# SPSD II

# SOCIO-TECHNICAL FACTORS INFLUENCING RESIDENTIAL ENERGY CONSUMPTION (SEREC)

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PART 1

SUSTAINABLE PRODUCTION AND CONSUMPTION PATTERNS

GENERAL ISSUES

AGRO-FOOD

ENERGY

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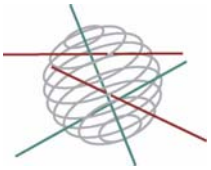
SCIENTIFIC SUPPORT PLAN FOR A SUSTAINABLE DEVELOPMENT POLICY
(SPSD II)



***Part 1: Sustainable production and consumption patterns***

FINAL REPORT

# Socio-technical factors influencing Residential Energy Consumption
# SEREC

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# 1. INTRODUCTION

To meet their Kyoto commitments, countries of the Northern hemisphere have to limit their atmospheric emissions due to energy consumption. Belgium has committed itself to reduce its emissions of 6 greenhouse gasses by 7,5% as compared to its emissions of 1990: this reduction has to take place during the period of 2008-2012.[1]

This research focuses on residential energy consumption, excluding transportation, and this report presents the main results of this SEREC research on "Socio-technical factors influencing Residential Energy Consumption" (SEREC) in Belgium. This research was supported by a grant from the Belgian Science Policy Office for the years 2004 and 2005 made to a multidisciplinary team in which sociologists and demographers (coordinated by F. Bartiaux, from the Institute of Demography of the Catholic University of Louvain) collaborate with engineers (Promotor: G. Vekemans, from Vito), with the support of a Danish Partner (K. Gram-Hanssen, socio-engineer).

## *1.1 The international context of the SEREC research: an unsustainable development*

### *1.1.1 An unsustainable development pattern*

The concept of sustainable development was first formulated in 1987 in the Brundlandt report (World Commission on Environment and Development, 1987) as follows: *'(…) to ensure the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply limits, -not absolute limits- but limitations imposed by the present state of technology and social organisation on environmental resources and by the ability of the biosphere to absorb the effects of human activities. (…)'*

This definition implies that development can be called sustainable if it takes into account economic, environmental and social aspects. Environmental protection, poverty reduction and economic development (amongst other global issues) have indeed long been regarded separately. Sustainable development starts from the observation that these issues are related and attention has to be given to these relations before positive lasting results can be obtained. Problems like climate change or delocalisation of factories to low-wage countries affect citizens globally. Sustainable development does therefore also have an international aspect.

Energy consumption has important economic, environmental and social consequences.
The positive consequences of energy are as diversified as its use. The availability of energy sources enables for example large increases in productivity, enhanced communications, quick transport and ever-increasing comfort for everyone's daily life.

On the other hand, the lack of modern fuels and electricity in several countries is directly linked with poverty, which further constrains the delivery of social services, limits opportunities namely for women, and erodes environmental sustainability. Today, one Belgian citizen uses on average the equivalent of 5.8 tons of oil each year, whereas an inhabitant of Bangladesh must live with 4 times less (UNDP, 2005). The consumption of electricity is still much more inequitable: 4310 kWh per year and per household in Belgium (see chapter 4 of this report), against... 22 kWh per year only in Ethiopia (IEA, 1997). Currently 1.6 billion people lack access to electricity and 2.4 billion people lack access to necessary energy services.

Today, the energy consumption pattern cannot be called sustainable.

[1] European Community, Council Decision 2002/358/CE.

### *1.1.2 Decline of Fuel resources*

Moreover, the reserves of the currently most utilised sources are running out. Indeed, estimations of the remaining reserves of oil, coal and gas largely differ, but most estimates do expect the reserves of both oil and gas, both proven and unproven, to run out during the course of this century considering the present rate of consumption. This is expected to result in a steep decline of the possible energy supply and/or a steep increase in the price of oil and gas.
For its energy consumption, the world mostly depends on fossil fuels. During 2002, the fossil fuels - coal, gas and oil - provided for 79.8% of the total global energy supply (IEA, 2004). Coal, gas and oil took respectively 23.1%, 35.8% and 20.9% of this total. The consumption of fossil fuels however does have severe implications for the environment.

### *1.1.3 Global warming and large pollutions*

One negative effect is commonly called the reinforcement of the Greenhouse effect by analogy with the action of the glass in a standard greenhouse. There is a normal Greenhouse effect as several gasses are present in the earth's atmosphere, and absorbs reflected radiation from the heated earth's surface. Life on earth owes its existence to this greenhouse effect. Without this natural greenhouse effect, the average global temperature would be -18°C, whereas it is now +15°C.
However, during the last two centuries, man has discharged large quantities of greenhouse gasses mainly through combustion of fossil fuel and also through cattle breeding, wastes treatment and industrial chemical processes. New substances like Chlorofluorohydrocarbons (CFC's) and their replacement products also increase the greenhouse effect. This anthropogenic discharge has strongly increased the average global temperature and has produced global climate change. Environmental reporting showed that in Belgium, 81% of the Greenhouse gas emissions result from energy consumption. In the three different Belgian regions, GHG-emissions due to energy consumption respectively accounted for 74%, 84%, and 98% in the Walloon region, in the Flemish region and in the Brussels-capital region (MIRA, 2005 and NIR 2005).

A significant climate change will have important consequences, which will be often adverse and mostly irreversible, on ecosystems, on socio-economic activities like food supply, water availability and public health. The most detrimental effects in Europe could comprise an increased frequency and intensity of extreme events (storms, droughts, heat waves, floods...) and more precipitation. If the current trend continues along the prognoses of the IPCC, the climate belts in Western Europe will shift North of approximately 500 km. (IPCC, 2001). For Belgium, the main immediate impacts of climate change are foreseen to be an increased risk of flooding and a higher morbidity and mortality during heat waves (Marbaix and van Ypersele, 2004): the 2003 heat wave in Belgium has caused nearly 1300 supplementary deaths of persons aged over 65 (Sartor, 2004).

Moreover, energy use also causes several other environmental and health risks. Nitrogen and sulphide oxides are both responsible for acid rains, resulting in damaged forests and woodlands, crops and monuments. Nitrogen oxide also improves the creation of ozone during hot summer days. Exposure to increased ozone concentrations during longer periods is harmful. Increased mortality rates during hot summer days have been directly related to increased ozone levels (MIRA, 2004).
Other consequences include discharge of small dust and sooth particles. These particles are small enough to enter lungs and can even penetrate the blood vessels. They initiate allergic reactions in lungs and can cause lung cancer in the long term.
Further negative consequences of energy consumption include all the dangers related to the use of nuclear energy, reduced intensity of the sunlight, noise pollution, etc. Renewable energy sources do not have all these negative consequences. Some are however not entirely free of different negative effects also related to fossil fuels. For example, minimising harmful gasses from the combustion of wood is a difficult activity; when improperly executed, wood combustion can cause large discharges of small particles, dioxins or NOX.

The result remains that the present need for energy consumption is not sustainable at all. Moreover, the overall consumption is still increasing. Countering or reversing this trend is one of the largest challenges the international community is confronted with.

### *1.1.4 The most promising potential: the negawatts[2]?*

Residential energy consumption accounts for a large part of the Belgian energy consumption: in 2003, residential energy consumption represented 25.6% of the total Belgian consumption. This figure is to be compared with the other shares: the industrial energy demand (33.5%), the transport sector, including air traffic, road traffic and shipping (26.9%), and the tertiary sector (10.7%) (FOD Economie, 2005).

The residential energy demand has continued to increase for several decades, at first sight in a similar way as the demand for the other sectors. However, energy efficiency indicators show that the residential sector does not obtain similar improvements in energy efficiency as the other sectors. Whereas the industrial sector in Belgium improved its energy efficiency by 15% between 1990 and 2002, the residential sector had an energy efficiency improvement of less than 5% in the same period. This is also below the European average of 9%. It is striking to note that the energy efficiency difference for the residential sector is much lower than in the Netherlands (13%) or in Denmark (9.3%) for the same period (Odyssee, 2004). Further description of the Belgian residential sector shows that the potential for improvements and for energy savings remains high. So, in other European countries or in other sectors, actions have been undertaken to reduce energy demand, and this led to improvements. However, the Belgian residential sector cannot show a similar progress and consequently large potentials to save energy remain.

## *1.2 The SEREC research*

### *1.2.1 Objectives*

This SEREC research focuses on residential energy consumption. Several other national or European studies revealed energy saving potentials in a technical way. The EURECO project showed for instance that electricity consumption in households can be reduced in several European countries by 38% on average, mainly by very common interventions (EURECO, 2002). The first investigations in the Belgian context were started under the framework of the SAVE Belas project. Results gave an indication that Belgian households can save approximately 37% of their energy use for heating and hot sanitary water production. These saving potentials can equally be achieved by reasonably common interventions (Vekemans *et al.*, 2001).

Given the present situation, the question remains how these energy saving potentials largely remain untapped up to this moment. Other European countries seem to achieve it with more success than Belgium. Therefore, the main focus of the SEREC research is on how these energy savings can be achieved at the household level. The saving potentials are further refined. Both technical and behavioural brakes and levers for implementing energy savings at the household level are to be clarified. The main topic throughout the report is thus the following: what are the factors leading to change of behaviours or to reluctance to changes in residential energy consumption?

### *1.2.2 Changing behaviours in residential energy consumption?*

To identify the factors leading to changing behaviours or to reluctance to changes in residential energy consumption, the approach follows two paths that are now well established: a socio-technical approach (Bijker *et al.*, 1987, Guy and Shove 2000, Diamond and Moezzi, 2000) that shows the technical limitations and possibilities for reducing residential energy consumption and a socio-

[2] Lovins (1990) introduced this concept to draw the attention on the amount of energy that can be saved.

cultural approach inspired by anthropology (Douglas, 1975, Douglas and Isherwood, 1979) that focuses on energy-related practices (Wilhite *et al*. 1996, Spaargaren, 1997, 2003). These practices are resulting from both structural effects – such as energy policies relevant to the country under study as well as social construction of habits and routines (Shove 2003, Kaufmann 2001, 2004) – and more individual lifestyles, motivations and justifications that are often quite far of being environmentally-oriented even if these practices has an effect, often adverse, on the environment (Bartiaux, 2002).

In this report, the first part sets up the stage by describing the actual state of the socio-technical context to residential energy consumption in Belgium. So the following chapters of this report first offer a detailed description of the residential sector in Belgium (chapter 2). This chapter is followed by a presentation of the energy-related practices and of their interplay with socio-economic and dwelling's characteristics as well as with social representations and knowledge on environment (chapter 3). This interest on energy-related practices is further expanded by trying to understand how these practices are led by both structural effects – namely energy policies – and lifestyles as expressed in daily electricity consumption; this is achieved by an international comparison between Belgium and Denmark (chapter 4).

Within a better-described context we then tackle the difficult question of *changing* these energy-related practices at the household scale: the second part of this report is devoted to this topic of changing practices. To study the factors leading to changing behaviours or to reluctance to changes in residential energy consumption, several methods have been developed or applied during this research. These methods are described below and draw on two different traditions: they are either technological tool – the methods used here vary from a complete energy assessment of the dwelling (chapter 8) or a follow-up of the electricity consumption during one year (chapter 7) to a quick scan of the electricity consumption (chapter 5) – or they are familiar instruments in the sociological tradition – diary (chapter 6), questionnaire and interviews (chapter 9). Though the methods used are varied, they have in common to be customised and they all intend to raise the awareness of the user (or consumer or citizen: Devine-Wright and Devine-Wright, 2005) to his/her own energy consumption (as for example Ueno *et al.*, 2005) or to stimulate his/her reflexivity on these matters. We conclude that awareness is not sufficient and various levers and brakes that influence changes and actions in the field of residential energy consumption are synthesised (chapter 10).

Finally, leaving the household scale, the third part of this report provides policy makers with a conclusion and many recommendations drawn from this research.

### *1.2.3 Methodologies*

This socio-technical study is composed of three main data-collection procedures and the interaction between the collection of social and technical data is one of the linchpins of the methodology developed for this research.

Firstly, a large-scaled socio-demographic survey has been performed in September 2004 on a representative sample in Belgium (n = 1000) and this phone survey focuses on energy consumption, practices, representations and knowledge.

Secondly, persons interested by an energy assessment and recruited by various channels (mainly an advertisement published in a free newspaper) had the possibility to participate to one of the four following « energy tests » (these tests are explained in detail in the corresponding chapters, in the second part of this report):

- The quick energy scan allows classifying the electricity consumption of one family in comparison with the average consumption of similar families.
- The energy diary (Cames and Brohmann, 2003) consists of a daily questionnaire on energy-related behaviours (n = 20, 1 week).

- A monitoring of the electricity consumption: the consumption of each main appliance is measured by appropriate monitoring devices (n = 40, 1 year).
- A complete energy assessment consists at first of a collection of dwelling characteristics and secondly of a proposal of specific recommendations to save energy (n = 40, 1 year).

Thirdly, in-depth interviews (n = 20) have been carried out in Belgium among the « energy testers » and among energy users who are not especially interested in energy savings. Similar interviews have been carried out in Denmark (n = 10) with owners whose dwelling has been reviewed for its energy consumption, as a labelling scheme is already in place in Denmark since 1998. All these interviews give the opportunity to deepen the observations gathered by the socio-demographic and technological surveys.

### *1.2.4 Acknowledgements*

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# PART I
# Residential Energy Consumption in Belgium

## 2. DESCRIPTION OF THE RESIDENTIAL SECTOR IN BELGIUM

The main goal of this chapter is to describe the residential sector in Belgium, focusing on the dwelling[3] characteristics. The main dataset is the SEREC Survey that we realised in 2004, an interviewer-based survey that gathered information on households as well as the physical characteristics and conditions of dwellings. Two censuses are used for comparison in these descriptions: the Belgian population census of 1991 and the Belgian General Socio-Economic Survey of 2001[4].

As a part of the SEREC project, in September 2004 we performed our own survey, called the SEREC Survey. As it was a phone survey, the samples were drawn from lists of fixed phone numbers. So this SEREC survey probably underestimates households made of young people living in a small dwelling, which is probably rented and seen as temporary (a mobile phone is then preferred).
Three random samples were extracted, one for each Belgian region (Brussels area, Flanders and Wallonia), as Belgian regional authorities govern a lot of aspects of energy policy. The total sample obtained was weighted to have correct distributions by region, income quartile and dwelling type. The weights for this procedure were calculated from the nationally representative sample survey on household budgets and consumption made in 2001.

### *2.1 Number of dwellings*

The counting of dwellings in Belgium is a key factor in this study for two main purposes: the first is that it allows to associate people with the spatial unit in which they live and that has consumption, the dwellings themselves. The second objective is to publish information about dwelling characteristics related to energy consumption.
The majority of dwellings are located in Flanders (57.1%), a third is found in Wallonia (32.3%) and 10.7% are in Brussels (Table 2.1).

#### *2.1.1 Increase in the number of dwellings*

From the numbers of the population census (1991), it is known that there was an overall increase of 148187dwellings between 1981 and 1991 to a total in 1991 of 3 748 164 dwellings. More recently, the Belgian Statistics Division indicated that the seasonally-adjusted index of the building permits granted in Belgium for new dwellings for private households rose by 13.2% in 2005. Permits granted for the renovation of residential buildings increased by 4.2%.

[3] A dwelling is a separate set of living quarters with a private entrance from the outside or from a common hallway or stairway inside the building. The entrance should not be through someone else's living quarters.

[4] The Belgian General Socio-Economic Survey of 2001 is also a census. Sources of these two censuses: http://statbel.fgov.be/ (July 2005)

**Table 2.1 Total number (N) and percentage (%) of dwellings in Regions and in Belgium according to the SEREC Survey (2004) and the Belgian population census (1991)**

| | | Flanders | Wallonia | Brussels | Total (Belgium) |
|---|---|---|---|---|---|
| Number of Dwellings | In the SEREC database | 549 | 311 | 103 | 962 |
| | In the 1991 census of Belgium | 2 141 557 | 1 212 139 | 394 468 | 3 748 164 |
| Percentage of Dwellings | | 57.1% | 32.3 % | 10.7 % | 100.0 % |

### *2.1.2 Increase of $CO_2$ emissions and the energy consumption of dwellings*

As already introduced in chapter 1, the primary source of $CO_2$ emissions in Belgium is the burning of fossil fuels: the residential and commercial sectors generate 22% of overall emissions[5]. In Belgium, these emissions have grown by 12% between 1990 and 1999. Obviously, these heating-related emissions strongly depend on temperatures, which may vary greatly from one year to the next: the $CO_2$ emissions caused by the residential and commercial sectors, for example, reached a peak in 1996 (3375 Gg $CO_2$), a particularly cold year, and an all-time low in 1990 (2609 Gg $CO_2$), an extremely mild year[6].

Final total energy consumption of the residential sector is still expected to grow significantly; in particular for electrical devices and hot water, in the reference case: 1.7% per year up to 2012 and 1.1% per year afterwards[7]. $CO_2$ emissions related to fossil fuels would then increase by 16% between 2001 and 2020 in the residential sector. The main supposed reasons for these increases[8]: the growth of the per capita income by around 45% in the next 20 years, the related increase in purchase of new household electrical appliances and devices, and the related increase in sanitary comfort. Other important supposed factors for increase include: generalisation of the central heating systems, larger floor area per person (combination of larger sizes of new houses and reduction in the number of persons per household), and higher indoor temperature allowed by the said income increase.

## *2.2 Structure of Dwellings*

### *2.2.1 Difference in the distribution of dwelling structure in Belgian regions*

Dwelling structure data are used as indicators of urban form and density by identifying changes in housing patterns and providing benchmarks for available housing types. In term of energy it appears that larger home, as detached houses, on average consumes much more energy than smaller one, as apartment for instance.

As shown by Table 2.2, the majority of dwellings in Belgium are detached or semi-detached houses (76.3%), followed by apartments (23.1%) and other (0.6%). But there is a significant difference in dwellings types between the Brussels region and each of the two other regions[9]. Brussels has less 3

[5] Source: www.climat.be (July 2005)

[6] Source: Federal Department of the environment, The Belgium's Third National Communication under the UNFCCC, 2002.

[7] Source: Fraunhofer report p.175.

[8] Source: idem

[9] One-way ANOVA established there was a significant difference in dwellings types between regions (F(2) = 74,684; p < ,01). Differences are significant between Brussels and each of the two other regions; Flanders (MD = 1,447; Std.Error = 0,121; Sig. = ,000; p = ,01) and Wallonia (MD = 1,428; Std.Error = 0,129; Sig. = ,000; p = ,01). Flanders & Wallonia are comparable (MD = 0,019; Std.Error = 0,080; Sig. = 1,000; p = ,01).

and 4 façade houses (5.9% only) than the two other regions (both 58.0%), while on the other hand, Brussels has more flats and apartments (71.8%). In Flanders and Wallonia, one dwelling out of three is a detached house (35.8%).
In appendix 1, the type of dwelling according to household income is displayed.

**Table 2.2 Distribution of dwellings in regions according to their structure (%)**

| | Flanders | Wallonia | Brussels | Belgium |
|---|---|---|---|---|
| Apartment | 17.9 | 16.1 | 71.8 | 23.1 |
| Semi-detached house (2 façades) | 23.0 | 25.7 | (22.3) | 23.8 |
| Semi-detached house (3 façades) | 21.5 | 22.8 | (4.9) | 20.1 |
| Detached house (4 façades) | 37.0 | 34.7 | (1.0) | 32.4 |
| Other | (0.7) | (0.6) | (0.0) | (0.6) |
| Total | 100 % | 100 % | 100 % | 100 % |
| N | 549 | 311 | 103 | 963 |

Source: SEREC Survey (2004), N = 963.
Figures in parentheses refer to numbers smaller than 30.

### *2.2.2 Almost half of the dwellings in Belgium are located in rural areas*

Cross-classified with other variables, urbanisation type data provide information about the socio-economic characteristics of householders.
According to the SEREC survey, 44.3% of dwellings in Belgium are in rural countryside, but still 23.7% of the dwellings are located in a large city (45.6% of them are located in Brussels). Only a few of the Flemish (16.7% ) and Walloon (10.4%) dwellings are located in cities, most of them are located in rural areas (see Table 2.3 and appendix).

But as is shown in Table 2.3, there are some differences in dwelling type between regions for the same area type. Most of the dwellings located in large cities are apartments or semi-detached houses with 2 façades (80.5% in Belgium; 94.1% in Brussels; 68.8% in Wallonia; 69.3% in Flanders). 71.8% of them are apartments in Brussels when only 37,4 and 25.0% are apartment in large cities in Flanders and Wallonia, respectively. On the other hand, on average, only 8.5% of the dwellings located in the rural countryside are apartments. But rural areas have 55.1% of detached houses (4 façades) in Flanders and 48.9% in Wallonia.

The distribution of dwellings according to the urbanisation type and household income may be found in appendix.

## *2.3 Dwelling Ownership*

Tenure Type data are a useful indicator of home ownership and social mobility trends, and are used by government departments in the development of housing and social welfare policies.

In Belgium, 79.8% of dwellings were owned while 20.2% were being rented. But there is a significant difference in dwellings ownership between Brussels and the two other regions[10] (Table 2.4). Among the occupied private dwellings in Flanders and Wallonia, 81.8% were owned, while 18.2% were rented. There is no significant difference between Flanders and Wallonia[11], but there is

[10] One-way ANOVA established there was a significant difference in dwellings ownership between regions ($F(2) = 16{,}137$; $p < {,}01$).
[11] MD = 0,036; Std.Error = 0,028; Sig. = 0,603; p = ,01

a major difference between Brussels and these two regions[12]. Only 59.2% of the dwellings are owned by the householders in Brussels (40.8% are rented).

**Table 2.3 Distribution of dwellings in area type (%)**

| | Flanders | | | Wallonia | | | Brussels | Total (Belgium) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rural | Other urban | Large city | Rural | Other urban | Large city | Large city | Rural | Other urban | Large city |
| Apartment | (9.3) | 18. 4 | 37.4 | (7.4) | 30.0 | (25.0) | 71.8 | 8.5 | 22.2 | 51.3 |
| House (2 F) | (11.3) | 32. 5 | (31.9) | 20.5 | 30.0 | 43. 8 | (22.3) | 15.1 | 31.7 | 29.2 |
| House (3 F) | 22.7 | 23.8 | (15.4) | 22.2 | (22.0) | (21.9) | (4.9) | 22.5 | 23.2 | (11.5) |
| House (4 F) | 55.1 | 25.2 | (15.4) | 48.9 | (18.0) | (9.4) | (1.0) | 52.5 | 22.9 | (8.0) |
| Other | (1.0) | (0.0) | (0.0) | (1.1) | (0.0) | (0.0) | (0.0) | (1.4) | (0.0) | (0.0) |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| N | 247 | 206 | 91 | 176 | 100 | 32 | 103 | 423 | 306 | 226 |

Source: SEREC Survey (2004), N = 955. Large cities are Antwerp and Ghent in Flanders and Charleroi and Liege in Wallonia. Figures in parentheses refer to numbers smaller than 30.

There have been major changes in these values since the 2001 Census[13]. The trend is that there are more and more dwellings owned across Belgium and this is the case within any of the three regions. The Belgian aspires to own his dwelling! The Belgium census (2001) showed that 68.0% of dwellings were owned (72.6% in Flanders; 68.1 in Wallonia and 41.3% in Brussels), 32% being rented (27.4 in Flanders; 31.9 in Wallonia and 58.7% in Brussels).

**Table 2.4 Occupied private dwellings by tenure according to regions**

| | Flanders | Wallonia | Brussels | Belgium |
|---|---|---|---|---|
| Owned | 83.5 % | 80.0 % | 59.2 % | 79.8 % |
| Rented | 16.5 % | 20.0 % | 40.8 % | 20.2 % |
| Total | 100.0 % | 100.0 % | 100.0 % | 100.0 % |
| N | 547 | 310 | 103 | 960 |

Source: SEREC Survey (2004), N = 960.

As shown in appendix, the owners have higher incomes[14] (28.2% earn more than 3380 € per month) than the renters (43.3% earn less than 1510 €).

To own a dwelling seems to be a strong incentive for the owner to buy more appliances: in average, owners have 10.4 large appliances whereas renters have 8.2. Furthermore, the mean number of

[12] With Flanders (MD = 0,243; Std.Error = 0,043; Sig. = ,000; p = ,01); with Wallonia (MD = 0,207; Std.Error = 0,045; Sig. = ,000; p = ,01).

[13] It can be noted that the figures drawn from the SEREC survey overestimate the proportion of owners, probably because the list of phone numbers, which we used to draw the sample for our phone survey, did not include the mobile phone numbers.

[14] One-way ANOVA established there was a significant difference in dwellings income between regions (F(2) = 4,712; p < ,01). Bonfferoni test revealed that there is a significant difference between income in Flanders and Brussels (MD = 0,293; Std.Error = 0,119; Sig. = 0,043; p = ,05), but no difference between Wallonia and the two other regions, with Flanders (MD = 0,188; Std.Error = 0,079; Sig. = ,053; p = ,05); with Brussels (MD = 0,105; Std.Error = 0,125; Sig. = 1,000; p = ,05).

refrigerator(s), separate freezer(s), electric stove(s), dishwasher(s), washing machine(s), tumble dryer(s), video(s) and computer(s) is significantly higher for owners[15].

## 2.4 Dwellings Floor areas

This information is useful as a broad measure of housing standards by providing an indication of dwelling size. It also enables the calculation of occupancy ratios, thus providing an indicator of overcrowding. There is a significant difference between regions[16] according to the distribution of dwellings' floor areas. Flemish and Walloon dwellings seem to be larger[17] and this may permit a large number of appliances.

43% and 38% of the Flemish and Walloon dwellings are equal to or larger than 150 m², whereas 17.5% of the Brussels dwellings are that large. On the other hand, 40% of the dwellings are smaller than 100 m² in Brussels while only 19% and 14% are that small in the two other regions (Table 2.5).

**Table 2.5 Distribution of dwellings in Belgium per floor area (%)**

| Floor area | Flanders | Wallonia | Brussels | Total (Belgium) |
|---|---|---|---|---|
| < 50m² | (1.1) | (1.0) | (5.8) | (1.6) |
| 50 to 99 m² | 17.7 | 13.2 | 34.0 | 18.0 |
| 100 to 149 m² | 18.1 | 22.8 | (28.2) | 20.7 |
| 150 to 199 m² | 16.6 | 14.1 | (9.7) | 15.1 |
| 200 to 249 m² | 15.1 | 11.9 | (3.9) | 12.9 |
| > 250m² | 11.3 | 11.9 | (3.9) | 10.7 |
| Does not know | 20.1 | 25.1 | (14.6) | 21.1 |
| Total (%) | 100.0 % | 100.0 % | 100. 0 % | 100.0 % |
| N | 548 | 311 | 103 | 962 |

Source: SEREC Survey (2004), N = 962. Figures in parentheses refer to numbers smaller than 30.

## 2.5 Construction and Renovation of the Dwellings

The year the dwellings were built was recorded and is presented in Table 2.6 below[18].
Buildings are older in Wallonia than in Flanders[19]. 34% of the dwellings in Wallonia were built before 1946, only 19% of the Flemish dwellings were built that early. On the other hand, 43% of the Flemish dwellings were built after 1975 when only 31% of the Walloon dwellings were built that recently.

[15] One-way ANOVA established there was a significant difference between the mean number of refrigerator(s) ((F(2) = 9,324; p < ,01), separate freezer (F(2) = 47,966; p < ,01), electric stove, dishwasher (F(2) = 61,795; p < ,01), washing machine (F(2) = 29,847; p < ,01), tumble dryer (F(2) = 30,046; p < ,01), video(s) (F(2) = 8,586; p < ,01) and computer(s) (F(2) = 6,557; p < ,01) and the tenure type (owners and renters).

[16] One-way ANOVA established there was a significant difference in floor area between regions (F(2) = 16,378; p < ,01). Bonfferoni test revealed that there is a significant difference between Brussels and the two other regions, Flanders (MD = 0,987; Std.Error = 0,194; Sig. = 0,000; p = ,01), Wallonia (MD = 1,161; Std.Error = 0,206; Sig. = 0,000; p = ,01), but no difference between Flanders and Wallonia (MD = 0,174; Std.Error = 0,129; Sig. = ,053; p = ,01).

[17] The survey data do overestimate the floor area. In this survey, the respondents estimated the floor area during the phone survey but one respondent out of five could not answer that question. Moreover, it is still unclear if the respondents estimated the floor area or the total area of their dwellings (Square meters per dwelling).

[18] Sample for Brussels is not significant n < 30.

[19] One-way ANOVA established there was a significant difference between these two regions (F(2) = 10,694; p < ,01).

The 2001 Belgian census has shown that almost one person out of five (19.2%) occupied a dwelling that was built less than 20 years before. The more recent dwellings are on average located in the German-speaking Community and in Flanders. In these two regions, approximately one dwelling out of four was built during the last 20 years. The large cities seem to hold much older dwellings. That is the case in particular for Brussels, Charleroi and Liege. Globally, in terms of renovation, one housing out of ten (10%) underwent significant transformations during the last ten years. With regards to this last point, differences between large cities and the other urbanisation types do not appear significantly, except that the town of Ghent slightly dissociates from other large cities for this number of the transformed dwelling (12.8%).

**Table 2.6 Occupied private dwellings by period of construction in each region (%)**

| Period of construction | Flanders | Wallonia | Brussels | Total (Belgium) |
|---|---|---|---|---|
| Before 1919 | 7.3 | 20.3 | (9.7) | 11.8 |
| 1919 to 1945 | 12.2 | 13.5 | (14.6) | 12.9 |
| 1946 to 1960 | 11.2 | 10.0 | (20.4) | 11.8 |
| 1961 to 1975 | 17.0 | 14.2 | (22.3) | 16.7 |
| 1976 to 1990 | 20.3 | 19.0 | (11.7) | 19.0 |
| In 1991 or after | 22.7 | 12.3 | (7.8) | 17.7 |
| Does not know | 9.3 | 10.6 | (13.6) | 10.2 |
| Total (%) | 100 % | 100 % | 100 % | 100 % |
| N | 547 | 310 | 103 | 960 |

Source: SEREC Survey (2004), N = 960. Figures in parentheses refer to numbers smaller than 30.

## 2.6 Energy used for dwelling heating

As shown by Table 2.7, it is with non-renewable energy sources that dwellings in Belgium are heated: mainly natural gas (50%) and oil (39%). 8% of dwellings are heated thanks to electricity (mainly produced from uranium). In this table, "other" regroups other types of heating energies (coal, wood, butane and propane). In the same table, respondents that could not answer this question account for 0.3% and they are mixed with the "other" category.
There is a significant difference between regions[20]: while in Brussels and Flanders the first source of energy is mainly natural gas (71% and 54% respectively), in Wallonia, oil is the first source of energy for dwellings (52%). That is a key point that can be considered as economically unfavourable for Wallonia with regards to the increase of oil prices[21]. In the same time, Flanders dwellings have the highest use of electricity for heating, 9%, when 7% and only 4% of dwellings are dependent of electricity for heating in Wallonia and Brussels.

## 2.7 Dwellings heating

### *2.7.1 Most dwellings have individual and quite old heating systems*

The great majority of Belgian dwellings have central heating system (86%), other dwellings (14%) are heated with chimney fire, stove, convector, electric radiator, etc.

[20] One-way ANOVA established there was a significant difference between any regions ($F(2) = 18{,}668$; $p < {,}01$).
[21] Crude oil prices jumped to the historical price of 70 $ per barrel on August 2005 in Belgium.

**Table 2.7 Main energy source used for dwelling heating in Belgium (%)**

| | Flanders | Wallonia | Brussels | Total (Belgium) |
|---|---|---|---|---|
| Gas | 53.9 | 35.9 | 70.6 | 49.9 |
| Oil | 34.8 | 52.4 | (22.5) | 39.2 |
| Electricity | 9.1 | (6.8) | (3.9) | 7.8 |
| Other or unknown | (2.2) | (4.9) | (2.9) | (3.1) |
| Total (%) | 100 % | 100 % | 100 % | 100 % |
| N | 549 | 309 | 102 | 960 |

Source: SEREC Survey (2004), N = 960. Figures in parentheses refer to numbers smaller than 30.

As shown in Table 2.8, 88% of the dwellings in Belgium that have central system have an individual one. Much less in Brussels, though: 54%, which means that about half of the dwellings in Brussels have collective heating systems.

**Table 2.8 Types of central heating in occupied housing units in Belgium (%)**

| | Flanders | Wallonia | Brussels | Belgium |
|---|---|---|---|---|
| Individual heating system | 93.7 | 89.4 | 53.7 | 87.8 |
| Other kind of heating system | 6.3 | 10.6 | 46.3 | 12.2 |
| Total | 100 | 100 | 100 | 100 |
| N | 479 | 255 | 94 | 829 |

Source: SEREC Survey (2004), N = 829 (households with central heating only).

As shown in Table 2.9, the age of the individual central heating system is quite high and significantly[22] different between regions. Heating systems are older in Brussels (24.5 years old) than in Flanders (16.6 years old) and Wallonia (15.2 years old).

**Table 2.9 Mean age of the boiler of the individual central heating system in Belgium**

| | Flanders | Wallonia | Brussels | Total (Belgium) |
|---|---|---|---|---|
| Mean age | 16.6 | 15.2 | 24.5 | 16.7 |
| Std. Deviation | 21.0 | 19.8 | 33.9 | 21.9 |
| N | 420 | 222 | 50 | 692 |

Source: SEREC Survey (2004), N = 692 (households with individual central heating only).

### *2.7.2 Most dwellings have additional regulation system*

The most powerful technique of energy conservation is turning off equipment when heating is not needed. A programmable thermostat allows presetting different temperature programs to efficiently meet comfort needs during different periods of the day or of the week.

[22] One-way ANOVA established there was a significant difference between regions (F(2) = 3,712; p < ,05). Bonfferoni test revealed that there is a significant difference between Brussels and the two other regions, Flanders (MD = 7,867; Std.Error = 3,262; Sig. = 0,048; p = ,05), Wallonia (MD = 9,280; Std.Error = 3,413; Sig. = 0,020; p = ,05), but no difference between Flanders and Wallonia (MD = 1,413; Std.Error = 1,811; Sig. = 1,000; p = ,05).

Most of the dwellings in Belgium have central regulation systems (98.6% have one), even if only 98.1% and 97.1% of the Walloon and Brussels dwellings have one, compared to the 99.3% of the Flemish dwellings that have one[23] (Table 2.10).

**Table 2.10 Additional heating equipment for heated area of housing unit (%)**

| | Flanders | Wallonia | Brussels | Total (Belgium) |
|---|---|---|---|---|
| Do have heating regulation system | 99.3 | 98.1 | 97.1 | 98.6 |
| Do not have heating regulation system | 0.7 | 1.9 | (2.9) | 1.4 |
| Total | 100 | 100 | 100 | 100 |
| N | 548 | 310 | 103 | 961 |

Source: SEREC Survey (2004), N = 961. Figures in parentheses refer to numbers smaller than 30.

### *2.7.3 Most dwellings have double glasses that limit heat transfers*

As shown in Table 2.11, only 67.5% of the dwellings in Belgium have double glasses everywhere. There is a significant difference between regions[24] for Brussels has less dwellings with double glasses than the other regions.

**Table 2.11 Double glasses windows in dwelling**

| | Flanders | Wallonia | Brussels | Total (Belgium) |
|---|---|---|---|---|
| Do have double glasses everywhere | 67.5 % | 71.9 % | 54.4 % | 67.5 % |
| Have some double glasses | 18.2 % | 15.2 % | 24.3 % | 17.9 % |
| Do not have any double glasses | 14.2 % | 12.9 % | 21.4 % | 14.6 % |
| Total | 100 % | 100 % | 100 % | 100 % |
| N | 548 | 310 | 103 | 961 |

Source: SEREC Survey (2004), N = 961.

[23] One-way ANOVA established there was a significant difference between regions (F(2) = 29,466; p < ,01). Bonfferoni test revealed that there is a significant difference between Flanders and the two other regions, Wallonia (MD = -,196; Std.Error = ,028; Sig. = 0,000; p = ,01), Brussels (MD = -,187; Std.Error = ,042; Sig. = 0,000; p = ,01), but no difference between Brussels and Wallonia (MD = ,009; Std.Error = ,044; Sig. = 1,000; p = ,01).

[24] One-way ANOVA established there was significant difference between regions (p < ,01).

# 3. ENERGY RELATED PRACTICES: DESCRIPTION, MEANINGS AND SOCIAL DETERMINANTS

This chapter describes and attempts to understand the practices linked to energy consumption. What do people do and why do they act as they do? What are their selection criteria when they choose their heating system? Efficiency, aesthetics, respect of the environment, profitability, or something else? What about bathing, lighting, cooking, or the laundry…?

## *3.1 Introduction*

This introduction reviews some of the social, economic and behavioural determinants that may influence energy-related practices, as previously shown by other studies. These practices include heating, bath and showering habits and behaviours related to electricity consumption, such as purchasing and using electrical appliances. It seems to be important to identify not only success but also failure factors in energy saving behaviours, in order to provide suggestions for the future (described in the third part of this report).

Energy-related practices are defined by various activities that are related to housing like lighting, heating and cooling or hygiene such as washing or leisure, for example TV, computer and stereo usage (Hertwich and Katzmayr, 2004). The "right" contents of all these functions are always socially constructed (Douglas, 1975, Wilhite *et al.*, 1996, Shove, 2003, Kaufmann, 2001, 2004). In our Western societies, the main purpose of energy consuming activities is to help gaining time for leisure and provides comfort (Anker-Nilssen, 2003). Energy-related practices are linked to composite services that differ from the traditional needs because they combine social and technological changes and through these never-ending changes grant better quality of life (Røpke, 2004). Everyday habits, for example cleanliness or eating, have also many symbolic meanings and are not just an answer to basic needs. E. Shove (2003) points out in her book that some of the daily routines and conditions that we do not think much about and that are not considered in an environmental perspective can be among the most environmentally-costly everyday practices. According to her opinion, we should try to understand as a complex framework the socio-technical, social-symbolic and socio-temporal configuration of habits that people take for granted but that are changing all the time. Some practices associated to cleanliness are generally seen as having a character of work such as laundering, while others are mostly seen as relaxing like bathing.

Some energy-related practices involve only one central technology (air-conditioning), others involve the coordination of multiple technologies (laundering). Generally energy-related practices are characterized by the increasing complexity of tasks. Usage of electrical appliances serves our comfort to help simplifying everyday household duties but at the same time, with the appearance of newer and newer appliances, the number of household appliances is continuously increasing. The market persistently replacing products with more efficient ones is tempting consumers to utilize them more and more often. Energy-related activities are specified by socio-cultural patterns that shape behavioural factors and personal preferences like the water temperature or having a bath because it is more relaxing or taking just a shower for saving time, money or energy. Behavioural factors interact when it comes to switching on and off the lights in the room after leaving it or putting TV and HI-FI on standby mode instead of turning them off (Hertwich and Katzmayr, 2004).

The *culture* is a principal factor that has a strong influence on energy related behaviours. The results of an American multicultural study (Hackett and Lutzenhiser, 1991) revealed that South Americans generally practice more energy consuming activities, while Asians approved more energy-saver behaviour. When it comes to energy saving behaviour in the household, various cultures cut their comfort down differently. To mention an example, Southern and Mediterranean people would reduce the temperature of the hot water, Europeans rather limit the use of the heater during winter wearing warmer clothes in the house and turning down the cooler during summer, whereas

Americans prefer to use thermostat all seasons. The Oxford study concerning residential light (1998) reports that, in Northern Europe and particularly in the Nordic countries, it looks more widespread to use lights at home to create ambiance: Nordic people pay more attention where to put the lights in their home, with which kind of fixture, shade and bulbs in order to make the house feel warmer and cosy. In Southern Europe, the need for artificial light is more constant because of less significant differences between the summer and winter daylight hours. Southern people generally use less light in their home and they are a little less attentive to choose bulbs and fixtures. Energy-saver and long-lasting fluorescent lights are less popular in Europe because they are considered to cause problems with electrical appliances; however in Japan, fluorescent lights are preferred not only in the offices but also in the homes (Diamond and Moezzi, 2000, Wilhite *et al.*, 1996).

Energy-related practices are also determined by several *socio-economic factors*. *Household income* is one of the most important variables influencing both energy spending behaviour and environmental concern: direct and indirect energy uses rise with income per capita in the household and, on the other hand, several studies (Anker-Nilssen, 2003, O'Neill and Chen, 2002, Hunter and Toney, 2005) show that a higher household-income predicts the least environmental concern. Barr *et al*. (2005) argue that people with environmental concerns, called as the committed environmentalists group, are most likely to own their home than non-environmentalists in England while non-environmentalists are significantly likelier to belong to the low-income groups.
Families having higher income have more energy-consuming practices in order to save time and maintain their usual comfort level. Despite the fact that these high-income families use more energy, they have in proportion lower energy expenses than low-income households. Therefore, they can afford to invest in more appliances and technical solutions because they prefer to purchase energy efficient appliances for their house rather than to change their everyday habits to consume less energy. Like in a vicious circle, higher income families tend to use more the new energy efficient appliances, as Moezzi's example illustrates it well: they buy a bigger energy efficient fridge labelled A, in order to store more food even the ones that do not need to be kept in the fridge (Moezzi, 1998).
Although lower-income families use less energy in absolute terms, relatively to their budget, their expenses are higher and so they are less likely to spare enough money to invest in new technical alternatives (Barr *et al*. 2005). Income is a predictor of appliances ownership too (Barr *et al*. 2005) and homeowners are more frequently investing in buying new appliances than renters. Lower-income households are more likely to choose direct energy saving practices (switching off the light in the unused room, waiting for a full-loaded washing) than high-income households.

Another important variable influencing energy-related activities is the level of *education*. Among the people with higher education, the awareness of environmental issues is likelier to be present and their concern on the future of the environment is higher than among people with no formal education. Though people with higher education are more aware of environmental issues and energy related practices, they are less engaged with energy saving behaviour according to a Norwegian study (Anker-Nilssen, 2003). In the context of the American Mormon population (Hunter and Toney, 2005), educated people are more concerned about the future than about jobs or prices and they are willing to sacrifice more as by joining organisation or giving to charities than non-educated people. However educated people rather believe in economic growth and also that development could not be harmful for the environment. Interestingly in England (Barr *et al.*, 2005), committed environmentalists are composed by people either less likely to have received any formal education or they were more likely to own university degree while a larger proportion of non-environmentalists had received no formal education or had obtained shorter degrees.

*Age* can be mentioned as a fourth factor to determine energy related behaviours. In the American study, (Hunter and Toney, 2005) elder people are not as much aware of environ-menttal future as younger ones. They are willing to sacrifice less for the environment but they are convinced that they do what is right in order to protect the environment and save energy. In contrast with the previous findings, Barr *et al*. (2005) showed that in England the mean age of people strongly concerned about environment is highest, whereas people hardly or not concerned at all for environment are the

youngest. A demographic study on the U.S. population (O'Neill and Chen, 2002) revealed that direct residential energy use rises with age while indirect energy consumption linked to transport and usage of car peaks at around 50-55 years old and after suddenly drops.

The American study (Hunter and Toney, 2005), the English one (Barr *et al.*, 2005) and the Norwegian one (Anker-Nilssen, 2003), all confirm different behaviours toward energy saving between *female and male* consumers. Each study in conjunction with the others brought into light that female consumers express more concern for maintenance of environmental quality by giving money to organisations and acting in a pro-environmentalist manner and they are more strongly engaged in energy saving practices.

Finally, *household size and household composition* also have an influence on energy related activities in the house. It has been shown in the United States (O'Neill and Chen, 2002) that two-person households use 17% less energy both residential and for transport than single-person households. Households with children consume 35% less indirect energy and 44% less direct energy, and the number of adults mostly influences the energy use devoted to transport. The English people with higher awareness on environmental issues tend to have smaller household size than non-environmentalists (Barr *et al.*, 2005).

## *3.2 Description of the practices*

### *3.2.1 Heating*

> *"How do I like my house heated? I have, I have a thermostat here, eh. Thus this is…a great facility! And this is a small silly thing but it makes for my comfort also, this thermostat."(Alexandre)*

> *"When nobody is in, we leave the room temperature on 15º C, when someone gets back home, he or she puts it around 17-18 ºC, except if we spend a long time in the house, we increase the temperature up to 20 ºC. It is enormous! (Laugh)" (*Antoine)

As shown by these quotes, in terms of heating, it seems that the behaviours are quite varied, even for the same persons, and that they are dependant to the context and possibly also to the activities. Some people prefer to heat as little as possible, only the occupied rooms for example, and they switch off the heating system as soon as they leave or even a little sooner. Others heat all over their house, all the time. In contrast to this diversity, all the interviewed persons asserted that they prefer to heat "*not too much*". But the average temperature varies from a dwelling to another. From the SEREC phone survey, it appears that the majority of the householders (58.4%) estimate that the temperature of their living room is equal to or superior than 21°C during a winter day when they are in.
This estimated day-temperature does not significantly vary with the household income, neither with the dwelling type, household typology or size, nor with the age or gender of the respondent (Table 3.1). But the estimated indoor temperature is linked to the region where the householders live: Flemish households are less numerous to report a lower temperature for their dwelling living room (38% of them answer that the day-temperature is lower than 21°C in their living-room, whereas 44% of Walloons choose this temperature and 55% in Brussels).

One can see that "*Not too much*" is thus very subjective and can mean different temperatures. What is common is the feeling that it is not good to stay in an overheated house. This feeling is well formulated by Daniel who cannot regulate his flat temperature and who suffers from the heat: *"I had to get used to a high temperature which I don't like and which I find unhealthy. For instance, at night 18˚ is too much. If I am cold, I just have to cover myself. And if it's 19˚, 20˚, it's too much, it's unhealthy. It's too dry, it's really unhealthy. It's unhealthy. It's an unhealthy lifestyle"* (Moreau and Wibrin, 2005).

As it was mentioned in chapter 2, appropriate use of thermostats can cut householders' bills by 20 to 30% and our survey shows that almost any dwelling in Belgium does have some possibility for heating regulation (98.6%) (Table 2.10). Decreasing dwelling room temperature of 1°C (from 20°C to 19°C) can indeed lead to an economy on heating of 7%. To turn down the thermostat from 22° to 19° can even lead to a reduction of 20% of a household heating bill (Salomon and Bedel, 2005).

The SEREC survey shows that most householders do also attempt to regulate the indoor temperature according to their presence or absence, the period of the day (day or night) and to a lesser extent, while they are airing the room. As Table 3.1 indicates it, the reduction of the temperature while householders are away (82.6% of the householders) or at night (89.7% of the householders) seems rather generalised, especially in Flemish households (84.3% and 91.9% decrease room temperature during absence or during the night). Besides this, it seems that the practice of turning off the heating while airing is much less frequent (59.9% of the householders) and do not depend on the region.

Concerning the age groups, there is also clear gradation between generations. We observed that the 30-49-year and 50-69-year age group declare mostly that they lower the temperature during their absences (89.0% and 83.1% respectively), while the less-than-30-year-old persons are only 77.2% to do so. Then the persons over age of 70 are those who lower the least among all the temperature of their heating system (61.5%). This order remains almost the same regarding the reduction of the temperature at night in the wintertime or for turning off the heating while airing the rooms. Finally, practices to regulate temperature in wintertime or while airing are more present with smaller income householders, or people living in uni-familial dwellings (not in apartments) or with children or in larger household or also with householders being in the 30-49-year and 50-69-year age group but do not depend on the gender.

