However, a social standard in favour of these technologies seem to be developed. To be tested?

☞ Two markets are developing in some countries: an "industrial" market and a more "alternative" market, linked to environmental-friendly organisations. Does this distinction exist in all the countries? Are there specific categories of consumers for these two types of markets?

4.3. Heating/cooling: indoor climate management

Indoor climate management concerns selections of heating equipment, heating management (daily or programme), and, more globally, the temperature of the accommodation.

We have little documentation regarding the heating systems, while they still represent a high proportion of the households' expenses. Depending on specific European countries, their carbon impact is variable.

Three mechanisms of behaviours may exist (or co-exist):

- making heating or ventilation systems less polluting;
- using more energy-efficient systems or less energy-polluting systems;
- managing temperatures and ventilations in the accommodation.

4.3.1. Changing heating systems: life moments, symbolic notations and social conditions

Changing a heating system may be regarded as a costly investment, which is consequently an important choice. Certain groups in the population, which are financially better off and of middle age seem to be in a more favourable "life moment" for this type of change:

- Acceptance to change some behaviours: to install a more efficient heating system

The proposition to install a more efficient heating system is fully agreed upon by respondents who appear to be potential good candidates for such a measure for the boiler of their dwelling is significantly older (nearly 15 years old) than on average (12 years).

Socio-economic characteristics:

- middle-aged respondents (30-69 years old)
- in couple
- the higher the household income, the higher the complete agreement to do so. [Bartiaux et al., 2006/EDF-15]

In the case of a district heating network, Henning (2005) also refers to the concept of a "life moment" in a survey in Sweden. Result show that there are moments in life that are more favourable when changing a heating system. This life period does not necessarily correspond to the moment when energy suppliers offer such an opportunity to change. In another survey, Henning (2004) examined what were the adoption conditions of a "combined pellet-solar system" in single family households. She showed that the social representations of the solar systems are ambivalent: people often "believe that the sun only gives energy during times when the energy is not needed". "Solar collectors are extremely visible on the top of roofs, [it functions] as an advertisement", so it "contributes to a positive image". The solar system combined with a "wood boiler" may positively change negative perceptions of solar energy production. However, decreasing negative representations of the system is not sufficient for adoption. Henning shows for example that cleanings of the ashes is a masculine task and rather weekly, "pellet stoves" have thus to be able to contain wood ashes for a week. Moreover, "bedrooms (particularly parent bedrooms) are the most private parts of Scandinavian homes, and, consequently, bedrooms doors are often kept closed. Computer simulations, on the other hand, show the need of an open doors for the heat distribution in the house". Finally, "pellet stoves" has to be installed in the "living room" for the distribution of heat, but this is the place "where the family socializes with friends, and also for that reason it is a space to keep clean. These facts seem to point towards an aesthetic looking, quiet (and expensive?) "pellet stove that does not produce a lot of dust and dirt".

Financial incentives are again welcomed to encourage households to buy more energy-saving/less polluting heating systems.

For households where the investment mainly replaced heating with electricity, the mean annual saving amounted to 5 770 kWh; approximately 33 % of electricity used for heating. The saving effect is largest for heat exchangers and smallest for automatic control. Households' economic profitability was largest for automatic control systems and heat exchangers. With the government subsidy, these investments were profitable in 75 and 73 % of the purchases. Only 20 % of the investments in pellets ovens were profitable, due to a too small price difference between pellets and electricity. [Bjørnstad, Grande, Sand, Wendelborg, 2005/SIFO-06]

The lack of development of maintenance and technological business channels may result in some technical problems after installing:

Some practical problems are reported, mainly for heat exchangers (ice on outer wall parts, filter problems, adjustments) and pellets ovens (pellets feeding, pellets quality). Nevertheless, most households were satisfied with the investment. [Bjørnstad, Grande, Sand, Wendelborg, 2005/SIFO-06]

4.3.2. Cooling: air conditioning?

The purchase practices of air conditioning systems and the ways in which it is used seem less developed in the available documents.

Shove (2003) analysed the evolution of air conditioning in terms of social standards and concluded that building built with air-conditioning highly determine use. For example, buildings with air-

conditioning are not equipped with other natural ventilation systems (the windows can not be opened, for instance). So air-conditioning becomes indispensable to use:

Homes built for air-conditioning omit features important in naturally ventilated design. (Shove, 2003)

4.3.3. Management of temperature in accommodations: routinised practices

The daily management of temperature regulation by opening/closing the doors and the windows, by actions on the energy management system constitute routinised practices, related to some rhythms (night/day, presence/absence). In a survey among Belgium respondents, the temperature management corresponds to a financial management of energy savings:

Acceptance to change some behaviours: to decrease the temperature of the dwelling by one degree:

More accepted by the respondents of the large-scale survey who reported that during the winter time, they diminish the temperature during the night, while they are absent for several hours or when airing, than their counterparts who do not have such energy-saving practices.

The majority who agree have a temperature in their living-room to be equal or above 21° (p. 124).

But there are technical obstacles: For instance, 23% have no thermostat.

Their socio-demographic characteristics: - Middle-aged respondents (30-69 years old), couples, the lower the household income, the higher the complete agreement to do so. [Bartiaux et al., 2006/EDF-15]

☞ "Heating" is a "big" budget heading of energy expenses. But comfort remains a key factor in behaviours. In Europe, the "air conditioning culture" is not as important as in the United-States (i.e., relative according to the countries) yet. What are the practices in each country of temperature management in winter and summer? What are the management practices during summer and winter concerning heating/cooling (put on clothes to prevent increasing the temperature, ventilation, darkness, curtains, plantation of trees, etc) and which appliances are used (e.g., air conditioners, supplement heaters, thermostats, etc.)? What are the changes in the building (orientation of the accommodations, fitting up of windows, etc.)?

☞ What are the perceptions of air conditioning? Are the barriers to adoption short or long term?

☞ Can we detect an evolution of the social standards towards a social "normality" of air conditioning?

4.4. Lighting

4.4.1. Using lighting sources

Concerning lighting, the available surveys focus on two aspects:

- switching off light when leaving the rooms or in unused rooms (usual answers, indeed stereotyped of energy savings);
- purchasing low consumption bulbs.

On the contrary, the number of lamps, the power of bulbs, the use times, the moments of day when they are used, are not part of the "scope" of the surveys.

In social representations, "light" has a practical function ("brightness") as well as an "intimacy function" including elements of comfort, atmosphere and construction of personal "territories".

Lightening uses strongly linked to comfort, ambiance, intimacy; these logics take precedence over the economic or environmental logics... [Zelem, 2005/EDF-09]

In another survey, it is mentioned that light may also "break a feeling of loneliness or insecurity" [Bartiaux et al., 2006/EDF-15].

It would be interesting to include other aspects than “the switching off” practice to deepen the issue of light (natural versus electric).

4.4.2. Low consumption bulbs: purchases but how are they used?

The adoption of low consumption bulbs seems to be in a characteristic development in many European countries:

The paper discussed and analysed the reasons for the rapid market success of compact fluorescent lamps in Hungarian households between 1995 and 1997. Since 1997, major new market forces have shaken up the Hungarian CFL (compact fluorescent light bulbs) marketplace, including the entry of the low-cost Asian CFL products, the boom in the opening of hypermarkets and do-it-yourself chains also selling CFLs, and the CFL often becoming the symbol of their marketing and price competitions. [Ürge-Vorsatz, Hauff, 2001/CEU-07]

The energy labels are also a choice criterion of these bulbs:

The EU energy label is used for the light bulbs, the product category chosen in the survey. The studies investigate the relative importance of the energy label compared with other product features (such as brand name, energy use) in consumers’ purchasing decisions. With regard to sustainability marketing, the most important result of our analysis is the significant willingness to pay for A-labelled energy efficient products. The willingness to pay for A-labelled products exceeds the cost savings that can be expected over the lifetime of the product. Finally, the analysis showed that brands are important. [Sammer, Wüstenhagen, 2006b/UNISG-16]