Summing up, it seems that the eldest and the youngest people, respondents who live alone or in an apartment and households with no children are the ones who pay the least attention to turn down the heating during absences, during the night or while airing.

For the couples, the temperature control has to conciliate the expectancies of both partners. The spouses know the differences; they have already been discussed before the interview. The respondents can thus speak very clearly about it.

**Table 3.1 Estimated temperature and reduction of temperature in some situations according to socio-economic characteristics**

| Socio-economic characteristics | % in total sample | Temperature | Reduction of temperature (%) | | |
|---|---|---|---|---|---|
| | | < = 20°C (living-room, winter day) | During absences of several hours | During the night | While airing |
| Total Sample | 100.0 | 41.6 | 82.6 | 89.7 | 59.9 |
| Region | | | | | |
| Flanders | 57.0 | 37.6 | 84.3 | 91.9 | 59.0 |
| Wallonia | 32.3 | 44.0 | 79.9 | 87.4 | 59.6 |
| Brussels | 10.8 | 55.4 | 81.2 | 85.1 | 64.9 |
| Sig X² | | 0.003 | 0.255 | 0.035 | 0.544 |
| Age of respondent | | | | | |
| 18 - 29 years | 8,3 | 41.6 | 77.2 | 72.2 | 53.3 |
| 30 - 49 years | 44.3 | 46.3 | 89.0 | 94.1 | 62.5 |
| 50 - 69 years | 34.9 | 39.0 | 83.1 | 90.9 | 63.5 |
| 70 - 89 years | 12.6 | 31.9 | 61.5 | 82.4 | 44.0 |
| Sig X² | | 0.093 | 0.000 | 0.000 | 0.001 |
| Gender of respondent | | | | | |
| Male | 41.3 | 41.5 | 79.7 | 86.7 | 58.5 |
| Female | 58.7 | 41.5 | 84.7 | 92.0 | 61.1 |
| Sig X² | | 0.924 | 0.047 | 0.008 | 0.431 |
| Type of dwelling | | | | | |
| Detached house (4 F) | 32.6 | 43.2 | 85.4 | 92.3 | 57.9 |
| Semi-detached (3 F) | 20.3 | 39.2 | 81.8 | 88.6 | 65.6 |
| Semi-detached (2 F) | 24.0 | 43.4 | 83.0 | 91.6 | 59.4 |
| Apartment | 23.2 | 39.3 | 78.9 | 84.8 | 59.1 |
| Sig X² | | 0.269 | 0.284 | 0.030 | 0.367 |
| Household size | | | | | |
| 1 person | 20.5 | 43.2 | 80.3 | 85.0 | 57.1 |
| 2 persons | 34.7 | 37.9 | 79.1 | 87.9 | 59.0 |
| 3 persons | 18.2 | 45.1 | 86.5 | 96.5 | 70.8 |
| 4 persons | 16.6 | 43.3 | 89.0 | 91.6 | 51.9 |
| 5 persons + | 10.1 | 42.3 | 81.5 | 90.2 | 61.3 |
| Sig X² | | 0.686 | 0.045 | 0.005 | 0.010 |
| Household composition | | | | | |
| 1 adult without children | 19.9 | 41.0 | 78.6 | 85.1 | 54.6 |
| 1 adult with children | 6.1 | 44.8 | 91.2 | 93.0 | 66.1 |
| 2 adults without children | 29.7 | 37.6 | 78.9 | 86.2 | 58.5 |
| 2 adults with children | 44.3 | 44.3 | 85.8 | 93.7 | 62.3 |
| Sig X² | | 0.335 | 0.014 | 0.001 | 0.233 |
| Household type + gender of respondent | | | | | |
| Male, living alone | 7.2 | 43.5 | 82.1 | 80.9 | 49.3 |
| Female, living alone | 18.9 | 41.8 | 81.4 | 89.3 | 60.3 |
| Male, in couple | 34.0 | 41.2 | 79.1 | 87.9 | 60.2 |
| Female, in couple | 39.9 | 41.4 | 86.5 | 93.3 | 61.6 |
| Sig X² | | 0.930 | 0.076 | 0.007 | 0.306 |
| Total household net income per month | | | | | |
| <1510 € | 24.9 | 43.8 | 75.7 | 88.7 | 62.7 |
| 1510 € = < 2260 € | 25.1 | 40.2 | 82.8 | 86.2 | 65.5 |
| 2260 € = < 3380 € | 24.9 | 39.1 | 91.1 | 95.0 | 57.5 |
| > 3380 € | 25.1 | 43.2 | 80.8 | 89.3 | 53.6 |
| Sig X² | | 0.517 | 0.000 | 0.014 | 0.041 |

Source: SEREC Survey (2004), N = 948.

Respondents who cannot regulate the temperature of their dwelling are excluded from the corresponding analyses.

Catherine and Eric, for instance, have divergent opinions about the heating and know it:
- Catherine: "*There, we are totally different!"*
- Eric*: "Divergent opinion! Well for me, I'm used to being often outside for my job, so inside I'm hot! But why is the heating still working on?"*
- Catherine: "*When I came home, it was 15°. Sorry, but it was a bit…It was not very cold but…I had the impression it was damp. So then what did I do? I put on the heating. And in an hour or two, I'll cut it off…But the house is slightly warmed up and it feels nice."*

It is more often the woman who has the feeling of being cold than the man. For Louis, for example: *It's rather between the parents that it has to be discussed whether the temperature is nice! But of course one sees that it's logical…The wife who remains at home, who moves less…eh, hum, who sits down for a while… who is cold more quickly than someone coming in from outdoors and for whom it is automatically already hotter, eh! Or someone moving about or who only has a few hours at home, he. So I imagine that has to be considered, surely…* (Moreau and Wibrin, 2005). Another interviewee tells how this discrepancy is translated into practice when her girlfriend comes: *"When we are coming back together, I would rather switch on [the heating] quietly but she does set it up with 3 or 4 supplementary degrees to have it working more quickly, so she said, but it doesn't heat more quickly! (Laugh). It doesn't help but! She tends to heat more, yes."* (Arthur). We met only one couple whose husband "likes his comfort" and a higher temperature than his wife does. They have decided to install an air-conditioning system says the man *"because we are oriented to South, and it's true that… after 2 or 3 sunny days, namely in the sleeping room, it becomes like a stove and that is"* he cannot finish his sentence before his wife says: *"yes, mostly for me"*. So in any case, the indoor temperature seems to be adapted to the female demand.

### *3.2.2 Sanitary hot water*

> "*My husband prefers showering and so do I often during summer time, but I [also] take a bath once a week. And I really benefit from this!"* (Maria)
>
> "He *prefers showering and I prefers bathing… but I take more regularly a shower than a bath: I take a bath when I really want to relax myself."* (Catherine)
>
> - I: *"And the showerhead, is it a normal one or a saving one?"*
> - M: *"This is a bathroom with a Jacuzzi-type bath. (…) The Jacuzzi, yes, at the beginning when we got it, it was like a new toy, but now, it is rather at the occasion of a bath that one operates the Jacuzzi, but it is not a goal for itself. But what is working here quite a lot is the shower! It is really the revelation. (…). Well, I don't see personally any interest getting marinated in your own scum, this is the first thing. Secondly, I believe that this limits the water consumption, mainly the hot water one's, if we compare the amount of water we can consume during a bath or during a shower and thirdly, with the type of showerhead we now have, I find the feeling of the water jet to be more agreeable than to get cooked or dying from the cold in a bath.*
> - I: *"And the showerhead, is it a normal one or a saving one?*
> - M: *"I don't know how it could be a saving one (…)"* (Jean)
>
> - I: *"And for small uses, like for washing hands or teeth, do you prefer cold water or warm water?"*
> - M: *"Warm water"*
> - F: *"Cold water"*
> - I: *"It is a detail, but for which reason do you prefer cold water or warm water?"*
> - F: *"For me, it is because the heat in the room, I don't like it, I have the feeling that when I wash my hands, I freshen myself up more with cold water. So, instinctively, cold water."*

– H: *"And me, it's for two reasons: because it is more comfortable and more efficient."* (Pierre (H) and Michelle (F))

From the large-scale phone survey, households' consumption of sanitary hot water appears to be linked to the social variables that denote the socio-economic status (household income, dwelling type) or that are related to household composition or to the age group of the respondents (Table 3.2). Higher incomes are associated with more showering and more bathing and so does the fact to live in a (detached) house rather than in apartment. The older persons (over 50 and especially over 70) have fewer baths and showers than the younger groups. The number of baths and showers per household and per week does not depend on the region or the gender of the respondent, although men who live alone report more showers per week than their female counterparts.

Summing up, it seems that the youngest, the persons living in a house (either detached or not) and the highest-income families are those who have the higher use of hot water. However, these results would not support the conclusion that energy policies should be directed to a reduction of sanitary-hot-water consumption for reducing energy consumption, as the analysis of the in-depth interviews will show below.

Indeed, regarding the practices and the motivations of the persons met, only a few interviewees associate their bathing or showering habits with something else than hygiene and comfort. The few persons who prefer showering rather than bathing may justify themselves with an environmental concern that is never the sole reason: the main reason is usually to save time. Others point to the relaxation dimension of bathing, as mentioned by E. Shove (2003, see also in the introduction of this chapter). On the other hand, special equipments for showering, like economical showerhead and the possibility to adjust water temperature, are never mentioned by the interviewed consumers by themselves, as the quote above illustrates it.

### *3.2.3 Electricity*

#### *3.2.3.1 Light, lighting*

> *"I like a lot indirect lighting [such as] the halogen here and I like well to have several lights, many of them, but I don't like to have small lights so one doesn't see much. And for me – I was forgetting it – it is very important to have a lot of natural light and large windows."* (Alexandre)

> *"Yes, I would have the tendency to feel guilty if I don't switch off the light right away. (…) Certainly, one says [to my grandchildren] to switch off the lights."* (Francine)

These two persons illustrate the generational differences when it comes about switching off the light while leaving a room. This difference is confirmed in the quantitative survey as it will be seen below. On the total surveyed sample, hardly a quarter of the respondents declare switching off the light each time they leave a room even for five minutes and 42.5% assert never doing it (Table 3.3). There are no significant differences between regions or dwelling types from a statistical point of view.

**Table 3.2 Use of sanitary hot water according to socio-economic characteristics (%)**

| Socio-economic characteristics | % in total sample | Baths per week per household | | Showers per week per household | |
|---|---|---|---|---|---|
| | | < = 4 (%) | > 4 (%) | < = 4 (%) | > 4 (%) |
| Total Sample | 100.0 | 68.3 | 31.7 | 33.4 | 66.6 |
| Region | | | | | |
| Flanders | 57.0 | 67.9 | 32.1 | 34.7 | 65.3 |
| Wallonia | 32.3 | 66.9 | 33.1 | 31.8 | 68.2 |
| Brussels | 10.8 | 74.8 | 25.2 | 31.4 | 68.6 |
| Sig $X^2$ | | 0.315 | | 0.625 | |
| Age of respondent | | | | | |
| 18 - 29 years | 8,3 | 68.4 | 31.6 | 25.3 | 74.7 |
| 30 - 49 years | 44.3 | 56.7 | 43.3 | 19.9 | 80.1 |
| 50 - 69 years | 34.9 | 75.5 | 24.5 | 41.5 | 58.5 |
| 70 - 89 years | 12.6 | 89.7 | 10.3 | 63.5 | 36.5 |
| Sig $X^2$ | | 0.000 | | 0.000 | |
| Gender of respondent | | | | | |
| Male | 41.3 | 67.9 | 32.1 | 35.0 | 65.0 |
| Female | 58.7 | 68.8 | 31.2 | 32.1 | 67.9 |
| Sig $X^2$ | | 0.788 | | 0.352 | |
| Type of dwelling | | | | | |
| Detached house (4 F) | 32.6 | 66.3 | 33.7 | 26.9 | 73.1 |
| Semi-detached (3 F) | 20.3 | 60.9 | 39.1 | 31.8 | 68.2 |
| Semi-detached (2 F) | 24.0 | 66.2 | 33.8 | 39.2 | 60.8 |
| Apartment | 23.2 | 79.4 | 20.6 | 36.7 | 63.3 |
| Sig $X^2$ | | 0.000 | | 0.014 | |
| Household size | | | | | |
| 1 person | 20.5 | 94.2 | 5.8 | 50.8 | 49.2 |
| 2 persons | 34.7 | 75.3 | 24.7 | 41.4 | 58.6 |
| 3 persons | 18.2 | 60.9 | 39.1 | 21.8 | 78.2 |
| 4 persons | 16.6 | 44.9 | 55.1 | 16.5 | 83.5 |
| 5 persons + | 10.1 | 45.4 | 54.6 | 19.6 | 80.4 |
| Sig $X^2$ | | 0.000 | | 0.000 | |
| Household composition | | | | | |
| 1 adult without children | 19.9 | 94.6 | 5.4 | 50.8 | 49.2 |
| 1 adult with children | 6.1 | 61.0 | 39.0 | 28.8 | 71.2 |
| 2 adults without children | 29.7 | 79.3 | 20.7 | 43.4 | 56.6 |
| 2 adults with children | 44.3 | 50.5 | 49.5 | 19.9 | 80.1 |
| Sig $X^2$ | | 0.000 | | 0.000 | |
| Household type + gender of respondent | | | | | |
| Male, living alone | 7.2 | 82.6 | 17.4 | 42.0 | 58.0 |
| Female, living alone | 18.9 | 87.4 | 12.6 | 46.6 | 53.4 |
| Male, in couple | 34.0 | 64.4 | 35.6 | 33.7 | 66.3 |
| Female, in couple | 39.9 | 60.1 | 39.9 | 25.7 | 74.3 |
| Sig $X^2$ | | 0.000 | | 0.000 | |
| Total household net income per month | | | | | |
| <1510 € | 24.9 | 83.0 | 17.0 | 51.1 | 48.9 |
| 1510 € = < 2260 € | 25.1 | 69.2 | 30.8 | 37.2 | 62.8 |
| 2260 € = < 3380 € | 24.9 | 63.9 | 36.1 | 28.2 | 71.8 |
| > 3380 € | 25.1 | 57.3 | 42.7 | 17.2 | 82.8 |
| Sig $X^2$ | | 0.000 | | 0.000 | |

Source: SEREC Survey (2004), N = 962.

On the contrary, the differences between households according to their income, size or age-group of the respondent are statistically significant: 49.6% of the members of the households with the lowest income assert to never switch off the light for five minutes against 36.6% of the ones with the highest

income; 46.9% of the living-alone persons never switch off the light for five minutes against 34% of the household's members made of 4 persons; and 53.8% of the 70-89-year-old-group asserted to never switch off the light for five minutes against only 30.8% of the 18-29-year-old-group. It may be hypothesised that other factors than a concern for energy consumption are explaining these differences, such as breaking a feeling of loneliness or insecurity, as shown for the TV kept on by very old persons (Caradec, 2004).

It is interesting to point that when we asked the interviewees what aspects of their energy consumption they care about, the first answer was generally about switching off electric lighting, which thus often came before heating if heating was to be mentioned. May this preponderance be explained because "Our grandmothers were already telling us to care about electric lighting" as said by a 47-year-old man (Macq, 2005) or because the light is visible (Moreau and Wibrin, 2005)?

Anyway, this concern apparently widely shared is not widely nor uniformly translated into practice for switching off unnecessary lights as demonstrated above. However, "saving lamps" or CFLs appear to be equally widespread, except that 70.9% in detached houses have at least one CFL against 54.6% in apartments.

#### *3.2.3.2 Dishwasher, washing machine, dryer and other electrical appliances*

- *"(…) now you make me remember, I have a juicer! (Laughs) Yes I bought one; I also have a toaster that I use sometimes, and no dishwasher!*
- *Would you like to have one?*
- *(Laugh) This is a luxury… Yes (Laughs) of course [I would like to have one!]*
- *And other appliances?*
- *Yes, of course [I have] a washing machine, as we said before. But except these ones, no other [appliance], well a dishwasher…"* (Arthur)

All respondents to the survey own many electrical appliances (Table 3.4). On average, Belgian households have nearly 5 domestic appliances (washing machine, dryer, freezer, ovens, and dishwasher) and nearly 4 for information and communication (TVs, DVDs, computers, playstations – called below 'TIC appliances'). Other appliances are devoted to tempera-ture regulation (fans, electric heaters, and for a few respondents, air conditioning).

Table 3.4 indicates that according to various socioeconomic characteristics, these means vary significantly. The range of variation is narrower for the housework appliances (which varies from 3.7 in Brussels or in apartments, to 5.7 for households of the 4$^{th}$ income quartile and 5.9 for households composed of 5 persons or more) than for information and communication appliances.
Indeed, the oldest respondents have the least number of such appliances (2.1) whereas nearly 5 appliances or more than that are found in the largest households (5 persons or more) or the most affluent ones. These households are also the ones having most TVs: the mean number of TVs is displayed in Table 3.6 below and it never exceeds 1.6 per household.

62% of the householders have at least one appliance labelled A or B (Table 3.4). The proportion is even higher in Flanders (66%), for higher income households (around 69%), houses (around 64%), adults with children (72%), female respondents (65%) especially when they are living with a spouse (73%) and the younger householders (around 68%).

**Table 3.3 Light and lighting practices according to socio-economic characteristics**

| Socio-economic characteristics | % in total sample | Switching off the light when leaving a room for 5 minutes | | Has CFLs ("saving lamps") (%) |
|---|---|---|---|---|
| | | Always (%) | Never (%) | |
| Total Sample | 100.0 | 23.1 | 42.5 | 64.2 |
| Region | | | | |
| Flanders | 57.0 | 21.6 | 45.6 | 64.7 |
| Wallonia | 32.3 | 25.5 | 37.7 | 65.2 |
| Brussels | 10.8 | 24.3 | 39.8 | 58.4 |
| Sig $X^2$ | | 0.130 | | 0.434 |
| Age of respondent | | | | |
| 18 - 29 years | 8,3 | 26.9 | 30.8 | 70.5 |
| 30 - 49 years | 44.3 | 20.8 | 40.8 | 60.6 |
| 50 - 69 years | 34.9 | 26.6 | 43.2 | 68.6 |
| 70 - 89 years | 12.6 | 21.4 | 53.8 | 60.3 |
| Sig $X^2$ | | 0.018 | | 0.065 |
| Gender of respondent | | | | |
| Male | 41.3 | 26.9 | 34.8 | 65.1 |
| Female | 58.7 | 20.6 | 47.8 | 63.8 |
| Sig $X^2$ | | 0.001 | | 0.668 |
| Type of dwelling | | | | |
| Detached house (4 F) | 32.6 | 23.1 | 37.1 | 70.9 |
| Semi-detached (3 F) | 20.3 | 21.9 | 44.8 | 61.2 |
| Semi-detached (2 F) | 24.0 | 22.8 | 47.4 | 66.1 |
| Apartment | 23.2 | 24.9 | 43.9 | 54.6 |
| Sig $X^2$ | | 0.390 | | 0.001 |
| Household size | | | | |
| 1 person | 20.5 | 19.6 | 46.9 | 58.6 |
| 2 persons | 34.7 | 25.8 | 42.1 | 65.9 |
| 3 persons | 18.2 | 25.3 | 42.5 | 66.3 |
| 4 persons | 16.6 | 27.7 | 34.0 | 68.2 |
| 5 persons + | 10.1 | 10.6 | 47.9 | 58.5 |
| Sig $X^2$ | | 0.002 | | 0.225 |
| Household composition | | | | |
| 1 adult without children | 19.9 | 18.7 | 50.3 | 61.1 |
| 1 adult with children | 6.1 | 22.4 | 39.7 | 62.1 |
| 2 adults without children | 29.7 | 28.0 | 42.2 | 64.3 |
| 2 adults with children | 44.3 | 22.1 | 39.7 | 66.0 |
| Sig $X^2$ | | 0.023 | | 0.681 |
| Household type + gender of respondent | | | | |
| Male, living alone | 7.2 | 25.0 | 35.3 | 55.9 |
| Female, living alone | 18.9 | 18.0 | 52.8 | 63.3 |
| Male, in couple | 34.0 | 27.4 | 34.9 | 67.3 |
| Female, in couple | 39.9 | 21.8 | 45.4 | 64.0 |
| Sig $X^2$ | | 0.018 | | 0.328 |
| Total household net income per month | | | | |
| $<$1510 € | 24.9 | 23.9 | 49.6 | 65.1 |
| 1510 € = $<$ 2260 € | 25.1 | 24.6 | 41.7 | 65.4 |
| 2260 € = $<$ 3380 € | 24.9 | 22.7 | 42.4 | 65.7 |
| $>$ 3380 € | 25.1 | 21.4 | 36.6 | 60.8 |
| Sig $X^2$ | | 0.031 | | 0.649 |

Source: SEREC Survey (2004), N = 962.

**Table 3.4 Electrical appliances according to socio-economic characteristics**

| Socio-economic characteristics | % in total sample | Mean number of large appliances | | Energy consumption of the appliance as factor of choice | Having at least one appliance with label A or B |
|---|---|---|---|---|---|
| | | housework | TIC | | |
| Total Sample | 100.0 | 4.95 | 3.85 | 84.1 | 62.2 |
| Region | | | | | |
| Flanders | 57.0 | 5.14 | 3.90 | 82.6 | 65.8 |
| Wallonia | 32.3 | 5.04 | 3.89 | 86.6 | 57.8 |
| Brussels | 10.8 | 3.68 | 3.49 | 83.9 | 56.3 |
| Sig ($X^2$ or F) | | 0.000 (F) | 0.155 (F) | 0.306 ($X^2$) | 0.030 ($X^2$) |
| Age of respondent | | | | | |
| 18 - 29 years | 8,3 | 4.08 | 3.94 | 87.7 | 67.9 |
| 30 - 49 years | 44.3 | 5.24 | 4.67 | 86.0 | 69.1 |
| 50 - 69 years | 34.9 | 5.08 | 3.44 | 84.8 | 61.0 |
| 70 - 89 years | 12.6 | 4.18 | 2.10 | 71.8 | 37.2 |
| Sig ($X^2$ or F) | | 0.000 (F) | 0.000 (F) | 0.003 ($X^2$) | 0.000 ($X^2$) |
| Gender of respondent | | | | | |
| Male | 41.3 | 5.11 | 4.00 | 83.1 | 58.6 |
| Female | 58.7 | 4.84 | 3.75 | 84.7 | 64.7 |
| Sig ($X^2$ or F) | | 0.010 (F) | 0.061 (F) | 0.494 ($X^2$) | 0.022 ($X^2$) |
| Type of dwelling | | | | | |
| Detached house (4 F) | 32.6 | 5.61 | 4.34 | 85.3 | 65.4 |
| Semi-detached (3 F) | 20.3 | 5.35 | 4.03 | 85.6 | 60.3 |
| Semi-detached (2 F) | 24.0 | 4.90 | 4.09 | 83.2 | 68.6 |
| Apartment | 23.2 | 3.73 | 2.78 | 81.3 | 51.1 |
| Sig ($X^2$ or F) | | 0.000 (F) | 0.000 (F) | 0.560 ($X^2$) | 0.005 ($X^2$) |
| Household size | | | | | |
| 1 person | 20.5 | 3.74 | 2.34 | 79.2 | 46.4 |
| 2 persons | 34.7 | 4.95 | 3.32 | 84.0 | 60.2 |
| 3 persons | 18.2 | 5.39 | 4.65 | 85.9 | 74.3 |
| 4 persons | 16.6 | 5.39 | 5.06 | 89.0 | 73.6 |
| 5 persons + | 10.1 | 5.91 | 5.35 | 82.3 | 60.2 |
| Sig ($X^2$ or F) | | 0.000 (F) | 0.000 (F) | 0.153 ($X^2$) | 0.000 ($X^2$) |
| Household composition | | | | | |
| 1 adult without children | 19.9 | 3.77 | 2.30 | 80.2 | 46.0 |
| 1 adult with children | 6.1 | 4.92 | 4.45 | 86.0 | 55.9 |
| 2 adults without children | 29.7 | 4.92 | 3.23 | 84.5 | 60.7 |
| 2 adults with children | 44.3 | 5.51 | 4.90 | 85.3 | 71.6 |
| Sig ($X^2$ or F) | | 0.000 (F) | 0.000 (F) | 0.448 ($X^2$) | 0.000 ($X^2$) |
| Household type + gender of respondent | | | | | |
| Male, living alone | 7.2 | 4.00 | 3.07 | 81.0 | 52.2 |
| Female, living alone | 18.9 | 4.05 | 2.71 | 81.9 | 47.0 |
| Male, in couple | 34.0 | 5.34 | 4.21 | 84.0 | 60.1 |
| Female, in couple | 39.9 | 5.21 | 4.24 | 86.1 | 73.1 |
| Sig ($X^2$ or F) | | 0.000 (F) | 0.000 (F) | 0.537 ($X^2$) | 0.000 ($X^2$) |
| Total household net income per month | | | | | |
| < 1510 € | 24.9 | 4.05 | 2.55 | 79.9 | 48.7 |
| 1510 € = < 2260 € | 25.1 | 4.79 | 3.63 | 86.7 | 60.4 |
| 2260 € = < 3380 € | 24.9 | 5.24 | 4.28 | 88.8 | 70.8 |
| > 3380 € | 25.1 | 5.72 | 4.94 | 80.9 | 68.5 |
| Sig ($X^2$ or F) | | 0.000 (F) | 0.000 (F) | 0.021 ($X^2$) | 0.000 ($X^2$) |

Source: SEREC Survey (2004), N = 962.

We now have a closer look at washing machines, dryers and dishwashers. Only 5% of the respondents do not have a washing machine (Table 3.5). In the following categories, the proportion having a washing machine is smaller than in the total, and the proportion varies between 80% and

90%: people living in Brussels (85%), in apartments (83%), alone (83%), especially males (81%), the youngest (87%) or the oldest (88%) and people with the lowest incomes (88%).
The same pattern with the same categories holds true when it comes to owning a dryer or a dishwasher, though the proportions of households having these appliances are much lower than for the washing machine: 65% of the surveyed households have a dryer and 58% have a dishwasher. In the above-mentioned categories, only about 40% own a dryer and around 30% a dishwasher. Detailed figures are displayed in Table 3.5.

To study the frequency of usage of these appliances, we have computed an index that estimates the frequency of use per week and per person always living in the household (so the figures presented in Table 3.5 are valid only for the corresponding sub-sample of households having the appliance under study). By doing so, we follow the indirect advice given by an interviewee: *"When I am alone, [to fill] one dishwasher can well last 4 days, almost 5. Because, because I don't need to do it. (…) I fill it up and when it is full, I make it work. Therefore, it happens that it works once during weekdays and then it works twice on the weekend, if I have a lot of people around during the weekend."* (Francine)

The great majority (79%) that has one washing machine declares that it is used at least once a week per person living in the household (Table 3.5) while 50% among those having a dryer use it once a week or more per person of the household. And among ten households with a dishwasher, seven use the dishwasher once a week (or more) per person of the household. The use per person is significantly higher for the three appliances for people living in Flanders (statistically significant for the washing machine only), or in a household composed of three persons or again, with a respondent who is aged 50-69 years, or who is a male. Men living alone have the most intensive usage of the washing machine and of the dryer (provided that they have these appliances) and male respondents living in couple, with children or not, report to use the dishwasher the most frequently. A previous small-scale survey realised in Belgium on these issues has shown that partners of the same couple have different declarations on these issues according to their gender and the gender connotation of the appliance – the dishwasher being the least female-connoted appliance among these three appliances (Bartiaux, 2003).

#### *3.2.3.3 Standby consumption*

> *"You see, it seems to me that when one switches the computer off rather often the same day, it's bad for the computer too. Therefore it is necessary to choose between the health of the computer and the energy consumption. The television on the contrary, I never leave it on if I am not at home, that's for sure."* (Alexandre)
>
> *"[We should] probably [try to] pay more attention, even more attention to the computers and the audiovisual equipments. Well, we try to be aware of [the fact that] when we switch them on, we really need to switch them on."* (José)
>
> *"Yes, I switch it off always, well, there I just have [forgotten]… But usually, it is always off."* (Maria)

Another practice strongly correlated with the consumption of electricity is the standby mode for some electrical appliances such as television, video recorder, computer, etc
.

**Table 3.5 Washing machine, dryer and dishwasher according to socio-economic variables**

| Socio-economic characteristics | % in total sample | Washing machine | | Dryer | | Dishwasher | |
|---|---|---|---|---|---|---|---|
| | | At least one | Use at least one time a week per person (estimation) | At least one | Use at least one time a week per person (estimation) | At least one | Use at least one time a week per person (estimation) |
| Total Sample | 100.0 | 94.9 | 79.4 | 64.8 | 49.6 | 57.5 | 71.6 |
| Region | | | | | | | |
| Flanders | 57.0 | 96.9 | 82.1 | 69.5 | 49.9 | 57.5 | 74.2 |
| Wallonia | 32.3 | 94.8 | 76.7 | 63.9 | 45.7 | 60.0 | 66.1 |
| Brussels | 10.8 | 84.6 | 72.4 | 42.3 | 50.0 | 50.5 | 64.7 |
| Sig $X^2$ | | 0.000 | 0.007 | 0.000 | 0.353 | 0.580 | 0.091 |
| Age of respondent | | | | | | | |
| 18 - 29 years | 8,3 | 87.3 | 87.0 | 41.8 | 57.1 | 34.2 | 92.6 |
| 30 - 49 years | 44.3 | 96.7 | 75.2 | 72.9 | 40.0 | 69.8 | 63.3 |
| 50 - 69 years | 34.9 | 97.0 | 87.2 | 68.6 | 58.7 | 54.8 | 81.6 |
| 70 - 89 years | 12.6 | 88.4 | 67.3 | 43.0 | 48.1 | 37.5 | 64.4 |
| Sig $X^2$ | | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Gender of respondent | | | | | | | |
| Male | 41.3 | 95.2 | 78.8 | 67.4 | 55.1 | 61.7 | 77.2 |
| Female | 58.7 | 94.7 | 79.8 | 62.9 | 44.0 | 54.5 | 65.7 |
| Sig $X^2$ | | 0.089 | 0.060 | 0.352 | 0.022 | 0.086 | 0.005 |
| Type of dwelling | | | | | | | |
| Detached house (4 F) | 32.6 | 99.4 | 79.6 | 70.1 | 47.9 | 71.2 | 74.4 |
| Semi-detached (3 F) | 20.3 | 99.5 | 77.6 | 78.4 | 44.4 | 64.4 | 69.0 |
| Semi-detached (2 F) | 24.0 | 95.6 | 79.8 | 66.8 | 47.7 | 56.3 | 66.7 |
| Apartment | 23.2 | 83.3 | 80.2 | 43.0 | 56.4 | 34.7 | 67.6 |
| Sig $X^2$ | | 0.000 | 0.858 | 0.000 | 0.463 | 0.000 | 0.384 |
| Household size | | | | | | | |
| 1 person | 20.5 | 82.7 | 83.5 | 39.1 | 62.5 | 30.5 | 57.6 |
| 2 persons | 34.7 | 96.7 | 88.4 | 61.7 | 54.0 | 52.3 | 86.8 |
| 3 persons | 18.2 | 98.9 | 98.3 | 74.1 | 73.1 | 69.1 | 90.8 |
| 4 persons | 16.6 | 99.4 | 47.5 | 81.1 | 21.1 | 72.3 | 38.8 |
| 5 persons + | 10.1 | 99.0 | 61.9 | 84.7 | 24.7 | 84.7 | 61.4 |
| Sig $X^2$ | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Household composition | | | | | | | |
| 1 adult without children | 19.9 | 82.2 | 81.6 | 38.2 | 57.1 | 29.3 | 54.7 |
| 1 adult with children | 6.1 | 98.3 | 93.0 | 71.2 | 48.8 | 61.0 | 78.4 |
| 2 adults without children | 29.7 | 96.5 | 87.5 | 60.7 | 55.0 | 49.8 | 87.2 |
| 2 adults with children | 44.3 | 99.1 | 71.6 | 78.6 | 43.6 | 74.9 | 65.0 |
| Sig $X^2$ | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Household type + gender of respondent | | | | | | | |
| Male, living alone | 7.2 | 81.2 | 87.0 | 42.0 | 65.5 | 42.0 | 70.4 |
| Female, living alone | 18.9 | 87.8 | 84.0 | 47.5 | 50.0 | 34.8 | 61.5 |
| Male, in couple | 34.0 | 98.2 | 77.2 | 72.7 | 54.1 | 65.6 | 77.9 |
| Female, in couple | 39.9 | 97.9 | 78.2 | 70.2 | 42.0 | 64.0 | 66.8 |
| Sig $X^2$ | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total household net income per month | | | | | | | |
| < 1510 € | 24.9 | 87.9 | 80.1 | 49.8 | 53.3 | 31.0 | 67.6 |
| 1510 € = < 2260 € | 25.1 | 93.8 | 84.0 | 61.6 | 7.4 | 52.3 | 74.0 |
| 2260 € = < 3380 € | 24.9 | 98.7 | 81.0 | 71.2 | 52.4 | 60.4 | 70.1 |
| > 3380 € | 25.1 | 99.2 | 73.1 | 76.8 | 43.0 | 86.3 | 69.7 |
| Sig $X^2$ | | 0.000 | 0.001 | 0.000 | 0.028 | 0.000 | 0.312 |

Source: SEREC Survey (2004), N = 962.

The results of pre-tests questionnaire revealed that everyone, even young people accustomed to computers, do not always know the concept of "standby mode". But that does not mean that these people do not use the "standby mode" function. This is why we asked the respondents having a television if they turn it off only from the remote control "always, often, sometimes or never" (Moreau and Wibrin, 2005).

Only 1% of the respondents do not have a television. Among all the others, 29% never leave it in standby mode and 37% always do so (Table 3.6). There are no statistically significant differences between male and female respondents, nor between household types, but there is one between types of dwellings and another one between age groups. If we add up the answers "always" and "often", respondents who are less than 30 years old are the ones who put their television in standby mode most regularly (67%). Concerning the other age groups, in average 53% declare to often or always do it and only 29% never leave their TV on standby mode. It seems also that the smaller the dwelling, the more frequent the TV is on standby mode (42% of the people in apartment always do so, whereas 31% of the people living in detached houses do). Differences between households according to the region of residence or to income are close to be statistically significant, the TV being more often in standby mode in Flanders and in the most affluent households.

## *3.3 Energy-related practices and knowledge*

### *3.3.1 Knowledge on standby consumption, climate change and renewable energies*

> *"Moreover… moreover, it seems to me that the electricity produced by … by other energies, namely nuclear ones and so forth, thus… it seems to me that I have seen a few [TV] programmes where they were explaining that if each inhabitant … limited his/her consumption, it would be possible… it would be possible to reduce the nuclear pollution and the like … in a rather considerable manner."* (Alexandre)

As a sociological study revealed (Boardman and Palmer, 2003), a majority of people are not concerned with climate change nor environmental issues, and for these authors, a general awareness at the level of $CO_2$ emissions is insufficient in Europe. Climate change is an increasing topic in daily citizens' conversation but it is not perceived as a most important of all environmental problems (Kasemir *et al.*, 2000). People's knowledge on climate change is often confused with other problems like ozone depletion or pollution, as we will also note it in chapter 8.

In the SEREC questionnaire, several questions were asked to evaluate the level of knowledge in the Belgian public on three issues that are related to residential energy consumption: standby consumption[25], climate change[26] and renewable energies[27]. .

[25] The question was: "According to you, does a television that is turned off from the remote control consume electricity? (Yes, no, doesn't know)".

[26] The score of knowledge on global warming is so constructed: the people who answer that the climate would be hotter in 20 years have three points. Moreover, every time the respondent correctly answers about the possible causes of the global warming, he gets one point. The presented causes are the auto-mobile traffic, the pollution of underground water, domestic heating, nuclear power plants, to throw dangerous products in the dump, the smoke rejected by the factories, the deforestation of Amazonia.

[27] The questions were the following: "Have you heard of renewable energies?" (3 points), "Have you heard of solar energy?" (1 point), "Do you know the solar photovoltaic?"(1 point), "Do you know the solar thermic?"(1 point), "Have you heard of wind mills?"(2 points), "Have you heard of the biomass?"(2 points). Each question had to be answered with either yes or no and the weighted sum of 'yes' gives the final score.

**Table 3.6 Standby mode use according to socio-economic characteristics**

| Socio-economic characteristics | % in total sample | Mean Number of TVs | TV in standby mode (%) | | |
|---|---|---|---|---|---|
| | | | Always | Often | Never[28] |
| Total Sample | 100.0 | 1.42 | 36.7 | 17.3 | 29.0 |
| Region | | | | | |
| Flanders | 57.0 | 1.43 | 40.5 | 17.5 | 26.1 |
| Wallonia | 32.3 | 1.47 | 31.6 | 15.6 | 33.6 |
| Brussels | 10.8 | 1.21 | 31.0 | 21.0 | 31.0 |
| Sig ($X^2$ or F) | | 0.006 (F) | | 0.068 ($X^2$) | |
| Age of respondent | | | | | |
| 18 - 29 years | 8.3 | 1.28 | 37.3 | 29.3 | 20.0 |
| 30 - 49 years | 44.3 | 1.52 | 40.1 | 15.6 | 27.9 |
| 50 - 69 years | 34.9 | 1.40 | 36.0 | 12.4 | 31.7 |
| 70 - 89 years | 12.6 | 1.23 | 28.1 | 28.9 | 28.1 |
| Sig ($X^2$ or F) | | 0.000 (F) | | 0.000 ($X^2$) | |
| Gender of respondent | | | | | |
| Male | 41.3 | 1.40 | 33.9 | 17.6 | 30.2 |
| Female | 58.7 | 1.43 | 38.8 | 17.2 | 27.9 |
| Sig ($X^2$ or F) | | 0.471 (F) | | 0.447 ($X^2$) | |
| Type of dwelling | | | | | |
| Detached house (4 F) | 32.6 | 1.55 | 30.6 | 15.2 | 37.1 |
| Semi-detached (3 F) | 20.3 | 1.42 | 34.4 | 21.4 | 25.0 |
| Semi-detached (2 F) | 24.0 | 1.55 | 40.9 | 16.4 | 28.0 |
| Apartment | 23.2 | 1.11 | 42.1 | 18.7 | 22.0 |
| Sig ($X^2$ or F) | | 0.000 (F) | | 0.008 ($X^2$) | |
| Household size | | | | | |
| 1 person | 20.5 | 1.05 | 36.6 | 16.2 | 33.0 |
| 2 persons | 34.7 | 1.38 | 30.2 | 19.3 | 31.4 |
| 3 persons | 18.2 | 1.61 | 44.8 | 10.5 | 23.8 |
| 4 persons | 16.6 | 1.64 | 40.8 | 17.2 | 29.3 |
| 5 persons + | 10.1 | 1.62 | 38.5 | 24.0 | 20.8 |
| Sig ($X^2$ or F) | | 0.000 (F) | | 0.010 ($X^2$) | |
| Household composition | | | | | |
| 1 adult without children | 19.9 | 1.09 | 36.0 | 19.4 | 31.7 |
| 1 adult with children | 6.1 | 1.48 | 39.7 | 12.1 | 27.6 |
| 2 adults without children | 29.7 | 1.37 | 29.7 | 18.7 | 32.2 |
| 2 adults with children | 44.3 | 1.60 | 41.3 | 16.4 | 25.7 |
| Sig ($X^2$ or F) | | 0.000 (F) | | 0.098 ($X^2$) | |
| Household type + gender of respondent | | | | | |
| Male, living alone | 7.2 | 1.21 | 43.9 | 15.2 | 25.8 |
| Female, living alone | 18.9 | 1.17 | 34.3 | 18.5 | 32.6 |
| Male, in couple | 34.0 | 1.44 | 31.9 | 18.1 | 31.3 |
| Female, in couple | 39.9 | 1.56 | 40.8 | 16.8 | 25.7 |
| Sig ($X^2$ or F) | | 0.000 (F) | | 0.356 ($X^2$) | |
| Total household net income per month | | | | | |
| < 1510 € | 24.9 | 1.17 | 34.2 | 20.5 | 30.8 |
| 1510 € = < 2260 € | 25.1 | 1.39 | 36.1 | 12.6 | 34.5 |
| 2260 € = < 3380 € | 24.9 | 1.51 | 35.0 | 16.5 | 28.3 |
| > 3380 € | 25.1 | 1.62 | 41.5 | 19.5 | 22.5 |
| Sig ($X^2$ or F) | | 0.000 (F) | | 0.070 ($X^2$) | |

Source: SEREC Survey (2004), N = 962.

As shown by Table 3.7, knowledge is rather good on the first two issues and it is weaker about renewable energies. The lack of information, namely on the share of nuclear energy used in

[28] The corresponding figures for the category "sometimes" are the complementary of the sum of the three other categories (always, often, never).

electricity production in Belgium, is echoed in the preceding quote, which includes several hesitations that are unusual in the answers given by Alexandre, a teacher.

81% know (or claim to know) that a television in standby mode consumes electricity. The same level of knowledge is not obtained on renewable energies (5.8/10) in the SEREC survey, with easier questions though.[29] The mean score on knowledge about global warming and its causes is 7/10; 17% has a score equal to or smaller than 5/10, 11% has 6/10, one third has a score of 7/10, one fifth has 8/10 and the remaining 18% has 9 or 10/10. In 1998, the same score was on average 4.9/10 (Bartiaux, 2004). It can be hypothesised that the 2003 heat wave and the numerous interventions in the media have increased the Bel-gian public's awareness. Charter (2000, 2002) showed that only 10% of the French people interviewed could describe spontaneously the role of $CO_2$ emission in the phenomenon.

Whereas the general level of environmental knowledge is high or fairly high, there are large variations between some socio-economic groups, these groups being defined according to household income, composition, age group and gender of the respondent. The higher the income is, the better the knowledge is on the three issues reviewed. Knowledge on environmental issues usually increases with household size and is (much) higher for men than for women. The age group often reveals significant differences: the youngest are the least informed on climate change issue and causes and the best informed on renewable energies. On standby consumption, young people have the same level of knowledge as in their parents' generations and they are less knowledgeable than them on climate change! Significant differences between regions are not observable for these three issues.

### *3.3.2 Knowledge and practices*

Is people's knowledge on environmental issues an important motivation to change daily energy-related practices? There are regional differences in Europe regarding climate change perceptions and attitudes toward energy reduction as a solution in the future (Kasemir *et al.*, 2000). In Switzerland and Sweden, people are generally more positive about the idea of conserving environment by reducing everyday energy consumption. Scientific knowledge and communication to everyday people seem to be increasingly important. In the UK, the Climate Impacts Programme has been set up to help bridge the gap between intended and actual behaviour by providing information and education (Sheppard, 2005). In this section, we try to see whether a better environmental knowledge is associated with environmentally-friendlier practices. Results are displayed by Table 3.8.

#### *3.3.2.1 Standby consumption*

Among the thousand of surveyed households, one third has a high number of large appliances (11 to 15 among the proposed list, which did not include small appliances such as radios, juicers, etc.) and these households have the highest knowledge on standby consumption (88%). The lowest level (60%) is obtained for the small minority of households (6%) having 5 large appliances or less. Other households have an intermediate knowledge (79%).[30] Respondents who never turn off the television set only from the remote control are more numerous (85%) to know that a TV in standby consumes energy than their counterparts who always do so (76%). Here, a better knowledge is associated to an energy-sound practice.

[29] See note 28.

[30] F significant at $p = 0.000$, but there is no significant difference when the number of appliances is divided by the number of persons living in the corresponding household.

**Table 3.7 Knowledge on standby consumption, climate change and renewable energies according to socio-economic characteristics**

| Socio-economic characteristics | % in total sample | Knowledge | | |
|---|---|---|---|---|
| | | Standby consumption (%) | Climate Change (mean score /10) | Renewable energies (mean score /10) |
| Total Sample | 100.0 | 80.8 | 7.00 | 5.77 |
| Region | | | | |
| Flanders | 57.0 | 80.4 | 6.96 | 5.76 |
| Wallonia | 32.3 | 81.2 | 7.02 | 5.62 |
| Brussels | 10.8 | 82.5 | 7.11 | 6.23 |
| Sig. ($X^2$ or F) | | 0.584 ($X^2$) | 0.665 (F) | 0.117 (F) |
| Age of respondent | | | | |
| 18 - 29 years | 8,3 | 81.0 | 6.77 | 6.45 |
| 30 - 49 years | 44.3 | 84.6 | 7.15 | 5.89 |
| 50 - 69 years | 34.9 | 80.4 | 6.88 | 5.83 |
| 70 - 89 years | 12.6 | 68.6 | 6.92 | 4.78 |
| Sig. ($X^2$ or F) | | 0.001 ($X^2$) | 0.087 (F) | 0.000 (F) |
| Gender of respondent | | | | |
| Male | 41.3 | 88.1 | 7.29 | 6.86 |
| Female | 58.7 | 75.7 | 6.80 | 5.00 |
| Sig. ($X^2$ or F) | | 0.000 ($X^2$) | 0.000 (F) | 0.000 (F) |
| Type of dwelling | | | | |
| Detached house (4 F) | 32.6 | 85.5 | 7.12 | 6.48 |
| Semi-detached (3 F) | 20.3 | 79.3 | 6.79 | 5.35 |
| Semi-detached (2 F) | 24.0 | 79.0 | 7.04 | 5.25 |
| Apartment | 23.2 | 77.4 | 6.96 | 5.69 |
| Sig. ($X^2$ or F) | | 0.327 ($X^2$) | 0.204 (F) | 0.000 (F) |
| Household size | | | | |
| 1 person | 20.5 | 72.4 | 6.84 | 5.24 |
| 2 persons | 34.7 | 83.7 | 6.88 | 5.94 |
| 3 persons | 18.2 | 76.6 | 7.09 | 5.98 |
| 4 persons | 16.6 | 88.0 | 7.43 | 6.05 |
| 5 persons + | 10.1 | 84.5 | 6.78 | 5.77 |
| Sig. ($X^2$ or F) | | 0.001 ($X^2$) | 0.003 (F) | 0.005 (F) |
| Household composition | | | | |
| 1 adult without children | 19.9 | 70.0 | 6.89 | 5.16 |
| 1 adult with children | 6.1 | 84.5 | 6.88 | 5.70 |
| 2 adults without children | 29.7 | 84.5 | 6.90 | 5.87 |
| 2 adults with children | 44.3 | 83.0 | 7.11 | 5.99 |
| Sig. ($X^2$ or F) | | 0.000 ($X^2$) | 0.260 (F) | F = 0.003 (F) |
| Household type + gender of respondent | | | | |
| Male, living alone | 7.2 | 77.9 | 7.41 | 6.77 |
| Female, living alone | 18.9 | 71.3 | 6.69 | 4.72 |
| Male, in couple | 34.0 | 90.4 | 7.25 | 6.89 |
| Female, in couple | 39.9 | 77.8 | 6.85 | 5.13 |
| Sig. ($X^2$ or F) | | 0.000 ($X^2$) | 0.000 (F) | 0.000 (F) |
| Total household net income per month | | | | |
| < 1510 € | 24.9 | 67.4 | 6.59 | 4.64 |
| 1510 € = < 2260 € | 25.1 | 81.7 | 6.87 | 5.60 |
| 2260 € = < 3380 € | 24.9 | 84.5 | 7.05 | 6.05 |
| > 3380 € | 25.1 | 89.6 | 7.46 | 6.77 |
| Sig. ($X^2$ or F) | | 0.000 ($X^2$) | 0.000 (F) | 0.000 (F) |

Source: SEREC Survey (2004), N = 962.

### *3.3.2.2 Climate change*

Among the energy-related practices described earlier, few are significantly associated with the score for climate change knowledge, which means that practices are led by routines and social pressures for comfort, cleanliness and convenience (Shove, 2003) that are strong enough to counterbalance a high level of awareness on climate change. This interpretation gains support when it comes to bathing and showering, as either a better knowledge is associated with more showers or no difference in knowledge is associated with a higher (or lower) number of baths per week and per household nor per person for showers. A slight effect, though not significant, exists for the number of baths per person – those having less than two baths per week being more knowledgeable than the others. Bathing and showering thus appear to be unrelated to environmental awareness and this result shows that an energy policy whose goal would be a reduction of sanitary hot water consumption could fail if it were presented as based on environmental protection.

When it comes to heating-related practices (Table 3.8), the respondents have a significantly better knowledge of climate change if they report that they lower the temperature during the night or during absences of several hours in the wintertime. There is no significant relationship, though, between the level of awareness about climate change and the estimated temperature in the living room during a winter day; nor is there one with the practice of turning off the heat while airing in the wintertime.

Concerning appliances (number and use), there are few significant differences according to knowledge on climate change, except for the total number of large appliances in the household, the frequency of use of the washing machine and of the dishwasher: the more appliances and the lower usage per person, the better knowledge. Awareness is thus not always enough to change daily routines (usage of dryer, lighting practices) and current definition of comfort and convenience (CFLs lamps, labelled appliances). This apparent mental compartmentalisation is further discussed elsewhere (Bartiaux, 2005) and it is consistent with results found in other studies. In Sweden for example, 60% of the people consider themselves as having a good knowledge on energy saving, but the real energy-saving behaviour is not in concordance with this result. Røpke discusses (2004) this global knowledge amongst the public and according to her opinion, most of the people are preoccupied with managing their everyday life and do not realise that they live in any kind of luxury.

### *3.3.2.3 Renewable energies*

The pattern here is more confused than for climate change knowledge, as most tested relations between an energy-related practice and the score of knowledge on renewable energies are either non-significant or nonlinear: the conclusion is that a better knowledge on renewable energies is not associated with a practice that saves more energy. There are just a few exceptions to this result, exceptions that appear to be anecdotic: respondents are significantly more knowledgeable on renewable energies if they lower the temperature during absences of several hours in the winter time (but not during the night or while airing), if a lower energy consumption is a criterion when buying an appliance, if they often or always switch off the light when leaving a room, if they own more appliances, if they use the washing machine less frequently, when taking household size into account whereas... the reverse is observed for the dryer.

In the Swedish population, such a discrepancy between knowledge on renewable energies and energy-saving behaviours is also observed (Viklund, 2004). Swedes generally tend to be environmentally friendly and they are highly and openly concerned with perceived nuclear energy danger and $CO_2$ emission causing global warming. With participating referendums, they strongly support wind and solar power as alternative energy sources but their energy-saving behaviours are not in concordance with their knowledge.

**Table 3.8 Knowledge on standby consumption, climate change and renewable energies according to energy-related practices**

| Energy-related Practices | % in total sample | Knowledge | | |
|---|---|---|---|---|
| | | Standby consumption (%) | Climate Change (mean score /10) | Renewable energies (mean score /10) |
| Total Sample | 100.0 | 80.8 | 7.00 | 5.77 |
| Estimated temperature (living room, winter day) | | | | |
| < = 19° | 14.9 | 83.6 | 7.16 | 5.77 |
| 20° | 26.7 | 82.5 | 7.01 | 6.26 |
| > = 21° | 58.4 | 79.7 | 6.97 | 5.54 |
| Sig. (X² or F) | | 0.710 (X²) | 0.523 (F) | 0.001 (F) |
| ↓ temperature (absence of several hours, winter) | | | | |
| Yes | 82.6 | 82.3 | 7.06 | 5.86 |
| No | 17.4 | 74.1 | 6.67 | 5.37 |
| Sig. (X² or F) | | 0.053 (X²) | 0.008 (F) | 0.027 (F) |
| ↓ temperature during the night (winter) | | | | |
| Yes | 89.7 | 82.1 | 7.04 | 5.82 |
| No | 10.3 | 68.0 | 6.46 | 5.32 |
| Sig. (X² or F) | | 0.002 (X²) | 0.002 (F) | 0.075 (F) |
| ↓ temperature while airing | | | | |
| Yes | 59.9 | 81.0 | 6.90 | 5.90 |
| No | 40.1 | 80.4 | 7.10 | 5.60 |
| Sig. (X² or F) | | 0.058 (X²) | 0.078 (F) | 0.083 (F) |
| Number of baths per week and per household | | | | |
| < = 4 | 68.3 | 81.2 | 7.06 | 5.75 |
| > 4 | 31.7 | 80.9 | 6.88 | 5.80 |
| Sig. (X² or F) | | 0.195 (X²) | 0.134 (F) | 0.794 (F) |
| Number of showers per week and per household | | | | |
| < = 4 | 33.4 | 74.8 | 6.82 | 5.39 |
| > 4 | 66.6 | 84.0 | 7.10 | 5.95 |
| Sig. (X² or F) | | 0.003 (X²) | 0.020 (F) | F = 0.001 (F) |
| Switching off the light when leaving a room for 5 minutes | | | | |
| Always | 23.2 | 84.5 | 7.13 | 6.14 |
| Often | 13.4 | 85.8 | 7.11 | 6.27 |
| Sometimes | 20.9 | 84.4 | 7.12 | 5.89 |
| Never | 42.4 | 75.6 | 6.82 | 5.34 |
| Sig. (X² or F) | | 0.021 (X²) | 0.064 (F) | 0.000 (F) |
| Has CFLs (“saving lamps”) | | | | |
| Yes | 64.2 | 83.1 | 7.00 | 5.86 |
| No | 35.8 | 77.2 | 7.00 | 5.66 |
| Sig. (X² or F) | | 0.023 (X²) | 0.963 (F) | 0.255 (F) |
| Appliances: number | | | | |
| 1 – 5 | 6.0 | 59.6 | 6.83 | 5.11 |
| 6 – 10 | 57.1 | 79.2 | 6.87 | 5.54 |
| 11 – 15 | 30.6 | 88.1 | 7.08 | 6.22 |
| > 15 | 6.4 | 78.7 | 7.78 | 6.19 |
| Sig. (X² or F) | | 0.000 (X²) | 0.001 (F) | 0.000 (F) |

Source: SEREC Survey (2004), N = 962.

**Table 3.8 (continued) Knowledge on standby consumption, climate change and renewable energies according to energy-related practices**

| Energy-related Practices | % in total sample | Knowledge | | |
|---|---|---|---|---|
| | | Standby consumption (%) | Climate Change (mean score /10) | Renewable energies (mean score /10) |
| Has at least one appliance with label A or B | | | | |
| Yes | 74.3 | 83.8 | 7.06 | 6.12 |
| No | 25.7 | 78.5 | 6.86 | 4.94 |
| Sig. ($X^2$ or F) | | 0.221 ($X^2$) | 0.135 (F) | 0.000 (F) |
| Appliances: use | | | | |
| Use of the washing machine/week*person | 94.1 | | | |
| less than 1 time | 20.5 | 75.0 | 7.35 | 6.03 |
| at least 1 time | 79.5 | 83.0 | 6.91 | 5.72 |
| Sig. ($X^2$ or F) | | 0.038 ($X^2$) | 0.002 (F) | 0.143 (F) |
| Use of the dryer/week*person | 64.9 | | | |
| less than 1 time | 51.4 | 81.9 | 7.10 | 5.69 |
| at least 1 time | 48.6 | 87.1 | 6.91 | 6.01 |
| Sig. ($X^2$ or F) | | 0.196 ($X^2$) | 0.177 (F) | 0.118 (F) |
| Use of the dishwasher/week*person | 57.3 | | | |
| less than 1 time | 29.5 | 80.9 | 7.44 | 5.91 |
| at least 1 time | 70.5 | 87.9 | 7.09 | 6.29 |
| Sig. ($X^2$ or F) | | 0.012 ($X^2$) | 0.025 (F) | 0.103(F) |
| TV in standby mode | | | | |
| Always | 36.7 | 76.4 | 7.12 | 5.73 |
| Often | 17.3 | 83.5 | 7.10 | 5.97 |
| Sometimes | 17.1 | 81.3 | 6.82 | 5.50 |
| Never | 28.9 | 84.7 | 6.91 | 5.79 |
| Sig. ($X^2$ or F) | | 0.099 ($X^2$) | 0.186 (F) | 0.422 (F) |

Source: SEREC Survey (2004), N = 962.

## *3.4 Energy-related practices and social representations*

### *3.4.1 Social representations*

- *H: "I think that we must respect the environment. But… As we must respect everything in general. But… But we shouldn't…"*
- *I: "Yes, and you?"*
- *F: "Well, it's true that there are things to do and others not to do when it comes to the environment. But I think that one can ring alarm bells as much as he/she wants, only those who want to hear it will hear it."* (Eric (H) and Catherine (F))

Our environmental knowledge is organised in representations, as Abric (1976, 1987) explains in his theory about social representation and social practices. All social representations are composed by two principles: the core and the peripheral elements, which are working in a parallel way. The central core has a stable structure whose function is the resistance against modification and change and this central core forms the attitudes and the stereotypes in our life. Peripheral elements are organised around the core and they are containing interpretations and selected information. Information coming from the individual's environment has an influence mostly on the peripheral part of the social representations. That is why changing someone's behaviours and everyday routines take a long time and could face a lot of resistance.

### *3.4.2 Social representations on environmental issues*

#### *3.4.2.1 Motivations to save energy*

> *"The appropriate energy, it exists, doesn't it! Yes… I am a little bit concerned… But okay… I wouldn't join Greenpeace either or… I try to pay attention; I don't throw my garbage on the street"* (Charlot)

At the end of the SEREC survey, several potential motivations to save energy were presented to the respondents who were invited to choose the principal motivation they have or could have to save energy. The results show a large variety in the motivation chosen as the main one (Table 3.10):

- 8.7% say "by education"
- 14.7% "for economic reasons"
- 17.7% "by a sense of collective responsibility"
- 28.8% "to protect the environment"
- 24.8 "to avoid wasting"
- 4.7% "by interest for the new technologies"
- 0.6% answer that "they do not have any motivation to save energy".

**Table 3.9 Principal motivation to save energy according to energy-related practices**

| Energy-related Practices | % in total sample | Principal motivation to save energy: By education | For economical reasons | Collective responsibility | Environment protection | To avoid wasting | By interest for new technologies | No motivation |
|---|---|---|---|---|---|---|---|---|
| Total Sample | 100.0 | 8.7 | 14.7 | 17.7 | 28.8 | 24.8 | 4.7 | 0.6 |
| Estimated temperature (living room, winter day) | | | | | | | | |
| < = 19° | 14.9 | 7.7 | 16.9 | 21.1 | 38.0 | 12.7 | 2.1 | 1.4 |
| 20° | 26.7 | 11.5 | 11.5 | 27.0 | 25.4 | 21.8 | 2.8 | 0.0 |
| > = 21° | 58.4 | 8.0 | 15.6 | 12.5 | 28.2 | 28.7 | 6.4 | 0.5 |
| Sig. ($X^2$) | | | | 0.000 (3 cells < 5: 14.3%) | | | | |
| ↓ temperature (absence of several hours, winter) | | | | | | | | |
| Yes | 82.6 | 8.2 | 14.4 | 19.7 | 28.8 | 23.9 | 4.3 | 0.8 |
| No | 17.4 | 11.1 | 13.6 | 11.1 | 27.2 | 29.6 | 7.4 | 0.0 |
| Sig. ($X^2$) | | | | 0.048 (2 cells < 5: 14.3%) | | | | |
| ↓ temperature during the night (winter) | | | | | | | | |
| Yes | 89.7 | 8.2 | 14.2 | 18.9 | 28.6 | 25.3 | 4.2 | 0.7 |
| No | 10.3 | 10.4 | 14.6 | 11.5 | 32.3 | 20.8 | 10.4 | 0.0 |
| Sig. ($X^2$) | | | | 0.063 (2 cells < 5: 14.3%) | | | | |
| ↓ temperature while airing | | | | | | | | |
| Yes | 59.9 | 7.9 | 17.1 | 18.7 | 28.2 | 23.9 | 3.9 | 0.4 |
| No | 40.1 | 8.9 | 11.1 | 17.0 | 30.5 | 25.9 | 5.9 | 0.8 |
| Sig. ($X^2$) | | | | 0.146 (2 cells < 5: 14.3%) | | | | |
| Number of baths per week and per household | | | | | | | | |
| < = 4 | 68.3 | 9.1 | 15.6 | 17.7 | 28.7 | 23.5 | 4.5 | 0.9 |
| > 4 | 31.7 | 8.0 | 13.0 | 18.3 | 29.6 | 25.9 | 5.3 | 0.0 |
| Sig. ($X^2$) | | | | 0.550 (2 cells < 5: 14.3%) | | | | |
| Number of showers per week and per household | | | | | | | | |
| < = 4 | 33.4 | 12.5 | 14.7 | 12.8 | 31.9 | 24.6 | 2.9 | 0.6 |
| > 4 | 66.6 | 7.1 | 14.8 | 20.3 | 27.6 | 24.1 | 5.7 | 0.5 |
| Sig. ($X^2$) | | | | 0.005 (2 cells < 5: 14.3%) | | | | |

Source: SEREC Survey (2004), N = 962.

**Table 3.9 (continued) Principal motivation to save energy according to energy-related practices**

| Energy-related Practices | % in total sample | Principal motivation to save energy | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | By education | For economical reasons | Collective responsibility | Environment protection | To avoid wasting | By interest for new technologies | No motivation |
| Total Sample | 100.0 | 8.7 | 14.7 | 17.7 | 28.8 | 24.8 | 4.7 | 0.6 |
| Switching off the light when leaving a room for 5 minutes | | | | | | | | |
| Always | 23.2 | 9.6 | 16.0 | 17.8 | 28.8 | 20.5 | 6.4 | 0.9 |
| Often | 13.4 | 14.1 | 16.4 | 21.9 | 28.1 | 17.2 | 2.3 | 0.0 |
| Sometimes | 20.9 | 4.5 | 12.1 | 22.7 | 30.8 | 21.7 | 6.6 | 1.5 |
| Never | 42.4 | 8.5 | 14.5 | 14.7 | 28.7 | 30.2 | 3.5 | 0.0 |
| Sig. ($X^2$) | | | | 0.003 (4 cells < 5: 14.3%) | | | | |
| Has CFLs ("saving lamps") | | | | | | | | |
| Yes | 64.2 | 9.0 | 13.5 | 17.8 | 31.1 | 23.6 | 4.5 | 0.7 |
| No | 35.8 | 8.0 | 15.7 | 18.3 | 25.1 | 26.9 | 5.6 | 0.3 |
| Sig. ($X^2$ or F) | | | | 0.452 (2 cells < 5: 14.3%) | | | | |
| Appliances: number | | | | | | | | |
| 1 – 5 | 6.0 | 8.9 | 17.9 | 14.3 | 23.2 | 30.4 | 3.6 | 1.8 |
| 6 – 10 | 57.1 | 9.1 | 15.1 | 17.9 | 29.5 | 21.9 | 6.4 | 0.2 |
| 11 – 15 | 30.6 | 6.8 | 12.6 | 18.8 | 27.6 | 30.7 | 2.7 | 0.7 |
| > 15 | 6.4 | 14.8 | 18.0 | 14.8 | 32.8 | 16.4 | 1.6 | 1.6 |
| Sig. ($X^2$) | | | | 0.069 (7 cell < 5: 25.0%) | | | | |
| Has at least one appliance with label A or B | | | | | | | | |
| Yes | 74.3 | 7.2 | 14.1 | 18.5 | 29.4 | 25.4 | 4.9 | 0.5 |
| No | 25.7 | 10.8 | 16.3 | 14.3 | 31.0 | 25.1 | 2.0 | 0.5 |
| Sig. ($X^2$) | | | | 0.265 (2 cells < 5: 14.3%) | | | | |
| Appliances: usage | | | | | | | | |
| Use of the washing machine/week*person | 94.1 | | | | | | | |
| less than 1 time | 20.5 | 7.1 | 14.7 | 15.8 | 30.4 | 25.5 | 6.0 | 0.5 |
| at least 1 time | 79.5 | 8.9 | 14.6 | 18.1 | 28.3 | 24.9 | 4.6 | 0.6 |
| Sig. ($X^2$) | | | | 0.931(2 cells < 5: 14.3%) | | | | |
| Use of the dryer/week*person | 64.9 | | | | | | | |
| less than 1 time | 51.4 | 8.1 | 15.9 | 16.5 | 30.8 | 24.3 | 4.4 | 0.0 |
| at least 1 time | 48.6 | 7.9 | 13.9 | 19.5 | 25.8 | 16.8 | 4.6 | 1.3 |
| Sig. ($X^2$) | | | | 0.299 (2 cells < 5: 14.3%) | | | | |
| Use of the dishwasher/week*person | 57.3 | | | | | | | |
| less than 1 time | 29.5 | 6.8 | 11.2 | 22.4 | 26.1 | 28.6 | 5.0 | 0.0 |
| at least 1 time | 70.5 | 7.5 | 16.5 | 16.8 | 29.1 | 26.0 | 3.4 | 0.8 |
| Sig. ($X^2$) | | | | 0.337 (2 cells < 5: 14.3%) | | | | |
| TV in standby mode | | | | | | | | |
| Always | 36.7 | 7.8 | 15.9 | 16.5 | 26.9 | 27.5 | 5.5 | 0.0 |
| Often | 17.3 | 9.1 | 8.5 | 13.9 | 32.7 | 29.1 | 6.1 | 0.6 |
| Sometimes | 17.1 | 8.1 | 19.4 | 22.5 | 21.9 | 25.0 | 1.3 | 1.9 |
| Never | 28.9 | 10.3 | 14.7 | 17.3 | 33.8 | 18.8 | 4.8 | 0.4 |
| Sig. ($X^2$) | | | | 0.005 (4 cells < 5: 14.3%) | | | | |

Source: SEREC Survey (2004), N = 962.

As will be further developed in chapter 8, it would be an error to promote energy savings by associating them only with economic savings as only one person out of seven primarily makes this relationship. Furthermore, this principal motivation varies quite a lot with many socio-economic characteristics (region, income level, dwelling type, household composition, gender and age group) as will be described below.

### *3.4.2.2 Representations on actors and solutions for saving energy*

We further asked questions on the type of actions and of actors that would reduce energy consumption – these questions were inspired by the different 'cities' of Boltanski and Thévenot (1991). For our respondents (Table 3.10), the "principal solution to reduce energy consumption" would be:

- 22.1% "the creation of new technological projects"
- 49.8% "campaigns of information and sensitisation towards the households"
- 19.8% "improving the systems of industrial production"
- 8.3% "increasing energy price".

Whereas half of the surveyed persons call for more information, we will show below that up-to-date and customised information do not bring about many changes in the practices that are related to energy consumption (chapters 7 and 8). On the other hand, two respondents out of four rely on industries or on new technological progress to reduce energy consumption, which does not denote a strong agency feeling (Bartiaux, 2004). Similarly, when it comes to defining the actors who "should mainly undertake actions for reducing energy consumption":

- 48.3% say "each family"
- 3.9% say "local groups"
- 27.2% say "public authorities" and
- 20.6% point to "the manufacturers".

These results are consistent with the French study mentioned above; the majority in France suggests an important change in everyday lifestyle and practices.

The opinions of our survey respondents concerning actors are interesting to know in the theoretical framework of social influence. As explained indeed by the literature on human behaviours, every individual tends to conform himself to social influences in order to gain the approval of the others. However, persons of high social status influence persons with a lower social status more (Moscovici, 1976). Experimental observation demonstrates that not only low-status individuals conform themselves to the influence of high-status individuals but also that incompetent individuals do so as well when faced with the influence of perceived competent individuals. The reasons for this tendency to change are related to two sub-categories of dependence, as Jones and Gerard (1967) proposed. Firstly, the *effect-dependency* category means that a person relies on another one for the direct satisfaction of a need while the other person is, in turn, in a position of providing gratifying answers to these needs. The second category of dependence is the *information dependency*: one person relies on another one to get information about the environment, its meaning and the possibilities of acting on it. According to Barr *et al*. (2005), important factors in this issue could be the normative influences on behaviour that are related to social pressures from family and friends, and to self-presentation, especially the extent to which individuals behave in ways that they believe significant in such a way that others will be impressed.

### *3.4.2.3 Representations on risk, actors and solutions for saving energy*

At the end of the SEREC survey, the respondents had to agree or disagree with the following statements, in the following order:

- "Being concerned about environmental matters is urgent, otherwise one heads toward catastrophe": 60% fully agree, 33% rather agree. This approbation would probably be less widely shared if this question were asked at the beginning of this survey on energy-related practices, in a survey on another topic or after having given the respondent the opportunity to express his/her concerns for the environment in a softer way.

- "Being concerned about environmental matters is a fashion phenomenon": 25% rather disagree, 52% fully disagree. These figures show an effort to be consistent for two successive questions as in total, nearly three persons out of four agree with the first catastrophe statement and disagree with the fashion one[31].
- "Being concerned about environmental matters is something that one should begin to take into account": 78% fully agree, 21% rather agree.

However, the strong homogeneity for this last statement is lost[32] when the respondents are grouped according to their opinion on the "level where actions to reduce energy consumption should be carried out" (Table 3.10).

**Table 3.10 Representations on risk, actors and solutions for saving energy**

| Representations on the environment | % in total sample | Being concerned about environmental matters is ...[33] | | |
|---|---|---|---|---|
| | | ... urgent, otherwise one heads toward catastrophe | ... is a fashionable phenomenon | ... is something one should begin to take into account |
| Total Sample | 100.0 | 1.54 | 4.08 | 1.23 |
| Principal motivation to save energy | | | | |
| By education | 8.7 | 1.38 | 4.20 | 1.16 |
| For economic reasons | 14.7 | 1.69 | 3.92 | 1.27 |
| By a collective responsibility sense | 17.7 | 1.45 | 4.17 | 1.20 |
| To protect the environment | 28.8 | 1.40 | 4.24 | 1.18 |
| To avoid wasting | 24.8 | 1.78 | 3.87 | 1.32 |
| By interest for new technologies | 4.7 | 1.24 | 4.11 | 1.10 |
| No motivation to save energy | (0.6) | (1.73) | (4.18) | (1.82) |
| Sig. (F) | | .000 | .012 | .000 |
| Principal solution to save energy | | | | |
| New technological progress | 22.1 | 1.55 | 4.23 | 1.28 |
| Campaigns of information and sensitisation of households | 49.8 | 1.52 | 4.10 | 1.20 |
| By improving the systems of industrial production | 19.8 | 1.57 | 3.95 | 1.25 |
| By increasing the prices of energies | 8.3 | 1.47 | 3.86 | 1.21 |
| Sig. (F) | | 0.778 | 0.044 | 0.178 |
| Who should mainly undertake actions for reducing energy consumption? | | | | |
| Each family | 48.3 | 1.53 | 4.22 | 1.20 |
| Local groups | 3.9 | 1.45 | 3.77 | 1.16 |
| Public authorities | 27.2 | 1.52 | 4.01 | 1.24 |
| Manufacturers | 20.6 | 1.62 | 3.89 | 1.31 |
| Sig. (F) | | 0.480 | 0.003 | 0.025 |

Source: SEREC Survey (2004), N = 962.

The ones answering "local groups" are the most agreeing (their mean score is 1.16) while the respondents who answer "the manufacturers" are the least (1.31), fully supporting that "to worry for the environment is something that one has to begin to take into account". The first statement ("Being concerned about environmental matters is urgent otherwise one heads toward catastrophe") shows a similar pattern, but the differences between groups are not strong enough to be statistically significant.

[31] Pearson's R=-0.216, sig=.000.

[32] at a very high statistical significance level, F: 0.025.

[33] in Table 3.10, the figures indicated are the average of the answers of the respondents of this category, the possible answers being: 1 for 'I totally agree', 2 for 'rather agree', 3 for 'neither yes nor no', 4 for 'rather disagree', 5 for 'I totally disagree'.

These results show that a collective concern for the environment seems to be widely shared in Belgium, with a lesser intensity though when the respondents think that the solution should come from another group than theirs.

### *3.4.3 Social representations on the environment, practices and socio-economic characteristics*

In his self-discrepancy theory, Higgins points out that our self-awareness also appears to motivate our behaviours by calling attention to the differences between who we are, how others see us, and who we would like to be (Higgins, 1987, Biel, 2004). These discrepancies can lead to such strong emotions as depression, frustration, anxiety, and guilt. Moreover, different cultures tend to reward the development of different types of selves. In developed countries where individualistic cultures emphasise personal rights, freedom and self-expression, a rationality conflict can arise between individual welfare and concern for environmental issues.

Respondents having – or not – environmentally-friendlier practices often choose different answers to these questions on environmental motivations and perceptions. To shed light on whether and how energy-related practices, environmental perceptions and socio-economic characteristics are associated, we performed an analysis of multiple correspondences (the graph is in appendix). The results may be summarised in the following manner. The horizontal axis reveals the inclusion in our consumerist society as it matches quite well with the household income distribution and with the number of large appliances owned by the household. The vertical axis may be interpreted as a continuum between reflexive and altruist practices and attitudes that are related to energy consumption – in the lower part of the graph – and non-reflexive and egocentric attitudes and energy-related practices – in its upper part. Four groups of consumers seem to be defined as follows.

In the lower and left quadrant, people of modest condition are represented: their household income is the lowest (for) they live alone, more often in Brussels, they are usually renters and less than 30 years old, their dwelling has no double-glass windows and its temperature is estimated to be below 19° on a winter day; they preferably associate the word “future” to the word of environment and they think that local groups are the actors who should undertake actions to reduce energy consumption.

In the upper and left quadrant, the day temperature is the highest (above 21°) although the boiler is the oldest (20 years or more), people are young elderly (50–69 years) who do not care lowering the temperature when they are absent or while airing, they have the most intensive use of the washing machine per household member although their principal motivation to save energy is or would be “for economic reasons”, “to avoid wasting” or “by education”. They have an anthropocentric vision of the environment as they associate it with “neighbourhood” and “health”. They trust the manufactures and the industrial system to act on reducing energy consumption and they call for information campaigns. They have little or no knowledge on renewable energies.

The third group is located near the centre of the graph in the lower and right quadrant and this group often has the opposite characteristics: respondents are 30–49 years old, they have reflexive energy-saving practices, the day temperature is at about 20°, they use the washing machine less, the boiler is more often a new one, these respondents trust families to act on energy savings (this probably denotes a higher sense of agency), they are less rare to think that a rise of the prices of energy would be the main solution for reducing energy consumption, they have a systemic and political view of the environment (they associate it with “ecosystem” and “politics”). Further to the centre in this right and low quadrant, one can see the motivation to save energy “by a sense of collective responsibility” and the highest score on renewable energies.

Finally, the upper and right quadrant is grouping the households with the highest income, living in couple, with or without children, owning their dwelling, which has many large appliances and a

medium-age boiler (5 to 19 years). They rather live either in Flanders or in Wallonia and the only perception in this quadrant is that the motivation of these respondents to save energy is or would be to protect the environment.

## *3.5 Conclusion*

At the end of this chapter discussing energy-related practices, social knowledge and representation, it can be concluded that a good environmental knowledge is not often associated with a strong environmental involvement: most of the time, the people's knowledge is not consistent with environmentally friendly practices. Therefore, awareness of and knowledge about environmental issues are not sufficient to bring about energetically-sound practices. This point will be further demonstrated in the second part of this report.

Other factors than awareness do interplay and we have shown in this chapter that energy-related practices and representations have complex and multi-dimensional meanings. They are namely defined by the presence or absence of reflexive practices that appear to be related to a sense of agency and a confidence in voluntary measures in the field of eco-policies. Furthermore, energy-related practices and representations are also socially constructed by a consumerist society whose access is stratified by household income. As emphasised by Anker-Nilssen (2003), the existing discrepancy between attitudes (awareness of environmental problems and of energy-related issues) and real energy spending behaviours appear in our results to be likelier for the respondents belonging to the age group of 50-69 years with a medium income.

To answer the question of why people do not save energy, we need to view people as active, knowledgeable social agents and we should pay attention to the culturally specific meanings of energy-related practices that root them in comfort, convenience and cleanliness. The results show people as social agents who operate within a cultural and a socio-technical framework and whose practices and choices are shaped by existing networks and infrastructures. Strategies for changing behaviour must take into account these social, institutional and cultural factors (Shove at al. 2003). The following chapter of this report intends to show how these social, institutional and cultural factors influence electricity consumption in Belgium and in Denmark.

# 4. RESIDENTIAL ELECTRICITY CONSUMPTION: LEVELS AND SOCIO-POLITICAL FACTORS IN DENMARK AND BELGIUM

This chapter[34] compares residential electricity consumption (excluding heating) in Denmark and Belgium with a double focus: the practices at the household level and their social and cultural determinants. To establish the determinants of electricity consumption at the household level, the relevance and importance of four groups of variables are assessed for both countries: household characteristics (composition, income and age of members), building characteristics (building type, area), electric appliance use and presence/absence of environmental concern. The purpose of this comparison is to understand which social, cultural and technical factors influence the level of household electricity consumption, and thus discuss to what extent energy policy in the two countries actually tries to influence these factors.

## *4.1 Electricity consumption in a cross-cultural perspective*

Previous studies on social and cultural aspects of energy consumption have typically focused on differences within a country, predominantly showing how higher social classes in a society use more electricity than the lower classes (Kuehn, 1998; Pedersen and Broegaard, 1997). Others have extended the explanation of social classes to include studies of how technology and consumption practices in everyday life influence the level of energy consumption (Aune, 1997; Gram-Hanssen, 2004 and 2002). Furthermore there have been studies about how developments in technology and consumption in general construct normality and, through this, strongly influence the level of energy consumption (Shove, 2003). In this chapter, we follow a slightly different line, as our interest is to compare two different countries to see in what ways differences in culture, social organisations or in energy policy between the countries influence energy consumption. The idea of comparing different cultures with respect to energy use has been successfully carried out in a study comparing Norway and Japan (Wilhite *et al.*, 1996); however, the cultural differences between Norway and Japan are presumably much greater than between Denmark and Belgium. Therefore, one of our main questions in this chapter is to find out if energy consumption follows the same patterns in both countries and if it is associated with the same factors.

### *4.1.1 Comparing energy policy in Denmark and in Belgium*

The objectives of Belgium's overall energy policy have not changed since the early 1970s[35] and priorities for a national energy policy are the following[36]: 1. To maintain the prices of energy at a competitive level by promoting efficient energy production and consumption with the least negative effect on the environment; 2. To let the whole population benefit from lower prices[37]; 3. To guarantee security of supply. In 1999, for the total primary energy supply, oil accounted for 41%, natural gas for 23%, nuclear power for 22%, coal for 13% and renewables for 1%[38.] "Because of this choice [of nuclear ener-gy], the country has constrained itself to a growing consumption and to a waste of energy, in order to reach an optimal return of the investments[39]." A progressive phasing-out of nuclear power was decided in 1999 and implemented by law (31/1/2003). Regions are responsible for energy-saving policies, but not much has been done in this matter with respect to

[34] This chapter is a revised version of an earlier work, published as Bartiaux and Gram-Hanssen (2005); in this chapter however, all figures concerning Belgium have been recalculated on a weighed sub-sample of respondents to the SEREC survey who gave their yearly electricity consumption (which meant for them to retrieve their last annual bill): this sub-sample has been weighed with the same 3 criteria in order to be as representative as possible. More details on this weighing procedure are to be found in the data section in the introduction of this chapter.

[35] http://www.iea.org/textbase/nppdf/free/2000/belgium2001.pdf read on 8-3-2005.

[36] http://www.plan.be/fr/bench/6_1.stm read on 8-3-2005.

[37] "The energy price for the industry sector is relatively low in Belgium (...). The households however pay a relatively high consumption price for electricity and have to pay high taxes on electricity", read on 8-3-2005 on http://www.plan.be/fr/bench/6_1.stm

[38] http://www.iea.org/textbase/nppdf/free/2000/belgium2001.pdf read on 8-3-2005.

[39] Knapen, 1997, p. 1.

households. Measures vary according to the region and there is no coor-dinating office in this respect. At the federal level, a tax on electricity consumption aims at financing the phasing-out of nuclear power, the federal policy of greenhouse-gases reduction as well as other services, which are also financed by another tax on natural-gas consumption[40].
The Danish energy policy has also been quite stable since the early 1970s, with a focus on economy, security of supply and environment, though the balance between these three objectives has changed over the years towards more focus on the environment in the 1990s[41]. Energy efficiency in the households sector has been a part of this policy throughout the years and includes energy taxes, subsidies for insulation of houses and regular campaigns on energy saving (standby consumption, A-labels etc.). Since 1996, the organisation of these activities has been initiated partly by The Danish Electricity Savings Trust (www.elsparefonden.dk), with an annual budget of 12 million euros, and partly by the Public Service Obligations (PSO) of the (private) grid companies, which are obliged by law to promote energy savings with a budget of approximately 25 million euros a year, both financed by a tax on consumed electricity.

### *4.1.2 Data and methods of this study*

In September 2004, as part of the SEREC project, we performed our own survey, hereafter called the SEREC Survey. It consisted of a phone survey comprising three random samples, one for each Belgian region (Brussels area, Flanders and Wallonia), as Belgian regional authorities govern a lot of aspects of energy policy. The total sample obtained was weighed to adequately represent distributions by region, income quartile and dwelling type. The weights for this procedure were calculated from the nationally representative sample survey of household budgets and consumption made in 2001. Furthermore, as this chapter focuses on electricity consumption, it relies on the sub-sample of respondents who gave their yearly electricity consumption (which meant for them to retrieve their last annual bill): this sub-sample has been weighed with the same 3 criteria in order to be as representative as possible. Regarding the Danish part of the data, Denmark has quite reliable registers of both persons and buildings; researchers are allowed to combine these registers with consumption data provided by the utilities. In this way, a database with approximately 50 000 households from the second largest city in Denmark, Århus, has been established. For each household, it contains 1. socio-economic and demographic data from the Danish personal data net (the Danish CPR register containing information on income, education, age, nationality, etc., on every Danish citizen), 2. building data from the national building data net (the Danish BBR register containing information on the year all the buildings in Denmark were constructed, their sizes and types, etc.), combined with 3. data on water, electricity and district heating delivered to the household[42]. From these data, we removed housing with business activities, week-end cottages, electricity-heated houses and households with extreme electricity consumption (defined as less than 500 kWh or more than 16 000 kWh). This database is one of the primary inputs for the analysis of the Danish presentation in this paper. Another important input comes from a study of 500 semi-detached houses in Albertslund, a suburb of Copenhagen. This study is based on the analysis of a questionnaire containing many of the same questions as those used in the Belgian SEREC Survey and the Albertslund study is further described in Gram-Hanssen (2002, 2003, 2004).

### *4.1.3 Background Variables*

The purpose of this chapter is to compare residential electricity consumption in Denmark and Belgium. We thus need reliable and comparable data from both countries on energy consumption in households. Table 4.1 shows one example of available data for this purpose, which is from the European Odyssee project (http://www.odyssee-indicators.org/). As it can be seen here, the

[40] Law on the organisation of the electricity market (29/4/1999) and law on gas transportation (12/4/95).
[41] http://www.iea.org/textbase/nppdf/free/2000/denmark2002.pdf read on 8-3-2005
[42] The database and its results concerning electricity consumption are further described in (Gram-Hanssen, Kofod and Petersen 2004). The full detailed statistical analyses are described in a Danish report (Petersen and Gram-Hanssen 2005).

average electricity consumption in Belgian households is almost 30% higher than the Danish average and the Belgian level has increased over the last decade, whereas the Danish one has been stable[43].

**Table 4.1 Average electricity consumption per dwelling in Denmark and Belgium**

| Country | Unit | 1990 | 1995 | 2000 |
|---|---|---|---|---|
| Denmark | kWh/dw | 4071 | 4223 | 4055 |
| Belgium | kWh/dw | 4627 | 5400 | 5602 |

Sources: Odyssee (http://www.odyssee-indicators.org/ read on 8-3-05)

Before concluding from these data that Belgian households consume much more electricity than Danish ones, we need to compare some of the fundamental background variables in the two countries to see if average households electricity consumption is a relevant parameter to be compared. We know from other studies that electricity consumption is strongly dependent on the type and size of housing, as well as on household size (Gram-Hanssen, Kofod and Petersen 2004). Therefore, we compare these background variables for the two countries to see if differences in these factors are the main explanation for the differences in electricity consumption. In the following two sections, we first look at building characteristics and afterwards, at household size. These statistics are drawn either from national statistics or from specific surveys.

## *4.2 Building characteristics*

### *4.2.1 Dwelling type*

In Denmark, nearly one dwelling out of two is a detached house while the number is one out of three in Belgium (see Table 4.2). Furthermore, Belgium has more semi-detached houses (44%) than Denmark (13%), while the opposite is observed for apartments (39% in Denmark, 24% in Belgium).

From the Danish data, we know that detached houses, on average, consume much more electricity than apartments, and a little more than semi-detached houses. If the same holds true for the Belgian data, the differences in housing types between the two countries are probably not part of the explanation for the differences in electricity consumption. The reason being that the lower amount of detached houses in Belgium, compared with Denmark, is outweighed by a lower amount of apartments in Belgium as well.

**Table 4.2 Distribution of dwellings in Denmark and Belgium according to their type (%)**

| | Denmark | Belgium |
|---|---|---|
| Detached house | 46 | 32.3 |
| Semi-detached house (3 facades) | 13 | 19.9 |
| Semi-detached house (2 facades) | | 23.7 |
| Apartment | 39 | 24.1 |
| Other | 2 | (0.0) |
| Total | 100 | 100 |

Sources: Denmark: Statistics Denmark 2005. Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004) and Survey on Consumption (2001)[44]

Note: Figures in parenthesis refer to a number in the sample smaller than 30 in the SEREC Survey

[43] The levels of consumption in these tables are higher than what we present later in this paper. The explanation is that the electricity consumption includes electricity-heated households, and for the Belgian data, it includes the low-tension consumption of the professional sector (shops, etc.), whereas the Danish data distribute consumption from week-end cottages to permanent residences and furthermore include farms. These comments also illustrate how difficult international comparisons can prove to be, in this field.

[44] As the SEREC survey was weighed according to official data on dwelling type (see the introduction for more details), the figures in Table 4.2 are quite close to official data: in the 2001 Belgian census, 75.9% of the dwellings are single-family houses (http://statbel.fgov.be/census/results4_fr.asp?q=1a – read on 12/1/5)

### *4.2.2 Floor Area*

Table 4.3 shows the distribution of dwellings according to floor area in both countries. Although the categories are slightly different for both countries, Danish dwellings seem to be larger. The SEREC Survey data for Belgium overestimates the floor area quite a lot when compared with the National Census data, probably because the (fixed) phone numbers sample, which we used, underestimates households made of young people living alone (see below) in a small dwelling seen as temporary (a mobile phone is then preferred). In the SEREC Survey, the respondents estimated the floor area during the phone survey, but one respondent in five could not answer that question.

**Table 4.3 Distribution of dwellings in Denmark and Belgium per floor area (%)**

| | Denmark | Belgium: CENSUS (2001) | Belgium: SEREC Survey |
|---|---|---|---|
| < 35 $m^2$ | | 8.8 | |
| 35 $m^2$ to 54 $m^2$ | | 19.2 | |
| < 50 $m^2$ | | | (0.9) |
| < 60 $m^2$ | 13.1 | | |
| 55 $m^2$ to 84 $m^2$ | | 27.5 | |
| 85 $m^2$ to 104 $m^2$ | | 21.9 | |
| 50 $m^2$ to 99 $m^2$ | | | 19.3 |
| 60 $m^2$ to 99 $m^2$ | 37.5 | | |
| 100 $m^2$ to 149 $m^2$ | | | 21.7 |
| 105 $m^2$ to 124 $m^2$ | | 12.8 | |
| > 125 $m^2$ | | 9.8 | |
| 100 $m^2$ to 159 $m^2$ | 34.9 | | |
| 150 $m^2$ to 199 $m^2$ | | | 14.4 |
| 160 $m^2$ to 199 $m^2$ | 9.2 | | |
| 200 $m^2$ to 249 $m^2$ | | | 14.9 |
| > 249 $m^2$ | | | 11.2 |
| > 200 $m^2$ | 5.4 | | |
| Does not know | - | - | 17.6 |
| Total | 100 | | 100.0 |

Sources: Denmark: Statistics Denmark (2005). Belgium: CENSUS (Socio-economic Survey) (2001) and SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)
Note: Figures in parenthesis refer to a number in the sample smaller than 30 in the SEREC Survey.

A larger floor area may permit a larger number of appliances and light and from the Danish studies we know that electricity consumption increases with the size of the home. As our data indicate that Danish homes are bigger than Belgian homes, we would expect electricity consumption to be higher in Denmark than in Belgium.

### *4.2.3 Household variables*

In Denmark, the mean household size is 2.18 persons, whereas in Belgium it is 2.36. In both countries, these figures vary according to the dwelling type as shown in Table 4.4. However, the SEREC sub-sample with data on electricity consumption clearly underestimated the single-person households; only 18.5% of the surveyed households being single-person households, whereas in official statistics, 32.7% of all households are made up of single-person households[45]. As a consequence, the mean household size in the SEREC Survey is 2.60, as opposed to 2.36 in the official statistics. In both countries, the highest-income households more often live in detached houses and the least affluent ones in apartments[46]. By comparing household sizes in Denmark and

[45] http://www.statbel.fgov.be/figures/d24_fr.asp read on 30-12-2004. These national figures are *de jure* (official registration) figures, whereas our survey is a *de facto* survey.

[46] The average incomes (in DKK) according to the type of housing are the following: for an owner-occupied detached house, 566 562; for an owner-occupied apartment, 430 345; for a cooperative dwelling, 344 583; for a rented house, 335 780 and for a rented apartment, 275 237 DKK. (Source: Statistics Denmark 2005, consumption survey).

Belgium, we found that more people live together in Belgium than in Denmark and from this fact alone, one would expect electricity consumption to be lower in Denmark compared with Belgium.

**Table 4.4 Mean household size in Denmark and Belgium according to dwelling type**

| | Denmark | | Belgium | | |
|---|---|---|---|---|---|
| | Mean household size (Denmark) | Mean household size (Århus data) | Mean household size | Income quartile distribution | |
| | | | | % lowest quartile | % highest quartile |
| Detached house | 2.63 | 2.83 | 2.8 | (17.5) | 47.2 |
| Semi-detached house (3F) | 1.99 | 2.5 | 3.1 | (16.8) | (19.4) |
| Semi-detached house (2F) | | | 2.8 | (24.5) | 20.8 |
| Apartment | 1.71 | 1.7 | 1.7 | 41.3 | (12.5) |
| Total | 2.18 | | 2.6 | 25.0 | 25.1 |
| N | 5 222 584 | 53 804 | 573 | 573 | |

Sources: Denmark (Statistics Denmark 2005) and Århus data base (2000). Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004) and Survey on Consumption (2001). Note: Figures in parenthesis refer to a number in the sample smaller than 30

Altogether we found, when comparing Denmark and Belgium with simple background variables, that by these factors alone one would expect Danes on average to consume less electricity per household than Belgians, as there are fewer persons in the households and more Danes live in apartments, whereas a higher Danish electricity consumption is expected as Danes live in larger homes.

## *4.3 Results*

In the previous section, we have shown that Belgian households use more electricity than Danish ones, and we have presented differences in background variables. In the following section, we will use our data on Danish and Belgian households to explore and possibly explain the relation between these differences. In the first section, we show the average electricity consumption for the different types of dwellings and for different sizes of households, and here we also compare survey data with other sources of electricity consumption to discuss the validity of our data. The next section concentrates on showing the importance and the correlation of all the relevant background variables for electricity consumption in each country. Then follows a section on ownership and practices regarding appliances in the two countries. The question we try to answer is whether ownership or use of appliances might explain the higher level of electricity consumption in Belgium compared to Denmark. The last section is concentrating on whether environmental concern or knowledge about energy saving might be part of the explanation for differences in electricity consumption in the two countries.

### *4.3.1 Electricity consumption by dwelling type and household size*

In this section we compare electricity consumption in Belgium and Denmark for different types of dwellings and for different sizes of households. Furthermore, we also compare our data on electricity consumption with other data sources of electricity consumption in households in order to discuss the validity of our data. Average electricity consumption in both countries is quite different for the three types of housing; that is the reason why we chose to analyse each type of housing separately.
Table 4.5A reveals huge standard deviations, showing that there are big variations in electricity consumption within each type of dwelling. Furthermore, the average electricity consumption in our sample is quite comparable with national average numbers, though for apartments, the lower level in our sample is explained by a larger number of small apartments in Århus than the national mean. In Belgium, the mean electricity consumption is higher than in Denmark, for every dwelling type and in

general, as shown by Table 4.5B. This difference may be partially explained by the underestimation of single-person households in the SEREC Survey, as electricity consumption correlated well with the household size ($R^2$ = 0.24).

**Table 4.5 Mean electricity consumption per dwelling type**

**A. Denmark**

| Type of dwelling | Number of households | Mean Electricity Consumption (kWh/year) | Standard Dev. | Mean Electricity Consumption per person (kWh/year) | DK Mean Electricity Consumption (kWh/year) |
|---|---|---|---|---|---|
| Detached house | 8573 | 4189 | 2062 | 1477.7 | 4042 |
| Semi-detached | 4950 | 3114 | 1523 | 1227.1 | |
| Apartments | 40 281 | 1720 | 865 | 1038.6 | 1934 |

Sources: The Danish average electricity consumption is calculated on the basis of Dansk Energi (2003); all other figures are based on the Århus database (2000).

**B. Belgium**

| Type of dwelling | Number of Households | Mean Electricity Consumption (kWh/year) | Standard Deviation | Mean Electricity Consumption per Person[47] (kWh/year) |
|---|---|---|---|---|
| Detached houses | 185 | 4885.1 | 2612.7 | 1895 – 1941 |
| Semi-detached houses, 3F | 114 | 5004.2 | 2971.8 | 1724 – 1751 |
| Semi-detached houses, 2F | 136 | 4336.1 | 2391.3 | 1582 – 1610 |
| Apartments | 138 | 2946.8 | 2403.1 | 1840 – 1857 |
| Total | 573 | 4311.5 | 2706.7 | 1774 – 1804 |

Source: SEREC sub-sample of households having given their yearly electricity consumption (2004)

However, when comparing the two countries per dwelling type and per household size, as shown in Tables 4.6A and 4.6B, the electricity consumption is always higher in Belgium; this is especially true for apartments: one person in an apartment in Denmark consumes 1400 kWh per year on average while his Belgian counterpart uses 2200 kWh per year. There are more households living in apartments in Denmark (39%) than in Belgium (24%), with the same mean number of persons (1.7), as previously indicated by Tables 4.2 and 4.4.