However, there is a gap between the knowledge of the existence of the energy-saving bulbs, the acceptance to buy some and the actual purchasing practices:

Acceptance to change some behaviours: To install (more) energy efficient light bulbs

2/3 declare that they fully or rather agree with this proposition of installing (more) energy efficient light bulbs. These respondents are however less numerous on average to have such bulbs than among the total sample surveyed. Significantly more often found in middle-income households [Bartiaux et al., 2006/EDF-15]

Low-consumption light bulbs suffer from a bad image linked to the counter-references (lack of luminosity, lighting time, price, etc.):

Lightening: routines and habits: Lightening: 14 % of French household energy consumption but only 7% of low consumption bulbs; low consumption bulbs suffers from a bad image; Lack of information, sellers not trained, low information campaigns, low distribution systems. [Zelem, 2005/EDF-09]

There are no studies that examine the way in which low consumption bulbs are used;(e.g., installation places, use time, sharing in accommodation with other types of lamps, giving up or not of other “energyvorous” luminous sources (halogens...), new uses, etc.)

4.5. Cooking

4.5.1. Culinary practices

Culinary practices are less examined in surveys and debates on energy savings of households. It seems that there is an energy saving potential on the usage of the oven and stoves. For example, we could focus on routine practices, which are less conscious in environmental terms (e.g., Put the lid on the pan, steam-cooking, use the oven’s heat to heat the kitchen after the cooking, make defrost food without using the microwave oven, put two dishes at the same time in the oven, put something in the oven which remains hot to defrost, defrost one’s fridge and one’s freezer, etc. are energy-saving practices [Moussaoui, 2007/EDF-12]).

It would be interesting to detect routine energy-saving practices, not usual in the “lists” of the energy savings, to understand the practices already implemented by households.

4.5.2. Appliances in the kitchen

People are generally not well aware of the energy used by the fridge. Although some types of households consider it as furniture rather than an electric appliance, or as "a necessity" which leaves little room for energy saving options:

Fridge = in France, 30/40 % of electrical consumption (2de after heating) but it "suffers" of its perceived characteristics: very usual, low-technicity, not perceived as an electrical appliance but more as a furniture (you don't switch-off, you forget it as an appliance consuming energy). Consumers don't buy frequently a new fridge. Buying criteria: budget, capacity, design, uses, special offers... electricity consumption is not a "first order" criteria. Energy labelling for fridge requires some effort (to pay attention, to read, to understand ...): so, it is more influencing for a specific profile of consumers: slightly more cultivated than the average, higher incomes, already concerned with environmental issues. To touch other kind of consumers, the central influencing agent is the seller (strong prescription function). [Zelem, 2005/EDF-09]

Moreover, studies in several countries showed that the purchase of a new fridge with an A-label does not necessarily mean a decrease in energy consumption, because consumers use the old fridge as well:

The research showed that new and energy efficient refrigerators and freezers do not necessarily contribute to reduce energy consumption in households, because consumers tend to keep using old appliances as long as they work. Old cold appliances are put into basements and second homes and continue to use electricity long after the "replacement", meaning that they are not replaced but added to. This delays the effect of the efficiency revolution by at least one "product generation". [Strandbakken, 2007/SIFO-07]

Data suggests for instance that income often determines the lifespan of fridges and freezers and government and industry data may assume a higher proportion of newer appliances in circulation than actually exists. Therefore, the author suggests that real gains in reducing energy demand from the residential housing sector may be accomplished more effectively through a closer exploration of behaviour and practices related to a segmentation of socio-demographic groups and targeting policies accordingly. One of the observations made for instance, is that older fridges are often kept in conjunction with the purchase of a new fridge where the older appliance can serve as a 'beer fridge'. [Young, 2008/RESOLVE-11]

The old one can also be given to young people moving on to autonomous accommodation, which corresponds to donations linked to important social "passage" rituals, but which also corresponds to a bad energy performance [Desjeux et al., 1996/EDF-13].