**Table 4.6 Mean electricity consumption per household size**

**A. Denmark**

| Household size | Detached houses | | | Semi-detached houses | | | Apartments | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Estim. Elect. Cons. (kWh/ year) | Estim. Elect. Cons. (kWh/year/ pers) | N | Estim. Elect. Cons. (kWh/ year) | Estim. Elect. Cons. (kWh/year/ pers) | N | Estim. Elect. Cons. (kWh/ year) | Estim. Elect. Cons. (kWh/year/pe rs) |
| 1 person | 1114 | 2762 | 2762 | 1139 | 2112 | 2112 | 20566 | 1433 | 1433 |
| 2 persons | 3123 | 3536 | 1768 | 1518 | 2792 | 1396 | 12933 | 1892 | 946 |
| 3 persons | 1545 | 4310 | 1437 | 889 | 3472 | 1157 | 3293 | 2351 | 784 |
| 4 persons | 1725 | 5084 | 1271 | 850 | 4152 | 1038 | 1288 | 2810 | 703 |
| 5 persons | 619 | 5858 | 1172 | 248 | 4832 | 966 | 300 | 3269 | 654 |

Source: Estimations with simple regression models computed from the Århus database (2000)

[47] The two means of the range are obtained as follows: the first one is the average of the electricity consumption divided by the number of persons who are always part of that household plus the number of persons who are temporary members of that household, divided by 3; the second one is the average of the electricity consumption divided by the number of persons who are always part of that household.

**B. Belgium**

| Household size | Detached houses | | | Semi-detached houses | | | Apartments | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Mean Elect. Cons. (kWh/ year) | Estimated Elect. Cons. (kWh/year/ pers) | N | Mean Elect. Cons. (kWh/ year) | Estimated. Elect. Cons. (kWh/year/ pers) | N | Mean Elect. Cons. (kWh/ year) | Estimated Elect. Cons. (kWh/year/pers) |
| 1 person | (17) | (3474.0) | (3474.0) | (19) | (2962.3) | (2962.3) | 71 | 2235.9 | 2235.9 |
| 2 persons | 69 | 4258.9 | 2129.5 | 97 | 3473.4 | 1736.7 | 47 | 2895.6 | 1447.8 |
| 3 persons | 45 | 5497.5 | 1832.5 | 58 | 4442.5 | 1480.8 | (10) | (3480.6) | (1160.2) |
| 4 persons | 39 | 5379.2 | 1344.8 | 39 | 5275.4 | 1318.9 | (11) | (7093.4) | (1773.4) |
| 5 persons+ | (15) | (6245.7) | - | 38 | 8110.5 | - | - | - | - |
| Total | 185 | 4885.1 | - | 250 | 4641.3 | - | 138 | 2946.8 | - |

Source: SEREC sub-sample of households having given their yearly electricity consumption (2004)

To give another perspective, it has been calculated[48] in a Belgian region, Wallonia, that a "saving" household of one person consumes 1575 kWh annually, while the cor-responding figures are 2200 kWh, 2705 kWh or 3150 kWh respectively, if there are 2, 3 or 4 persons. These values are between the means estimated for Danish semi-detached houses and apartments.

### *4.3.2 Analysis of all background variables*

Results from multiple regression analyses for the three different types of housing are summarised in Tables 4.7, 4.8 and 4.9, where the 'explaining' variables are presented in descending order of their explanatory power, which is the reason why the variables appear in different order in the different tables. The variables are written in bold if their additional effect is significant. In all tables, each new line represents an additional explanation where the effect of the above variables is accounted for. This means, for example, that Table 4.7A shows the effect of a larger floor area when the effects from the number of persons and the income of the household are already taken into account.

For each type of housing in Denmark, the number of persons living in the household is the single most significant explanation for electricity consumption. The more people living in the household, the more electricity is consumed. However, as is generally known and as can be calculated from Tables 4.6A and 4.6B, it is more efficient to live with more people in a household, for the electricity consumption per person decreases with the number of people living in a household. The background variables with the second and third largest explanatory power in Denmark are the income of the family and the floor area – two variables that are strongly interrelated especially for detached and semi-detached houses. Together, the number of persons, income and floor area explain between 30 and 40% of the total variation in electricity consumption in the three different types of housing, which also means that 60-70% of the variation in electricity consumption in Denmark is unexplained by these variables.

[48] CwaPE, 2003.

**Table 4.7 Detached houses: multiple regression on electricity consumption**

**A. Denmark**

| Background Variables | Effect on Electricity Consumption (kWh/year) | Explanatory Power Change in $R^2$ (%) | Sig.B |
|---|---|---|---|
| **Per person in the household** | 541 | 27.6 | 0.000 |
| **Per 100,000 DKK in gross income** | 90 | 5.8 | 0.000 |
| **Per 10 sq. meter floor area** | 95 | 2.5 | 0.000 |
| **Per age square[49] of oldest person** | -0.35 | 1.3 | 0.000 |
| **Per 0-6 years old child** | -158 | 0.5 | 0.000 |
| **Per 13-19 years old child** | 179 | | |
| **Long education / no education** | -278 | 0.02 | 0.000 |

Based on analysis of the Århus database, n = 8573

**B. Belgium**

| Background Variables | Effect on Electricity Consumption (kWh/year) | Explanatory Power Change in $R^2$ (%) | Sig. B |
|---|---|---|---|
| **Per person in the household** | 628.5 | 7.6 | 0.000 |
| **Per superior quartile in net income** | 498.9 | 4.0 | 0.005 |
| Per 50 sq. meter floor area | 199.1 | 1.2 | 0.124 |
| Per age square of respondent | 0.232 | 1.1 | 0.135 |
| Per 10-19 years old child | 317.9 | 0.6 | 0.267 |
| Per 0-9 years old child | -201.7 | 0.2 | 0.574 |
| Per education degree | -48.4 | 0.0 | 0.826 |

SEREC sub-sample of households having given their yearly electricity consumption (2004), n = 183. Adjusted $R^2$ = 15%

For Belgium, the explanatory power of the models varies a lot: the adjusted $R^2$ equals 15% for the detached houses but it is much higher (31%) for the apartments and for the semi-detached houses (39%). Fewer variables are significantly correlated with the electricity consumption in Belgium: the net-income quartile and the household size are the only variables to always be significant.

**Table 4.8 Semi-detached houses: multiple regression on electricity consumption**

**A. Denmark**

| Background Variables | Effect on Electricity Consumption (kWh/year) | Explanatory Power Change in $R^2$ (%) | Sig.B |
|---|---|---|---|
| **Per person in the household** | 556 | 34.8 | 0.000 |
| **Per 10,000 DKK in gross income** | 100 | 4.1 | 0.000 |
| **Per 10 sq. meter floor area** | 99 | 2.1 | 0.000 |
| **Per age square of oldest person** | -0.3 | 0.6 | 0.000 |
| **Per. 0-6 years old child** | -211 | 1.0 | 0.000 |
| **Per 13-19 years old child** | 159 | | |
| **Long education/ no education** | -247 | 0.3 | 0.000 |
| **Not Danish or Western citizenship** | -797 | 0.3 | 0.000 |

Based on analysis of the Århus database, n = 4950

[49] In the multiple regression analysis, the actual age, and not only the age square, is used, in order to follow "the hierarchical principle"; the actual age however has no explanatory power.

**B. Belgium**

| Background Variables | Effect on Electricity Consumption (kWh/year) | Explanatory Power Change in $R^2$ (%) | Sig. B |
|---|---|---|---|
| **Per person in the household** | 1155.2 | 33.6 | 0.000 |
| **Per superior quartile in net income** | 466.8 | 2.8 | 0.001 |
| **Per age square of respondent** | 0.291 | 1.8S | 0.008 |
| Per education degree | 181.8 | 0.5 | 0.176 |
| Per 50 sq. meter floor area | 69.9 | 0.2 | 0.362 |
| Per 0-9 years old child | 202.4 | 0.2 | 0.388 |
| Per 10-19 years old child | 129.0 | 0.1 | 0.530 |

SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004), n = 247. Adjusted $R^2$ = 39%

**Table 4.9 Apartments: multiple regression on electricity consumption**

**A. Denmark**

| Background Variable | Effect on electricity Consumption (kWh/year) | Explanatory power Change in $R^2$ (%) | Sig.B |
|---|---|---|---|
| **Per person in the household** | 291 | 21.9 | 0.000 |
| **Per 100,000 DKK in gross income** | 20 | 1.3 | 0.000 |
| **Per 10 sq. meter floor area** | 119 | 7.2 | 0.000 |
| **Per age square of oldest person** | -0.1 | 1.3 | 0.000 |
| **Per. 0-6 years old child** | -76 | | |
| **Per 13-19 years old child** | 117 | 0.3 | 0.000 |
| **Long education /no education** | -63 | 0.1 | 0.000 |

Based on analysis of the Århus database, n = 40 281

**B. Belgium**

| Background Variables | Effect on Electricity Consumption (kWh/year) | Explanatory Power Change in $R^2$ (%) | Sig. B |
|---|---|---|---|
| **Per person in the household** | 1304.0 | 24.7 | 0.000 |
| **Per superior quartile in net income** | 470.2 | 2.7 | 0.026 |
| **Per 0-9 years old child** | 1060.3 | 2.5 | 0.032 |
| Per age square of respondent | 0.171 | 1.1 | 0.147 |
| Per 10-19 years old child | -382.1 | 0.2 | 0.563 |
| Per education degree | -40.4 | 0.0 | 0.807 |
| Per 50 sq. meter floor area | -27.9 | 0.0 | 0.779 |

SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004), n = 137. Adjusted $R^2$ = 31%

These results also show similarities between the two countries: the presence of one or more small children decreases the mean electricity consumption whatever the dwelling type in Denmark but only in detached houses in Belgium. The presence of teenagers has the effect of increasing electricity consumption in both countries except in Belgium for families living in apartments, where the presence of teenager(s) means a decrease (not significant though) of the mean electricity consumption.

### *4.3.3 Ownership and use of appliances*

To explain the higher level of electricity consumption in Belgium compared with Denmark's, we now turn to the practices that actually use electricity. The somewhat higher electricity consumption in Belgium may be partially explained by a higher number of appliances. In Table 4.10, it is seen that more households in Belgium have tumble dryers, washing machines and electric fans. Even more interesting than comparing the ownership of appliances would be to compare the use of these appliances, which we do below.

### *4.3.3.1 Data and Methods on ownership and use of appliances*

The Danish data used in this section came from a study in Albertslund, where 500 households answered a questionnaire on energy consumption, ownership and use of appliances. The households lived in semi-detached houses and came from the middle and lower middle-classes in Denmark and thus were not representative of the whole country. These statistics, therefore, also need to be compared with national statistics on ownership of appliances. In both countries the households studied are grouped into 3 classes of equal amplitude to make comparisons possible between the 'lower consumption group', the 'middle consumption group' and the 'higher consumption group'. Of course, the boundaries of the three groups vary in Denmark and in Belgium.

**Table 4.10 Ownership of electric appliances, % households**

| Appliances | Denmark | Albertslund survey (DK) | Belgium | Appliances | Denmark | Albertslund survey (DK) | Belgium |
|---|---|---|---|---|---|---|---|
| Tumble dryer | 48 | 43 | 63 | Video | 85 | | |
| Washing machine | 76 | 92 | 96 | DVD-player | 54 | | 87 |
| Dishwasher | 60 | 52 | 60 | PC | 81 | 78 | 71 |
| Electric stove | 88 | 100 | 61 | Electric fan | (Not common) | | 41 |
| Microwave oven | 66 | 62 | n.a. | Electric radiator | n.a. | | 29 |

Sources: Denmark (Statistics Denmark 2005) and Albertslund survey (2001). Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

In Belgium, the lower-level group was made up of 48% of apartments and 34% of semi-detached houses, the middle group had only 11% of apartments, the rest was distributed on detached and semi-detached houses (42% and 47% respectively) and a similar pattern characterised the higher consumption group: 13% of apartments, 37% of detached houses, and 50% of semi-detached houses (Figures not shown). The mean age of the respondents differs significantly between the 3 groups and it decreases from 54 years in the 'lower group', 50 years in the 'middle' group to 48 years in the 'higher group'. The mean household size follows an inverse pattern: 1.8 persons, 2.7 persons and 3.4 persons. As also indicated by the above results, net income is also associated with the inclusion in one of these 3 groups: the 'lower consumption group' counts 43% of households whose net income is situated in the first quartile, the 'middle consum-ption group' includes 34% of households belonging to the third quartile of net income, while 48% of the households in the higher consumption group have the highest net income (fourth quartile). At a regional level, the Brussels area is over-represented in the 'lower group' and so is Wallonia, to a much lower degree though, while proportionally more households in the Flemish region are in the higher consumption category.

### *4.3.3.2 Washing and drying practices*

Nearly all Belgian households in the SEREC study (96%) have a washing machine, which is generally used several times per week. The electricity consumption is significantly correlated with this usage frequency ($R^2$ = 4.5%). Nearly two thirds of the Belgian house-holds have a dryer and use it less frequently than the washing machine. The correlation between dryer use and electricity consumption is even higher ($R^2$ = 6.6%). In three households out of four, the dryer is used as often[50] as the washing machine; on the whole, 66.6% of the households surveyed used both the washing machine and the dryer several times a week and 8.4% once a week or less. The use of both appliances is indeed highly correlated ($R^2$ = 18.2%).

[50] At least within our categories of frequency.

**Table 4.11 Ownership of a tumble dryer per group of electricity consumption (% households)**

| Denmark | Lower<br>419-2382 kWh/year | Middle<br>2383-3458 kWh/year | Higher<br>3459-8289 kWh/year |
|---|---|---|---|
| Have a tumble dryer | 21% | 38% | 68% |
| Do not have a tumble dryer | 79% | 62% | 32% |
| N | 163 | 167 | 174 |
| Gamma (sig.) | 0.597 (0.000) | | |
| **Belgium** | **Lower<br>547 – 2833 kWh/year** | **Middle<br>2834 – 4852 kWh/year** | **Higher<br>4853 – 15551 kWh/year** |
| Have a tumble dryer | 46% | 63% | 80% |
| Do not have a tumble dryer | 54% | 37% | 20% |
| N | 191 | 192 | 190 |
| Gamma (sig.) | 0.473 (0.000) | | |

Sources: Denmark: Albertslund survey (2001); Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

**Table 4.12 Weekly tumble-dryer use per group of electricity consumption (% households)**

| Denmark | Lower<br>419-2382 kWh/year | Middle<br>2383-3458 kWh/year | Higher<br>3459-8289 kWh/year |
|---|---|---|---|
| Once a week or less | 53% | 34% | 21% |
| Several times a week | 47% | 66% | 79% |
| N | 32 | 59 | 108 |
| Gamma (sig.) | 0.334 (0.000)[51] | | |
| **Belgium** | **Lower<br>547 – 2833 kWh/year** | **Middle<br>2834 – 4852 kWh/year** | **Higher<br>4853 – 15551 kWh/year** |
| Once a week or less | 55% | 33% | 23% |
| Several times a week | 45% | 67% | 77% |
| N | 88 | 119 | 153 |
| Gamma (sig.) | 0.420 (0.000) | | |

Sources: Denmark: Albertslund survey (2001); Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

The usage frequency of the washing machine does not seem to differ between the 2 countries (Table 4.13). More households have a tumble dryer in Belgium than in Denmark and this holds true both when comparing the SEREC data with general statistics from Denmark and with the Albertslund data in each of the three 'consumption groups' (Tables 4.10 and 4.11). Frequency of both washing and drying seems to be about the same in both countries (Tables 4.12 and 4.13).

**Table 4.13 Weekly washing machine use per group of electricity consumption (% households)**

| Denmark | Lower<br>419-2382 kWh/year | Middle<br>2383-3458 kWh/year | Higher<br>3459-8289 kWh/year |
|---|---|---|---|
| Once a week | 24% | 11% | 3% |
| Several times a week | 76% | 89% | 97% |
| N | 139 | 166 | 170 |
| Gamma (sig.) | 0,462 (0,000) | | |
| **Belgium** | **Lower<br>547 – 2833 kWh/year** | **Middle<br>2834 – 4852 kWh/year** | **Higher<br>4853 – 15551 kWh/year** |
| Once a week or less | 24% | 8% | (6%) |
| Several times a week | 76% | 92% | 94% |
| N | 168 | 190 | 189 |
| Gamma (sig.) | 0.523 (0.000) | | |

Sources: Denmark: Albertslund survey (2001); Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

[51] These coefficients are calculated with the same variable with more categories: one use/week, 2, 3, 4, 5-25.

### *4.3.3.3 Washing the dishes*

Both in Belgium and in Denmark, three households out of five have a dishwasher (Table 4.10). As expected, to have a dishwasher or not correlates quite much with electricity consumption. Its average use also strongly influences consumption (not shown here).

**Table 4.14 Ownership of a dishwasher per group of electricity consumption (% households)**

| Denmark | Lower<br>419-2382 kWh/year | Middle<br>2383-3458 kWh/year | Higher<br>3459-8289 kWh/year |
|---|---|---|---|
| Have a dishwasher | 35% | 53% | 68% |
| Do not have a dishwasher | 65% | 47% | 32 % |
| N | 164 | 173 | 175 |
| Gamma (sig.) | | 0,419 (0,000) | |
| Belgium | Lower<br>547 – 2833 kWh/year | Middle<br>2834 – 4852 kWh/year | Higher<br>4853 – 15551 kWh/year |
| Have a dishwasher | 37% | 59% | 83% |
| Do not have a dishwasher | 63% | 41% | 17% |
| N | 190 | 192 | 191 |
| Gamma (sig.) | | 0.586 (0.000) | |

Sources: Denmark: Albertslund survey (2001); Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

### *4.3.3.4 Refrigerator*

In Denmark, having a low-energy refrigerator or freezer is not significantly correlated with a low level of electricity consumption. It seems to be the same in Belgium (Table 4.15). However, in both countries, the number of refrigerators in the dwelling is highly correlated with electricity consumption (Table 4.15 for Belgium, figures for Denmark not shown here).

### *4.3.3.5 Daily duration of housework*

From time-use surveys (which are harmonised in Europe), it appears that Belgian women spend more time per day doing "household and family care" chores than Danish women: of course, all these chores do not imply the use of appliances all the time but still, these surveys indicate that on average, a Danish woman spends 3 hours and 20 minutes each day doing these tasks (3:13 for the employed), while her Belgian counterpart spends nearly 4 hours (3:58; and 3:46 for the employed). There are no differences for men (Eurostat, 2003, Aliaga and Winqvist, 2003).

**Table 4.15 Characteristics of the refrigerator(s) per group of electricity consumption (% households)**

| Denmark | Lower<br>419-2382 kWh/year | Middle<br>2383-3458 kWh/year | Higher<br>3459-8289 kWh/year |
|---|---|---|---|
| Have a low-energy refrigerator-freezer | 53% | 62% | 49% |
| Do not have a low-energy refrigerator-freezer | 47% | 38% | 51% |
| N | 79 | 65 | 70 |
| Gamma (sig.) | | -0.055 (0.628) | |
| Belgium | Lower<br>547 – 2833 kWh/year | Middle<br>2834 – 4852 kWh/year | Higher<br>4853 – 15551 kWh/year |
| Have at least one appliance of class A or B | 59% | 70% | 65% |
| Have no appliance of class A or B | 22% | 18% | 21% |
| Does not know | 19% | 12% | 14% |
| N | 190 | 192 | 190 |
| Gamma (sig.) | | -0.122 (0.062) | |
| Mean number of refrigerators | 1.07 | 1.25 | 1.37 |
| F (sig.) | | 22.8 (0.000) | |
| Mean age of main refrigerator | 7.4 | 7.5 | 7.7 |
| F (sig.) | | 0.145 (0.865) | |

Sources: Denmark: Albertslund survey (2001); Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

How the use of appliances – and sometimes the power decision to buy them – increases the domestic power in a rather unequal gender system has been discussed for Belgium (Bartiaux, 2003) and a comparison with Denmark would be interesting. From available statistics on time use and on labour force participation, the Danish society seems to be more egalitarian than Belgium's. Further research is needed to study whether (and how) this could have consequences for electricity consumption.

### *4.3.3.6 Lighting*

Neither in Denmark nor in Belgium, does a significant correlation appear between having CFL and the electricity consumption (Table 4.16). In Belgium, 25% of the 'lower group' reports that they always switch off the light when leaving a room for 5 minutes; so do 24% of the 'middle group' and the 'higher group' (not shown here).

**Table 4.16 Ownership of CFL lamps per group of electricity consumption (% households)**

| Denmark | Lower<br>419-2382 kWh/year | Middle<br>2383-3458 kWh/year | Higher<br>3459-8289 kWh/year |
|---|---|---|---|
| < 25% CFL | 74% | 81% | 73% |
| 25% - 50% CFL | 14% | 11% | 14% |
| > 50% CFL | 12% | 8% | 13% |
| N | 170 | 170 | 176 |
| Gamma (sig.) | 0.029 (0.727) | | |
| Belgium | Lower<br>547 – 2833 kWh/year | Middle<br>2834 – 4852 kWh/year | Higher<br>4853 – 15551 kWh/year |
| Have CFLs | 63% | 65% | 65% |
| Do not have CFLs | 37% | 35% | 35% |
| N | 189 | 192 | 190 |
| Gamma (sig.) | -0.026 (.0.719) | | |

Sources: Denmark: Albertslund survey (2001); Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

### *4.3.3.7 PC and TV*

On average, and adding up TVs, videos and DVDs, Danish households appear to have fewer of them than Belgian households, as shown in Table 4.17. Moreover, Danes spend less time watching TV and video than do Belgians: 2 hours per day as opposed to 2:18. The difference is mainly due to the unemployed persons (proportionally more numerous in Belgium), men and women aged 45 years and over with no children at home (Eurostat, 2003).

When it comes to PCs, in Denmark there are 14% more households with a PC than in Belgium (see Table 4.10) and as seen in Table 4.17 the mean number of PCs correlates with the level of electricity consumption both in Denmark and Belgium.

In Belgium the number of TVs, videos or DVDs and the number of PCs used in the household are significantly correlated with the electricity consumption group. In addition, we tried to include some information in the survey about the standby consumption, but it appeared from the pre-tests that this notion was not clearly and equally understood. So we asked the following question: "Do you switch off the TV only from the remote control?" The proportions of the 'never' answers are 37% in the 'lower consumption group', 31% in the middle group and 20% in the higher group.

In Denmark the survey shows significant correlation between a high number of appliances with standby normally on and the level of electricity consumption.

**Table 4.17 Ownership of TVs, videos and PCs per group of electricity consumption (% households)**

| Denmark | Lower | Middle | Higher | |
|---|---|---|---|---|
| | 419-2382 kWh/year | 2383-3458 kWh/year | 3459-8289 kWh/year | |
| Mean number of TVs +Video, DVDs | 1.8 | 2.2 | 2.9 | |
| N | 148 | 158 | 162 | |
| Mean number of PCs | 0.62 | 0.99 | 1.37 | |
| N | 154 | 149 | 156 | |
| Belgium | Lower 547 – 2833 kWh/year | Middle 2834 – 4852 kWh/year | Higher 4853 – 15551 kWh/year | Sig. of F |
| Mean number of TVs | 1.27 | 1.42 | 1.61 | 0.000 |
| Mean number of video/DVD | 1.01 | 1.24 | 1.51 | 0.000 |
| Mean number of PCs | 0.60 | 0.92 | 1.23 | 0.000 |
| N | 191 | 190 | 191 | |

Sources: Denmark: Albertslund survey (2001); Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

### *4.3.3.8 Energy saving and environmental concern*

In the Danish questionnaire, it was asked whether the households were careful about saving energy. The majority of the households think that they are somehow or very careful about energy savings and this has a strong correlation with the household level of electricity consumption (Table 4.18). The same turns out to be true in Belgium, to a minor degree, with the results to the question "Do you think that you have done your best to save energy?" The answer is positive for 62% in the 'lower group', 55% in the 'middle group' and only 40% in the 'higher group'. This could indicate that the people in Albertslund (Denmark) are more careful about saving energy. The reasons why some people are more careful than others may be diverse, though.

**Table 4.18 Opinions per group of electricity consumption, Denmark (% of households)**

| Denmark | Lower | Middle | Higher | N |
|---|---|---|---|---|
| | 419-2382 kWh/year | 2383-3458 kWh/year | 3459-8289 kWh/year | |
| Very careful about energy saving | 51% | 30% | 22% | 181 |
| Somehow careful about energy saving | 45% | 66% | 66% | 313 |
| Normally not careful about energy saving | 5% | 5% | 12% | 38 |
| N | 177 | 178 | 177 | |
| Gamma (sig.) | | -0,400 (0.000) | | |

Sources: Denmark: Albertslund survey (2001)

For Belgium, Table 4.19 shows the average value for opinions on this topic. The value '1' was given if the respondent fully agreed with the proposition and the value '5' if s/he fully disagreed; '3' was neutral. More persons in the lower consumption group report that they have done their best to save energy and that they disagree with the ideas that energy saving is not one of their priorities. The association between energy saving and the idea of comfort on the one hand, and the association between energy saving and its requiring too much effort, on the other, do not yield significant differences between the three consumption groups.

In the Danish survey, a question was asked as to whether it was important to save natural resources for environmental reasons: 87% absolutely agreed with this and only 0.5% disagreed. It was further asked whether it is important to save natural resources for economy reasons and 79% absolutely agreed with this while only 1,3% disagreed. None of these questions, however, show correlations with the household level of electricity consumption.

**Table 4.19 Representations and opinions per group of electricity consumption, Belgium (average score)**

| Belgium | Lower<br>547 – 2833 kWh/year | Middle<br>2834 – 4852 kWh/year | Higher<br>4853 – 15551 kWh/year | Sig. of F |
|---|---|---|---|---|
| I think I have done my best to save energy | 2.43 | 2.73 | 3.02 | 0.000 |
| [Energy saving] is not one of my priorities | 3.99 | 3.76 | 3.65 | 0.066 |
| [Energy saving] requires too much efforts | 4.11 | 4.08 | 3.91 | 0.233 |
| I don't want to loose in my comfort | 3.37 | 3.59 | 3.59 | 0.245 |

Source: Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

Another question in the Belgian survey was: "What is, or what would be your main reason for saving energy?" Results are reported in Table 4.20. It is difficult to conclude from these figures that households with moderate electricity consumption valued the protection of the environment more than other households and it is even more hazardous to think that this environmental concern would drive their practices towards lower electricity consumption.

Another way of comparing attitudes concerning the environment in the two countries is through the Eurobarometer[52]. Approximately 1000 inhabitants in each of the 15 earlier European Union member countries, including Denmark and Belgium, were asked about their attitudes, concern and knowledge about the environment.

**Table 4.20 First three main reasons for saving energy per group of electricity consumption, Belgium (% of households)**

| Lower<br>547 – 2833 kWh/year | Middle<br>2834 – 4852 kWh/year | Higher<br>4853 – 15551 kWh/year |
|---|---|---|
| To protect the environment (28%) | To protect the environment (29%) | To avoid wasting (33%) |
| To avoid wasting (24%) | To avoid wasting (27%) | To protect the environment (23%) |
| By sense of a collective responsibility (18%) | By sense of a collective responsibility (20%) | By sense of a collective responsibility (16%) |

Source: Belgium: SEREC Survey, sub-sample of households having given their yearly electricity consumption (2004)

As indicated in Table 4.21, it seems as if Belgians are more optimistic in their view that lifestyle changes can help the environment, whereas more people in Denmark doubt that the environment is an issue that they can influence as individuals.
People in Denmark however feel much better informed than in Belgium, especially on issues that are related to electricity consumption such as climate, consumption, nuclear power (in Belgium, electricity is mostly produced with such power).

But it remains to be studied whether and how information motivates behaviours or not in our societies: "the increase of social-actors reflexivity on themselves goes faster than their capacity of action" (Martuccelli, 2002, p.146).

Overall it seems difficult to use attitudes concerning the environment as an explanation of the differences in electricity consumption between the two countries.

[52] See The European Opinion Research Group (2002) available on http://europa.eu.int/comm/environment/barometer/barometer_2003_en.pdf read on 18/1/5.

**Table 4.21. Opinions on environment**

| Which of these opinions comes closest to yours? | | | | |
|---|---|---|---|---|
| | Human activity is currently in harmony with the environment | The deterioration of the environment can be halted by changing our way of life | Human activities can lead to irretrievable damage to the environment | Others and not answered |
| Denmark | 5% | 38% | 52% | 5% |
| Belgium | 5% | 55% | 35% | 6% |
| EU15 total | 4% | 45% | 44% | 6% |
| "Very" or "fairly well informed" on environmental questions | | | | |
| | Summary for 25 environmental questions | Climate | Consumption | Nuclear Power |
| Denmark | 58% | 65% | 65% | 48% |
| Belgium | 38% | 45% | 37% | 32% |
| EU15 total | 43% | 53% | 46% | 38% |
| Individual actions | | | | |
| | The environment is an issue beyond my control as an individual | My actions can make a real difference to the environment | | Others and not answered |
| Denmark | 42% | 51% | | 7% |
| Belgium | 30% | 52% | | 18% |
| EU15 total | 43% | 43% | | 14% |

Source: Eurobarometer, 2002

## *4.4 Conclusion*

Household electricity consumption is lower in Denmark than in Belgium and this chapter explores this difference. One part of the explanation could reside in the fact that the survey data used for Belgium underestimated single-person households and households living in small spaces, two factors correlated with low electricity consumption. However, when controlling by household size, the difference between the two countries remains and our results indicate that part of the explanation of the higher electricity consumption in Belgium could be the number and use of appliances. Tumble dryers are more widespread and so are electric fans and radiators (less than half of the surveyed households had none of these two appliances). Altogether, there are more TVs and videos per household in Belgium and more time is spent watching TV in Belgian households. More time is also probably devoted to preparing food and to cooking in Belgium. Time allocation for household chores, use of appliances and their implicit meanings should also be seen in the framework of gender systems that seem to be more egalitarian in Denmark. Factors that do not seem to explain the difference in electricity consumption include the use of both energy-efficient lamps and energy-efficient appliances. Based on a Eurobarometer survey, it has been hypothesised here that attitudes and environmental concerns are probably not factors that can explain the differences observed in electricity consumption; information on environmental matters could play a role, but this needs to be further studied.

From a policy point of view it is interesting to know if these differences, which result in different levels of electricity consumption, are based on general cultural differences or if they are to some extent influenced by differences in energy policy, including public campaigns, taxes, etc. The lack of weighty explanations for the large differences in electricity consumption between the two countries, combined with the fact that Danish electricity consumption has been stable for the last decades, whereas the Belgian consumption has grown, suggests however that the stronger focus on energy saving in the Danish energy policy, compared with the Belgian policy, actually have had a positive result. The findings in this chapter however also point to factors with a huge impact on electricity

consumption, which neither in Denmark nor in Belgium are part of energy policy, including the (growing) size of houses, the growing portion of single-person households and the growing number of appliances in all households.

# PART II
# Changing Energy-Related Practices, A Possibility?

## INTRODUCTION

Is changing energy-related practices a possibility? Which factors are pushing people to change their minds and their habits in the field of energy consumption and which factors are slowing them down? Do people know what they could change? In other words, is it a question of lack of information? Do they want to change? If so, do they know how to translate their will into effective changes?

This second part of the report tackles these questions.
Four methods are presented in this part of the report. On the one hand, the technical aspects are explained in details. On the other hand, qualitative interviews, done with a few users of these methods, have brought elements on the issue of changing energy-related practices.
Finally, a chapter tackles this issue of changing behaviours from a more general point of view, drawing upon the SEREC survey (which has been already presented and analysed in chapters 2 to 4 of this report) and around 20 in-depth interviews, which were conducted with lay-persons. So the basis of this chapter is more representative, whereas the preceding chapters are based on voluntary households that are interested in energy savings.

The factors which are supposed to have an influence on changing behaviours are:

- Personal and social factors (household size and income, interest in new technologies, environmental awareness...)
- The type of information: energy consumption is not of common knowledge. It is often technical and technological. Does information bring people to change their behaviours? Which effects will detailed, personalised and customised information have on the users of those methods?
- The source of information: the content of the information is one thing, but the status of the informants is another one. Experts, heating specialists, architects, various actors of the building of a dwelling do not only spread information but may also have an influence on the decisions taken.
- The characteristics of the method itself (investment needed from the participants, technical support, needed follow-up, theoretical and practical parts, duration...)

The next four chapters present the methods and their "impact" on changes in the field of energy consumption. They are followed by the chapter with a broader scope and based on the SEREC Survey. Finally, a concluding chapter attempts to give a synthesis of the factors that may be seen as brakes or as levers for changing energy-related behaviours.

# 5. THE QUICK SCAN: SET-UP, METHODOLOGY AND RESULTS

The SEREC-project intends to examine several tools that deliver recommendations to the participating households. The first tool is the Quick Scan whose aim is to deliver information to the participating households in a very quick and comprehensive way. This tool has been developed by VITO during the research and it is based on statistical data on electricity consumption gathered by the large-scale SEREC survey.
The set-up and the aim of this tool make it an ideal computer-based application. On the basis of very few specific variables, the result should show some personalised information. The following recommendations however are not personalised. This tool therefore fills one side of the spectrum, providing very fast and accurate information, but almost no possibility to give tailor-made results to the participating households.

## *5.1 Set-up of the quick scan*

The scan needs to be based on statistical results. Statistical data are however very hard to find in Belgium. Unlike in Denmark, Belgian figures on individual energy consumption are available to a much lesser extent for research. Some figures have been collected during the biannual household questionnaire of 2003 in Flanders by the Flemish Community, but these figures could not be accepted, as there was absolutely no indication of their representativity for Belgium.
During the large large-scale SEREC survey, much effort was made to inform the respondents beforehand and to ask them to prepare their yearly electricity and gas bills. Thanks to this effort, a large percentage of the respondents were able to transmit their yearly electricity consumption.
Thanks to this database, the design for the quick scan was possible. A total number of 553 data were available.

The Quick Scan takes into account the most relevant data from the households. The first and most important variable influencing residential energy consumption is the number of persons in the household. The second variable giving a statistical influence is the type of dwelling. The database was divided into four types of dwellings: apartments and studios, detached houses, semi-detached houses with 2 facades, semi-detached houses with 3 facades.
Except these two variables, almost any other variable can be chosen, but without reasonable statistical significance.

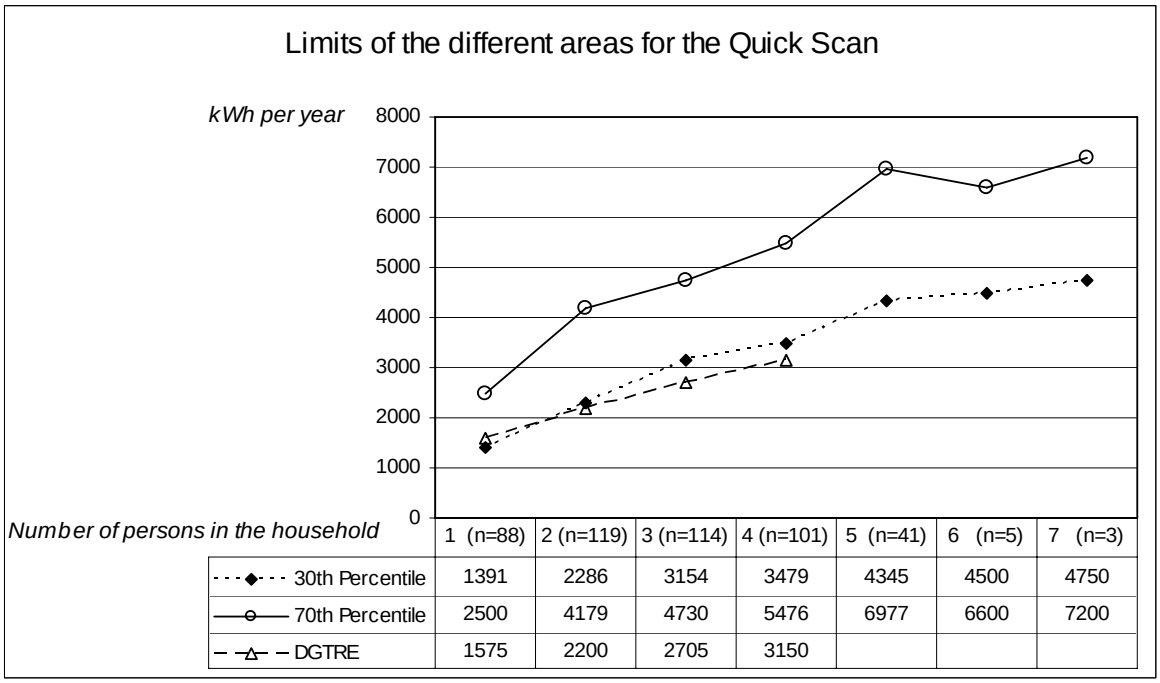
The last variable which could have a statistical added value is the income quartile of the household. However, it has been decided not to use this variable for two reasons. First of all, it would pose some ethical problems. The results of the Quick Scan would be based on the income quartile of the family, creating impressions which would differ broadly from the ones the Quick Scan is trying to convey. When the monthly income of a family is in the higher income quartiles, the statistical distributions of this profile are placed higher than the distributions from lower income quartiles. This creates, unintentionally but very strongly, an impression as if a family with a larger monthly income is allowed to consume more. This impression should certainly be avoided.
A second reason to omit the income data is the barrier for the user. The tool will also be available on the internet. It is therefore creating a much larger barrier for the user if the he or she is requested to transmit his monthly income over the internet before the results can be obtained. The Quick Scan is mostly a sensitisation instrument. The barriers for participation or utilisation should be as low as possible.

In the final version, three variables are requested from the users: the number of persons in the household, the type of dwelling and the annual electricity consumption. Profiles of different consumers are assembled for the first two variables. The general distribution for one profile is assumed to be lognormal. The different distributions for each type of houses have been checked and this lognormal distribution has been reasonably confirmed. There was no case where the regular normal distribution was as close to the real distribution as the logarithmic distribution (see appendix).

The separation into different profiles avoided the application of a linear regression. Linear regression implicitly assumes a causal relationship between independent and dependent variables, and this should be avoided in this case.

The users receive information about the saving potential in their house, based on the limit of the 'Energy-saving area'. This 'Energy-saving area' is the left-hand side of the distribution and it contains the smaller consumptions. However, the boundary is only based on the number of persons in the household. Therefore, the type of house is not interfering with the definition of the saving potential. This potential is only dependent on the number of persons in the household. So a family of 4 persons in a detached house does find itself on a different distribution than a family of 4 persons in an apartment, because the profiles are different. However, with a similar consumption, the energy-saving potentials are the same.
The limit of this energy-saving area is based on the distribution of the electricity consumption. Depending on the number of persons, the limit was defined as the 30$^{th}$ percentile of the distribution. In a similar way, a limit for a 'high energy-consumption area' was defined as the 70$^{th}$ percentile.
These limits are therefore not extreme. Still, 30% of the population finds its consumption in the energy-saving area, and this is quite a large part. The recommendations for the other households are also based on this reasonable limit. They should not be based on extreme limits, as this is likely to counter motivation and interest. Figures for families with more than 5 members are based on trend extrapolation, due to the low number of relevant data.

**Figure 5.1 Limits of the different areas for the Quick Scan**




| | 1 (n=88) | 2 (n=119) | 3 (n=114) | 4 (n=101) | 5 (n=41) | 6 (n=5) | 7 (n=3) |
|---|---|---|---|---|---|---|---|
| 30th Percentile | 1391 | 2286 | 3154 | 3479 | 4345 | 4500 | 4750 |
| 70th Percentile | 2500 | 4179 | 4730 | 5476 | 6977 | 6600 | 7200 |
| DGTRE | 1575 | 2200 | 2705 | 3150 | | | |

The same figures corresponded very well with indications from the Ministry of the Walloon Region, Directorate General of Technology, Research and Energy (DGTRE). In a communication, figures were given for electricity consumption of 'Energy saving families'. These figures and the results for the limits of the different areas for the Quick Scan are both shown in Figure 5.1.

## *5.2 Launch of the Quick SCAN (Edisontest)*

The SEREC research started with the intention to develop the quick scan without a lot of further detailing. This tool had to be applied to 10 persons at least. The development of the tool as described above has given the possibility for a much wider application. In collaboration with the IT specialists

for VITO's Emis website (http://www.emis.vito.be), an extensive online version was developed and was posted both in Dutch and French on the VITO website: http://www.vito.be/edisontest. The Quick Scan was named 'Edisontest' to give the direct hint towards electricity and the website went online on the 24th of October 2005. There are no links to the test from other internet pages.

The online tool directly gave a lot of advantages for further research as it became more precise. The site was launched with some emails to colleagues and friends. Apparently, the response was very large; only through these emails the test received over 600 users during the first week. This large response enabled the creation of a larger database with the data entered by the users.

These data are not automatically used to convert the existing database and to alter the calculations. The data are first controlled manually before integration. The first launch of the website showed the following needs for data deletion:

- Some users 'played' with the test, entering first a complete set of data. Afterwards, parameters were varied, often with the same annual consumption but with different housing types and household members, or with varying consumption keeping the other parameters equal. These entries were deleted.
- Some users tested the tool, by entering an estimation of the consumption rounded up to a hundred or a thousand. These data were equally deleted.
- Some users entered incorrect numbers. Consumption were considered incorrect below 500 kWh per year and over 40 000 kWh per year.

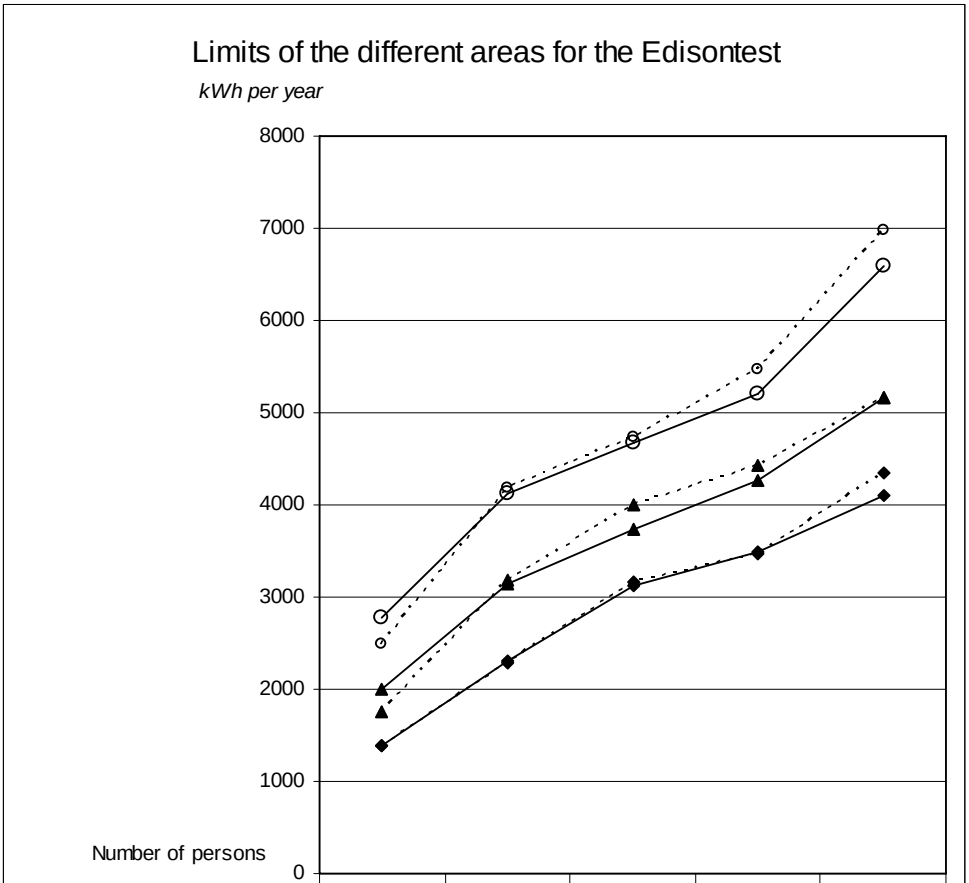
Other users' patterns emerged:

- During daytime, the tool was more often used to give an indication based on estimation. Most estimations were entered during office hours. Users with fluctuating consumption declarations while keeping other parameters equal (members in the household, type of house…) occurred more during daytime. The impression is that this part of the users used the test to find a reasonable consumption for their household.
- In the evenings, a considerably higher number of correct entries were encountered. Apparently, users then performed the test with exact figures based on annual electricity bills. When variations occurred, it was mostly involving the other parameters, keeping the consumption the same. This gives an impression of users who are creating a better idea of the size of their consumption in relation to other households.

After manual control, 261 data entries were retained as plausible. During the first phase of these internet-based procedures, the question of representativity always remains. In this case, another effect can be stated: the test is internet-based, limiting the possible users to a very specific part of the population having direct access to internet. This could push the average consumptions upward.

The first controls are explained in more detail in the appendix. The first results revealed a very acceptable spread of the entered data, along that already in the existing database. For individual dwellings only, a much larger number than expected of very high consumptions were entered. These consumption levels are extremely high for dwellings without electrical heating. It can therefore be assumed that these entries present dwellings with electrical heating. These outliers cannot be kept in the final database.
The results of the inclusion of the new data for the test are presented in Figure 5.2.

**Figure 5.2 Different percentiles of the distributions before and after inclusion of the new data**




| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 30th Percentile (new) | 1391 | 2300 | 3115 | 3500 | 4100 |
| 50th Percentile (new) | 2000 | 3148 | 3743 | 4261 | 5159 |
| 70th Percentile (new) | 2780 | 4130 | 4674 | 5200 | 6600 |
| 30th Percentile (original) | 1391 | 2286 | 3154 | 3479 | 4345 |
| 50th Percentile (original) | 1756 | 3183 | 4000 | 4431 | 5159 |
| 70th Percentile (original) | 2500 | 4179 | 4730 | 5476 | 6977 |

The results are quite surprising. Due to the fact that the test is only accessible through internet, higher consumptions and therefore higher averages could be expected. However, the remaining result mostly gives a slight decrease of the original distributions. This means that maybe the users are somehow more energy-conscious than the average households, but this difference is very small. In general, the users are very well spread within the original distributions.

## *5.3 Reactions and perceptions*

The tool allowed users to give reactions on it. Only a part of the users actually transmitted their impressions. The impressions can roughly be divided into three types.

- Some users simply stated their appreciation of the tool : "Fast, simple and thus a useful instrument", or " This is amazing! Finally a reference to evaluate yourself";
- A second type of comments indicated doubts about the calculations or hints to modify the calculation: "There is a large difference if one is cooking on gas or on electric stoves", or "Is

it not possible to take into account if a person is working at home or at the office? Because somebody who is at home all the time will consume more."

- The last type, however, contained more than half of all reactions. These users directly ask how the proposed reduction can be achieved practically. "How can I find advice for efficient energy-saving measures?" "I don't know how I can save more energy."...

Two other types of reactions were gathered by the Demography team (UCL) and these informal reactions broaden the appreciation of the Quick Scan. First, a strong interest was expressed by a group of members of environmental NGOs. They only regret that the tool was solely designed for evaluating electricity consumption and not gas or fuel consumption. The second reaction worth mentioning is an absence of reaction to an e-mail sent to about 40 persons working or studying in demography and social science. This indifference tends to show that the interest in comparing one's energy consumption is not that easy to bring about when energy matters are not (at all) among every-day concerns.

## *5.4 Conclusions*

The Quick Scan is now a widely applicable tool. In its present form as an internet-instrument, its success is quite surprising. The tool can remain in its present state and does incite visitors to look closer at their own consumption and to search for solutions to reduce their consumption. The tool cannot yet give precise recommendations but it solves the question whether "a household consumes a lot". This question was present for many households and was difficult to solve without valuable references.
Now with a minimum of input, the user can get an indication on the size of his consumption.

The internet version of this tool attracts quite a lot of visitors. The distribution of the different consumptions of the visitors is not very different from the initial distribution. This gives the impression that not only energy-saving households are interested in this tool, but that a large part of internet users are concerned as well.

To satisfy fully the expectancies of the users, two aspects would be very helpful. One type of users are doubtful about the correct calculation or representation of the results. A clear explanation of the background of the test could readily inform these users. This could be added as a technical note or a background document.

The second improvement is the indication for effective energy-saving measures, though a specific page showed the most efficient measures to reduce consumption. This does not, seemingly, suffice for a large part of the users. The most effective solution for these households would be an electrical audit. When this type of audit is possible, the Edisontest can be a strong incentive, or trigger, for these households. It indicates the possible problems of large consumptions and could then directly link the users to an official auditing program.
The same triggering effect can be achieved for audits concerning heating energy consumption. This assessment is already implemented in an official program, the EAP-audit. When establishing a test similar to the Edisontest but based on gas consumptions, the result can be a good tool to increase awareness about heating energy consumption. The users confronted with higher energy consumption can then be directly guided to the official auditing program.

To increase awareness for electrical consumption, a more generalised use of the Edisontest can simply be a presentation of this Quick Scan on the annual electricity bill. At the moment, the annual consumption is compared to the annual consumptions of the two preceding years. This gives an indication of the relative differences, but the main question "if this consumption is a lot?" is not answered. This application would make the tool equally available for households without access to the internet.

# 6. THE ENERGY DIARY, PRESENTATION AND RESULTS

## *6.1 Presentation of the applied method*

As seen in chapter 5, the Quick-Scan is a tool elaborated for a large application as it is a very basic tool, very quick to apply and it can get people interested. The complete energy assessment, which will be presented in chapter 8, performs several controls, evaluations and measurements of all technical factors related to energy consumption within a dwelling. This assessment focuses therefore mostly on the technical characteristics of the house and behavioural patterns are not evaluated.

The energy diary is a tool that can be used to bridge this gap. Contrary to the energy assessment, the energy diary tries to make people more conscious of their consumption. Another objective of this study is to evaluate the energy diary itself as a tool. The diary has been elaborated by Cames and Brohmann (2003) in Germany. The application of the diary in the framework of this project is the first application of the diary in the Belgian context.

The final diary consists of five specific parts.

-Background information on the energy diary

-Starting questionnaire: a questionnaire covering general data of the household, of the house and the equipment, as well as general behaviour towards energy consumption and ecological issues. This questionnaire has to be filled out at the start. The participants are advised to fill this out on a Sunday.

-Diary: The participants receive 7 schemes, one for each day. This scheme gathers the information about the presence of the members of the household, the heating habits, ventilation habits, lighting habits and usage of different equipment for cooking and washing. There is one scheme for every day. The diary is filled out during one week.

-Final questionnaire: This questionnaire asks the same questions as the starting questionnaire concerning heating and ventilation habits. Any difference between the answers of the two questionnaires can give an indication of whether the behaviour or convictions of the participant have been altered.

-A long list with energy-saving recommendations that cover all possible areas of energy consumption except transport. The recommendations focus on behavioural interventions or on the replacement of cheap parts of installations.

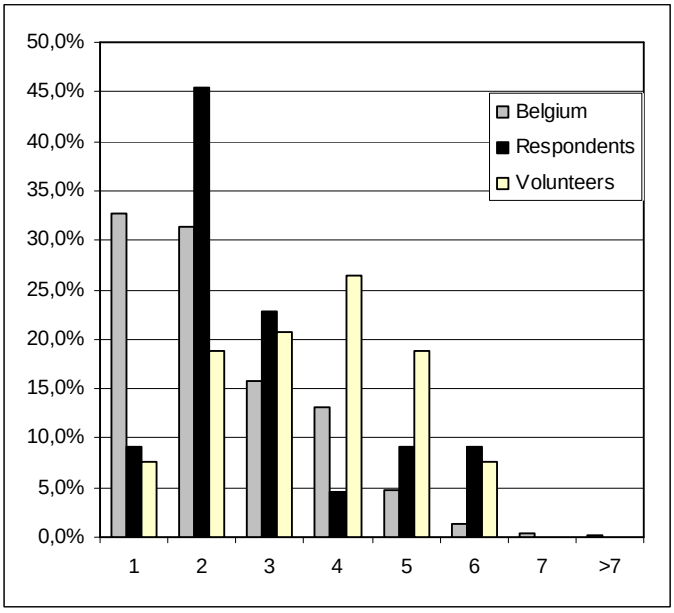
The entire diary is sent to the participants at the start of the week.

For the application of the four tools in the framework of this project, a large base of volunteers was needed. In order to reach almost all social groups, an advertisement was placed in 'Metro', a freely distributed newspaper. An advertisement was also posted on the Vito website. Finally some 180 volunteers answered.
Out of these 180 volunteers, 56 specifically mentioned their interest to participate to the energy diary exercise. These persons have been contacted and were requested to fill in the diary.
The diary was sent at the first week of March 2004. The meteorological conditions were favourable, as the weather was almost continuously very cold during the weeks after the diary was sent.
In the study of Cames and Brohmann in Baden-Württemberg, 22 acceptable energy diaries were returned out of a contacted sample of 61 participants. In the case at hand, 22 acceptable diaries were also returned.

When looking at the answers given, several trends can be distinguished. To show some of the dynamics, the figures show both the profile for the volunteers and the respondents. The volunteers are the persons mentioning their interest in the energy diary (n = 56) and the respondents finally sent an acceptable diary back (n = 22)

First of all, the size of the households is larger than that of the Belgian population, as is represented in the figure below. There is a clear lack of participation of one-person families.

**Figure 6.1 Distribution of household size of the participants in comparison with the Belgian average**



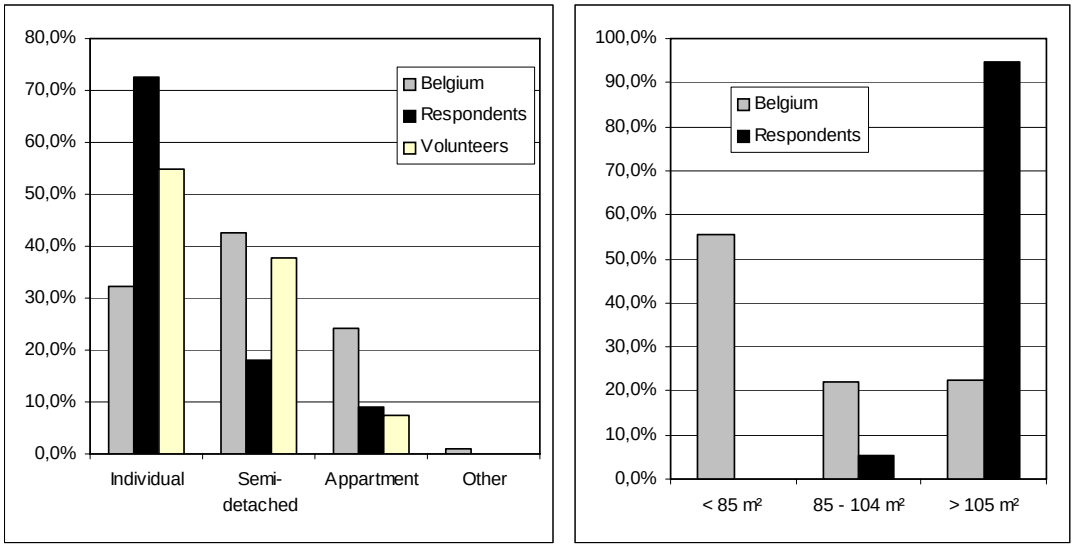

A strange effect becomes visible when comparing the actual respondents with the original volunteers. Originally, a lot of households consisting of 3 persons or more volunteered. The most answers were returned by smaller families.

Moreover, most families occupy an individual house, and a much larger percentage than average actually owns this house (90% compared to 68% on average). The houses of the participants also have a larger habitable surface, as it can be seen in Figure 6.2.

A full representation of energy-related behaviour is a very complex task. Most persons are not thinking about their energy consumption during their daily activities. However, the same daily activities each have their specific effect on energy consumption. A procedure which tries to describe the behaviour in view of deriving an effect on energy consumption should at least focus on specific points.

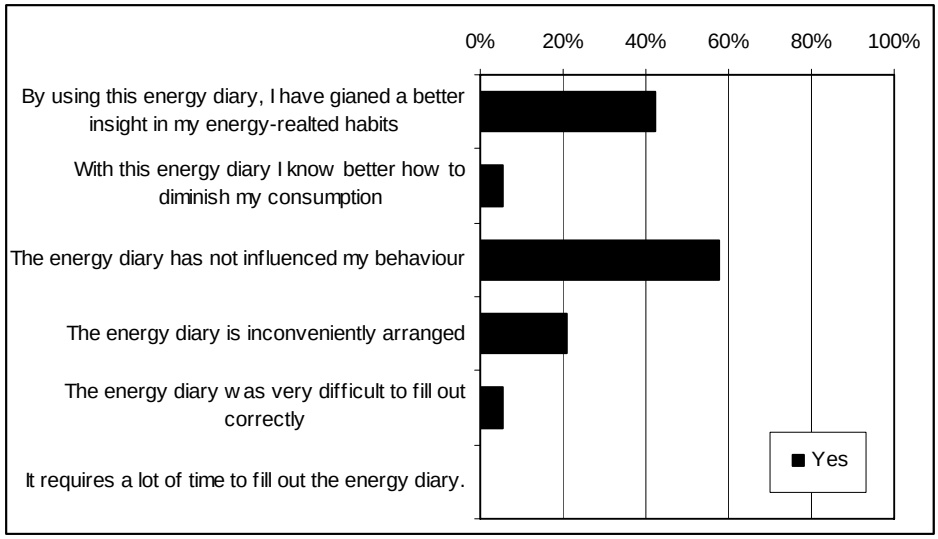
One possible use for the energy diary is to be used as a tool for a larger public. If the diary can in this way directly induce a reduction of consumption, then the tool can be effectively applied for larger parts of the society.
Unfortunately no straightforward evaluation of this effect is possible. The actual energy consumption of the household can be monitored before, during and after the application of the energy diary, but the effect of the diary cannot be singled out clearly. In order to have an impression of this effect, two options have been retained. First, the participants have been asked to note their own impressions on the tool. Secondly, an evaluation is possible by asking several questions before the start of the diary, and asking the same after the diary had been applied. Any changes in the answers can indicate a change in opinion on energy-related issues but it can also be due to chance.

**Figure 6.2 Distribution of housing type and habitable surface of the participants in comparison with the Belgian distribution**




The figure below shows first of all the evaluation given by the participants themselves.

**Figure 6.3 Impression of the participants after application of the energy diary**




The figure below shows first of all the evaluation given by the participants themselves. The answers given by the participants are very clear. More than 40% of the participants note that the diary helped them gain better insight in their energy-related habits. But almost nobody gained information on how to diminish their consumption and more than half of the participants clearly stated that the diary did not influence their behaviour.
On the contrary, nobody found the diary too lengthy to fill out. Before the application, it was feared that this tool required too much active involvement from the participants, so no acceptable participants would be found. In general the response rate was around 39%, which is not that low.
But the result shows already a serious inconvenience in the conception of the diary. The participants gain insight in their practises, but the diary does not help them to find practical ways to change their behaviour. This is remarkable because with every energy diary, a long list with possible energy-saving recommendations had been added.

## 6.2 Acceptance and effects of the Energy Diary

### 6.2.1 Methodology

Four participants have been interviewed three months after they had filled up the diary. This small number of interviewees brings us to be very careful in not drawing general conclusions. And as mentioned above, all diary-participants were from the beginning interested in energy-savings: they answered an advertisement to have a chance to be selected for having a complete energy assessment and the Energy Diary was rarely the first choice (the energy assessment was on the top of the podium), it was rather the second or the third one. The participants to this energy diary are thus already interested in energy consumption topics and have generally gathered information on the issue: in a sense, it is logical to have this 'bias'.
However, the interviewed participants were motivated for economic reasons ("if it is possible to consume less, why paying for nothing?") and ecological beliefs ("if it is possible to help to protect the planet")

### 6.2.2 The perception of the Energy Diary

As seen in the answers given to the questionnaire from VITO, the interviewed participants have found that the explanations about the method were clear. Most of them have not found it difficult (just putting some crosses) heavy or annoying (it was only for seven days and it doesn't take much time to fill it in). Obviously, living with a larger family makes it harder and more complex, as Huguette says: " *I have children who practice a lot of sports, so the beginning and the end of the showers, yes, I have found it complicated to fill it in and it has taken me a lot of time*".
Huguette also complained because she found the diary not practical nor accurate enough, she regrets that no room has been envisaged to write down the use of small electrical appliances, for example.

### 6.2.3 Effects of the diary?

**The list of the advices**
The interviewees have expressed either that they did not really remember what these advices were about or that they already were applying them, which did not bring anything new or "exciting". As Huguette says: *"[the advices], I knew them already, almost all of them (…) because I have participated [while] being already conscious about all that, so I don't have the feeling to have learned a lot"*.

**The energy diary in and of itself**
According to the interviewees, the energy diary undoubtedly brings the participants to have a better view of their daily habits in the matter of energy consumption, like switching the lights on and off and the number of washes done every week, for instance. Hubert presents the diary as *"a confirmation of the habits I have"* and Cindy has found it interesting to see the consumption of the household *"on paper"*.
Participants are thus more conscious, but they themselves talk about a very short and limited effect; as Hubert says: *"I have not found anything beneficial enough so as to change my behaviour, thus I haven't found a magical potion"*.
The consequences are also a reflection about standby consumption (Hubert) and about night and day consumption (Huguette), a use of saving energy bulbs and a social discussion about energy: talking about the diary with family members, friends, neighbours, colleagues, makes the people talk about that subject.

But given the fact that the participants were already paying attention to their energy consumption, neither the list of advices, neither the filling up of the diary really provoked changes, other than the 'small ones' described above. Huguette expresses that she does not see, even after the Energy Diary,

what is left to be done: *"I have the feeling that I cannot do much more, that I cannot reduce [my consumption] much more"*.

## *6.3 Conclusions*

The energy diary could have been a tool to bring participants to get a clearer description of their consumption and to get more conscious about it in the perspective of having elements to act on it. But the diary does not really give the opportunity to measure the consumption that is associated with each of the various energy-related practices reported on the diary. To combine the diary with an electrical assessment or with an extended version of the Quick-Scan test in order to show the influence of the behaviour on consumption could be a way to improve this method.

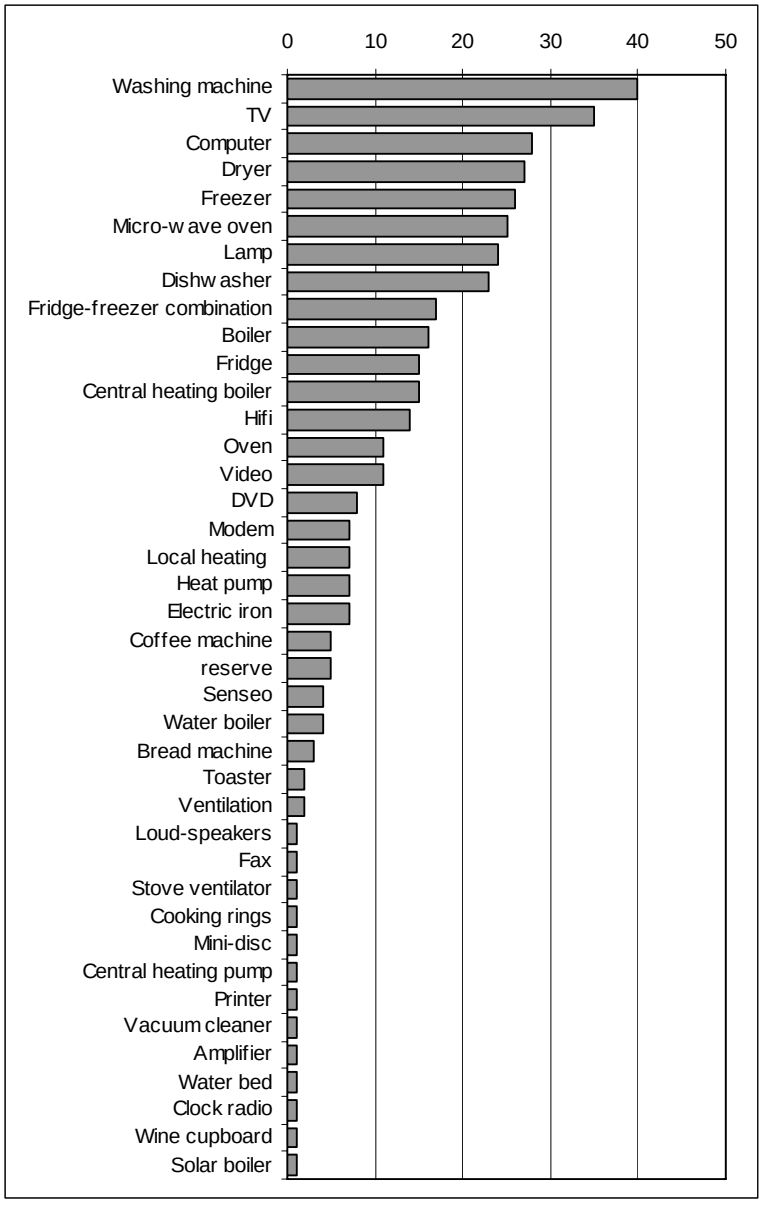
The interest of this method could have been the increase of consciousnesses brought about the filling of the diary. Unfortunately, this has not happened as filling such a diary in its actual version (Cames and Brohmann, 2003), for one week (as it was done in Belgium) or two (as done in Germany) is only acceptable by persons who are already quite interested in, and knowledgeable about, their energy-related practices.
And a raised consciousness does not systematically imply a behavioural change, as will be extensively shown in the chapter devoted to the energy assessment procedure (chapter 8).

# 7. THE 'ELECTRICAL AUDIT'

## *7.1 Description*

The electrical audit was based on measurements of electrical appliances. These measurements were performed on a maximum number of appliances in the same households that volunteered for the EAP-audit. Detailed measurements of peak loads, standby loads and working conditions have been performed. Detailed descriptions of each appliance were also made. The audit equally installed measuring equipment on appliances with larger energy consumption.

**Figure 7.1 Measured electrical appliances during the campaign**




The actual registration depends on the practical possibility of installing a measuring device on the specific appliance. Built-in appliances like kitchen re-frigerators or stoves were often unreachable.

419 separate devices ha-ve been monitored during this campaign, and these data are added to the data on the total con-sumption of the house-holds.

During the EAP audit, all electrical meters have been installed. The mea-suring appliances were collected after one year, in November and Decem-ber 2005.

The participants were asked to monthly collect the figures on each coun-ter and to send them to VITO. This was not a heavy burden for them, accor-ding to the interviewees.

Figure 7.1 represents the amount of meters in the households according to the measured appliance. This figure shows different categories of appliances, though differences within one category are still possible. The category 'computer' often includes measurements of modems, fax machines, printers, loudspeakers, headphones, scanners... together with the main computer. The aim was to establish an idea for the owner of the part of the consumption that was related to the use of information technology. When a computer installation included several appliances, all were measured at the same time. The aim was not to achieve exact technical product data for each product, but to draw a distribution of the electrical consumption for each owner. The amount of appliances in one computer installation can be very significant. The maximum number of different appliances in one complete installation was 21, and 16 of these devices had a standby power load.

Two specific problems were encountered. The first concerned the estimation of electricity consumption for light. Detailed measurements of this consumption were not possible in the set-up of this project. It was necessary to make an estimation, which is based on a detailed database of installed light fixtures in each house and on a description of the owners of their daily habits.
Secondly, another important distinction was necessary concerning heating equipment and central heating installations. Energy consumption for the heating of the house should not be included in this analysis. The first step was the definition of the primary heat installation. Different houses contain several heating installations: first of all, a central heating system, and fireplaces, local electric heaters or stoves. The primary installation is the one that is capable of heating the entire heated volume without additional sources. In most cases, this was a central heating system on gas or on heating oil.
In the cases where the primary heating system was electric, the actual yearly electricity consumption for heating was calculated and this part was not taken into account for the current analysis.

In this analysis, a large part of electricity consumption for heating remains. This part does cover for instance all secondary heating installations, such as portable electric heaters or stoves. This part also covers electric boilers for sanitary hot water. Secondary electricity consumptions of the primary heating installation are also covered here. A central heating installation mostly includes pumps and regulation units, all of which consume electricity.

## *7.2 Establishing the report for the households*

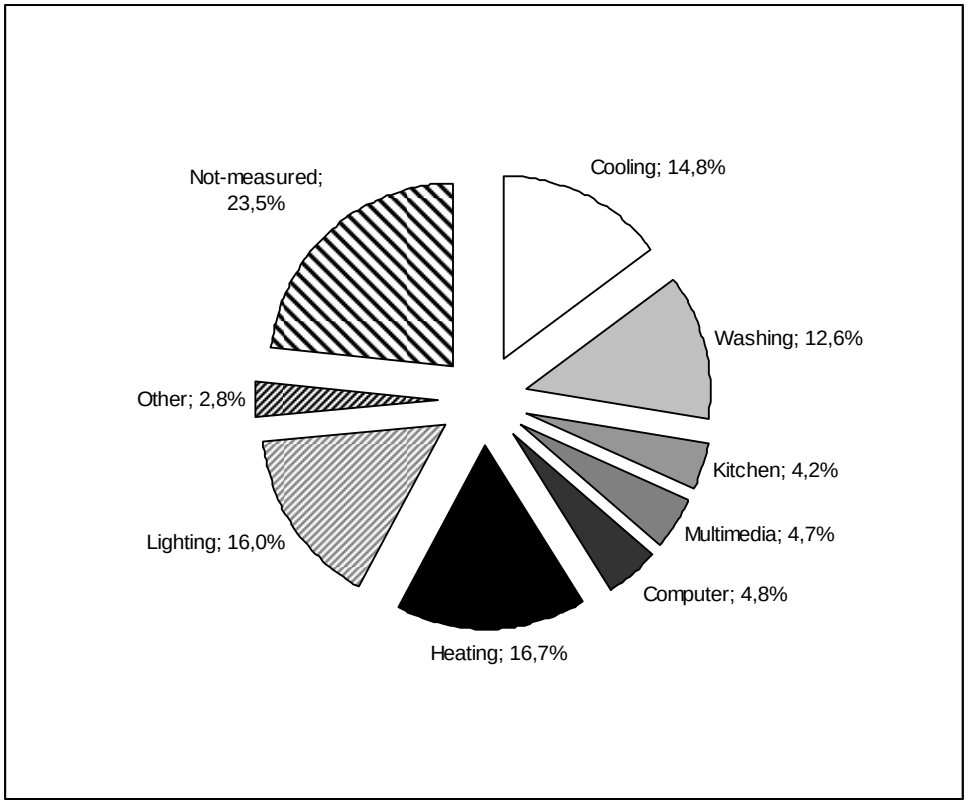
The households collected the data monthly. In August, a detailed report was created with a distribution of the household's electrical consumption and an analysis of each part with saving potentials and energy saving recommendations. An example of such a report can be found in the appendix 4.
To make the report clear and structured, different parts of the total electricity consumption were detailed:

- Cooling: this part concerns cooling equipment, fridges, freezers and fridge-freezer combinations. Cooling equipment in central or local air conditioning installations is not included in this part.
- Washing: this part includes washing machines, dryers and dishwashers.
- Kitchen: this part comprises cooking rings, ovens, microwave ovens, and other electrical equipment for cooking.
- Multimedia: TVs, video recorders, DVDs and hifi chains are included in this part.
- Information technology: this part includes computers and all related equipment.
- Heating: this part gathers the electrical consumption for domestic hot water boilers, water pumps for central heating systems, regulation units and central heating boilers.
- Lighting: this part estimates electricity consumption for all electric lighting.
- Other measured appliances: this part is composed of other available appliances, which could difficultly be ranked in aforementioned parts. It can include, for instance, toothbrushes, clocks, rainwater pumps, irons, central vacuum cleaning systems, water beds, water desalinators, ventilators, etc.
- The non-measured consumption consisted of the remainder of the total electricity consumption. During the measurement campaign, not all appliances could be reached.

## *7.3 General results*

The general appreciation of the results firstly shows the extreme variety of electricity consumption. The first aim was to establish a 'standard' distribution of electricity consumption, based on the distributions in the households.

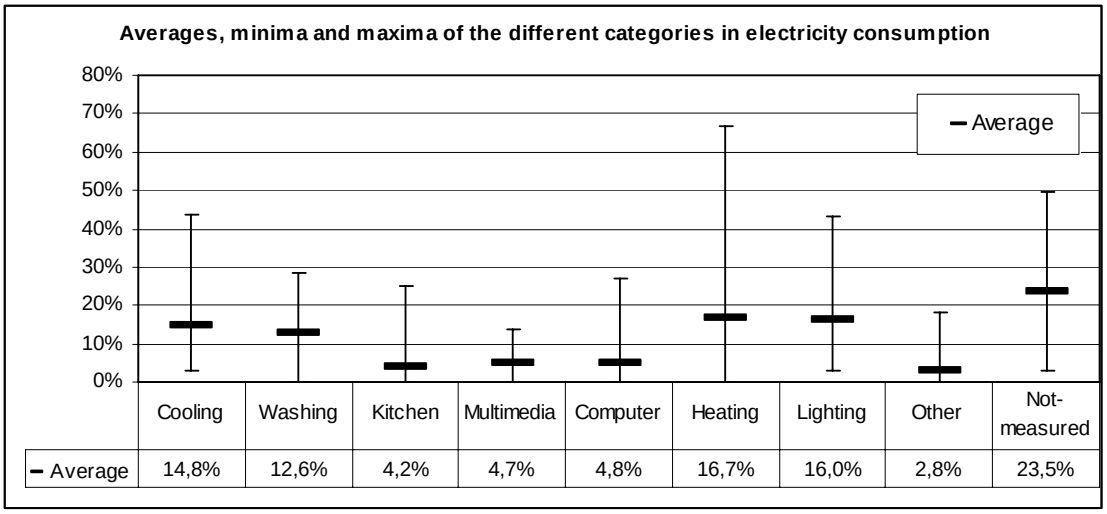
**Figure 7.2 Average distribution of different consumption categories in the households**




This average distribution is shown in Figure 7.2. This figure shows an acceptable result for the measurement campaign set-up; the average unmeasured consumption is only 23.5%.
Furthermore, it seems to indicate that the four major areas in consumption, Cooling, Washing, Lighting and Heating, only take up 60.3 % of the total consumption. The rest is scattered between multiple uses.

This approach has but little significance. A more realistic view is obtained by looking at the variation of the different parts and the minimum and maximum obtained values. Figure 7.3 shows the average percentage that one specific part takes up in the measured electricity consumption. At the same time, this figure shows the variation of this percentage by indicating the smallest and largest encountered percentages in one specific distribution

**Figure 7.3 Variation in the different parts of the electricity consumption**




| | Cooling | Washing | Kitchen | Multimedia | Computer | Heating | Lighting | Other | Not-measured |
|---|---|---|---|---|---|---|---|---|---|
| Average | 14,8% | 12,6% | 4,2% | 4,7% | 4,8% | 16,7% | 16,0% | 2,8% | 23,5% |

Based on these results, one can conclude that a 'standard' distribution representing the averages of the different parts, cannot be of significant value for one single household. Variations of the different percentages over 60% are very well possible. The variety of consumption patterns in households is too large.

## *7.4 Specific results, recommendations and reactions*

During the measurements on the different appliances, several possible recommendations emerged. They often concerned reduction of standby power consumption and consumption for lighting. During the evaluation of the measurement results, several other specific recommendations could be made for each household. In general most of the recommendations dealt with the following areas:

- Cold appliances: fridges and freezers often represented a large potential for energy savings. Very often households invest in energy-efficient fridges and freezers, based on an A or A+ labels. The old fridge however was kept in the basement and continued to function the year long. Most owners feel like they do not use these old fridges very often, they only use them for some drinks. So they don't consume a lot of energy. But they are very surprised to find out that these old fridges should better be discarded. Replacements of other appliances were equally often recommended.

- Standby power consumption: a very valuable and interesting part was the measurement of all standby powers of the appliances in the house. Often, owners were well aware of the existence of standby power losses, but the interest to diminish them only emerged after the full calculation was done by the energy experts based on the measurements. This part is mostly related to behaviour and the recommendations were therefore often carried out on the spot (e.g. installation of adaptors with interrupters or disconnection of unused appliances.)

- Lighting: Owners are aware of the availability of energy saving bulbs, but a lot of false ideas are present concerning their performance, cost, lifetime or effectiveness. Detailed information on different types of lamps or installations is often not known, so the owners are pleased to learn that different possibilities exist for the installation of energy-efficient lighting. In quite a similar way, a big motivator was not to learn about the different options alone, but also to see the results of the measurements, showing the actual benefit for their own house.

- Large primary energy savings can be achieved by replacing electrical equipment for water heating like domestic hot water boilers by boilers heated by oil or gas.

## *7.5 Reactions from the households on the analysis*

### *7.5.1 Reactions from the households after the detailed report*

A questionnaire accompanied the detailed report, so the participants could return their reactions. Some of the reactions were:

- *"I find this overview very interesting. Especially the comparison with other normal consumptions is valuable. It is a pity that not all consumptions are included."*
- *"The halogen lamp will be replaced by an energy-saving bulb. The freezer will be replaced; it is currently out of service."*
- *"1 freezer is put out of service (consumption too high). "*
- *"Funny feedback on p. 8* (this refers to the description of the electricity consumption of the central heating boiler). *This energy is not being used for the preparation of hot water."*
- *"Yes, interesting, I did not know that the electrical heating used so much. But be careful, an evaluation which is too positive can incite people to pay less attention."*

All returned questionnaires stated explicitly that the report was interesting. (n = 21)

### *7.5.2 Results from the in-depth interviews*

With these measurements, the electrical consumption becomes « visible ». By collecting the figures, the participants increase their consciousness of this consumption: *"in fact, we were already paying attention before, but for us, it was really interesting to realise what we consume, how and via which device* (Antoine)"

Even if some of the interviewees do not really know what these numbers represent, they use the small meters to compare the consumption of an electrical appliance with another one. Some received ideas are then deconstructed, as Michel says: *"we have preconceptions related to the consumption. We have the impression, for example, that a microwave oven consumes a lot, but finally, it does not work for very long periods, so when we look to the meters, when we collect the figures, it is not the microwave oven that consumes the most."*

Once again, this doesn't bring a tremendous change in the participants' behaviours, but a lot of interviewees have expressed the fact that they became more aware of the consumption of some devices. The main example of this is the standby consumption of electrical devices like televisions, DVD players or radios. The fact that the electricity meters make some noise makes the consumption even more "real", as Clara expresses it: *"when we see the consumption, we don't really laugh…we weren't very conscious about it, before. Yes, yes, [we knew that] it consumes a lot; but now, we hear tic…, tic…, tic…"*

A few interviewees even mention that they do not use halogen lamps anymore: *"yes, for example, that lamp, another halogen lamp, I don't switch it on anymore: for what is it useful?"* (Luc). Or Maria: *"in that corner (…) we had a halogen lamp… My God! I was so surprised by its consumption! Enormous: more than my washing machine!"*

Even if a higher level of consciousness is reached, the behavioural changes seem to be very small, according to the participants. This is not only because the use of common electrical appliances is driven by habits which are obviously hard to change but also because the use of some devices, like the main fridge for instance, is impossible to avoid…

The electrical audit also helps the participants to know which electrical appliances consume the most and consequently which one they could replace first in case they were to buy new ones. The

interviewees spontaneously speak about the labels and will adjust their purchases according to this labelling system.

## *7.6 The electrical audit: a tool for changing behaviours?*

### *7.6.1 Can effects of the metering campaign be derived from numerical results?*

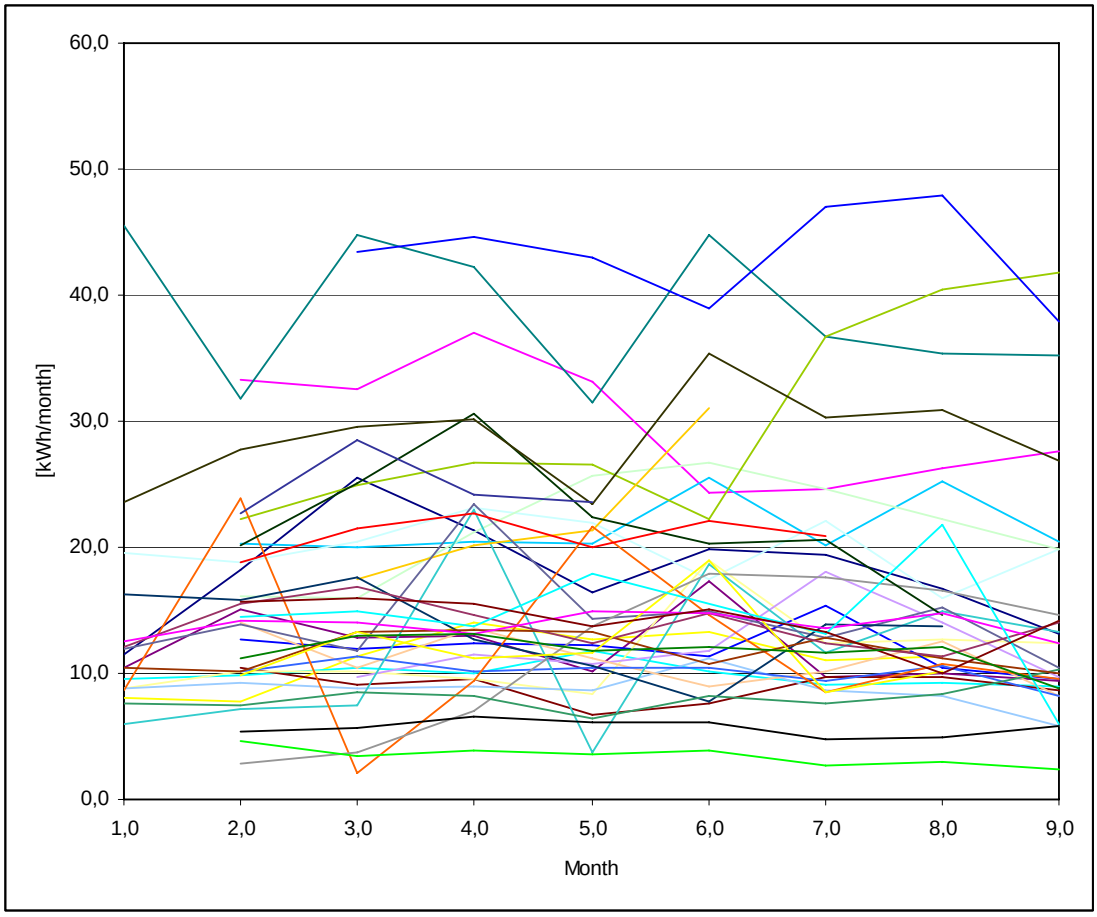
The metering campaign makes the actual consumption visible. This may lead to the question if the actual measured consumption is diminishing after installation of the meters.

Of course, several aspects are influencing the actual consumption of several appliances.
First of all the weather has to be mentioned. Heating appliances or boilers will consume more often in winter than in summer. There is quite a similar effect for the consumption for lighting. Shorter periods of daylight will increase the consumption for lighting.
In summer, fridges and freezers will have higher consumptions.
Besides the weather, changes in household composition equally occur and have an impact. In some of the households, babies were born, in other households children left home to go to university or left home completely. This has of course large effects on the monthly consumptions.
Other effects can be visitors staying over, short or longer holidays, etc.
Finally, numerous small effects should be noted, such as changes in appliances, cloudy or clear weather, daily differences in cooking, washing or drying, etc.
This extreme amount of influencing factors equally shows in the measuring results.

When the effect of the metering campaign should be regarded, all other effects should be singled out as much as possible. It was therefore decided to look at the consumption of the different washing machines during the measuring period. In theory, changing seasons do not largely affect the use of washing machines. Other appliances, such as tumbler dryers, fridges and freezers, or heating equipment are more affected. Secondly, actual behaviour can directly influence the consumption of the washing machine. It is thus a good type of appliance to determine whether the measured consumption can reveal differences in behaviour through the campaign.

This effect is shown in the next figure, which gives the monthly consumption of the washing machine in the household. The extreme dependence on all types of factors can readily be seen in the graph. There are only very few families with a rather steady profile, most consumption varies strongly from month to month without any trend.

**Figure 7.4 Absolute variations in monthly energy consumption of the different washing machines followed during the project [kWh]**




In an effort to derive a somehow clearer trend, the first month after installation of the measuring device was taken as a reference of 100%. Relative diversion of this reference in the months afterwards was followed. These results are given in the next figure.
Here also, very few trends can be distinguished. Only a few households give a steady trend, which is steadily decreasing or steadily increasing. In most households, the differences with the first month are swinging from positive to negative and back again.
It is obviously very hard to conclude on differences in behaviour based on these patterns.

### *7.6.2 Potential energy savings*

How much energy does this electricity consumption represent in comparison with the energy consumption for heating? Different types of energies cannot be simply added. Electricity is not a primary energy source, because other energy sources are used to create it. In this conversion process, energy gets lost. The overall conversion efficiency is often a point of discussion. In this study, the starting point in the European prenorm prEN 15315 was taken. The norm proposes the equivalence between 1 kWh of electricity and 2.8 kWh of primary energy. In comparison with oil and natural gas (both with an equivalence factor of 1.1), this makes 1kWh electricity comparable with 2.55 kWh natural gas or oil.

**Figure 7.5 Relative variations in monthly energy consumption of the different washing machines followed during the project [kWh]**

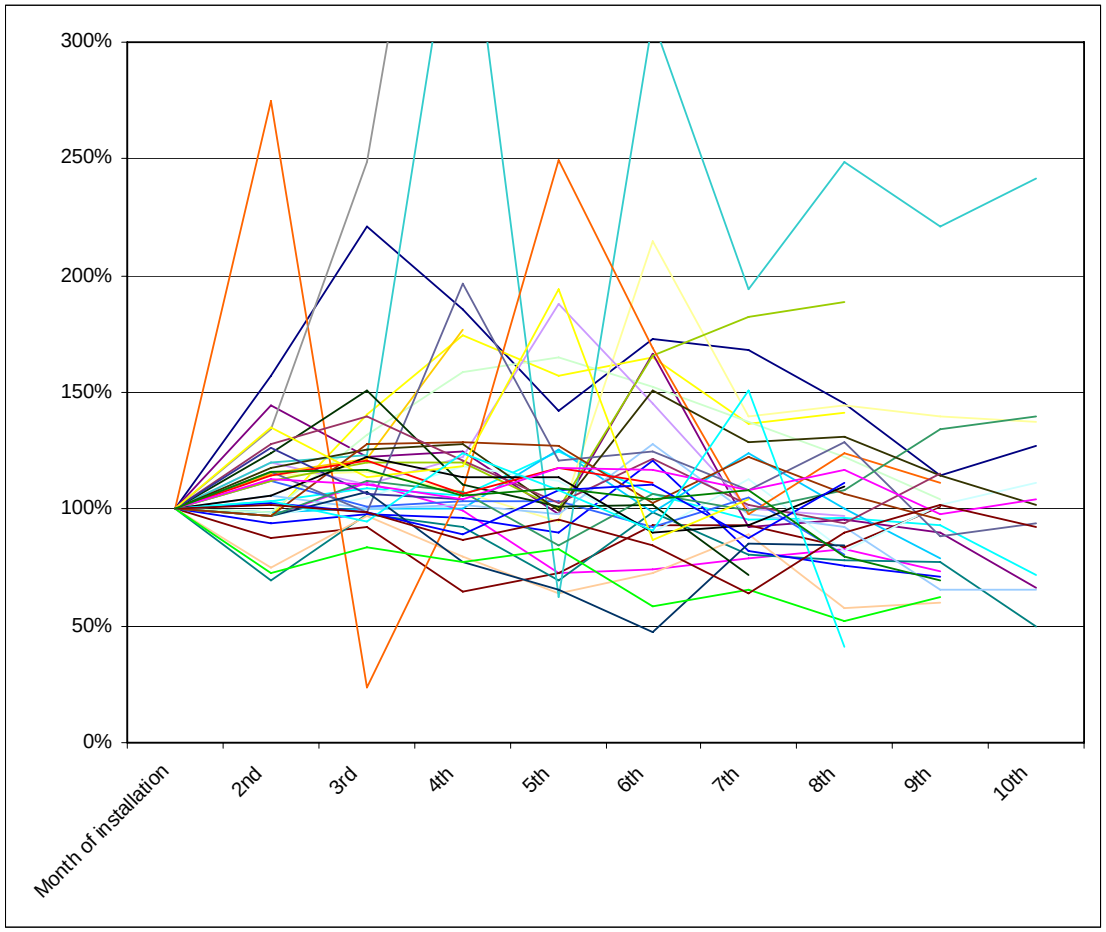
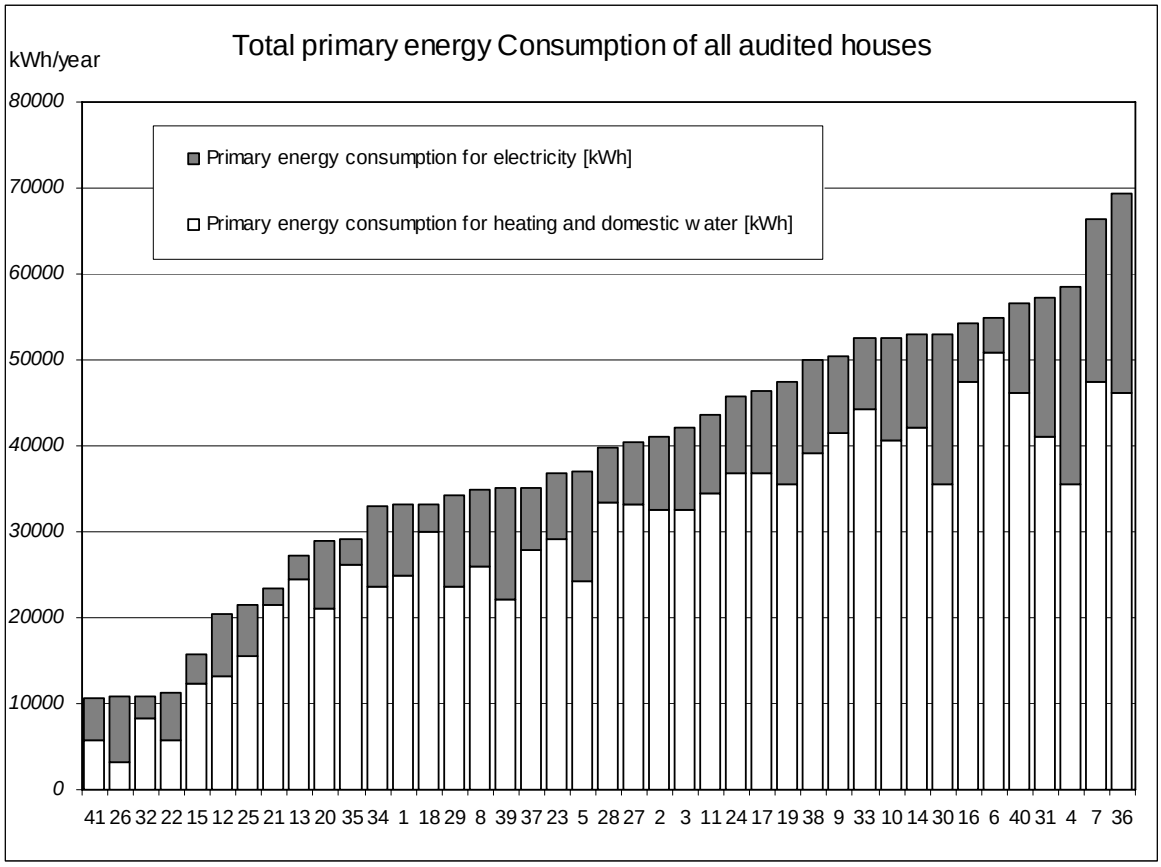



Figure 7.6 compares the electricity consumption and the energy needed for the heating of the house and domestic hot water.
This comparison shows the electricity consumption, but in this case this solely means the remaining electricity consumption. All electricity needs for the heating of the house or for domestic hot water have been subtracted. Because some houses are totally or partially electrically heated, this heating energy is subtracted in order to allow comparison between the households. This remaining electricity consumption still takes up a large slice of the total primary energy use of a household. On average, this remaining electricity consumption represents 27,1% of the total primary energy use. But this percentage varies between 7,8 % and 74 %.

This average ratio is likely to increase in the future, as more and more attention is being paid to better insulation, driving heating energy needs down and more and more different types of electrical appliances are manufactured and sold, pushing electricity needs up.

**Figure 7.6 Comparison between primary energy needed for heating and for remaining electricity consumption**




### *7.6.3 Establishing an audit procedure*

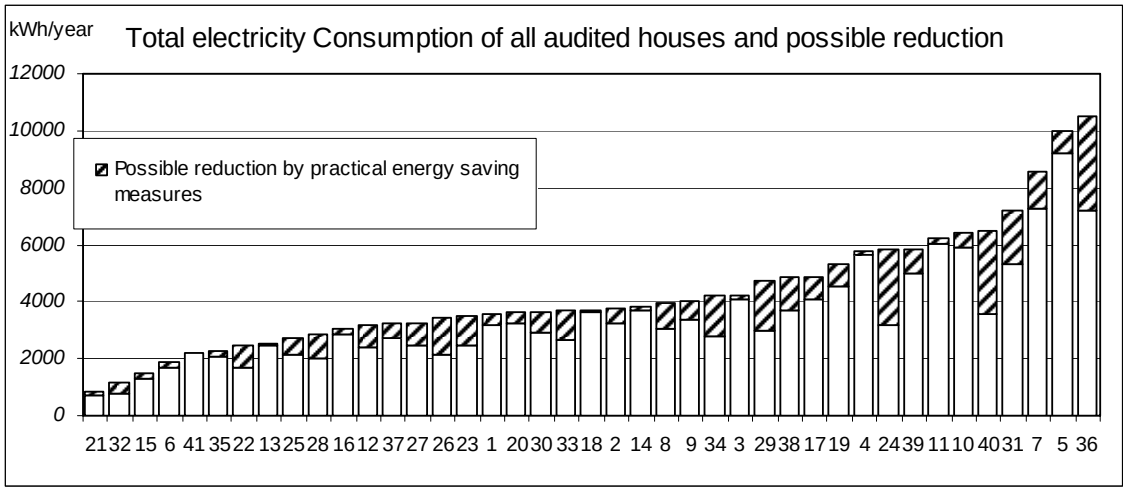
The audit can only be a useful tool if it can effectively indicate saving potentials and saving recommendations.
In an audit, the expert should first be able to draw a distribution of the electricity consumption of the household. There exist standard average distributions, but as discussed above, these standard distributions are mostly of no use for a singular household. The variations in reality are much too large. But the expert can base his distribution on power measurements of the appliances, databases, and a survey of all installed appliances and lighting fixtures. This should possibly give a much more precise distribution of the annual electricity consumption.