It is noticeable that there is no information on the use and purchase of eco-labelled "dishwashers".

4.5.3. An example of behavioural change: waste management

Another activity partly linked to cooking and kitchen activities is waste management (sorting, recycling). Waste management is often examined in terms of behavioural change. Studies on recycling show that a positive and strong behavioural change is possible by good infrastructure conditions, in spite of the constraints it requires in terms of daily practices, in terms of available space, etc.:

"The sorting of waste is an emblematic case of the management of the flows within the framework of an environmental problem. (...). The households have adapted their behaviour to the constraints the selective collection system implemented by the local communities generated. (...) The individual behaviour is then structured by structural mechanisms of collective nature. (...) The selective collections device of the waste represents the only major innovation which really imposes to the inhabitants strong change requirements in the habits within the domestic scope" [EDF-08]

Change motivations are various, in spite of the constraint generated by sorting. The six main motivations to recycle mentioned by people are: citizenship, social valorisation and social pressure on the bad sorters, "local" ecology (preservation of the living environment), fight against consumption excesses through the limitation of wasting; actions in favour of employment (sector creating jobs), and, simplicity of sorting modes.

4.6. Cleaning

Only few documents are available that discuss cleaning (e.g., of the body, of clothes and of spaces), although these activities seem important contributors of energy consumption. These activities are highly socially embedded in their material implications (domestic tasks, appliances and consumptions), in their social relationships (in particular between husband and wife), and in their symbolic notations (what is pure/impure, tidied/untidy, clean/dirty).

4.6.1. Using washing and housekeeping appliances

Shove (2003) showed that the social standards of washing (clothes) have been highly evolved over the last 50 years:

« Though the frequency of laundering has increased, water temperatures have plummeted.» (Shove, 2003)

Some practices noticeably increase the energy consumption (more appliances) and some others participate to decrease consumption (lower temperatures). All practices necessary to the clothes management are ambivalent and Shove shows that "it is not sure this indicates an increase in standards":

To the extent that domestic laundering has a history, it is one of establishing and constantly revising expectations about degrees of whiteness, the precision of ironing, the quality of starching, the duration of boiling, the fragrance of freshness, and so forth. (Shove, 2003)

Another energy-consuming appliance is the dryer. The owning rate is various according to the countries. For instance, in Belgium, "only" 65% of the "surveyed households" have a dryer (95% have a washing machine) but little seem ready to do without them:

Acceptance to change some behaviours: Not to use electrical dryer: Among those having an electrical dryer, only 11% would completely agree with the proposition of not using it and 6% claim to do so. The intensity of the disagreement is higher for the respondents using this appliance more often. [Bartiaux et al., 2006/EDF-15]

4.6.2. Washing machine labels

Energy consumption of the washing machine seems to be a criterion for buying washing machines (A labels), but the brand remains the most important criterion:

The EU energy label is used for the product category chosen in our survey, washing machines. The studies investigate the relative importance of the energy label compared with other product features (such as brand name, energy use) in consumers' purchasing decisions. With regard to sustainability marketing, the most important result of our analysis is the significant willingness to pay for A-labelled energy efficient products. The willingness to pay for A-labelled products exceeds the cost savings that can be expected over the lifetime of the product. Finally, the analysis showed that brands are important. In the washing machine sample, the willingness to pay for a premium brand compared with a no-name product is about a 50% premium and almost twice as much as the difference between A- and C-labels. However, in a market where 80% of the products are A rated – as in the case of the Swiss market for washing machines – there is little left to differentiate. [Sammer, Wüstenhagen, 2006a/UNISG-14]

4.6.3. From bathing to showering?

The social standards have changed during the 20th century from bathing once a week to showering once or twice a day:

“Contemporary enthusiasm for regular power showering is consistent with an emphasis on image and appearance, on the curative and therapeutic properties of invigoration, and on a distinctive blending of pleasure and duty.” (Shove, 2003)

The arguments provided on the preference of the shower are rarely (only) ecological. For instance, "save time" is the most mentioned argument in the survey in Belgium [Bartiaux et al., 2006/EDF-15].