In a second step, saving potentials can be derived from comparisons with 'reasonable' consumptions. In this sense, the saving potentials have been determined based on average household consumptions. For instance, when a fridge had a high consumption, the saving potential was not determined as the difference with the best possible energy-saving A++ fridge on the market. The saving potential was determined as a difference with an average energy-saving fridge, for example 180 kWh per year. This way, the recommendations were not too strict, but reasonable. In the case of a further developed electrical audit, personal discussions between the expert and the household are necessary to define these saving potentials in more detail. As in the energy assessment, these recommendations can be equally precise and detailed.

For the audits performed during this project, the saving potentials are shown in Figure 7.7. On average, a possible saving of 18.7% was achieved, with a maximum of 46%. As both the reactions of the concerned households were very positive, and as the technical results show considerable

reduction potentials, the electrical audit can form a very useful tool to reduce residential energy consumption. It should be noted that this saving potential does not include savings by different behaviour or by interventions made during the electrical audit itself. As a matter of fact, several households installed sockets with switches during the audit for the appliances which showed large stand-by consumptions.

**Figure 7.7 Reduction of the electricity consumption by energy saving recommendations**




### *7.6.4 Practical implementation and points to consider*

The electrical audit cannot yet be practically implemented. During the SEREC survey, the results were obtained by measuring one by one the different appliances. As this had not yet been done in a Belgian context, these measurements were very useful, and the results are clear. But when a future electrical audit will have to be established, it cannot be based on continuous measurements of appliances. During the discussion on the energy assessment, it showed that the final price of such an audit played an important role. When continuous measurements of the appliances will be necessary, the price of an electrical audit will be too high and this will form a large barrier for market entrance.

A practical implementation of the electrical audit will have to be based on different indicators. During an electrical audit, the expert can base himself on different power measurements and characteristics of the appliances. The database built up during the SEREC survey can serve to link these indicators with yearly consumption.
This approach will not achieve the same level of detail, but it will allow to pinpoint the different saving potentials in the house. A practical audit will then need the survey of all installed and available appliances and light fixtures. For the larger appliances a power measurement is equally performed. The results are then calculated based on input from the owners and the measurement database. In total, this should ask not more then two hours from the expert, lifting the total price of the electrical audit between 100€ and 150€.

A link can be found in different ways considering the specific category of consumption:

- A major potential for reduction can be found in lighting, despite different efforts by authorities to make households aware of the advantages of high-efficiency lighting. An expert can already draw numerous conclusions based on a survey on the different installed lamps in the house. An estimation of the actual operation time of the different lamps can be put together by a questionnaire or an energy diary.
- Saving potential equally remain important with the cooling and heating appliances. The replacement of old fridges and freezers can be recommended. Most importantly, old fridges are to be removed. In quite a few cases, they continue to be operational in addition to the new fridge.

- Finally, for some households, the remaining non-measured energy consumption was very high. One possible explanation is the wide range of appliances which are scattered through the house, and which by themselves have a very modest consumption, but make up a large part together. These can be special bathtubs, toothbrushes, clocks, game consoles, toys, kitchen equipment... An expert should make a list of all electrical appliances in the house, because of this effect.

## *7.7 Conclusions*

The need for the electrical audit is present, as can be seen from the reactions of the households and from the reactions of the users of the Edisontest. The evaluation is technically not as complicated as for the energy assessment. But the results can be much more interesting on a short-term basis, so energy saving effects can be equally large.

The technical calculation of the energy savings is not so large. But in practice, it seems that many recommendations are much more often put into practice by the households. A part of these recommendations are immediately implemented during the audit itself. This is often because the recommendations do not require large interventions or large investments for a reasonable reduction in energy consumption.

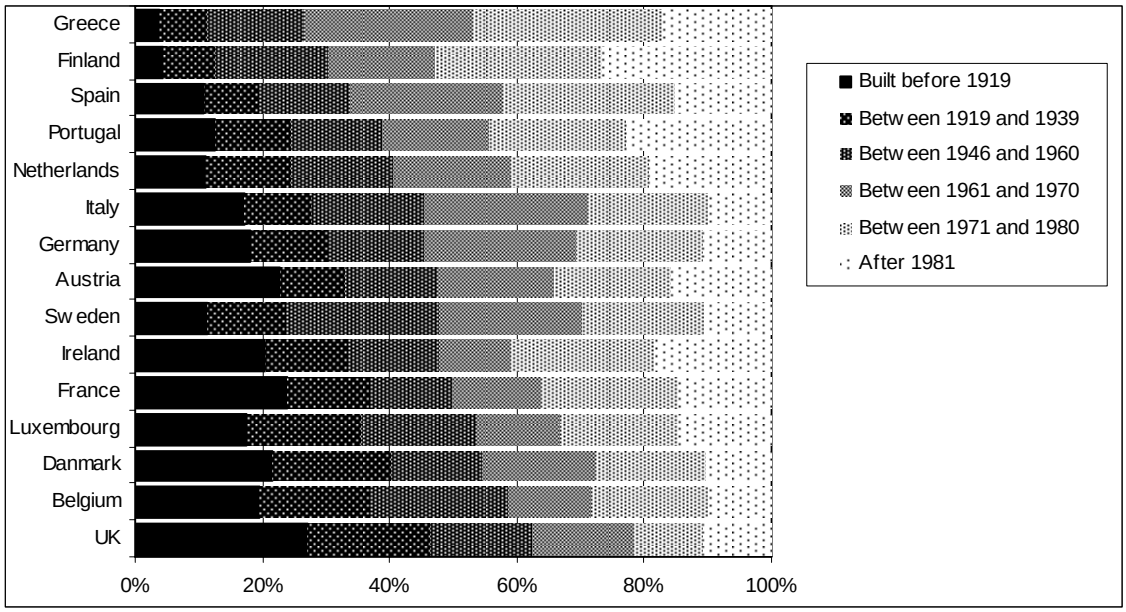
The total electricity consumption is strongly related to behaviour. The expert will thus have to base himself partly on estimations of the owners. One of the possibilities to be considered is an adapted version of the energy diary as a preparation of the audit. This part can reduce the time of the actual audit and consequently the price. At the same time, the diary can prepare a description of the actual habits of the household.

# 8. THE ENERGY ADVICE PROCEDURE

## *8.1 Presentation of the Energy Advice Procedure*

The residential sector in Belgium appears particular when compared to that of neighbouring countries. The average Belgian energy consumption for a dwelling lies significantly higher, even when corrections for climate conditions have been taken into account. This can be seen in Figure 8.1, which shows the average heating consumption per house, taking into account climate differences.

**Figure 8.1 Distribution of building age in different European countries (Eurostat, 1991)**



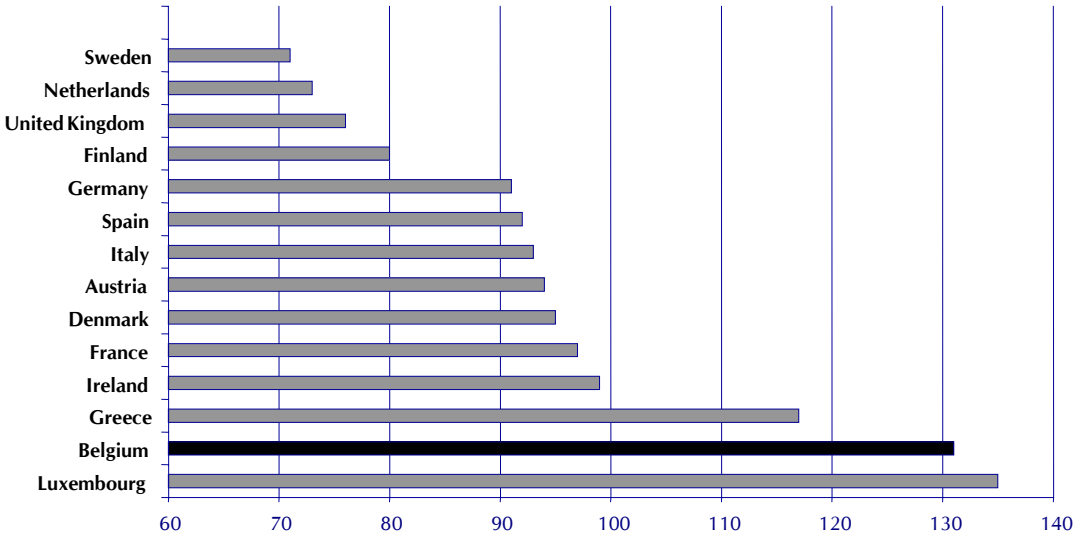

This way, the representation rather gives an idea of the average energy efficiency in a country. Unfortunately, the Belgian average consumption (26,2 MWh/dw) is significantly higher than any other European country, except Luxembourg.

There are several reasons that help explaining this extreme result. First of all, the average Belgian building stock is on average very old. This is clearly visible in Figure 8.2, where a distribution of the age of the building stock through different European countries is shown. Belgium has one of the oldest buildings stocks to start with.

At the same time the average surface is amongst the highest in the European Union. This figure does not however match the figures from the Belgian National Institute for Statistics: in 2001, only 9.1% of all private dwellings had a floor area larger than 125 $m^2$ (Bartiaux and Gram-Hanssen, 2005). Still, this does not explain the difference completely.

Additional reasons can be found in the local building culture and the corresponding legislation. There is a strong habit, which is maintained through the years, for a Belgian to build his own house. This does result in a very diverse spectrum of constructions and techniques. At the same time, building regulation and supervision from authorities have been fairly weak in the past. As such, residential construction rarely happens in a consorted and professional way. The end result is a building stock with a huge variety, and with poor energetic properties.

**Figure 8.2 Average size of a dwelling in m² surface**




In order to deal with the problem of this poor average performance, the energy authorities enabled the conception of an Energy Advice Procedure (EAP), designed to evaluate the performance of existing buildings, to label this performance and to propose effective interventions for improvements. This conception started with the set-up of the procedure around 1998. Both the complete procedure and software for single-family houses have been completed by now.
The procedure has been jointly worked out by the Belgian Building Research Institute (BBRI), the Catholic University of Louvain-la-Neuve (UCL), ICEDD and the Flemish Institute for Technological Research (VITO). The aim of this project was to develop an evaluation procedure for energy experts in the three Belgian regions. A software has equally been developed. And this software will be made available to the experts certified by the regions.
Former available procedures and software focused solely on the building envelope. These procedures were based on the official regulations in place, which required a maximum insulation value for the envelope. In practice, this k-value was not reached during the building process and this was not followed up by the authorities. Moreover, positive or negative effects of design as well as building orientation, solar gains, ventilation heating requirements and heating installation types were not taken into account. The actual heating load or heating consumption was not calculated.

The EAP is targeted towards the evaluation of the yearly energy consumption. It is a procedure being developed for two specific situations:

- The first situation is a change of ownership of existing buildings. The seller of the building will have to present a certificate with the corresponding labels of the energetic performances. This information can give the buyer more insight in the value of the building. The labels should therefore, in a similar way as the labels for the new constructions, influence the price of the existing building. The present procedure is not yet conform to the prescription of the European Directive on the energy performance of buildings (Dir. 2002/91/EC).
- The second situation is that in which an owner wants to invest in a renovation of the building. The performance of an audit according to the EAP can give precise and detailed information about the most effective ways to increase the energetic performance.

These are not necessarily two distinct situations. Renovation is often performed after the purchase of an older building, and studies show that renovation is a strongly growing trend in the Belgian construction market (Dhondt, 2004).

If the impact of the EAP has to be tested, the effect in these two situations should be regarded. The first question should be: In case of a renovation, what information results from the procedure, and how does it affect the future renovations executed by the owners? And in case of the sale of a

building: what is the appreciation of the resulting information and how does it affect the view of the owners and potential buyers on the building?

## *8.2 Framework of the study*

VITO performed the full energetic analysis of 41 different houses throughout Belgium. These audits covered two parts. First, the EAP has been applied to the building.

The application of the EAP during the audits constituted a complete overall test of the procedure. First of all, the energetic analysis of the building was performed trough the EAP with the final software. This already gives an indication of the practical applicability of the theoretical procedure. Secondly, energy saving recommendations were presented to the owners. And finally the procedure led to a detailed report for the owners, presenting all results and labels together with additional information. It was requested to the owners, one month afterwards, to answer a questionnaire about their perceptions of the procedure, their impression of the results and their ideas about the effects.

To decide exactly which 41 houses to analyse, several actions were undertaken in order to gather volunteers from all over Belgium for this research. Finally some 250 families responded. Out of this group, VITO selected the participants according to several criteria. Given the number of houses to be audited, it was not possible to compose a sample that would be representative for the entire Belgian housing stock. The large variety in energetic performances of the Belgian houses, made this even more difficult. The sample had to be composed to provide a thorough test of the EAP. So the aim was not to achieve a representative sample, but a selected sample with the largest possible diversity and variety.
This diversity was reached not only on technical criteria such as energy source, heating installation, house dimensions, type of house, and building age, but also on sociological criteria, like net monthly family income, family composition and age of the family members. The selection, according to sociological criteria, showed to be equally important. The EAP not only takes technical data into account, but also the actual heating energy consumption of the inhabitants is of importance. Moreover, a variation in education level of the volunteers had to be maintained to test the comprehensibility of the EAP and the final report.

The energetic analysis of the houses consisted of the full EAP. During this project, the different procedures have been executed by experts from VITO, which also contributed to the development of the EAP and software. The procedure is based on the normalised European heating calculation methods being developed, but does not take lighting, electric households appliances or air conditioning into account. The procedure covers however the following three large parts:

- The building envelope: The entire envelope of the heated volume is described. This description takes into account all different parts with their compositions, sizes, orientations and configurations. The description of the envelope is undoubtedly the most complex and labour-intensive part of the evaluation.
- The heating installation: The main heating installation is described. The energetic performance of the installation is split up in separate performances for production, distribution, control system and heat emission. The procedure determines a theoretical calculation of the energy consumption, based on all technical data. But the procedure equally gives results calculated from the actual yearly consumption of the family, thereby taking the actual consumption of the family into account.
- The hot tap water: The installation for heating domestic water is described. The energetic performance distinguishes the production performance, distribution losses and storage losses.

The EAP equally foresees the control of the thermal comfort during the summer and the ventilation (Vekemans, 2003). However, these aspects have not been applied in the framework of this study.

For every separate part, for combinations, as well as the composite entity, every time a label is attributed, energetic losses and gains are shown, as well as energetic and economic effects in case of renovation. Labels are attributed from A+ to E, where A+ indicates an excellent performance and E an insufficient performance. The criteria for labelling do depend on the part being judged. For instance, the criteria for windows are much wider than those for walls or roof parts. The criteria were chosen in correspondence with the actual building practices in Belgium, so A+ corresponds with the best technically possible practice and E with the worst. Given the fact that the procedure has been set up for existing residential buildings, the criteria to define the different classes have been chosen wide enough. Not every older building should fall immediately under label E. The final result shows a label for the three main parts: one for the building envelope, one for the heating installation and one for the hot tap water.

Together with the judgement on the classification of a specific part, a recommendation for an improvement is produced and the results of this potential future intervention are calculated.

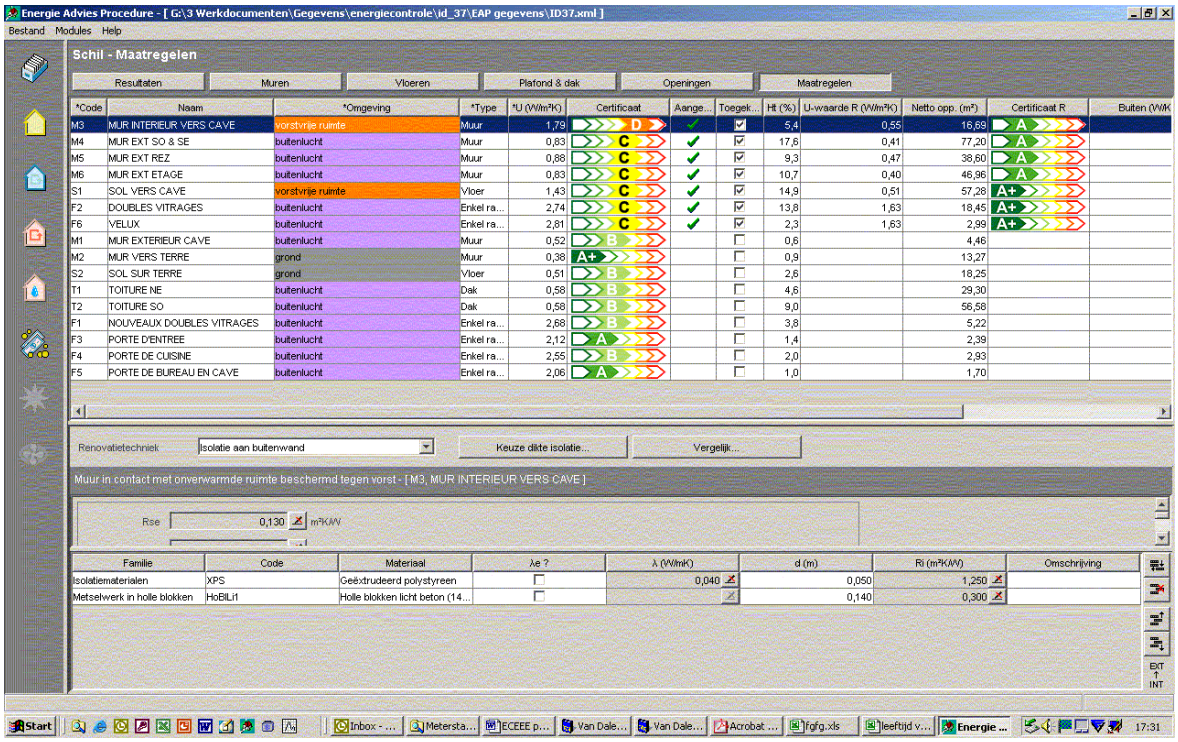
This is visible in Figure 8.3, where a screen of the EAP-software is displayed. The evaluation of the building envelope shows the envelope line per line by its different components, each with a label. Some of the weaker parts are proposed to be replaced by: A or A+ components.

The procedure produces its results, therefore, not only as a certification and a label for the existing situation, but at the same time by presenting a possible future situation where the weakest parts have been renovated. For every analysed house, a report was composed, which included all technical details, practical explanations of the procedure and technical sheets for every proposed intervention. This report was discussed with the owners of the house in order to ensure that all the results were clear. All renovations in the houses executed after the EAP-analysis have been followed up and the results are presented at the end of this section.

## *8.3 Results of the EAP and saving potential for renovations*

The actual results of the EAP offer good insight in the actual state of the investigated houses and the related saving potentials. The analysis of the building envelope yields a yearly energy need. This is connected to the analysis of the heating installation in order to give the yearly primary energy consumption. To complete the total consumption, the yearly primary energy consumption for the heating of domestic hot water is added.

**Figure 8.3 Screen view of the evaluation of the building envelope in the EAP-software**

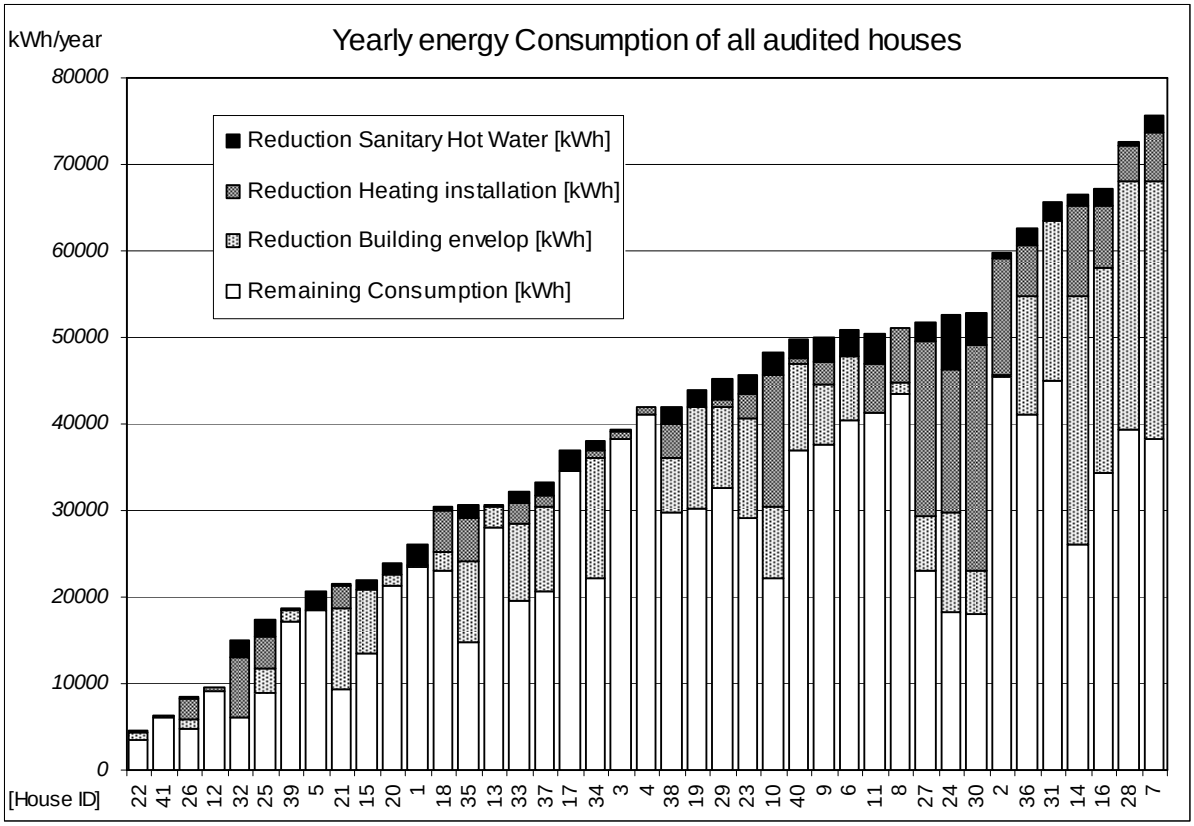



This result shows the yearly energy consumption, totally independent of the inhabitants' behaviour. The calculation defines an envelope in the building containing all rooms and spaces, which can possibly be heated by the main heating installations. In reality, several rooms are often kept colder. But the procedure takes a 100% occupation into account. This is not only occupation in space, but also in time. Reductions in practical consump-tion because the heating is turned off during the day, are not taken into account. This is needed to keep standardisation and comparison between different buildings possible. However, it stays very clear that this consumption is a purely theoretical consumption. This theoretical consumption stays useful in case the building is sold. However, for actual renovations, it is useful to readapt all results in function of the actual energy consumption of the family. The difference between the theoretical consumption, which is purely a calculation result and the real consumption, which is also derived from the household's energy bills, will be discussed below.

A member of the household can give the real or practical energy consumption, and this information is taken into account. The entire calculation is repeated in reverse. The load curve of the heating installation is adapted and this leads to altered heat losses in envelope, installation and domestic hot water. Energy saving potential is deducted from each of the three parts. The results for all audited houses are shown in figure 8.4.

The reduction potential of most of the houses is very large. These potentials are determined according to the actual situation, taking technical as well as practical restrictions into account. In former studies, similar exercises showed an average reduction potential of 37% (Vekemans, 2001). The average saving potential in this case was 32%, so this result confirms former investigations in this field.
The saving potential was determined on the basis of 260 practical energy saving recommendations. These recommendations cover all possible interventions to reduce the heating charges of the audited houses. It is hardly possible to distinguish a certain type of intervention as the most effective. This depends too much on the actual situation in the house. The recommendations and their results are gathered for every broad category in table 8.1.

**Figure 8.4 Practical energy consumption of the audited houses and reduction potentials**




The presentation of energy saving recommendations like in Table 8.1 gives some indications. The variation in each category is very large. It will now depend largely on the priorities put by the owner to decide which intervention will be executed. Based on the information that follows from the EAP, the decision criteria can roughly be put in one of two distinct categories: environmental or economical. The environmental criteria are mostly related to actual energy consumption and reductions. The economical criteria indicate effects on the energy bill.

Table 8.1 already shows one indication very clearly: showerheads are apparently moderate in energy savings compared to larger interventions. However, their economical yield is huge; this is the only acceptable general conclusion, which can directly be drawn from these data. The clearest result is that, whereas some recommendations can yield considerable savings in some cases, they have practically little or no effect in others. So generalisations are very hard, and they are technically incorrect.

**Table 8.1 Proposed Energy saving recommendations and their respective energetic and economical effect**

| | | Yearly Primary Energy saving [kWh] | | | Time to breakeven [years] | |
|---|---|---|---|---|---|---|
| **Advice** | **#** | **Average** | **Minimum** | **Maximum** | **Minimum** | **Maximum** |
| Reflection foil behind radiators | 12 | 70 | 0 | 141 | 4,4 | ∞ |
| Maintenance boiler | 4 | 467 | 0 | 1513 | 1,6 | ∞ |
| Windows and doors | 53 | 950 | 0 | 8448 | 9,0 | ∞ |
| Inner wall insulation | 14 | 1001 | 111 | 3992 | 1,7 | 11,3 |
| Distribution pipes insulation | 31 | 1136 | 101 | 4923 | 0,6 | 67,5 |
| Floor insulation | 14 | 1239 | 245 | 2201 | 5,1 | 51,3 |
| Showerhead | 29 | 1421 | 439 | 2744 | 0,3 | 4,2 |
| Control system | 16 | 1990 | 108 | 6504 | 1,5 | 180,0 |
| Storage tank insulation | 1 | 2156 | 2156 | 2156 | 5,0 | 5,0 |
| Outer wall insulation | 21 | 2283 | 100 | 5872 | 13,0 | ∞ |
| Roof insulation | 22 | 4995 | 85 | 31113 | 0,8 | 133,6 |
| Solar boiler | 21 | 5735 | 3049 | 9425 | 5,2 | 61,0 |
| Boiler replacement | 22 | 6519 | 1189 | 17765 | 4,3 | 58,1 |

### *8.3.1 Intervention at the building envelope*

Several recommendations propose additional insulation for the building envelope. These recommendations are split between insulation of the walls as well as the roof, doors, windows and floors. For the walls' insulation, the theoretical building physics shows that additional exterior insulation of walls is the best option in many cases. This solution gives easier remedies for cold bridges and thus, gives better prevention of condensation. Interior insulation presents risks of condensation in walls and is a reduction of available room space. For every case where insulation is recommended for a wall separating the heated space and the exterior, the insulation is proposed for the outside of the wall. The presented recommendations for inner wall insulation only recommends the insulation at the cold side of an inner wall separating the heated space with unheated rooms, such as: the garage, caves or attics.
A very important effect for the economic viability of additional insulation is the possibility for the owners to carry out the interventions themselves, without the help of a contractor. Supposedly, this is the situation for floor insulation, roof insulation and insulation of inner walls. Insulation at the exterior of walls and replacement of windows and doors by more performing alternatives has to be executed by professionals. These interventions are therefore much more expensive and less profitable. The only exception constitutes the replacement of single glass windows by high performance double glass windows. This replacement recovers the costs mostly within ten years and very commonly within five. Any other contracting work is less interesting from an economic point of view.
However, when the work can be carried out by the owner, the reduced price of the interventions enables substantial savings of both energy and money. The insulation of roofs, especially, is often very cost-effective. If feasible, these interventions often give a reduction potential of 30% on the actual energy consumption.

### *8.3.2 Interventions at the heating installation*

Recommendations concerning the heating installations also show some patterns. Proper insulation of distribution tubes is quite often neglected. However, this is also a rather easy intervention, which can be done by the owner; the cost-effectiveness is therefore rather high. However, other common recommendations, like installation of reflection foil behind radiators, turn out to be almost without energetic effect.

The largest saving potential can be achieved economically by boiler replacement. This is often cost-effective on the longer term and has more energy saving potential than installation of solar boilers.
At the side of preparation of domestic hot water, the insulation of distribution tubes returns. Owners often request a detailed evaluation of the effects of a solar boiler. However, this intervention recovers only rarely within less than 20 years, considering the energy prices derived from the last bills of the reviewed dwelling. This assumption is explained in the following paragraph. The result for solar boilers is quite deceiving. Information about the installation of solar boilers was largely distributed and official policies aimed to encourage the installation of solar boilers. However, the economic results take the effects of subsidies, fiscal advantages and other premiums into account. And even in this case the economical viability of these installations is pretty low.

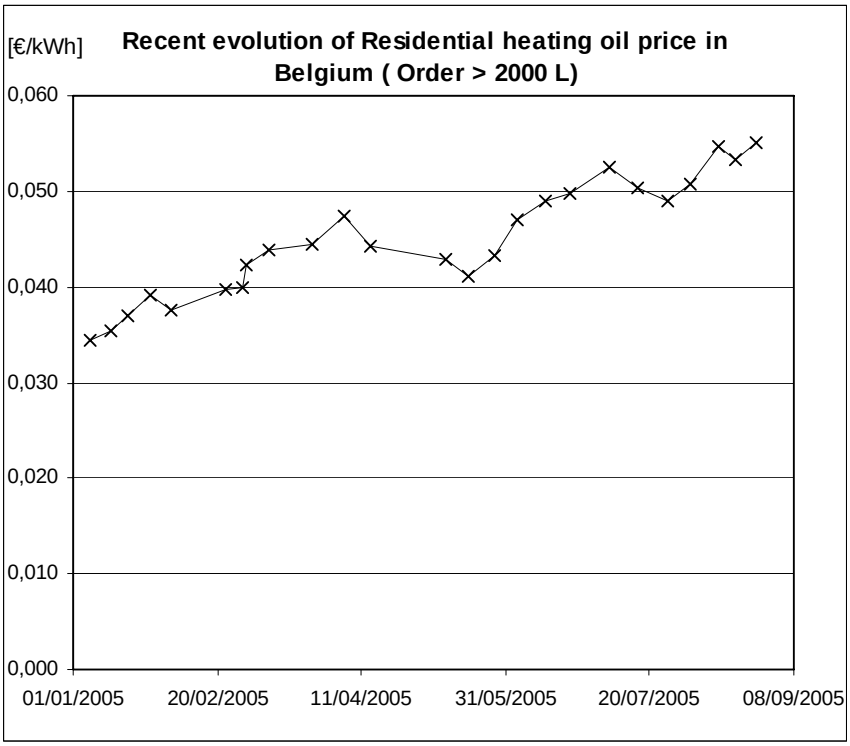
### *8.3.3 Remarks concerning the observed energy prices*

The calculated payback periods as well as all economic gains resulting from different interventions in the households have been calculated using the actual energy prices of the different families. This means in practice that energy prices have been deduced from the households' yearly energy bills. The prices are therefore average prices through 2003 and 2004.

Several possibilities have been considered to take into account an anticipated increase of these prices. The current situation in Belgium is directly linked to the steep increase in price of oil on the world oil market. The prices for energy, for heating oil especially, as seen in Figure 8.5, are increasing rapidly.

This concern to take increases in energy prices between 2003 and 2005 into account, is therefore well justified.
It is however much less clear how this increase can be taken into account. Theoretically, calculating the effect of an intervention with a higher energy price results in a lower payback period. The energy price for this calculation should then be the average energy price during the entire payback period. This means that if a payback period is about 15 years, the energy price taken into account should be the average energy price between 2004 and 2019. Residential energy prices in Belgium are represented in Figure 8.6. The historical evolution of these prices does not show linear trends. The prices shown in this figure are average figures prepared by the Federal Ministry of Economic Affairs. Actual prices depend on tariffs, peak-loads or time during the day. Even the average figures show a strong non-linear pattern for all energy sources. This does not allow predictions for the next decades. A method requiring a straightforward prediction of the energy prices is therefore of no use.

**Figure 8.5 Recent evolution of the price for residential heating oil in Belgium (Petrolfed, 2004)**




Instead, another theoretical possibility is to assume an average increase of the energy prices of 2.5 to 3% on top of inflation. The recent evolutions of the prices have already caught up with this 3% for 2005, but this does not imply that the average increase over the next decades will be higher too.

When this assumption is accepted, the effect on the economic calculations can be performed by using exactly the same figures as before. Only the nominal interest $r_N$ for the payback period is replaced by a calculation interest $r_C$.

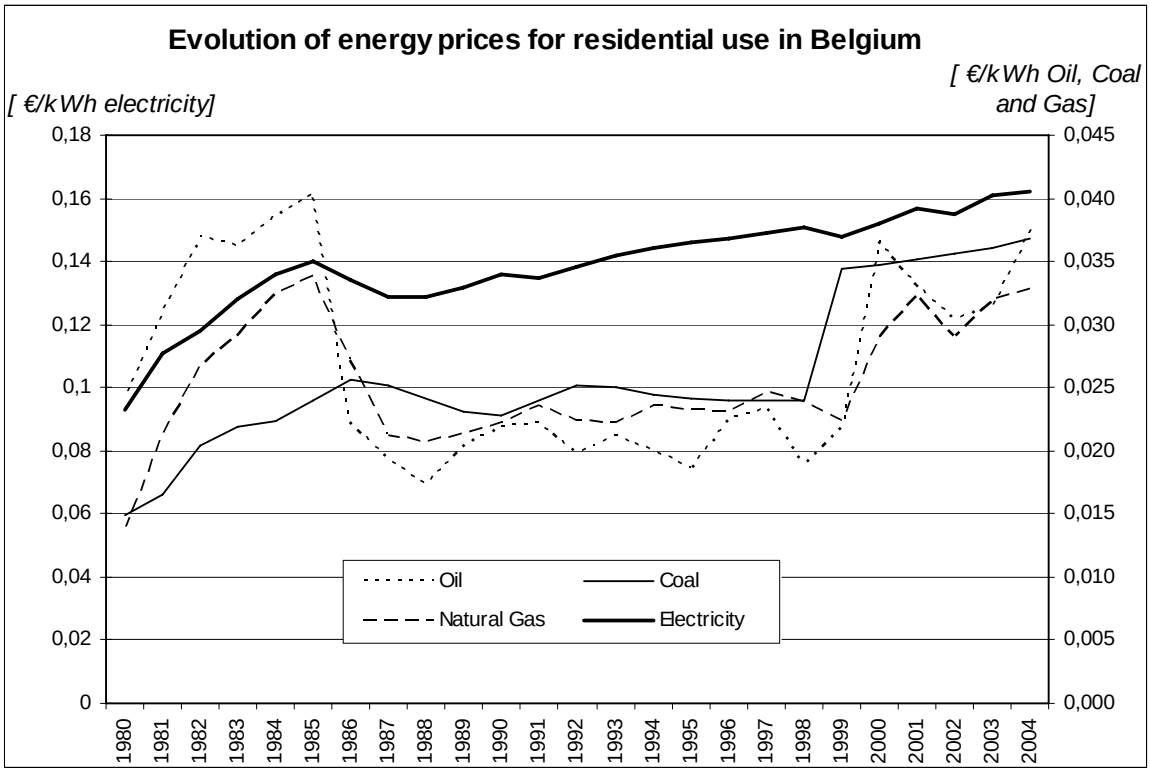
Originally the payback-period is then calculated as :

$$PBP = \frac{\ln\left(1 - \frac{I}{B} \times r_N\right)}{\ln(1 + r_N)} \text{ [years]}$$

Where:

- PBP : the Payback Period [years]
- I : The initial investment for the intervention [€]
- B : The yearly gain due to the investment [€/year]
- $r_N$ : the nominal interest [%]

**Figure 8.6 Evolution of energy prices for residential use in Belgium (Mineco, 2005)**




Due to the assumption of increasing energy prices, $r_N$ is replaced by $r_C$ where:

$$r_C = \frac{1}{1+e} \times \left( \frac{r_N - i}{1+i} - e \right) [\%]$$

Where:

- $r_C$ : the calculation interest [%]
- $r_N$ : the nominal interest [%]
- i : the average inflation [%]
- e : the average increase of the energy price on top of inflation [%]

The effect of this procedure can be seen by varying the different parameters. Table 8.2 gives a possible range of the different parameters, and the resulting range for the calculation interest.

**Table 8.2 Possible ranges for the calculation interest and its parameters**

| | **Min** | **Max** |
|---|---|---|
| $r_N$ | 3% | 10% |
| i | 2% | 5% |
| e | 0% | 6% |

The resulting $r_c$ varies then between – 4,7% and + 4,8%.

The large range of the possible $r_c$ does not give any clearer indication. The range is so large, and both extreme results can still be considered possible. The lowest $r_c$ would have a negative effect on the PBP, whereas the highest $r_C$ would have a positive effect.
So finally this method does not give any indication either on how the possible increase of energy price can be taken into account. Any future evolution of the energy price can be annihilated by inflation or interest rate evolutions. It has therefore been decided to keep the current prices, and any future changes over the long term are not considered.

Shortly, evolution of energy prices has not been taken into account. Therefore any pay-back time should always be considered as an indication rather than a fact.

A proposal inspired from the Danish energy label could be, not to calculate the payback time but to indicate the total costs with the annual saving in the units of consumption and in money, together with the estimated lifetime. This turns the focus a bit away from the problems of payback time, though it gives the same information in a quite easier understandable form. Second, the sociological results show that not all owners expect interventions in their house to be profitable. This is explained more in detail further.

### *8.3.4 Saving potentials and payback periods*

The initial results pointed out an average energy saving potential out of 32%. When regarding the economic reality of these recommendations, one can add up all the interventions for each house, which are cost-effective in less than 5 years. Then, the same exercise can be done for all the interventions, which achieve break-even between 5 and 10 years, 10 and 20 years, and finally longer than 20 years. For every range, this sum can be regarded as a package of interventions. The effect on the energy consumption of these packages is known. Averages are shown in Table 8.3.

**Table 8.3 Average reduction of primary energy consumption when all interventions are gathered per house according to their payback period**

| | Energy reduction potential | Percentage of total energy savings |
|---|---|---|
| T < 5 years | 8,9 % | 24% |
| 5 < T < 10 years | 9,1 % | 25% |
| 10 < T < 20 years | 5,3 % | 14% |
| 20 years < T | 13,4 % | 37% |

This means that on average, for the audited buildings, the consumption of primary energy can be reduced by 8.9% with interventions that recover the costs on less than five years. If the payback period is extended to ten years, this can give way to an additional 9.1% reduction, or 18 % in total. These figures do somehow show the large potential for energy reductions in the residential sector. It has, of course, to keep in mind that these figures stem from a varied and selected sample of 41 buildings, which can hardly be representative for the entirety of Belgium. Moreover, the figures in Table 2 overestimate slightly the actual potential. This straightforward representation does not regard interactions between different interventions. One common interaction is between insulation and the heating installation. Insulation has an effect on the net energy need of the house. Consequently, the load of the heating installation will decrease and so the annual total efficiency of the installation will decrease too. This explains that when the reductions of Table 2 are added, the total cumulative reduction seems to be 36,7%, and not 32% as stated above.

Still these are valuable indications. Usually, energy reduction is seen to be a rather long-term undertaking. It is hopeful at first sight to see that a substantial part of the reductions can be executed in a cost-effective way.

### *8.3.5 Limitations of the payback period as an indicator*

One should however not be completely pinned down to the interpretation of payback periods when considering the results of an audit. This approach has some serious inconveniences and leads easily to misinterpretation. One of the first reasons is the fact that all reductions are calculated as a share of the actual present yearly consumption of the family. This means that when a family has an energy-saving behaviour, its consumption is significantly reduced. At the same time, the resulting energetic and financial benefits for any proposed intervention are reduced in the same way. So this approach

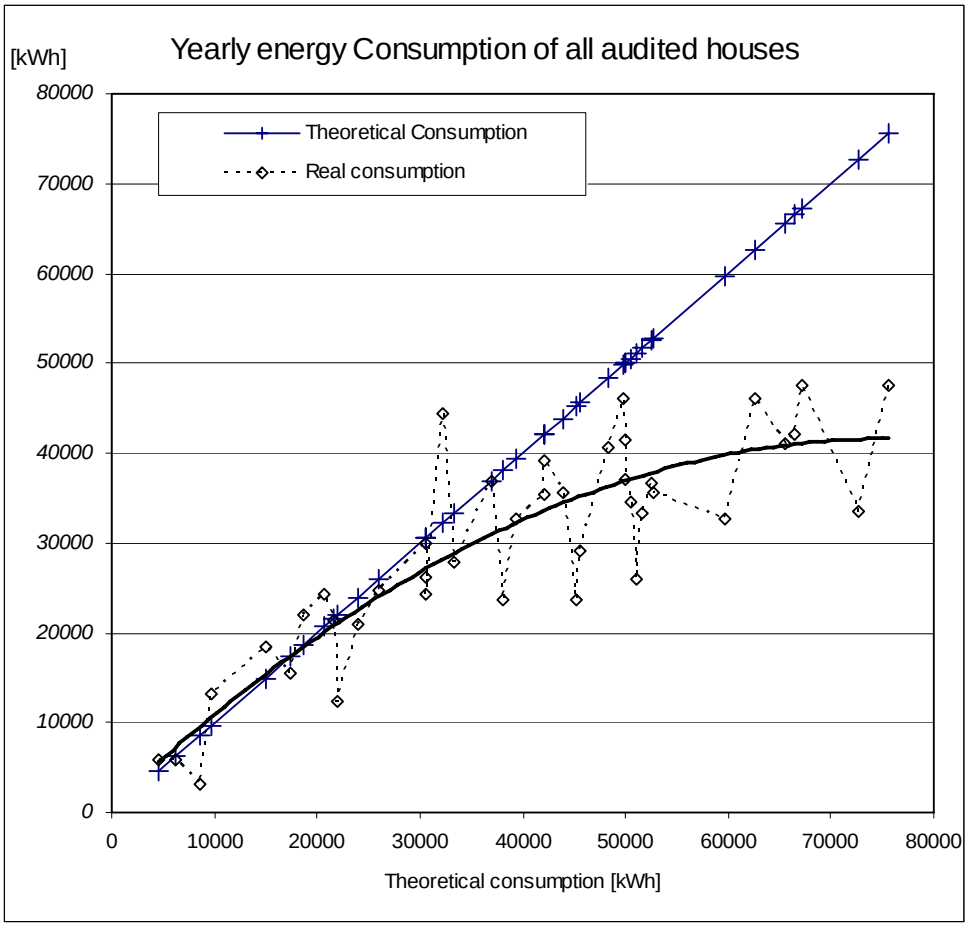
leads to the paradox that the more one's behaviour is energy saving, the less cost-effective the proposed interventions will be. Apparently less energy conscious consumers will find interventions at their building much more cost-effective. This is an important aspect of this standardised procedure, because this procedure has not been designed to influence behaviour, or to give advice on this level. However, if the major reduction potential lies on the behavioural side, it should be noticed by the expert.

A second effect is quite similar. The procedure starts from the present situation of the building. When the present heating installation produces the heat in a very expensive way, the annual energy bill will increase seriously. This is often the case with electric space heating systems. The effect on the results of the procedure will be analogous. Because the heating energy is very expensive, the potential economic benefits suddenly increase. Often in dwellings with electrical space heating, almost every possible intervention turns out to be cost-effective. The few situations when the installation of a solar boiler turned out to recover the costs in less than 15 years were in this case. It is therefore not directly the best idea to simply follow the interventions with the lowest payback period. Energetically, it is a strange decision to connect a solar boiler to an electric heating for domestic hot water. It would be much more effective to tackle the principal energy source instead, and to propose the replacement of the main heating installation. These are only two of the cases which show that even with the most detailed software, the expert still has to be able to judge situations in an objective and technical way.

### *8.3.6 Practical consumption versus theoretical consumption*

As explained above, both the theoretical as the practical or real consumption of the households are considered. Comparing these two data shows remarkable results. The comparison between the real and the theoretical energy consumption for the audited houses is shown in the scatterplot in figure 8.7. For both for theoretical and practical energy consumption, the trend line is added to show a more general behaviour.
The straight line represents the theoretical energy consumptions. This shows the large variation of the audited houses considered in this project. The smallest consumption corresponds to a small apartment, whereas the largest consumption – equivalent to 75.670 kWh per year – corresponds with a large poorly isolated house from the start of the last century. Every possible energetic performance in between was represented in the selected sample.
The real consumption, however, does not follow the same line. This real behaviour is curved and attains a maximum level around 41 000 kWh per year. The variation around this trend remains large and has an amplitude of about 9 500 kWh. Still, if this general trend is realistic, it may imply that the reduction potentials discussed above will not be attained in practice.

**Figure 8.7 Comparison between the yearly theoretical and practical energy consumption**




As an example, one can look at a house at the far right side of the curve. There, the house can have, for example, a theoretical consumption of 75 000 kWh per year. This is possible in practice for a very large and badly insulated house. At the same time, the real consumption attains a level of about 41 000 kWh. This is still quite a large energy consumption for a household; it equals roughly 3.800L of heating oil per year.

At the event of an audit, energy saving measures are proposed. When some of these interventions are carried out, the theoretical energy consumption of the house is reduced. When some very advantageous interventions are carried out, this can lead to a reduction in our example of 30%. This means that the theoretical consumption is reduced to 45 000 kWh, or 30 000 kWh are saved and the house shifts towards the middle of the curve.
However, with a theoretical consumption of 45 000 kWh, the real consumption varies around 35 000 kWh or roughly 3.200L of heating oil per year. This means that in reality, only 600L of heating oil are saved, which is considerably less than the 30% set forward by the theoretical savings.

This difference between theory and practice can be explained by differences in behaviour of the household. The considered houses are usually either larger or poorly insulated or both. The inhabitants limit their energy consumption for economic reasons. They limit their consumption by reducing the heated volume of their house. Some rooms, usually sleeping rooms or hobby rooms are kept unheated. The inhabitants use their building eventually to less than the full 100%. When a partial renovation of the house is carried out, the owners often increase their use of the building afterwards. So an intervention for a better insulated construction or a more efficient heating installation does not yield a smaller consumption but a higher level of thermal comfort.

This presentation of the facts given in the example above explains the rebound effect. In reality, the effects will almost certainly not be so outspoken. Different rebound effects exist for different types of interventions. For example, the rebound effect for the installation of solar boilers is much smaller than for installations of double glass. Second, this effect originates in the differences in behaviour of the households before and after the interventions. This behaviour and these differences cannot be generally described in a formula.

The rebound effect is known, but it can hardly be quantified. Studies for Flemish houses suggest the same effect, but practical data is lacking to take this effect into account in calculations. (Hens *et al.*, 2001) Other studies for Austria suggest a general average rebound-effect of 20 to 30% (Haas *et al.*, 2000). A review of studies in America suggests a rebound effect between 10 and 30% for space heating (Greening *et al.*, 2000).

### *8.3.7 Practical consequences for the expert*

An expert should understand the dynamics of household behaviour and the results on the energy consumption. If the expert notices a large difference between the theoretical and actual consumption, the results of the audit need to be adapted on two points:

- The actual savings per energy saving measure.
- The spatial effect of household behaviour.

When considering the possible savings through the implementation of a measure, the expert should take into account the behaviour. When the measures are part of a larger renovation, most probably the behaviour of the household will change considerably after the renovation, therefore only the theoretical consumption can give an indication for future savings. This is not the way savings are calculated in EAP for the moment; EAP considers savings proportionally, based on the real consumption. This can lead to overestimations of the savings. For smaller interventions, behavioural changes could be less, so the proportional approach of EAP is more acceptable.