4.7. Entertaining

The general tendency is an accumulation of appliances [see D14]. Especially increasing comfort standards seem responsible for this growth, in particular the energy consumption of brown products (corresponding for example to 16% of the electric consumptions of the French households in 2000) [EDF-08]:

The report points out that the biggest single factor in [increasing energy consumption] has been the proliferation of energy using products – particularly consumer electronics. The report points out that the rising number of energy using products in the home has been responsible for a doubling of household energy use between 1972 and 2002; a figure that is expected to rise by a further 12% by 2010. [Owen, 2006/RESOLVE-08]

For example, the limits of switching off night lights of appliances, multiplication of television programmes, and the individualisation of practices of family members causes an increase in the number of televisions in accommodations:

Crosbie's research explores the ways in which the design and marketing of electronic goods – particularly television sets – encourages wasteful energy behaviour. Interviews for instance, highlighted the fact that 'the practice of watching television becomes more energy intensive without viewers changing their viewing behaviour'. Many interviewees argued that sets (and also DVD players and digital radios) are now designed to be left on standby rather than being switched off. A couple of interviewees were told not to turn sets off as they would lose display and programming capabilities. She points to the advertising and marketing campaigns for plasma TV sets which are aesthetically pleasing rather than pointing to their unlabelled energy use. Interviewees preferences for digital broadcasting; widescreen functions and tuning TV sets into radio broadcasting also pointed to higher energy used that was encouraged by product design. Other interview data pointed to the 'individualization of TV viewing', whereby energy inefficient viewing habits were being encouraged by the greater choice of TV programmes and the need for more household TV sets to accommodate the new ways of viewing provided by the new technology. In conclusion, Crosbie argues that it is not enough for government policies to focus on changing individual behaviour in these regards, but that this must happen in tandem with proactive, early changes to lifestyle products themselves: ones which are designed to encourage more energy efficient practices in households. [Crosbie, 2008/RESOLVE-02]

Moreover, while the recycling of waste linked to cooking is now more visible and admitted like a normal practice, recycling of brown appliances remains as yet invisible:

The main findings in this part of the research suggested that there was generally a lack of understanding and awareness among interviewees and postal questionnaire respondents in regard to the disposal of small waste electrical and electronic equipment. A frequent response from some of the individuals who took part in the semi-structured interviews for example when asked about recycling small waste and electronic items was: 'I've never thought about it'. Often, interviewees could not remember which method of disposal they used in regard to such items. The researchers argue that this was often in contrast to bigger items of waste electrical and electronic equipment. For instance 'the TV was sold' and 'the washing machine was taken by the retailer when the new one was delivered'. Small waste and electronic equipment was often not considered to be waste at all, for instance as the same way as other recyclables such as paper and glass. From the questionnaire data, the researchers suggest that up to 97% of these items are not being recycled but were often being disposed of in the general household refuse (26%) or via civic amenity centres (33%). It was apparent from some of the interviews that some people were often active in trying to find out how and where electrical goods could be recycled but this was mostly for larger items. The researchers also found a correlation with active recyclers in other areas of waste that were more likely to visit civic amenity areas in order to dispose of small waste electronic and electrical equipment in a responsible way. [Derby, Obara, 2005/RESOLVE-09]

Moreover, the survey underlines the need for households to get a pragmatic information to manage one's waste rather than an increasing awareness (which refers to the results of the D14):

The researchers argue in particular that it is often the case that householders do not require further information on *why* they need to recycle, but would become more engaged in finding out *how* they can recycle. They suggest therefore that efforts must be made to find the best ways of doing this, taking account of national, regional and local householder to improve recovery rates of small electrical items needs rather than the current one-size-fits-all approach. [Derby, Obara, 2005/RESOLVE-09]

4.8. The market of energy efficient appliances

The market of energy efficient appliances seems to have two important limitations. First, the energy labelling scheme has to be improved:

In 2007, only 46% of the more than 5000 controlled household appliances in stores were correctly labelled – that was 10% better than the previous year. Of last years (2007) testing of ovens, only 1 of 9 brands had wrong energy class, but only 1 out of the 9 were labelled completely according to the regulations. The freezers tested in 2005 – were all correctly labelled, but of the 10 tested fridge-freezers, 2 were in the wrong energy class (1 qualified for a better class!). These compliance tests are important to make sure that the energy labelling scheme is to be trusted. [Rødningen, 2007/SIFO-05]

Second, the "energy efficiency appliances" business channel seems to be victim of its own success, because labels A are not enough to follow the evolution of energy performances. New labels (e.g., A+ and A++) are introduced which often seem "confusing" for households:

The book shows that the Energy labels complete changed the market situation for washing machines in Germany from late 90ties to 2000, but this was, so far, not the situation Italy and Spain. While the percentages of A and B labels machines were nearly 90% in Germany, the figures in Italy was only 27% and Spain 36%. In the Northern part of Europe the A –labels machines have reach the roof of high market shares. The criteria for the EU have not managed to keep up with the technical development. Today you will find a large number A+ and A++ machines in the market, and this labelling system is confusing consumers. Furthermore, the book emphasis the important of the use phase compared with the production and distribution phase. For all important environmental parameters, - also for energy – the environmental impact is linked to the use-phase. Use of the machines covers for more than 95% of energy. The DEEP book then present and discuss the Australian Energy label. In this label the use phase is integrated in the system, because the label distinguishes between cold and warm washes. From chapter 4 of the DEEP book we will emphasis consumer trust in labels. They trust labels that are certified by independent bodies and that are scientific based. [Rubik, Frankl, 2005/SIFO-10]

4.9. Energy efficiency is not enough

Researchers in social sciences show that energy efficiency cannot be the only solution to decrease consumption:

“The important issue should not be the mechanically derived energy efficiency of appliances, but the resulting, “actual” energy efficiency. It is perfectly possible to use an energy efficient appliance in an inefficient way.” (Throne-Holst, 2005)

Energy efficiency calculations are often carried out *ante post*, and the implementation and current use of the developed products are little provided or not taken into consideration” (Throne-Holst, 2005).

This leads to greater need to analyse the "rebound effect" which is “Potential savings minus Current savings”.

There are rebound effects at the macro-economic and at the macro-social levels (linked to demographic factors, like the increase in number of accommodations, linked to economic growth, to accumulation of appliances; see D14). Moreover, there are rebound effects at the micro-economic and micro-social levels (an energy-efficient appliance is used more often, because it consumes less, the insulation of the accommodation leads to an increase in heating temperature, etc.).

Social sciences show that the rebound effect is often linked to the gap between purchase practice and the use of an appliance. Moreover, there is an “energy efficiency gap”, because “consumers give little consideration to future savings in deciding whether to install energy efficiency measures, or purchase energy efficiency products, with the exception of light bulbs”. The main reasons given in a UK literature review are:

Adverse selection – energy efficient performance is not reflected by price signals, thereby removing the incentive to purchase such measures/appliances.

Transaction costs - costs associated with time, risks, purchasing; plus ‘hassle’-factor.

Bounded rationality – when quantifying optimal level of energy efficiency to invest in, consumers tend to under-estimate.

High discount rates – evidence suggests consumers require short pay-back on investments in

energy efficiency. It is argued that the high discount rates may be appropriate to reflect opportunity costs or barriers to investment in energy efficiency. [Oxera, 2006/CSE-01]

📁 To better understand the consumption dynamics, we can thus:

- Follow the appliance in the consumption process (Throne-Holst, 2005; Alami, Desjeux, Garabuau-Moussaoui, 2008): purchase; use; durability; repairs; disposal, and analyse practices, social representations and social relationships at each level;
- Understand the place of the appliance in the domestic system and in "the interaction with other appliances in households".

📁 This allows us to follow "the social life of things" (Kopytoff, 1986) and to show why the "energy efficiency measures are delayed, disturbed and reduced in the everyday life of households", that is to say why it is "changed" (Throne-Holst, 2005).

The disaggregated energy behaviours shows an extension of practices, material culture, meanings, social standards and symbolic notations, and psychological and economic mechanisms that influence each energy consumption activity. Moreover, each behaviour corresponds with specific profiles.

- ✓ Purchase and use are not always "coherent";
- ✓ There are different rebound effects of energy behaviours;
- ✓ Several constraints and priorities weigh on households;
- ✓ The analysis of the offer of products and services is crucial to understand spreading and adoption of eco-efficient appliances.

Barriers and drivers are more various, so they can be considered as complex. But they also become more concrete, so they could be more operational for policy makers. We can follow different energy consumptions in their process and better understand the specific barriers as well as acceptable drivers for action.

5. Highlighting new coherence in behaviours

We have broken up energy behaviours and have linked them to other domestic practices (the use of the washing machine is linked to other hygiene practices, the use of lights is linked to lighting and to darkening practices in the accommodation, etc.), and now we discuss the coherences between different types of behaviours.

5.1. Coherent arguments into practice

An emblematic example of links between several practices is the link between energy, water and waste. In several surveys, we find a link between energy conservation and water conservation, because these domestic resource flows are nowadays becoming rarer than in the 20th century. We have seen that the management of waste was also a fast-developing practice, and that it is common that the three "attentions" are linked in the discourses and in the practices of individuals:

The Green Living Initiative is an interesting attempt to integrate different levels of activity and decision-making into the complexities of household behaviour change. It makes the point that, in order to be regarded as sustainable, behaviour change in households must address a current policy approach which isolates behaviours and often differentiates between energy use, water use and waste management rather than to see them as intricately linked into habits and practices which could be used to reinforce each other. [Dresner, Ekins, Willis, 2006/RESOLVE-05]

Water and energy use are for example related to financial, environmental and anti-waste motivations.

With regard to waste, we find environmental, anti-waste and criticism of overconsumption arguments.

Thus, according to justification and motivations of households, some practices seem to have coherence.

5.2. Sustainable consumption

Within this framework, does "sustainable consumption" give a new coherence to some series of behaviours that were not linked in the past. In the people's perceptions, "sustainable consumption" itself is an aggregation of diverse behaviours, including the purchase, use, and disposal of goods and services:

"The recycling of household wastes, purchase of 'sustainable' products, using energy efficient appliances, choosing green electricity tariffs, composting garden and kitchen waste, investing in 'ethical' funds, conserving water or energy, buying organic food, returning electrical goods for reuse or recycling, switching transport mode, changing travel behaviour, buying remanufactured or reused goods, reducing material consumption, pursuing 'voluntary simplicity' and so on." (Jackson, 2005)

In previous quote, the link between different behaviours is "consumption" in the broad sense of the word ("purchase, use and disposal of products, services and practices") and their "direct or indirect implications for resource consumption".

We can thus wonder if this link is developing in social representations of European households. For example, the question of the link between "direct and indirect energy" is not obvious:

This study clearly distinguishes two types of energy consumption which may be relevant for our project (direct and indirect energy consumption). [Abrahamse, Steg, Vlek, Rothengatter, 2007/RUG-02]

However, in France, "responsible" consumption (or "citizen" consumption, terms used more commonly than "sustainable consumption"), which found a favourable echo at least in the discourses (without any mechanical effect on practices) is today challenged by households, who consider that this notion was used for instrumental purposes by companies:

"In 2004, 61% of the French people had confidence [in big companies] to act on the environmental and social problems. Four years later, they are only 41,3% to lend credit in the fight for a more responsible planet" (TNS, 2008)

This same survey underlines the fact that 75% of the French people associate sustainable consumption with decrease of their consumption, and there are only 19% of them ready to pay more for products more respectful of the environment. They would thus be more in favour of practices of reduction than in "sustainable" purchases.