When considering the priorities between different measures, the expert should consider the spatial effect of reduced consumption. When an audit reveals a large difference between real and theoretical consumption, the households often limit the heated volume of their house to a specific part. Often the living room and the kitchen are heated. Other areas function as buffer between heated and unheated spaces.

In this case, an expert can, for example, advise the replacement of the only remaining single glass window in the house, for instance, in the second bedroom. This will not result in any effect on the energy consumption. If this is a small intervention and there is no indication that the behaviour of the household will change, interventions in buffer areas do not yield the calculated results. On the other hand, if a small intervention in the small heated space is advised, this can yield much larger savings than calculated.
So the expert should be able to consider the behaviour of the household for the evaluation of energy-saving measures.

# 8.4 Acceptance and effects of the EAP

## 8.4.1 Methodologies

In order to establish an idea of how this procedure is perceived by the owners of the house, two methods have been combined. Firstly, VITO sent a questionnaire to all house owners one month after the audit: the results of the questionnaire gave some indication about the value of the audit. Secondly, the team of UCL made 14 in-depth interviews (Kaufmann, 1995), (11 from January to March 2005 and 3 in September 2005). The changes brought after the EAP, the perception of this assessment method as well as the perception of the energy advisors were the main topics of those interviews.
An assumed name has been given to interviewees to assure the anonymity.
The following analysis of these in-depth interviews realised in Belgium has been further expanded in a comparative analysis with Denmark, where the EAP is already a legal obligation since 1997. Results of this comparison between Denmark and Belgium may be found in Gram-Hanssen, Bartiaux, Jensen and Cantaert (2005).

## 8.4.2 Motivations to participate to the EAP

The participation to the EAP was absolutely voluntary and free of charge. The participants were, in most of the cases, curious about topics related to the field of energy and to the environment. Still, the specific reasons that have led the participants to take part to this EAP may lead to a better understanding of the participants' reactions to this process and of the effects of the EAP towards them. The motivations expressed during the interviews are indeed various and multiple; to get a better knowledge of the residential energy consumption is one of the most oft-cited motivations to participate in the EAP, especially if this knowledge can be supported by practical advices. As Veronique expressed: *"I wish I would have advices, which would tell me 'look, at this level, you consume too much, it could be possible to reduce by doing this or that'. Yes, how could I say, also to be reassured about… being less guilty. So, in order to know if we are doing right or if we're not doing right at all." […]*
This knowledge is valued by the participants, either by interest towards topics linked to the energy consumption (environment, new technologies…), either to help the participants to make choices in a short, medium or long term (renovation works, purchases…).
The financial aspect is often quoted too. The bills which stay high despite the attempt to reduce them and the will to '*rationalise the expenses* (Michel)' have motivated the participants.

## 8.4.3 The perception of the EAP

**Experts**

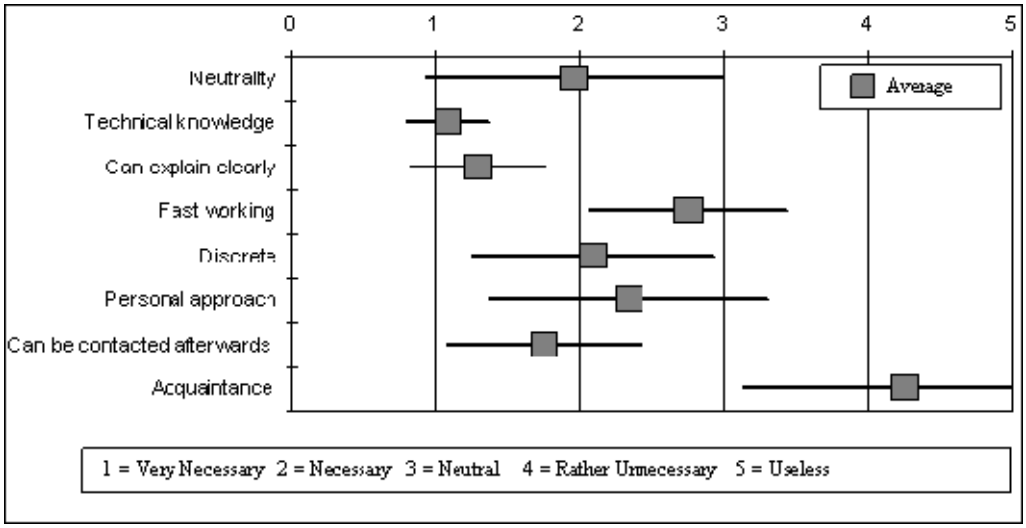
Because of their personal presence (during approximately four hours), the energy advisors play a key role in the EAP, of course for the running of the procedure, but also for the perception of it by the participants.
In most of the cases, the interviewed participants knew neither the VITO nor the energy advisors. Despite this, the latter enjoy a trust from the outset. Things like the preliminary contacts, the advisors' punctuality and their sense of professionalism bring the participants to the assessment to accept and to legitimate the energy advisors. The energy advisors are in most of the cases seen as competent specialists; as Claude says: *"Well, he didn't have an expert-figure, I would say: he didn't present himself as having the way of knowing but as someone who knows his field very well and who presents it very well. That is how I have seen him".*

The information transmitted by the energy advisors to the participants plays a central role in the legitimacy of those experts. Many participants to the audit have followed the different stages of the assessment (measurements, encoding of the data, and compilation of the report) very closely. Some

of them say that they asked a lot of questions during the day, even though they were sometimes afraid of bothering the advisor. An interviewee has even taken personal notes during the assessment to avoid losing informal and oral information. The advisors are indeed generally seen by the interviewees as external and consequently objective, contrarily to salesmen and go-betweens (like heating specialists), often presented as partial and self-interested. According to the interviewees, the advisors have a global vision of the possibilities (complete information that could bring good advices and new ideas). *"I think, well, that they have the knowledge of a bit of the ensemble of the systems available in the residential field. To have the advantages and the disadvantages of a system, that's worth it!"* (Michel)

Neutrality is thus a requested skill for the energy advisors, as shown in Figure 8.9, drawn from the survey questionnaire sent by the VITO to the 40 EAP-participants.
Most of the interviewees insist on the difficulties they encounter to obtain valuable information. To have an energy advisor at home and at hand is a stroke of luck; for once, the information comes to them without any effort needed and furthermore, they have the possibility to ask any question they would like. What has been appreciated is the fact that the energy advisors don't judge the renovation works and the choices made by the interviewees.
The advisors explain the results orally after the measurements and the output of the results.
Helena expresses that for her, it is this oral explanation that counts the most: *"it* [the labels] *was a detail, to know that I have a label B, a label C, a label A, for now it is not really important. What was important was, above al,l if we had acted properly and if we use our energies in a correct way but that was more in relation with the discussion with the person from the audit than with the final report which gives us a result between A and C."*

**Figure 8.8 Important characteristics for an expert (n = 26)**




The results of the questionnaire and the analysis of the interviews show the importance of at least two skills for the energy advisor: technical knowledge, as told before, and the capacity to explain the results clearly, as can be seen in Figure 8.9. The interviewees have indeed appreciated the expert's knowledge, but also the fact that their explanations were clear; '*human*' as says Wim. The possibility to ask questions and to contact the advisor after the EAP has also been appreciated.

The relation between the house owners and the advisors can vary, depending on the house owners' previous knowledge about heating systems, insulation techniques and so on. Three kinds of relations have been noted: house owners either feel equal to the advisor, inferior to him or feel indifferent towards him. Those sentiments will be illustrated with three examples. Alain, a Belgian agronomist, has been talking equally with the energy advisors: *"Well, being trained as an engineer, not in the field of energy, but in agronomy… but anyways… even so we know quite a lot of basic*

*principles and so, towards those principles, it was interesting to have some complements from a specialist who was able to get the situation clearer about certain points, about certain doubts, I would say"*.
Luc admires the advisors' knowledge and asks a lot of questions during the EAP, also taking notes: *"He* [the energy advisor] *has been able to tell me everything, because he is qualified, and not theoretical, not an engineer who comes from his ivory tower; showing 'like this', 'like that' (…)"*.
Others like Clara and Veronique said that the advisors knew much more than they did and therefore, they had asked questions to be fully informed.
And others just don't bother, like Sofie, for instance, who let them work, but without being attentive to what was happening and without asking any questions. In her case, the assessment wasn't really a way to get new information; its aim was more to reassure her that she was already doing it right before the EAP and that in the field of economical energy consumption she knew a lot on her own (i.e. without the energy advisors' intervention).

**Report**
A report has been given to the participants the day itself. As seen before, oral information seems in general comprehensible to the interviewees. Some of them have read the report, although they are not as enthusiastic concerning this written information. Some find the information too technical, complex and detailed; as Wim said : *'I found it very nice that they came, but I think that the report could be more synthesised, more 'straight to the point'. There are some concrete elements, like investments that we could make, but we don't need all the technical twaddle to know what it is about […]. I find it very detailed…of course, when you like to read, it is interesting, but I prefer something more synthesised'*.

The answers given to the questionnaire show that most of the report was received with interest (see Figure 8.10.). The respondents were also asked for the attention they would pay to the report if they were to buy a new house. This question had been asked before within the framework of other surveys and preliminary investigations, but these results give a different indication. The experiences during this study showed that most owners do not have a correct idea of what an audit actually is about. An audit is a rather vague term. When asked for their willingness to pay for an audit, respondents may very well have a different form of audit in mind rather than a full scale house-audit.

In this case, the question was possible, because the owners now had received an audit and, were aware of the information the report could provide. None of the owners indicated that the report would not interest them in case of a transaction. The most attention would be paid to the appreciation of the building envelope (73%), followed by the general appreciation (64%) and the heating installation (59%). Some owners specifically indicated that this report would influence their appreciation of the price for a new building. However, the report will not provide the final arguments for the decisions. The qualitative interviews show a variety of motivations that have been considered to buy the house such as: space, luminosity, location. Among these motivations, the energetic characteristics of the dwelling are not necessary the principal criteria.

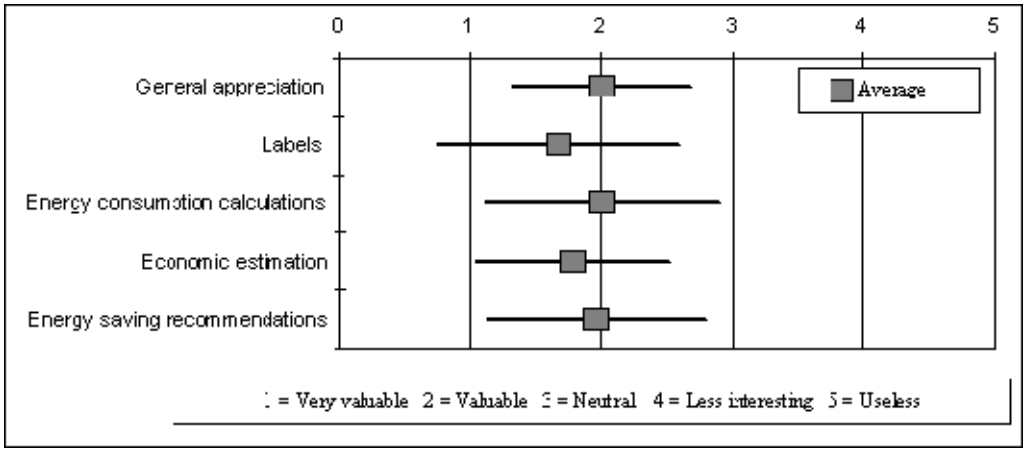
**Labels**
According to the answers given on the questionnaire, the most interesting or valuable information resulted from the audit, the participants often cited the labels as most interesting. However, during the in-depth interviews, only a few of the Belgian interviewees spontaneously did mention the labels from their dwelling. Probably most of them had forgotten, as these labels had no meaning at the time of the interview in the Belgian context, where the European directive on labels is not yet a legal obligation or a common practice. Therefore, nearly nobody considers upgrading his/her labels as a challenge, except two persons. Clara says: *"He* [the energy advisor] *clearly stated it – and this has somewhat comforted us – that "with a house like this one, you will never reach an A-label, because the house is not adequate for that. The materials are not modern", we can do what we can but… I think we got an E for the building envelope and I think we can go up to a D or… (…) I thought it was possible to upgrade to an A-label, that maybe… but he told me "no, not with a house like this one"."* [Label D for the envelope]. Claude also expresses the idea of the labels as a way to know if the

situation has to be changed: *"those* [labels] *on housing allow to know where we are, I mean, between A and B, there is a tiny difference, it doesn't speak for itself, but I mean, in my case, if I would have an E or a F, then yes, we would have said : 'there is something that has to be done', so for me, I find it interesting. It is much more eloquent than numbers and graphs…"*

This will to do what is possible to have a higher label and, more generally, the labels system, may be related to a vision of the consumer characterised as an entrepreneur: new information will (automatically) bring about the desire and adequate actions to improve a position in the labels system. In this case, the information delivered by the label turns out to be of no use unless it is presented with a set of realisable scenarios to get a higher label. Nevertheless, this improvement desire is expressed only once in the interviews. To the contrary, one young couple expresses its satisfaction to have what they perceived as a good label: "*It is not super-insulated, they say, but well [insulated], we are happy."* [Label C for the envelope]. These persons are nevertheless in the market logic for they plan to sell their dwelling in a few years or so. Another person rapidly finds a good excuse: *"We did not get a good result [label D for the envelope] but he says that the software was not adapted for the apartments and that was the reason why we had a C or... And he says it should be better"*. The limitations of the software save the situation where the advices received are not often consistent with this person's daily practices (for example, TV in stand-by mode and open doors during the interview).

According to the interviews, the labels thus have no effect by themselves in the present socio-political context and if the context changes, attention should be given to the tendency to find that the labels are "well enough for my dwelling". This tendency is probably rather general, as the search for excellence is not neither highly valued nor widespread in Belgium. A second limitation for the labels efficiency comes from the well-shared ability to find good excuses for an unpleasant situation. Finally, and this is probably more fundamental, a label for a building certainly does not show by itself the margins of action: for this house or this apartment, which label is it possible to reach and, more importantly, how is it practically possible to get this better label? These limitations suggest that the logics of the labels system that was designed for the appliances may not be transposed as such in the housing market.

**Figure 8.9 Distribution of opinions concerning different parts of the report (n = 25).**




**Payback period**

The owners were provided with the payback period of each recommendation: this information was the sole decision criterion that was computed by the software. This situation of 'monopoly' probably overestimates the psychological weight that the interviewees gave to these payback times. It also questions the calculation of this variable as well the underlying hypotheses.

During the discussion between the energy advisor and the householder, payback periods were logically commented on. This means that the project which is not profitable can be mentioned. During the in-depth interview, nearly all Belgian interviewees report on the comments made by the energy advisor about payback period and all the next quotes are about renovations that the energy advisor recommends not to do because of too long a payback period:
- *""Not worth the investment" they say",* about replacing the windows with double glass.
- *"I was interested by the solar at one moment. (…) He says that it was a 2,500 € investment and that in Belgium, it will never be profitable. (…) Well, I am not an expert; I am not an engineer either; I am just interested in that [energy savings]."* (He speaks four times about solar energy during the interview for regretting each time that the energy advisor did not find this option was a good solution.)
- *"I had read that solar panels would be interesting but, precisely, the Vito has done the study and 33 years would be necessary to have them profitable."* As in the preceding interview, she mentions it three times, with regrets each time.
- *"We have spoken and they say themselves that it was very expensive to insulate the façade (…)"*

Nevertheless, the payback time has not the same meaning for every house owner; among other things, it depends on the duration foreseen to live in the reviewed dwelling. Indeed, the gap is wide between two young Belgian couples. One is planning to sell after a few years, thus wants to know whether its dwelling meets the legal norms and limits the investments to "replacement investment". Another couple views its house as its home for a longer period and makes durable investments, maybe also because they have a strong "ecological conscience" with its moral implications.

Furthermore, it is worth noticing that in general, house owners don't expect renovations to be profitable in a single economic sense. To install a new kitchen is not a good investment, and in the same way some house owners do not always think that all energy renovations must be profitable. This, on the other hand, is not the same as saying that money does not count – economy is always an aspect of a renovation project. To summarise, economic factors have no effect by themselves, they are always interpreted according to the social position and situation of the family (Gram-Hanssen *et al*. 2005, pp. 10-11).

### *8.4.4 After the EAP: are the advices implemented?*

The first effects of the audit can be seen from the interventions, which the owners are, eventually, willing to carry out. One part of the interviews concerned the modifications carried out in the house as a result of the audit.

There are plenty of possibilities in cases of renovations or new buildings (choices of the heating or insulation systems, choices of materials used…), or even for the daily life (choices of electrical appliances, usages and habits…). In front of this wide range of possibilities, the energy advisors can give a wished nudge: *"I really expect to get some practical advices. If someone could steer me for one thing or another concerning the renovation… (Véronique)".*
But as we will see below, this complement of information doesn't mean that the participants know exactly what to do or how to implement the given advices.

There is also a huge variety of possible behaviours related to energy consumption. Even if the experts weren't looking for orienting the behaviour of the participants, the interviewees themselves refer to it. The energy advisors can then have a role of a kind of teacher and the participants are the pupils who would like to get the assurance that they are doing it the right way, as Veronique expresses it: *"Yes, how could I say, to be reassured about… being less guilty. So… to know if we are doing right or if we're not doing right at all."* But the participants can also give another role to the energy advisor: the one who reassures them that they cannot change anything in order to have better behaviours, as Clara says: *"one of the energy advisor has told us, and this has comforted us, he has told us 'with a house like yours, you will never reach an A label; it is impossible because your house doesn't lend itself to it'. The materials aren't modern; we can do what we can, but…"*

**Heavy or light measures**

Even if the advices and recommendations are, in principle, accepted, the house owners still may not follow it. Otherwise, the house owners can be more or less inclined to change the house according to a lot of considerations other than the energy advices and recommendations. First of all, it makes a difference whether the measures recommended are "light" or "heavy". The definitions of these "light" or "heavy", however, do vary from one family to another and is dependent on the life situation, the interests and the capacity of the family. For example, some households will find the recommendations "light" because they will consider them cheap according to their budget and easy to realise according to their knowledge or their "do-it-yourself skills". Second, it makes a difference whether the specific measure is kept within the household's plan of the house and again, whether eventual plans are kept within the family's life situation as a whole. Consequently, people will be more inclined to accept energy saving measures if that part of the house is to be renovated for reasons other than energy. The understanding of how, when and why some of the advices are followed and others are not, also comes from an everyday life perspective. In this explanation, people are bound into social, material and cultural structures, which are not that easily changed, especially if criteria, other than energy consumption, run against the advice (Gram-Hanssen *et al.*, 2005, p. 8).
Advices regarding energy savings may therefore be more or less easy to carry out. "Light" measures are those considered as easy to implement as they require, for example, no huge investments: neither in time nor in money. On insulating heating pipes, Clara says: "We have realised that it was interesting for our consumption and there was much to do in order to gain a little." The heavy measures, on the other hand, can be those that require more time or economic investment. Michel, for example, has an electric heating system. He is aware that it isn't the best system to have, but still, changing to another one will not be an easy choice: *"The guys from VITO have made a simulation on the energetic level, so it is obvious that it would be more interesting to change to another heating system, but it is necessary to see whether it is feasible and then it is also necessary to see on which period of time the investment could be amortised because we need to start from nothing: nothing exists, now"*. When asked what he means by 'feasible', he answered, not only with financial arguments (the prices of oil compared to the one of electricity), but also more technical aspects like the place to put the boiler, the possibility to evacuate the gazes, the fact that the pipes will be apparent and, last but not least, the investments he has already done to enhance his present heating system.

**Brakes/levers to changes in the case of the EAP**

Some investments, even if they are considered interesting when they are presented by the energy advisors, may not be concretised. In trying to understand which projects are on the top of the 'running list', or why some advices are not followed, we will look at some of the criteria or explanations that can be deduced form the interviews. These criteria include (at least) economy concern, convenience, as well as identity.

A lack of feasibility or too high a needed financial investment are among the reasons that can slow down the action or even cancel it. As Clara expresses it: *'For the solar panels, we were interested, but we thought that the investment was huge, payback time: 33 years, this is really an idealist's investment… we will wait until we have the money to do that, I think* [she laughs]*'*. Even if she has a strong ecological concern and if she has gathered information on that topic before the visit of the energy consultant, the investment seems too huge to be concretised, especially because she had no support from the energy advisor in this matter.

Clara also shows another type of explanation for not following advices from the assessment; it is much more related to the well-known criteria of convenience. *"It [the assessment] is more of a higher consciousness than a real change of the behaviours. Because, the washing machine, anyway, with the kids, our clothes and their clothes, you quickly have a big amount of clothes to wash and the tumble dryer, it is true that I sometimes think 'hum, maybe…' and then I sometimes put the*

*clothes on the radiator to dry them… If it is a little bit, it's ok, but if I put a lot (on the radiator), it doesn't help either."* With this extract, it is obvious that a higher level of consciousness (brought forth by the assessment, among other things) may provoke a little change. Nonetheless, radical changes are rare, because the alternative solution has not been considered as good enough for applying.

Another criterion is related to the question of identity. If following the advices is in line with the identity perception of the interviewees, it may induce the activity. However, the following two stories are examples of how the opposite may also be the case. Antoine says: *"The EAP occurred after the works* (done when moving into their house]. *I think that after it, we only installed the thermostat, which we planned to install anyway. After, other works have been done (…) and some are still to be done. (…) the thermostat, that we planned to install anyway."* This repetition suggests that he wants to show himself as the master of 'his' work of renovation, despite the fact that his technical knowledge is somehow limited. Another hypothesis is that the EAP did not give him precise instructions on how to insulate the back façade, so he could not integrate the required measures in his work plan and make this project his own. This may be related to the *'by chance'* of Maria, who tells how she happened to buy a CFL (compact fluorescent lamp), following an advice received during the EAP: *"And we were by chance in a supermarket and by chance, there was a saving lamp*[53] *and now we have it since a month, euh, this is the second month and its consumption is nearly nothing, isn't it?"* Surprisingly (or is it by chance?!) Maria is not invoking chance another time during this interview. Later she says while showing that lamp *"but it's ugly, isn't it? But I have seen others, with a balloon shape"*. So she is not totally convinced, maybe that is why she calls for chance? With this CFL, Maria is maybe realising an identity compromise between the push-and-pull factors for saving energy.

**Social explanations**

Energy savings are rated higher in some families than in others, either because of economic or environmental reasons. In this section, we will discuss different social explanations for being more or less concerned with energy savings. When interpreting the interviews, we involved some social background knowledge. The sole socio-economic variable that we gathered about the interviewees is the household total income quartile; we used this variable in conjunction with many others to select the 40 households having, for free, an EAP.
During the interviews, the current labour status and the professions were asked and numerous indirect data on socio-economic status may be derived from other excerpts of the interviews. Unfortunately, these socio-economic data are not comparable across all interviews and they do not allow us to establish for sure each interviewee's social position, both inherited and obtained. In the following, we will first look at the interviewees' comments on energy prices, then discuss which types of families are the most keen to express interest in savings and then finally, discuss from where and why some people display environmental concern.

At least three interviewees said that energy prices were not "very expensive":
"The energy (price) is quite decent" (Maria, twice in the same sentence)
"(The electricity price is) not really expensive (…) I don't find it very expensive" (Kristien)
"When it was about an EAP, I had completely forgotten electricity, for example. But it's true that it is also energy! And they also give tips, it is true that it is possible to limit consumption and avoid wasting (…) one is not always thinking [of these saving tips] for electricity whereas (for) gas, well, it's more painful because one pays at the moment gas has to be paid and bills (are) huge, and oil, at the price it has …" (Luc)

These persons have quite different household incomes (they are respectively in the 2nd, 3rd and 4th quartiles) but all of them do enjoy an upper social position, probably accompanied with rapid upward social movement for at least the first two quoted persons. It can thus be hypothesised that in the Belgian context, a desire to show one's social success is incompatible with the affirmation that

[53] Literal translation from the Dutch, for CFL.

energy prices are (too) high as there are policy measures that provide the poorest with a minimal and guaranteed access to energy while social stigmatisation of the poorest may be a side-effect of these measures.

When, in some of the Belgian families, there is no need for saving money, some persons justify their actions otherwise. Wim and Kristien (both are 28) have followed the advices that are about *"the little things of life"* as they expressed it. They reduced their stand-by consumption (radio, TV), they "switched off the heating" during the week-ends when they were not present in their apartment and they justify these actions with an Epicurean argument: *"we are not really stingy, but I say: 'why should we pay when we don't have to?'"*

The hypothesised association between the rapidity of social upward mobility and the economic motivation for energy savings was in fact first formulated by one of our interviewee (a sociologist!): *"I have the impression that we (his spouse and himself) are in an ideal situation for saving energy because, as I was telling you, we both have a [modest] origin – I cannot say "poor", we should go backward at least to 2, 3 or 4 generations to speak of poor – but none of us has a consumption-oriented mentality; plus the social-security system, the fact that both of us hold a university degree and have jobs, which are not especially well paid but we largely have, nonetheless, what is needed to live: therefore, we can afford to buy window frames whose price is 25% higher because they are more ecological."* He thus suggests that an interest for energy savings is likelier in middle or upper-class families that did not attain this status in one generation. This hypothesis should be tested in a larger sample but it is consistent with the views expressed by Veblen (1899) and Bourdieu (1979).

This theory is further confirmed with these two empirical findings: among the interviewees who tell how they try to make some energy savings, most of them say, as namely in the following quote, that it is not becoming "excessive". Secondly, the "nouveaux riches" are the least prone to saving energy: such a couple tells that since the EAP, *"the doors are a little more closed but it has not become excessive, certainly not, but yet, we pay more attention"*. The use of the passive voice ("the doors are a little more closed") and the word "excessive" seem to indicate that they do not want to give an image of themselves as being "excessively" concerned with saving – they have a rather good income (3rd quartile, living in pair) – and they "never have really asked themselves" about a link between energy consumption and environment, as asked by the interviewer. The interviewer then asked whether they followed "Kyoto and the like" and his answer was: *"We have studied that at school. For the rest, no"*. Finally, this hypothesis is further credited with another interviewee who applied all advices that he received, except if they were too expensive: his economic situation required strong savings (*"we don't have economic resources without limits!"*, 2nd quartile for 5 persons) and he also had a strong global environmental concern.

Among the three quoted Belgians above, the last one certainly has the highest income (he is an important executive in the private sector) but he is nevertheless the only one to be interested in energy savings and to act accordingly. The absence of an economic motivation is counterbalanced in his case by an attraction for new technologies (CFLs, solar panels), which he has to keep in the acceptability limits of his social environment: after the EAP, he bought and installed a few CFLs and he was asked by some persons whether he would *"light up with candles"*. The interest for new technologies and a mild environmental concern for *"protecting our blue planet as one says, isn't it?"* are probably not always sufficient to counteract the pressures of his social network for not showing a need for saving energy or a competence for it.

**One year after: results from the last questionnaire**

One year after the audits, a small questionnaire has been sent to the participants. This questionnaire mentioned all the energy saving measures proposed after the audit. For each measure, the participants could note if they had implemented the measure in the meantime or if they still planned to do so.

The results showed that only some 11% of all proposed measures had actually been implemented. In general, these measures were the smaller interventions: insulation of distribution pipes or installation of saving showerheads.
However, some 23% of the proposed measures were still being planned by the households. These measures could result in much larger energy savings, but they required equally larger interventions in the house.
The participants left several remarks in the questionnaire giving a better idea about the dynamics of their decisions:

- *"Boiler replacement was only interesting if the boiler had to be replaced."* The argument shows that the general behaviour to use a product until it is finished and to replace it afterwards is still difficult to change in some cases.
- *"We added insulation air-tightening for the blinds."*
- *"We installed a second bathroom and a study."*
- *"The intervention in the sleeping room and the bathroom a longer term intervention."* (So not yet implemented)
- *"No energy saving interventions, but we installed a second sleeping room"*.
- ...

To our surprise, more than half of the reactions of the participants mentioned interventions to reduce electricity consumption and not heating energy consumption. Apparently, measures to reduce electricity consumption are more readily accepted than measures to reduce heating energy, or the implementation of these measures was mentioned to show that some energy savings had nevertheless been achieved:

- *"We will soon buy a new energy-saving freezer."*
- *"More light bulbs will be replaced by energy-saving bulbs"*
- *"One freezer has been switched off, (consumed too much)"*

The low response of the participants to implement energy-saving measures can partly be explained by the selection of the households. The households reacted to the advertisement and mails. But most of the households were not planning major interventions or renovations in the near future. They were interested in the research and in the performance of their dwelling. But in many cases, renovation had just been performed by the owners before the audit.
Still it is not sure if this can explain this low response entirely.

### *8.4.5 Insights of the Danish situation*

This section is also largely inspired from the comparative study between Denmark and Belgium done by the Danish Building Research Institute (Gram-Hanssen *et al.*, 2005).
In Denmark, an act of 1966 ordered all buildings to be energy-labelled as of January 1st 1997; large buildings every once a year, small buildings every time they are sold. Concerning owner-occupied households, the idea in the Danish labelling scheme is that all houses shall be labelled before they are sold, so that the new owners can see the energy standards of the house they intend to buy. The labelling procedure also includes recommendations for improvements of the energy standards of the building. Specially-trained energy consultants, educated as architects, engineers or building technicians conduct the building assessments. Both schemes have an energy certificate with labels (one in Denmark and three in Belgium) and an energy saving plan. In the energy plan, the most profitable energy-saving measures, in terms of payback period, are listed. This plan should be revised, in conjunction with the following building assessment. There exists an exhaustive database on dwellers holding an energy label for a small building. These labels were issued in order to render the seller and the buyer aware of the building's energy rating and energy plan before agreeing on the sale. It is the seller's duty to requisition the label and to pay for it. Consequently, the new house owner does not meet the energy consultant. The actual energy-labelling scheme consists of three main ratings, concerning electricity, heat, and water consumption; in addition to that, a rating for environmental impact in the form of a $CO_2$-emission figure is found. Concerning heat, the actual figure of energy consumption per m2 is referred to as either category A, B or C, furthermore

subdivided into five numbers, so that A1 represent the best category and C5 the worst. The label is attached to an energy plan that has sections for heat savings, electricity savings and water savings. Each of these plans consists of a list addressing different saving objects. For heating, this might be insulation, boiler, energy transmission system, hot-water tank and ventilation. In any case, the energy consultant can add the comment: "ought to be bettered". In the end of each plan, all proposals for bettering are summed up in total costs and in annual saving in the units of consumption and money. Also, the total lifetime is stated.

The main two differences between the Belgian and the Danish assessment procedures are the compulsory aspect of the Danish one – Danes automatically get an energy label because they buy a new house - and the presence of the Belgian energy advisor during the assessment, which is not he case in Denmark as the assessment took place before the owner(s) bought the house in Denmark.
Those two aspects undoubtedly influence the differences of 'perception' of the Belgian and Danish assessment procedures, as showed below.

In Belgium, the results to the questionnaire and the answers given during the interviews show a high level of trust towards the energy advisors. In Denmark, instead, there is from the outset a possible scepticism towards the expert and the system. The person who makes the energy label is normally the same as the one who makes a condition report on the technical conditions of the house, which is another Danish mandatory system related to house transactions. This system has recently been criticised in the media for being scamped work, where the experts earn easy money. Several of the Danish interviewees refer to these critics, when we asked about their trust in the label, even though they might think that their energy label is done quite well. The most sceptical of the Danish interviewed, Kristensen, expresses it ironically this way: *"Well, the advice they give, you can actually just take a copy. I think they just put it in a copy machine every time they have to make one. Then they just take a copy, I think"*. As expressed in this quotation, some of the interviewees did not find any new knowledge in their label, or they are sceptical towards parts of the information they get. This holds true maybe especially for those of the interviewed who are some kind of experts themselves, either theoretically or practically. On the other hand, the most trustful and at the same time those who think they need energy advices most, among Danish interviewees, are persons that have bought a house for the first time and have neither practical nor technical skills.

Alongside this scepticism, the majority of the Danish interviewees however endorse the idea of the energy label: that you should get knowledge on the energy state of a house before you decide to buy it and advices to improve it as well. In the Danish cases, there seems to be some kind of paradox. People do read the label, they like the idea of the label, but they do not think the label taught them anything new or useful. Maybe this paradox has something to do with a lack of practical knowledge.

In the Danish interview, we also hear about scepticism towards energy labels on white goods. Some of the interviewees have heard, through the media, that it is the producers who label the products. To them, this of course devaluates the system. However, they still look after the arrows when buying white goods because they have no alternative to this system and they still think that they can rely at least partly on it. So, from the Danish cases we also hear that there is less trust in systems with marketing interest. However, this scepticism may not be generalised: in the Danish cases, there are also examples of house owners that have chosen energy glass instead of ordinary double glass because of advices from craftsmen renovating their house.

Another huge difference between the Belgian and the Danish procedures is the role of economy and payback time. In the Danish system, it is explicitly stated that only those measures that are economically reasonable should be mentioned. In this way, economy is chosen as criteria by others than the house owners.

Furthermore, when comparing the Danish and the Belgian interviews, it appears that attitudes towards saving are more socially distributed in Belgium and more politically and "generationally" distributed in Denmark. The sample size of the interviews is quite small to be too conclusive, but it

may be raised as a hypothesis that a more egalitarian society, such as Denmark's, shows other distributions than the Belgian socio-economic distribution of attitudes towards energy savings. However, when comparing actual energy consumption, it is important to notice that, both in Denmark and in Belgium, socio-economic background variables are important explanations (Bartiaux and Gram-Hanssen, 2005).

### *8.4.6 Recommendations for future implementation*

**The costs of the audit**

While the owners recognise the specific value of the results for them, they do not seem willing to pay a large sum for the performed audit. The EAP and the software have been developed with in mind a limit for an audit of 4 hours and thus a limit of the actual cost of an audit of less than 250 EURO. However, according to the survey performed on the 41 dwellers, 95% of the owners who answered this questionnaire are not willing to pay more than 200 EURO for a similar audit. 67% of the owners are not even willing to pay more than 100 EURO. In order to implement the complete procedure in Belgium, the discussion on the final price to be paid by the owners will clearly be of importance. This lack of willingness to pay contradicts the other results.

Figure 8.9 shows that many owners do not like fast-working experts. This is related to the quality of the audit, which is appreciated. A fast audit cannot possibly yield the same quality as a thorough analysis of the building. And because the owners did not have to pay for their audit in the framework of this study, they do not immediately link the working hours of the expert with the final price. Future appreciations of owners who order their audit from a commercial expert can therefore change this pattern of answers considerably.

Results drawn from the large-scale SEREC survey show that in the Belgian public, the accepted price for an energy assessment is much higher, as shown by the table below, despite the high proportion of "does not know". The accepted higher prices hold true even when comparing the respondents who already knew what an energy assessment was about and those who didn't know before the survey but were provided with information read on the phone by the surveyor.

**Figure 8.10 Willingness to pay for the audit (n = 26)**

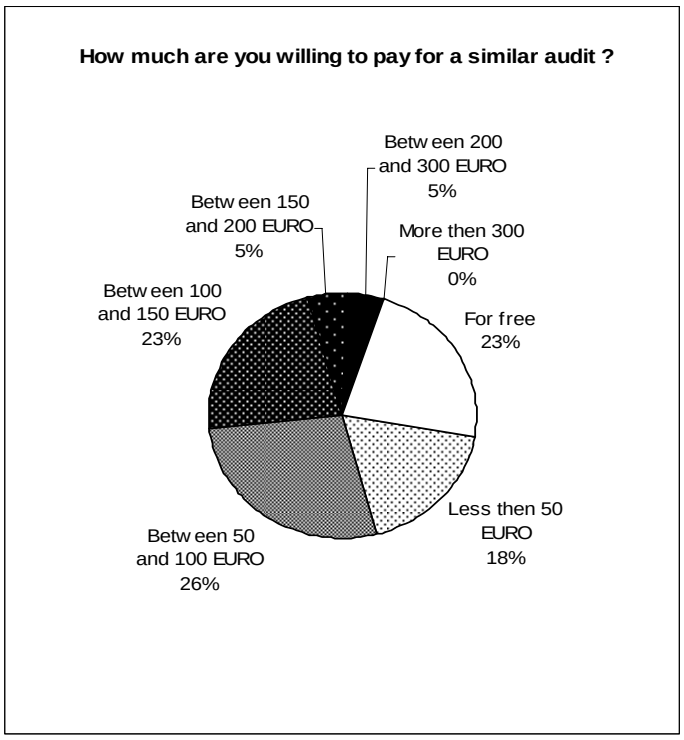



**Table 8.4 Accepted price for an energy assessment**

| | | Large-scale SEREC Survey | | |
|---|---|---|---|---|
| | EAP participants [%] | Answered positively to the question 'Do you know what an energy-audit is?' | Answered negatively to the question 'Do you know what an energy-audit is?' | Total |
| Free of charge | 23 | 19.2 | 17.4 | 17.8 |
| 1€ to 49 € | 18 | 5.8 | 3.4 | 3.8 |
| 50 € to 99 € | 26 | 8.7 | 7.9 | 7.8 |
| 100 € to 149 € | 23 | 18.8 | 8.6 | 10.7 |
| 150 € to 199 € | 5 | 3.8 | 3.0 | 3.1 |
| 200 € to 299 € | 5 | 9.6 | 7.0 | 7.2 |
| 300 € to 2500 € | 0 | 12.0 | 6.9 | 7.9 |
| Not interested at all | - | 3.8 | 5.7 | 5.0 |
| Does not know | - | 18.3 | 40.1 | 35.1 |
| Total | 100 | 100.0 | 100.0 | 98.2 |
| No answer | - | - | - | 1.8 |
| N | 26 | 208 | 700 | 908 |

**Labels**

As currently done during the energy assessments performed by the "Guichets de l'énergie" of the Walloon region, priorities in the advised renovation work could be mentioned. If the labelling system is seen by the regional authorities as an important incentive to save energy, different paths to upgrade labels should be presented to the dweller.

**Payback period**

To summarise what is developed earlier in this section, the calculation of the payback period raises a major problem as the included prices of energy are both constant and fixed to the level of the last bill(s). Two identical houses reviewed the same day can therefore have very different payback periods for the very same recommendation if their respective fuel tanks were filled one year or one day before the energy assessment, in a context of rising energy prices; given the foreseen fossil energy depletion, the geo-political constraints and the increasing constraints of climate change mitigation, there are few reasons to think that energy prices will decrease.
To address this problem, several possibilities may be considered:

1. To develop scenarios on, for example, two pathways of rising energy prices: as shown earlier, this seems to be difficult to implement.
2. To provide the dweller with a set of simulated payback periods for each recommendation: one as it is now, with an energy price simulated as constant since the last bill with an estimated rate of inflation of 3% (a); another one with the energy price of the day of the assessment simulated as constant (b); a third one with a 20% higher price than the previous one (b), kept as constant (c). This solution – as the preceding one – would have the advantage to qualify the payback period as an indicator that is dependent on the hypotheses done for its calculation.
3. To suppress all payback periods and to give for each recommendation the corresponding total cost and annual saving in the units of consumption and money together with the lifetime of the product, as they do in Denmark. The underlying hypothesis for calculating the monetary annual savings should be mentioned.

We would not recommend keeping the current computation of one single payback period per recommendation as it was when the energy assessments were performed in the framework of this research because our in-depth interviews repeatedly show that these single payback periods were misleading and interpreted as an objective result that was "calculated by the computer" rather than as an output of one simulation – among many other possible simulations – based on a rather unrealistic assumption on constant energy prices since the last bills. The third solution appears to be the best option to be developed.

**$CO_2$ reduction**

Our in-depth interviews have shown that some dwellers are interested in energy savings more for environmental than for economic reasons. On the other hand, several interviewees are interested in social comparisons to know "whether we are luxury people" (as said by Kristien). Furthermore, on an ethical perspective and with Figure 8.7 in mind, it may appear unfair that two different houses may have the same labels and the same saving potentials in relative terms whereas their yearly energy consumption differ with a factor 3 or 4. Finally, the Danish labelling system has an indicator for the dwelling total $CO_2$ emissions, as described above.

For all these reasons, we would recommend to add on the report of the reviewed house an indicator showing the dwelling position in a scale of tons of $CO_2$ emitted yearly by the dwelling. Here again, underlying hypotheses on heating spaces, periods and temperature should be made clear to the dweller. Furthermore, each recommendation should be presented with the corresponding tons of $CO_2$ yearly saved if the recommendation is implemented.

## *8.5 Conclusions*

The EAP-audit is the most elaborated and detailed procedure discussed within the framework of this research. This research gave the opportunity to apply this procedure, for the first time in Belgium, on a larger scale. For each house, the specific composition of the building envelope and heating

installation is determined. Only with these data can a complete analysis of the heating energy consumption be possible. However, this complexity did not remove all barriers for a good result.

The procedure is first-of-all directed towards technical changes. Investments can be made in the house and this will often result in larger energy savings. Behavioural changes are not addressed. Secondly, the reactions of the households imply that the technical presentation of the results of the EAP-audit should be altered. The households do not directly find the information that is important for them, the report cannot be personalised according to each situation or the given results are wrongly interpreted.
Thirdly, some indications are over- or underestimated. The report shows always the Payback time, for instance. This indicator is however not useful in this context. On the other hand, clear indications for environmental aspects or lifetimes of interventions are often requested. These indicators are easy to implement, but they are currently not clearly stated in the report.

In general, this gives a view on the important role of the energy expert. His or her role as an advisor of the specific household has to be more clearly defined. It is often unclear what responsibility the expert has or which questions he cannot answer. Questions or energy consumption are often related to safety, well-being, indoor climate, air quality or hygiene. The current experts have to follow some training already, as it is rare to find experts who are both informed about the building envelope and the heating installation. All other related aspects are equally important and need to be addressed in trainings too, but it will be very hard to provide experts who can take responsibility on all related fields.

The energy expert actually has the role of transferring the technical knowledge in a clear way to the households. However, the program for the EAP-audit does not provide a lot of features to adapt the results to the wishes of the household. The program has been designed to provide the technical results, but the transfer of these results cannot yet be personalised. In technical circles, several years of research have gone into precise calculation of technical results. But the proper presentation of the results for households has rarely been a priority. This research is the first step to distinguish the ways how the results can be clearly explained to the households and how these can motivate households to implement measures.

At the moment, all this personalisation needs to be done by the energy expert on a case–by-case basis. This can induce different situations. In many cases, the expert will not personalise the results because this takes too much time. Consequently, the motivation of the households will be tempered and the audit will not yield much results.
In other cases, the personalisation will be done, but this will require a lot of time from the expert, increasing the total price for the audit.

This project shows that elaborate education of energy experts is necessary for the residential sector. This education should include fields related to energy saving. Also, the test of the social skills for energy experts is necessary.
The supporting agencies and administrations should try to improve the current procedure. The improvements should allow the technical results to be presented in a more clear and personalised manner.

# 9. INSIGHT FROM THE SURVEY QUESTIONNAIRE AND FROM THE GENERAL IN-DEPTH INTERVIEWS

In the SEREC phone survey, we asked the respondents whether they did the uttermost to make energy savings in their household and 21% of the respondents answered "completely", 32% "rather yes", 39% "rather no". The other answers received less than 6%. Among the respondents who did not say that they do the uttermost to make energy savings, the reason for not doing so was generally that the respondents did not want to lose any comfort (28% answered "completely" or "rather yes"). It also appears that one fifth of the people had the impression that their efforts would not have an impact and answered that it would be a drop in the ocean. On another side, one fifth of the respondents also estimate that they do not have enough financial means. Economic reasons thus play a role, but not a fundamental one for the majority of people. Even if they think that energy savings are useful, a number of the respondents are afraid to lose their comfort and/or their action would appear insignificant to them.

The following question in the SEREC phone survey consisted of a list of 8 propositions to save energy and for each one, respondents were invited to give one of the following answers: "I already do it, completely, rather yes, neither yes nor no, rather no, not at all". The intentions to have energy-savings practices are quite high, as shown by table 9.1.

**Table 9.1 Actions the respondents would be ready to undertake (%)**

| Energy-saving intention | Does it already | Completely | Rather yes | Neither yes nor no | Rather no | Not at all | Total |
|---|---|---|---|---|---|---|---|
| To install (more) energy efficient light bulbs | 20.7 | 38.7 | 28.3 | 1.5 | 6.6 | 4.2 | 100.0 |
| To use renewable energies | 1.8 | 38.2 | 41.7 | 5.8 | 8.9 | 3.6 | 100.0 |
| To install economic showerheads | 22.9 | 38.0 | 26.6 | 3.0 | 6.3 | 3.2 | 100.0 |
| To decrease the temperature of the dwelling by one degree | 14.9 | 31.9 | 35.2 | 2.4 | 11.0 | 4.5 | 100.0 |
| To improve the insulation | 27.7 | 31.5 | 27.3 | 2.5 | 7.3 | 3.7 | 100.0 |
| To pay more for an electrical appliance that consumes less | 18.9 | 30.6 | 38.4 | 2.9 | 6.6 | 2.5 | 100.0 |
| To install a more efficient heating system | 11.8 | 28.2 | 30.8 | 4.5 | 15.6 | 9.2 | 100.0 |
| Not to use electrical dryer (N = 618) | 6.1 | 11.0 | 20.5 | 5.9 | 27.7 | 28.8 | 100.0 |

Source: SEREC, September 2004, N = 961.

Nearly two respondents out of five completely agree to install (more) energy efficient light bulbs, to use renewable energies or to install economic showerheads. There is also a high potential in reducing energy consumption when it comes to heating as three respondents out of ten would totally agree to decrease the temperature of the dwelling by one degree, to improve the insulation or to install a more efficient heating system. Again, these figures refer to intentions and intentions will not necessary be followed by corresponding actions.
We further describe these intentions by associating them with corresponding energy-related practices or knowledge and when relevant, with the technical characteristics of their dwelling. We then portray the socio-economic characteristics of the respondents reporting that they would be ready to undertake them: in these profiles descriptions, we focus on the socio-economic subgroups that are the most numerous for agreeing with the proposition – for example the youngest or the inhabitants of a detached house, etc. – to provide policy-makers with information on the sub-population they could target in case they would consider developing policy measures in the field corresponding to the

reviewed proposition. The propositions are now examined according three areas – heating, sanitary hot water, electrical appliances – as we did in chapter 3.

# 9.1 Heating

### *9.1.1 To decrease the temperature of the dwelling by one degree*

> *"One always tells oneself one degree in addition and... I don't know anymore how many grams of $CO_2$"* (Antoine)

> *"(...) I would be an adept to have around 21° or so... I don't know to what norm it corresponds, 20°, 21°. ... Maybe [it is] not too much, too elevated. I believe that, having lived in a boarding school, back in the fifties ... one is a little accustomed to cold [temperature], isn't he. Hey... this is a comfort that... one didn't especially look for [at that time] whereas my wife is rather from a circle where it is overheated!"* (Louis)

To decrease the temperature of the dwelling by one degree is a proposition that would be significantly more accepted by the respondents of the large-scale survey who reported that during 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[54]. Thus, reported intentions and practices appear here to be consistent. Furthermore, the highest share (57% or above) of those saying that they would be either completely ready or rather ready to decrease the temperature of the dwelling by one degree evaluated that during the winter, the temperature in their living-room to be equal or above 21°.