There are other initiatives of "putting into visibility" environmental impacts of energy consumption practices:

- analysis of the life cycle of products and services and acceptability by consumers:

There is a wide range of environmentally sound products that are not characterized simply by higher total cost, but rather by a different investment profile, namely higher initial cost versus lower operating cost. As a consequence, the lifecycle cost for these products may be even lower than for conventional alternatives. This observation has important implications for the understanding of consumer decisions for eco-innovation, and hence for sustainability marketing and for the design of policy measures. Rather than finding ways to make customers pay more for environmentally sound products, the marketing challenge needs to be re-conceptualized as one of lowering customers' perceived initial cost and increasing their awareness of life-cycle cost. [Kaenzig, Wüstenhagen, 2008/UNISG-01]

- carbon offset

- environmental footprint

✉ We can ask stakeholders if some of these tools are emerging in public policies and how they are taken into account.

6. Specifications

6.1. General specifications

- ✓ The “comfort loss” notion remains primordial in the acceptability of change ⇒ Better understanding its definition for households.
- ✓ Purchase, practices, investment and change for renewable energies are different actions methods corresponding to different households profiles. ⇒ To be tested.
- ✓ Distinguish individual and situational/structural barriers for change
- ✓ We can wonder if there are "easier" living fields to change, or if the "problematization" is linked to public policies that invest only in some fields.
- ✓ As a consequence, are there barriers that can be easier to overcome than others?
- ✓ The link between energy efficiency and reducing use is not mechanical.
- ✓ The rebound effect is important to take into consideration.
- ✓ There are social groups and lifestyles that are more willing to change: but are they really "big consumers"?
- ✓ It seems that there are “life moments” in which changes are easier than other moments.
- ✓ The gender practices issue has to be developed.
- ✓ The various energy behaviours are not always linked, but some other coherence types and links between behaviours appear: take into consideration the categorisations of the households to understand what is coherent for them.

6.2. Specifications for the Work Package 4 – Interviews with stakeholders

6.2.1. Examples of stakeholders to meet

- ✓ Visit some "unexpected" important actors to take into consideration: for example banks seem to play a role in the management of some of these risks.
- ✓ A recruitment difficulty resides in the difference between "big" institutional visible actors who have a little influence on household behaviours (to be checked) and "small" proximity actors who are actors in households' decisions.

6.2.2. Examples of questions/themes

- ✓ The intermediary actors have their own symbolic notations, values, constraints and barriers. These need to be explored and developed with them.
- ✓ The energy efficiency markets, of the renewable energies and of consumption control is growing, but still seems underdeveloped. Refer to the national specificities, in particular regarding the sharing-out between big groups and small craftsmen.

6.3. Specifications for the WP5 and WP6 – Consumers focus groups and quantitative survey

6.3.1. Examples of variables and groups

- ✓ Men/women differences in behaviour types should be developed.
- ✓ " Pioneer/ mainstream" people: evolution of the contents of behaviours in time between those two populations is interesting (spreading of energy and environmental "innovations")
- ✓ The role of children in family behaviours appears underdeveloped.
- ✓ In the same way, while the "community" level was put forward in the D14 as a relevant action level, the influence of neighbours, friends, colleagues and social networks on behaviours, and relationships of behaviours on social networks are rarely studied.

6.3.2. Examples of questions/themes

- ✓ Organise behaviours into a hierarchy from more acceptable to less acceptable
- ✓ It would be interesting to have a wider vision of "practices" and practices making part of "energy behaviours" drawing up a wider list of what is usually retained in surveys/studies.
- ✓ Relate the perception of "high consumption" for people to behaviours that are associated with a significant level of energy consumption.
- ✓ Ask if the people bought such or such object, but also ask questions on its use.
- ✓ There are moments in life, linked to financial comfort, changes in accommodations, family changes etc, which are more favourable to renovation and to installing equipment.
- ✓ The distinction between different types of behaviours may thus be carried out depending on the "native" categories. Some were provided here as an example, but we would have to define their relevance (quantitative survey) and to find some others (focus groups).
- ✓ Refer to the justification, motivation and underlying logic criteria mentioned.
- ✓ Study how to take into consideration behaviour evolutions and their dynamics: there may be a progressive change in behaviours (more and more involving, a threshold not to exceed, etc.)

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