However, among the subgroup of respondents who state that they would completely agree with this proposition of decreasing the temperature of their dwelling by one degree, there are several technical obstacles worth mentioning: 23% have no thermostat in their dwelling; 3.4% have neither a thermostat nor a radiator with a thermostatic valve; and 25% have no external probe nor a radiator with thermostatic valve. Summing up, three respondents out of four who completely agree with this proposition of decreasing the temperature of the dwelling by one degree have the required technical equipment (like a thermostat) to do so whereas one out of four does not have it. For example, we met Daniel who cannot regulate his flat temperature and who suffers from the heat: *"I had to get used to a high temperature which I don't like and which I find unhealthy. For instance, at night 18˚ is too much. If I am cold, I just have to cover myself. And if it's 19˚, 20˚, it's too much, it's unhealthy. It's too dry, it's really unhealthy. It's unhealthy."*

The respondents who say that they would completely agree to decrease the temperature of the dwelling by one degree have the following socio-economic characteristics:

- The vast majority (77%) is among the middle-aged respondents (30–69 years old); however, the youngest and the oldest respondents (less than 30 years old and more than 70, respectively) are proportionally a little more numerous to state that they completely agree with the proposition.
- They live as couples, with (14% of the total surveyed) or without (10%) children.
- The household income is the only socio-economic variable to be highly and significantly associated with the intention to decrease the temperature of the dwelling by one degree: the lowest the household income, the highest the complete agreement to do so. The pattern is reversed for those who rather agree to do so.
- There is no significant relationship between this intention and the dwelling type, which means that the respondents who report that they fully agree with the proposition of

[54] For the 3 corresponding tables (not shown), $\chi^2$ is significant.

decreasing the temperature of their dwelling by one degree are living in dwelling types distributed as among the total population.

- Among the respondents quite or rather interested with this proposition, more than half have not "heard about the fiscal measures decided by the [public] authorities to help people diminish their energy consumption".
- Their motivation to save energy is or would be mainly motivated "by a sense of collective responsibility" or "to protect the environment".

### *9.1.2 To install a more efficient heating system*

> *"The boiler, it is since... We will change it but we need money, of course"* (Veronique)
>
> Arthur (A) is looking to buy an apartment and the interviewer (I) asks him whether he would consider changing the boiler:
> – (A): *Yes, maybe yes... if it is an old boiler that … consumes a lot of oil... I will certainly think about it twice before keeping it: that is clear!*
> – (I): *And if you change it, would you change it rather for economical reasons or for ecological reasons?*
> – (A): *Well... in my opinion, it would be above all for economical reasons*
> – (I): *Yes*
> – (A): *But I think that for the moment, economy and ecology are going well together. Thus, one can hit twice with one stone..."*

Among the respondents of the large-scale survey who fully agree with this proposition to install a more efficient heating system, 17% have no central heating, 21% have no thermostat and 90% have no external probe.[55] We do not know however whether the respondents had one of these equipments in mind when fully agreeing with the proposition of installing a more efficient heating system. Summing up, about three respondents of the SEREC survey out of four who fully agreed with the proposition to install a more efficient heating system, have the technical equipment to do it (as a thermostat, for example), while one out of four does not.

73% of the SEREC total sample lives in a dwelling having an individual boiler. Among this sub-sample, 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) or than it is the case (8 years) for the boiler of the respondents who report that they are already applying that proposition. Detailed results on this topic are in Table 9.2, and Table 9.3 shows that the evaluation of the "oldness" of the boiler matches very well with the mean age of the boiler as reported by the respondents. The general "oldness" of the boilers that are heating the surveyed 653 dwellings having an individual boiler may also be expressed with the following figures: one fourth of these dwellings has a boiler of 4 years or less, half of them have a boiler that is ten years or less and for another fourth of these dwellings, the boiler is 20-years old or more

.

[55] For the 3 corresponding tables (not shown), $\chi^2$ is highly significant.

**Table 9.2 Estimated mean age of the boiler according to the agreement of the dweller**

| To install a more efficient heating system | Does it already | Completely | Rather yes | Neither yes nor no | Rather no | Not at all | Total |
|---|---|---|---|---|---|---|---|
| Mean age of the boiler | 8.4 | 14.54 | 11.7 | 10.23 | 11.4 | 12.4 | 11.9 |
| Standard deviation | 9.44 | 10.8 | 8.746 | 7.9 | 9.6 | 10.6 | 9.9 |
| Minimum value | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Maximum value | 35 | 51 | 37 | 28 | 40 | 39 | 51 |
| N | 101 | 177 | 200 | 28 | 93 | 52 | 652 |

Source: SEREC, September 2004, N = 653.

**Table 9.3 Estimated age of the boiler according to the evaluation of the dweller**

| **Evaluation of the dweller** | Mean age of the boiler | Standard deviation | Minimum value | Maximum value | N |
|---|---|---|---|---|---|
| Very recent | 3.4 | 4.6 | 0 | 30 | 113 |
| Recent | 8.8 | 6.8 | 0 | 37 | 331 |
| Neither recent nor old | 16.8 | 7.9 | 3 | 40 | 61 |
| Old | 22.5 | 7.9 | 3 | 51 | 121 |
| Very old | 28.4 | 8.2 | 14 | 43 | 21 |
| Total | 11.8 | 9.8 | 0 | 51 | 647 |

Source: SEREC, September 2004, N = 653.

The respondents who state that they completely agree to install a more efficient heating system have the following socio-economic characteristics:

- 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 the proposition.
- They live as couples (80%), with or without children, with male respondents living in couple being much more inclined to fully agree with this proposition than their female counterparts.
- The household income is also highly and significantly associated with the intention to install a more efficient heating system; here, and contrary to the preceding proposition, the highest the household income, the highest the complete agreement to do so. Those who rather agree to do so are more often to be found in the 2$^{nd}$ quartile of household income.
- As above, there is no significant relationship between this intention and the dwelling type, which means that the respondents who report that they fully agree with the proposition of installing a more efficient heating system are living in dwelling types distributed as among the total population.
- As above, among the respondents quite or rather interested with this proposition, more than half have not "heard about the fiscal measures decided by the [public] authorities to help people diminish their energy consumption".
- The respondents fully agreeing with this proposition express that their motivation to save energy is or would be mainly "by a sense of collective responsibility" or "to protect the environment". In comparison with the total population surveyed, these respondents answer more often "by a sense of collective responsibility" and less often "to avoid wasting".

## 9.2 To improve the insulation

> *"(…) if one can make it so that, with a better insulation of the roof, a better insulation of the windows (…) it's possible to diminish the bill, everyone is breaking even."* (Jean)

> *"The house is not correctly insulated. Thus, there is no double-glass everywhere in the house. (…) I have not done the financial effort to change that aspect."* (Anne)

Among the respondents of the large-scale survey who fully agree with this proposition, 20% have no double-glass windows at all in their dwelling (against 15% in the total population) and 21% have it on some windows (against 18% in the total population).[56] It is also interesting to note that the difference in the agreement (or disagreement) for considering this proposition is significantly different between the respondents having partially double-glass windows and those having double-glass on all their windows.[57] Maybe concrete and personal experience is the best advocate for a better glass insulation, as echoed in the following quote: *"there (one part of the roof), it was not insulated – I have lived here for years, during the winter, it was cold – so yes, [after the work for insulating it], the usefulness of the insulation, you feel it!"* says Sofie, who experienced the benefits both during the summer (not too hot) and the winter (not cold anymore).

Respondents who agree (they completely or 'rather' agree) 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 more often estimating the same temperature at 21°–22°.

There is also here a gender issue as among the respondents who fully agree with this proposition, male respondents are more numerous than their female counterparts to think that the decision to insulate the roof should be taken by both partners and less numerous to think that this should be a male-only decision than the female respondents. Each gender has thus the tendency to reject the decision in the other gender territory, which means in the male territory for women and in a "both-partners" field for the men. The latter generally means in the woman's territory, as shown by a recent qualitative research on do-it-yourself decisions and practices (Puraye, 2005).

The respondents who state that they completely agree to improve the insulation of their dwelling have the following socio-economic characteristics:

- Just as for the preceding proposition (to install a more efficient heating system), 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, with an over-representation of the 1st quartile of household income (as for diminishing the rooms' temperature by one degree). Those who rather agree to do so are more often to be found in the 2nd quartile of household income, as for both preceding propositions (diminishing the rooms' temperature by one degree and installing a more efficient heating system).
- Contrary to the 2 propositions above (diminishing the rooms' temperature by one degree and installing a more efficient heating system), there is a 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.

[56] $\chi^2$ is highly significant.

[57] The Bonferroni test of testing means differences is significant ($p = 0.045$).

- Just as above, among the respondents quite or rather interested with this proposition, 45% have not "heard about the fiscal measures decided by the [public] authorities to help people to diminish their energy consumption".
- The respondents fully agreeing with this proposition express that their motivation to save energy is or would be mainly "to protect the environment" or "to avoid wasting", but less often "for economical reasons" than the total population surveyed.

## *9.3 Sanitary hot water*

> *"We [prefer] showers, it's quicker and we have an economic showerhead. (…) We bought it when we were in the other apartment because we found that the other one was dirty. (…) We went to the supermarket and we never knew that it was an economic showerhead. (…) [The energy advisor] told us that it was an economic showerhead, here we are."* (Wim)

When it comes to bathing and showering, the SEREC survey mentioned only one proposition: to install economic showerheads.
Summing up all the baths taken during a week by the respondents and the other members of their household, data show that in total, two thirds of the surveyed persons have 4 baths or less per week. The same holds true for the respondents who fully agree with this proposition. Only those who say that they already use economic showerheads are more frequently found in this category.
When averaging the number of showers taken by all household members per week, there is a U-type curve according to the agreement or not with the proposition of using economic showerheads, as shown in table 9.4. This result shows that the economic rationality is certainly not the sole driving factor here.

The respondents who state that they completely agree to install economic showerheads have the following socio-economic characteristics:

- Just as for the preceding propositions, the vast majority (78%) 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, as it was the case for the proposition on improving the insulation.
- Persons living alone, with or without children, are proportionally much more in favour of installing economic showerheads than spouses and, on the other hand, these living-alone persons are proportionally less numerous to report that they already do it. Do these results mean that the information on the availability of these economic showerheads is not widespread enough?
- Lower-income households – especially 1st quartile – are over-represented among the respondents who state that they completely agree to install economic showerheads, just as for improving the insulation and diminishing the rooms' temperature by one degree.
- Consequently, and as for improving the insulation, there is a significant relationship between this intention of installing economic showerheads and the dwelling type: dwellers living in an apartment are quite likelier to express their intention to do it.
- The respondents fully agreeing with this proposition more often express that their motivation to save energy is or would be mainly "to protect the environment", but less often "for economical reasons" than the total population surveyed.

**Table 9.4 Estimated mean number of showers per week and per household**

| Agreement of the dweller for using economic showerhead | Mean number of showers | Standard deviation | Minimum value | Maximum value | N |
|---|---|---|---|---|---|
| Completely | 9.8 | 9. 8 | 0 | 52 | 358 |
| Rather yes | 9.3 | 8.8 | 0 | 42 | 252 |
| Neither yes nor no | 4.4 | 5.9 | 0 | 35 | 28 |
| Rather no | 9.8 | 7.8 | 0 | 28 | 60 |
| Not at all | 11.0 | 14.5 | 0 | 60 | 28 |
| Total | 9.5 | 9.4 | 0 | 60 | 727 |

Source: SEREC, September 2004.

## *9.4 Electricity consumption*

### *9.4.1 To use renewable energies*

> *"[In the neighbourhood] there is always some wind. Thus I had thought to install a small windmill, here [on my roof]. I had already thought about it, I searched on Internet. But there is nothing existing… when you type "windmill" you immediately get things that cost 2 or 3 million euros! Well, it's unaffordable."* (Charlot)

> *"(…) I tell myself that we cannot continue as we are doing now. I am annoyed for example that in Brussels, there is no mean to choose the energy supplier. In Flanders, it is possible and for example, if I wanted to have 'green energy' as they say in Flanders, in Brussels one cannot choose renewable energy sources, it doesn't exist, it can't be helped. I see on my bill that it is 0.003% of renewable energy, that is not a lot, is it."* (Clara)

80% of the respondents of the large-scale survey declare that they fully or rather agree with this proposition of using renewable energies (table 9.1). However, as shown with the two quotes cited above, there are several obstacles before this wish becomes a reality, the main ones being market-related and financial ones. Respondents who are better informed on renewable energies, and who know that expression, are significantly more in favour of using them than the respondents who don't know that expression. The lack of information, namely on the share of nuclear energy used in electricity production in Belgium, is echoed in the following quote, with several hesitations (unusual in the answers given by this teacher): *"Moreover… moreover, it seems to me that the electricity produced by … by other energies, namely nuclear ones and so forth, thus…, it seems to me that I have seen a few [TV] programmes where they were explaining that if each inhabitant … limited his/her consumption, it would be possible… it would be possible to reduce the nuclear pollution and the like … in a rather considerable manner."* (Alexandre)

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

- The respondents who are the most likely to agree to use renewable energies are 30–69 years old, the youngest respondents (less than 30 years old) are proportionally more numerous to state that they agree with this proposition.
- Couples with children are also over-represented among the respondents who fully agree with the proposition.

- Contrary to the preceding propositions, the agreement with this one, on using renewable energies, is not significantly related to household income.[58]
- As for improving the insulation and installing economic showerheads, there is a significant relationship between this intention/wish of using renewable energies and the dwelling type: dwellers living in an apartment are quite likelier to express this wish.
- As for installing a more efficient heating system, among the respondents quite interested with using renewable energies, nearly half of them (48%) have not "heard about the fiscal measures decided by the [public] authorities to help people diminish their energy consumption".
- The respondents fully agreeing with this proposition express more often than the total population surveyed that their motivation to save energy is or would be mainly "to protect the environment" or "by a sense of collective responsibility".

### *9.4.2 To install (more) energy efficient light bulbs*

> *"(We have) energy efficient light bulbs where I don't mind that we lose 20 seconds to have them switched on."* (Jean)
>
> *"(…) since I am here [in this studio] I have installed the full system with saving lamps, so I follow the system of several lamps, the contrary of my education where there was one lamp for reading – a question of saving – and today, I have used the system of saving lamps and I switch 2 or 3 lamps."* (Daniel)

Two respondents of the large-scale survey out of three declare that they fully or rather agree with this proposition of installing (more) energy efficient light bulbs (table 9.1). These respondents are however less numerous on average to have such bulbs than among the total sample surveyed (63%).[59] The agreement (or not) of installing (more) energy efficient light bulbs is not related, though, to the habit, or lack thereof, of switching off a light "when one leaves a room for five minutes". Finally, the most the respondents agree with this proposition, the lower their (total) electricity consumption, except for those refusing it completely: these respondents have the least electricity consumption.

The respondents who state that they completely agree to install (more) energy efficient light bulbs have the following socio-economic characteristics:

- There is no association between the age of the respondent and his/her agreement to this proposition.
- There is no association either between household composition and the agreement of the respondent.
- Contrary to all preceding propositions, the complete agreement with this one on energy efficient light bulbs is significantly more often found in middle-income households (2nd and 3rd quartiles).
- There is no association between the dwelling type and the agreement of the respondent.
- The respondents fully agreeing with this proposition more often express that their motivation to save energy is or would be mainly "to protect the environment" and less often "for economical reasons" than the total population surveyed, whereas the respondents reporting that they already do it exhibit an inversed pattern.

[58] $\chi^2$ is not significant ($p = 0.084$).

[59] $\chi^2$ is highly significant.

### *9.4.3 To pay more for an electrical appliance that consumes less*

> *"When we will buy a fridge, we will pay attention to the label"* (Antoine)

> *"(…) the stove, it is an old one (…) it is clear that if we had the money, we would buy something more correct. (…) The same [holds true] for the washing machine, it is the old one of my parents, it has more than 20 years but it is still working. (…) The dishwasher is quite recent, we bought it 3 years ago (…). It is a 'Super A' it was also a choice both for economy and ecology (…). The freezer is also a 'Super A' for which we got a subsidy."* (Alain)

70% of the respondents of the large-scale survey declare that they fully or rather agree with this proposition of paying more for an electrical appliance that consumes less (table 9.1). As seen before with energy efficient light bulbs these respondents are however proportionally less numerous to have such labelled appliance than among the total sample surveyed (62%)[60], but they are more numerous to state that a lower energy consumption is for them a criterion when buying an appliance. The agreement (or not) of paying more for an electrical appliance that consumes less is not related to the (total) electricity consumption, contrary to the result obtained for energy efficient light bulbs.

The respondents who state that they completely agree to pay more for an electrical appliance that consumes less have the following socio-economic characteristics:

- There is a clear association between the age of the respondent and his/her agreement for this proposition: the respondents aged 50 and over are more represented among those fully agreeing.
- There is no association either between household composition and the agreement of the respondent as for the proposition on energy efficient light bulbs.
- The complete agreement with this proposition on paying more for an electrical appliance that consumes less is somewhat more often found in low-income households (1st quartile).
- The complete agreement with this proposition is higher for respondents living either in an apartment or two-facade house.
- The respondents fully agreeing with this proposition more often express that their motivation to save energy is or would be mainly "to protect the environment" and less often "to avoid wasting" than the total population surveyed, whereas the respondents reporting that they already do it more often have "an interest for new technologies".

### *9.4.4 Not to use electrical dryer*

> *"[We have] about ten laundry loads per week (…) for a family of six (…) [I don't use the dryer] each time… for example, one cannot dry pullovers in the dryer, so… A number of clothes are drying in the lobby there or on armchairs, and during the summer in the garden. But that is not the case for all clothes; it is true that the dryer works a lot. Yes: it is not a very saving [behaviour] (…) otherwise, to have clothes everywhere in the house every time…"* (Anne)

> *"The dryer, I have always dreamed to buy one because it is said that it is so convenient, but knowing that its consumption is enormous, one puts that into parentheses."* (Veronique)

Very few respondents of the large-scale survey have the same reaction as Veronique: among those having an electrical dryer, only 11% would completely agree with the proposition of not using it and 6% claim to do so.

[60] $\chi^2$ is highly significant.

As could be expected, the intensity of the disagreement is higher for the respondents using this appliance more often[61], and this result holds true when taking the household size into account. The disagreement (or not) with the proposition of not using the electrical dryer is not related with the (total) electricity consumption, a similar result to the one obtained for the proposition of paying more for an electrical appliance that consumes less.
The respondents who state that they completely agree not to use their electrical dryer are not numerous enough [62] for drawing their socio-economic profile.

## *9.5 Conclusion*

Summing up, Belgian dwellers seem quite open to the idea of improving their home in a more energy-efficient manner, as they expressed it during the SEREC large-scale survey and the in-depth interviews. Of course, these intentions to improve the insulation, to install a more efficient heating system – which seems quite necessary for at least 15% (of all the dwellings) for which the boiler is aged 20 years and over – or to use renewable energies are just intentions which will not necessary be followed by corresponding behaviours. In this respect, a large ignorance of the fiscal measures has been observed among the respondents of the SEREC survey. However, the high intensity of the agreement to improve energy efficiency and probably energy-consumption diminution indicates a high potential for the acceptability of policies aiming at lowering residential energy consumption. This will be further developed in chapter 13, which is devoted to policy recommendations.

[61] F is highly significant.
[62] From a statistical point of view: all cells have less than 30 respondents.

# 10. HOW TO AND WHY RAISE THE AWARENESS OF ENERGY CONSUMERS? SYNTHESIS OF THE DIFFERENT METHODS TESTED

This chapter synthesises the characteristics of the four methods described in the earlier chapters – the Quick Scan, the energy diary, the electrical audit and the complete energy assessment of the dwelling. Each method has obviously positive aspects and weaknesses that are synthesised here, namely in terms of changing the energy-related habits of the participants. In chapter 9, the reactions of the surveyed laypersons are also described: the principal motivations to save energy are the sense of collective responsibility and the will to protect the environment. The will to change and the intentions to change are present, but they are not sufficient to bring about changes in energy-related practices, as we will show below.

## *10.1 Synthesis of the different methods*

### *10.1.1 The interest of the participants to the methods*

The participants to the methods were all interested in a way or another: whether it was to save money, to avoid energy wasting, by interest in new technologies and in environment protection or by social comparison... However, it has to be stressed that due to the recruitment methods we used, all participants were interested in the topic of energy savings. Two tests done during this research with (more) randomly selected samples brought about nearly no interest at all.

Participants to the Quick Scan are interested in comparing their own electrical consumption with others having the same 'profile'. Some reactions left on the webpage indicate that the advices given were not always practical enough to make them change their actual consumption.

The interviewed participants of the energy diary were already paying attention to their consumption and did not really want to change their practices, as they thought that they were already doing what they could. The list of advices did not really help them because they already knew these tips. To fill up this energy diary has increased their consciousness of their daily acts, but this does not mean that they will further change their behaviours. For instance, to increase the visibility of the electrical consumption related to their daily behaviours, could bring them a step further.

The electrical audit has broken some wrong ideas, according to the participants, and it has made them more conscious about their effective consumption. But once again, most of the interviewees have expressed the difficulty to change the equipment or their habits in order to reduce the (now visible!) consumption. They mostly agreed to pay attention to the labels of electrical appliances and white goods for their next purchases. Residential electric consumption appears to be more easily reduced by householders' investments in efficient appliances rather thanby changing daily routines.

The participants to the energy assessment were very pleased with the customised advices coming from 'neutral' experts, but generally, no change or solely minor changes have been done.

### *10.1.2 The type of information received by the participants*

The information received is summarised in Table 10.1. The more the advices are customised, the more the participants appreciate them: more general advices are not really used by the participants who seek information relative to their own energy consumption. This does not imply however that the participants use this customised information by implementing the recommendations that they have received: other brakes are intervening, as summarised in the last section of this chapter.

### *10.1.3 Main reactions*

The most valued elements are the personalised information, especially in the energy assessment of the dwelling, the possibility to compare with other households (Quick Scan: Edison test) and between several energy-consuming devices (electrical audit), and the easiness of the use of the methods. The diary brought about the least interest, as the families who volunteered to fill this energy-diary were already interested and knowledgeable about their energy-related practices.

One way to increase the impact of those methods on behavioural changes is to combine them, as shown in the next section.

## *10.2 Methodological developments*

### *10.2.1 Main problems to be solved*

A major problem for each method is that the participants were already interested in energy savings before participating and thus, rather knowledgeable about their energy-related practices. This raises a methodological problem that is difficult to solve.

### *10.2.2 Complementarity between the Energy assessment and the Electrical audit*

The electrical audit has some advantages when it is compared to the energy assessment. The recommended measures are more often short-term measures. In general, there is already a part of the recommended measures that concerns only behaviour. So no extra investments are necessary. Sociological interviews show that these behaviours are rooted in habits and they are difficult to change immediately.
Other measures mostly ask smaller interventions or smaller investments. Whereas the interventions following the energy assessment often are very large in scope, the electrical saving potentials can often be addressed by connecting a multiple socket with an interrupter or by changing bulbs. Savings are, therefore, often more interesting in the short term.

Electrical audits can often be applied more easily than the full Energy Assessments. The energy assessment sometimes has a small effect or the possibilities to carry out recommendations in practice are sometimes small. For example in an apartment, some recommendations are very hard to implement: an owner can not insulate walls of his apartment without a common approach with all the other apartment owners in the building. Renters are equally confronted with this practical problem. They cannot interfere in the building; this is the responsibility of the owner.
In apartments or rented dwellings, an electrical audit can still be useful. The household will keep the possibility to interfere and to reduce its consumption

**Table 10.1 Comparison of the four methods**

| | **Quick Scan (Edison test)** | **Energy Diary** | **Electrical Audit** | **Energy Assessment** |
|---|---|---|---|---|
| **Type of information** | Fast and 'semi-customised' information: comparison with other Belgian households + general advices. | A list of advices plus comprehensive information on own energy-related practices. | The consumption (both in standby mode and in 'normal mode') of some installed electrical devices. | Labels and customised advices |
| **Main reactions of the users** | Interested by the comparison and the 'self-evaluation'. Not enough advices to know how and what to change. | Easy to fill in the case of small families. The received advices were already known. This method does not bother, but does not bring something new for the user, either.<br>No contact with the Energy Advisor. | Funny to compare the electrical consumption of several devices. It deconstructs wrong ideas about consumption. | The customised information is highly valued as well as the contact with the Energy Advisor. Only a minority did not learn a lot. |
| **Main problems to be solved (for 1. the users, 2. the researchers, 3. the method in general)** | Statistical data (2).<br>Social bias because of the use of Internet (3).<br>No personalised advices (1). | Only people interested in that subject have participated, without learning something really new (3). | High price for continuous and complete measurements (3). | Heavy method to implement (1-2-3). |
| **Evaluation of the costs** | Can be freely used. Cost for set-up and maintenance of the website can be reduced. | Can be freely used. | Full measurement of all devices during a one year period is too expensive to be practically carried out.<br>A reduced method with a new audit procedure can be practically done. Based on an estimated workload of 1 to 3 hours, the price should be between 100 and 300€. | Current evaluations vary between 400€ and 600€ per assessment. |
| **Does this method possibly lead to changes and action in the field of energy use?** | The advices are not personalised enough to be implemented.<br>But it could be interesting to implement the Quick Scan on the electricity bills. | The participants seem to be more aware of their habits linked to their energy consumption, but this does not imply any further change in their behaviours. | Some uses of electrical devices can be altered, but if no other possibility is given, the participants are not willing to change. | Even if the advices are customised, the barriers to changes remain numerous and strong. Little things are easily changed (as the use of economic showerheads) |

The current evolution to promote private experts for residential housing is very interesting and it creates an easy access to the residential market for electrical audits at the same time. Then, the electrical audit can be implemented as an addition to the energy assessment by the same expert. This practical implementation could yield considerable results.

## *10.3 Awareness is not enough! Other brakes and levers*

Changes in energy-related practices can happen by what we will call levers and they can be slowed down or even cancelled by what we will call brakes. This section tries to present the most relevant ones, in order to get a better understanding of the complexity of the social factors shaping individual practices and sometimes individual choices concerning practices and investments related to energy consumption. These brakes and levers are summarised in Table 10.2. They contribute to understanding the modifications, undertaken or not, after one of the four methods. Theoretical references as well as interviews conducted in this research force us to be very careful about predictions in the field of future energy behaviours. Consumers are pushed by a combination of several factors, which are not only numerous and complex, but also in competition and even paradoxical: the same argument has a double valence, being possibly a lever or a brake to changes in a more energy-saving behaviour. This is summarised in the table below, presenting the major levers and barriers to changes in energy-related practices.

### *10.3.1 Energy policies*

The importance of energy policies has been illustrated by the comparison between Belgium and Denmark (Chapter 4) and the topic of energy policies is further developed in the analysis of the perceptions of environmental policies by the Belgian public (Chapter 12).

### *10.3.2 Market pressures*

Energy is a consumption good, even if it is for a major part an invisible and immaterial consumption. High prices on energy can either push people to pay attention or they can not change their behaviours at all, like higher prices on cigarettes do not systematically bring smokers to stop. Several interviewees think that energy prices are “quite reasonable” (most interviews were made during the winter 2004-2005), which is a brake for boosting energy savings. Only 8% of the respondents to the large-scale survey estimate that to increase energy prices would be “the principal solution to reduce energy consumption” (chapter 3).

### *10.3.3 Social pressure*

In a consumerist society such as ours, pressures are numerous to consume more goods, to heat homes more during a longer period around the winter and to cool them during the summer, to travel more... all activities that require more and more energy. The dream for some interviewees is to have air-conditioning at home. Convenience is particularly valued (Shove, 2003). It seems that there are no corresponding levers to this consumerist pressure.

### *10.3.4 Comfort*

Comfort is also pointed by E. Shove (2003) and numerous interviewees as a central objective for improving their home. However, comfort has a double valence as it can trigger energy-saving actions, especially in the area of insulation, or the demand for comfort may justify high indoor temperature.

### *10.3.5 Daily routines*

Hertwich and Katzmayr (2004) assume that changing energy-consuming practices into energy-saving behaviour is a very slow process because these practices are inserted in everyday routines. Even if the consciousness is raised by proper information, habits remain hard to change (Kaufmann, 2001), and the interviews show that as well.

But habits can be modified, if other motivations are strong enough to the actor's eyes. As seen in the interviews, social pressure can act this way (having kids and wanting to protect them, being in a social environment with energy-friendly behaviours…).

To have the possibility to switch to another practice is an important issue too: many interviewees have expressed that they keep their habits because of a lack of other possibilities that are not seen as easy to adopt and as comfortable as the previous ones.

**Table 10.2 Levers and Brakes to change**

| LEVERS to change | BRAKES to change |
|---|---|
| Energy policies that are existing and enforced | No clear energy policy nor consistence between the different authorities |
| Market pressures (e.g.: high energy prices) | Absence of pressure from the market |
| Social pressure to consume less??? | Social pressure to consume more |
| Comfort (ex: changing simple glasses for double glasses) | Comfort (not willing to lower the indoor temperature) |
| Habits: energy-saving habits acquired since childhood or influenced by the children (via school…) | Habits are very difficult and slow to change! Importance of convenience |
| Social network supporting energy savings | Social network not supporting energy savings |
| Sufficient income to make energy-related investments; wish to decrease the bills; help of subsidies to make energy-saving investments. | Insufficient income to do what is wished to save energy (e.g. solar panels) or wish to show that there is no need for thrift for higher incomes. |
| Agency feeling: yes, things can change for the better and households have some "power" | No agency feeling: what households could do is so small in front of the industrial and political decisions |
| Environmental values that are interiorised enough to be a motivation | Peripheral environmental values and/or wish to appear "different from the ecologists" and to have "no exaggerated practices" |
| Identity (pride of consuming less than other households) | Identity (pride of consuming more than others – conspicuous consumption) |
| | Technical factors of the building / renters and not owners / no feasible alternatives |

### *10.3.6 Social influence*

Friends, colleagues, neighbours, family members, children, the media watched, read or listened are elements of the social support. In energy matters as in other matters, people are not acting as pure individuals, but as persons involved in various social relationships, and they are expecting support for their action from the persons, or the networks, they value the most. The participants to the energy assessment, for instance, have often talked about it to acquaintances, who are not always supportive, such as the persons who asked an interviewee whether he would "light up with candles" after he had

installed a few saving lamps. Another interviewee, Maria, has spoken several times during the interview about the advices to save energy that she receives from her daughter.

### *10.3.7 Income*

The energy prices may be a brake to changes in the field of energy for people interested in some new energy techniques, but who cannot afford these investments (like solar panels, for example). A lot of interviewees have expressed that they are interested in some ecological choices (like solar panels or a more effective heating system), but that their price discouraged them from 'acting' in this way.

### *10.3.8 Agency feeling*

Managhten and Urry (1998) have shown how environmental problems can generate either an agency feeling or its contrary, a helplessness sense. Given the actual situation of the environment, two positions are indeed possible: firstly, to think that personal changes that influence residential consumption will not make any difference, because the industrial and political fields have more influence on the global consumption than the sum of the personal attempts. People thinking like this do not have an agency feeling: why make efforts if they are not even useful?
Secondly, others think that even if it is a small thing, it has to be done, in order to try to get a better situation. Small changes are possible, like paying attention to household waste as was frequently mentioned in the interviews.

This research has also showed that the agency feeling is related to the social position obtained by the families and that it strongly influences the openness to environmental information (chapters 3 and 9).

### *10.3.9 Environmental values*

There is a link between values, habits and behaviours. Biel (2004) makes a difference between environmental values that are sufficiently interiorised to make the actors more likely to act in a pro-environmental manner and more peripheral values, which are more neutral and do not constitute a lever to adopt pro-environmental behaviours, as in the next quote taken from Wim's interview: *"for a part, the environmental matters interest us, yes, not like the persons from Greenpeace, for instance, but we try to pay attention. […] Little things like sorting waste, papers… That's what we try to do, but it doesn't work at 100%, there are obviously things that don't work, like I will not take the paper off the glass, for instance, I find that exaggerated."*

### *10.3.10 Identity factors*

Identity factors are also related to energy practices, as in conspicuous consumption (Jensen, 2005) or in showing his/her environmental concern (Keierstead, 2005). Our interviews repeatedly show a rather wide concern to present oneself as a moderate person without "exaggerated" practices due to ecological values and without "excessive" concern for the environment.

### *10.3.11 Technical aspects*

Even if the willingness to change is present, technical factors can slow down or even cancel the motivation to change. People have to deal with the dwellings they have bought, often for reasons that have nothing to do with energy consumption (like having large rooms, enough luminosity etc.). Other persons do not have the possibility to make changes because of their renter status.

## *10.4 Conclusion*

Three points are important to underline. Firstly, there is always a combination of several lever factors: none will thus be sufficient by itself. However, one brake factor will be sufficient. Secondly, the weight that is given to the different lever factors also depends on the action to be undertaken or on the practice to be changed. This process of priorities-setting is often non conscious, except of course in situations where explicit advices are given, for example by an energy expert. Thirdly, the same factor can be experienced as a brake or as a lever; there is thus no straightforward solution.

# PART III
# POLICY RECOMMENDATIONS AND CONCLUSIONS

## 11. PERCEPTIONS OF THE ENVIRONMENTAL POLICIES BY THE BELGIAN PUBLIC

This chapter presents the perception of the environmental policies by the Belgian public and it is based on a content analysis of a sample of in-depth interviews. The following chapter is devoted to policy recommendations which are drawn from these perceptions of the Belgian public as well as from all the results obtained in the SEREC research.

This chapter summarises the perceptions on policies concerning the environment and, more specifically, energy consumption.

### *11.1 The responsibilities toward pollution*

The biggest variation between the opinions of the interviewees concerns the responsibilities towards the actual environmental situation. On one hand, the actual situation is seen as the result of a structural organisation of the society, driven more by politics than by individuals. On the other hand, other interviewees believe that the citizens-consumers are the ones responsible for the actual environmental situation. The industrial sector is also cited as a big polluter, but a lot of interviewees insist on the choice people have as consumers: by buying environmentally friendlier products, consumers can orientate their production. The two points of view are further described below.

#### *11.1.1 Individual responsibility*

Marc illustrates his opinion with a sentence of Hubert Reeves: *"pollution is not a big problem; it is 6 billion small problems"*. He adds that we talk too much of pollution as the responsibility of *"this huge industry"* while we would have to consider *"people like adults [...] by trusting them, by telling them that they can do something"*.

These "micro-responsibilities" call for giving the opportunity to individuals to make more ecologic choices, as will be developed in this chapter.

#### *11.1.2 "Society" as the main responsible*

The interviewees often present the society as a whole, or the consumption system, as the main responsible for pollution. In relation to this, they do not have a high agency feeling: what they can or could do seems very weak and useless, as Jeanne says: *"I have the feeling [...] I have such a little capability of changing things!* [...] *It is the profitability that counts to the detriment of [the respect of the environment]"*. For her, the preservation of the environment is a collective responsibility and the task of *"Politics with a big P"*, but she adds that it is also the responsibility of each person. To present the society as the main responsible does not thus systematically mean that the individual responsibility is denied, as Pierre expresses it: *"it is convenient for me to buy really cheap Chinese products but, when you realise that China is the biggest polluter in the world* [...]*, but it is not for that reason that the daily responsibility of each person does not exist"*.

Those "macro-responsibilities", in turn, call for large-scale politics, like the Kyoto protocol.

### *11.1.3 Belgium and the rest of the world*

A widespread opinion is the lack of coordination of the different political actors on a worldwide scale. That energy consumption concerns all the inhabitants of the planet has been often evoked. The fact that the Kyoto protocol has not been ratified by the United States has been mentioned in a large majority of the interviews. The interviewees seemed to ask themselves what difference their efforts – those of Belgian citizens – could make if the biggest polluters themselves do not take measures to slow down their energy consumption. This feeling of injustice and this lack of agency feeling of 'small voluntary individuals' towards 'huge-voluntary-polluters' constitute a brake for adopting behaviours that could lead to a decreasing energy consumption... What impact do those efforts have in comparison with the pollution of the rest of the world ? Worldwide initiatives, like the Kyoto Protocol are parts of these macro-responsibilities of the public authorities.

## *11.2 Roles of the public authorities*

### *11.2.1 On environment protection*

Most interviewees seem to consider that the role of public environmental policies is essential to face the current environmental situation. According to the interviewees, it is the duty of the public authorities to protect the environment for the actual collective well-being and for the well-being of the next generations.
For Luc, there have been abuses in the industrial world and bad habits from the consumers: the role of the authorities is thus to counter-balance that.
Several interviewees find that the actual environmental policies are not numerous and demanding enough. José, for example, criticises several times during the interview the authorities: *"[…] for the moment, the political and economic powers do not think, [or they do] think in the short-term, for direct interests and not that much for future generations."*
Other interviewees think that the public authorities are alarmist. Eric, for example, thinks that the authorities *"make a storm in a glass of water"* and adds: *"I think that we over-react a little bit. I don't say that we don't have to pay attention but... the world has been going round for ages..."*. He thinks that the protection of the environment is a "fashionable" topic.
It is interesting to note that his wife considers, on the contrary, that the authorities have a role to play for the environment in preventing environmental problems for their children. This same pattern has been found in another couple.

### *11.2.2 On energy-consumption reduction*

Globally, the interviewed persons seem very open to policies aiming at decreasing residential energy consumption. Information and subsidies to investments and to lower energy-using devices encounter a clear interest. By these means, the households simultaneously save money and energy.

#### *11.2.2.1 Information*

Concerning this topic, part of the interviewees considers that the information about energy consumption and savings is easy to get and the major part finds that information too hard to get: people regret to have to go to the information instead of having information coming to them. Those interviewees insist to the efforts they have to make to be correctly informed. Some of them also regret that a major part of the information is available only on the Internet (which is growing in Belgium, off course, but which is not available in every household!). Antoine stresses the fact that it is the role of the authorities to increase the awareness by raising campaigns, but he also regrets the contents of the information: *"I have the feeling that the information maybe passes wrongly in the sense that it is told 'pay attention to your energy consumption', but it is a little bit like the tobacco, there is not enough information about how to make those energy savings […].'*

About the trust in information on climate change, opinions largely differ: most interviewees think that even if the experts may not have one same discourse, they can not all be wrong, whereas some interviewees find this discourse too alarmist and contradictory, which leads to their suspicion. This topic is further studied in Bartiaux (2005), who concludes that "the openness to environmental information depends on the possibility for the consumer to hear about it, which appears to imply or to necessitate an agency feeling."

#### *11.2.2.2 Subsidies*

To have a financial support for saving-energy investments (for double-glass windows, for instance) is obviously appreciated by the households. But the information concerning these financial incentives and the steps to follow to get them are not obvious at all. Moreover, the fact that these subsidies are regionalised and thus differ from one region to another, and the fact that there is no central point from whence to gather all the information makes it harder and discourages household dwellers.

### *11.2.3 Regulations or persuasion?*

Wim, who is not especially interested in environmental matters, raises the question of the regulations. He doubts the efficiency of the regulations or at least, he considers that it is not useful to regulate if the authorities do not have the necessary means to control the respect of the ensuing regulations, as the next sentence shows: *"[…] the regulation is there, but is it followed everywhere? It is not because there is a regulation that it will be effective* (…). *We could have regulation about everything, but it would be difficult to put policemen everywhere!"*.
On the other hand, Eric and Catherine seem to prefer awareness to regulation. *"I think that everyone has to be aware*. (…) *It is better when it comes from oneself"*. This couple expresses that they do not want to feel forced to do something for the environment (like recycling or reduce their energy consumption) and they prefer to do it by their own will.

## *11.3 Social support through political involvement*

In their energy-related behaviours, people make individual 'choices', even if these 'choices' are most often not conscious and take place within a social framework. Individual acts aiming at the reduction of energy consumption must be framed and supported by policies going in that sense and motivating citizen-consumers. So the individual and collective levels of responsibility toward the environment work together and constitute a consistent frame for action.

### *11.3.1 The power of social comparison*

According to the interviewees, a lot of them like to compare their consumption in time, but also with others. It seems important that their consumption is average or below average. A young interviewed couple, for instance, was proud to tell that a person of their family started paying attention after having realised that she consumes a lot more then the couple itself. And Marie, the housewife of a very wealthy household, was happy to notice that her family does not consume much at all, in comparison with the families around them. Moreover, to realise that the household consumes more in comparison with others can be an incentive to modify the behaviours and try to reduce its energy consumption.
In this respect, the quick scan is an interesting tool for it compares the yearly electricity consumption of the household to the corresponding consumption of households but it remains to see whether it is an incentive to change.

### *11.3.2 The power of example*

If the persons have the feeling of being the only ones to make an effort, they will easily and quickly lose their motivation. If a collective effort is made (like it is now the case for selective sorting of domestic waste), it will encourage people to start or go on with their energy-saving behaviours.
But these energy-saving behaviours have not only to occur within and between households. It is also important that the public sector participate to a common effort in public buildings, like schools, hospitals and administrative buildings. Interviewees have for example, spontaneously mentioned the waste of energy occurring at their workplace (like computer screens unused but still switched on, lights never switched off, too much heating and sometimes, no possibility to regulate it).
As interviewees with children have expressed it, schools could play a major role in showing the example: children, if they learn some habits going in the sense of energy economies are probably going to act in that sense later on, and they will also perhaps influence their own parents.

### *11.3.3 The bad image of Belgium*

Some interviewees have expressed the idea that the environmental policy is not sufficient in Belgium and that the country does not have a glorious image in that field in front of other (European) countries. José criticises Belgium several times during the interview as the '*biggest polluter of Europe*' and because Belgium is far behind its neighbour countries, such as the Netherlands, concerning the reduction of the energy consumption, and Spain, with the development of renewable energies and windmills.

### *11.3.4 The subsidies as the recognition of a socially aware act*

Subsidies are not only a way to save money. They can also be interpreted as recognition that the beneficiary acts as a citizen toward a collective well-being and therefore subsidies can also be a source of pride.

## *11.4 Conclusion*

Most interviewees consider that the role of public environmental policies is essential to face the current environmental situation and that it is the duty of the public authorities to protect the environment for the actual collective well-being and for the well-being of the next generations.
The interviewed persons seem quite open to policies aiming at reducing residential energy consumption. They regret the scattered character of information on this topic and they plead for a centralised source of information that should be practical. Some respondents also point the lack of control of environmental regulation.
Finally, our respondents point to the need for consistency between private and public energy-related practices both in the residential sector and in public buildings: this desired consistency calls for an energy policy that frames and supports individual and collective efforts toward energy-consumption reduction.

# 12. PRACTICAL RECOMMENDATIONS FOR THE DIFFERENT TOOLS

## *12.1 The Edisontest presentation*

The positive results for the Edisontest show a need for this type of application. Whereas numbers do not show strong indications for lay-people, the representation in the Edisontest is apparently more effective in comparing families to each other.
There is no direct link to recommendations to save energy so people have to do more effort before they actually find a practical solution to reduce their energy consumption. But the tool does trigger some interest.
For some time now, the electricity suppliers have been looking for an acceptable way to present electricity consumption on the annual bills. At the moment, the annual consumption is being compared with the consumption of the two former years. The representation of the Edisontest could show a more telling indication of the energy consumption of the household.

## *12.2 The Energy diary*

The results of the energy diary do not allow a straightforward application of this tool. To combine the diary with an electrical assessment or with an extended version of the Quick Scan test in order to show the influence of the behaviour to the consumption could be a way to improve this method.

The interest of this method could have been the increase of consciousnesses brought about by the filling of the diary. Unfortunately, this has not happened as filling out such a diary in its actual version (Cames and Brohmann, 2003), for one week (as was done in Belgium) or two (as in Germany) is only acceptable by persons who are already quite interested in and knowledgeable about their energy-related practices.

## *12.3 The Electrical audit*

The electrical audit is somehow an outsider in this list. This test was not foreseen in the original project proposal. However, the measurements and the reactions of the participants revealed a strong interest in an explanation of the electrical results. The electrical audit was therefore just a step away from the measurements.

The interest in the results is surely encouraging. The electrical audit proves to be an instrument which is both technically feasible and which will have a good acceptance in general.
The audit results have now been based on the measurements of the appliances. For a complete auditing procedure, some minor steps can result in completion. The large number of measurements performed in the framework of this project are the first existing ones in Belgium, no similar measurement programs have been set up yet. Other international measurement results are equally available. These can allow setting up general rules to indicate the electricity consumption of different appliances based on some very specific variables. From that point on, an audit can be performed without the long-term measurement program.

The inhabitants readily accept most results. Moreover, energy-saving measures are more easily implemented. These measures are often behaviour-related or can be implemented with very small interventions. Also, larger interventions are often put into practice, because they allow replacement of old appliances.
The possible market for this tool is larger thanfor the EAP-audit. When the EAP-audit is applied in a voluntary framework, the electrical audit is a necessary addition to it. When inhabitants want their energy consumption to be evaluated, they do not make the difference between electrical energy and

heating energy. Secondly, the application of the instrument does not take as much time as the EAP-audit. From the moment when an expert is present in the household, it represents a small additional task for a large additional result. The actual saving potentials from the electrical audit are not so large, but the measures are more easily put into practice.

There are also several households that are not considering an EAP-audit, but who will be very interested in the results of an electrical audit. This group contains, for instance, all renters. Other households do not anticipate larger renovations. Great possibilities to save energy remain in the electrical part of their consumption. The electrical audit is a very strong instrument to address this potential.

## *12.4 The EAP-audit*

### *12.4.1 Consequences for experts*

The first test of the Energy Advice Procedure in Belgium results in several consequences for future experts using this or similar tools. The EAP-software is compiled in quite a structured way and results are generated automatically. This creates the impression that these results reflect the individual situation, because they are based on the data collected during the audits. However, this does not suffice for a complete audit.
The results of the audit are personalised because they are based on measured data. These results need a personalised presentation too. When presenting the results, the expert will have to take the specific situation of the household into account.

The difference between the theoretical and real consumption is already a strong indicator. A large difference will exist in most situations where an audit is performed prior to a renovation. The expert then has to inquire into the intentions of the owners, because larger renovation will most probably cause larger modifications in behaviour. All calculated energy savings need to be calculated taking this into account. At the moment, this is not possible with the existing EAP-software, so these modifications need to be done manually.

The presentation of the different measures in the EAP-report needs to be personalised too. For the moment, several households explain that the final report is very hard to handle. Priorities cannot easily be identified and are lost in the large amount of information.
The different measures are described and their importance is indicated with the Pay Back Time (PBT). The results during the tests however showed that the PBT is technically very variable and it can only be an indication of the economical value of a measure. However, interviews and questionnaires show that the households understand the PBT rather as a fixed number, a result from the computer program. Moreover, this value is mostly used as an argument against application of the measure and almost never as a motivator.
We therefore strongly advise to avoid further use of the PBT; not only is it misunderstood, it creates another barrier for implementation of measures.

A second consequence for experts is strongly related to this appraisal of the PBT. In technical reports for industry and decision makers, energy-saving measures are seen as an investment. The PBT or the Net Present Value are in this case very clear indicators of the economic value of this investment. This has led to the common use of these indicators in all communication or information about all kinds of energy-saving measures.
The results from this research however show that this approach has little or no value for the residential sector. As a matter of fact, households rarely regard energy-saving measures as investments. These interventions are implemented as upgrades of their home and they much more follow the dynamics of consumption. Rarely do people expect their consumption to be profitable.

This means that experts should have an understanding of the dynamics of consumption when presenting the different energy-saving measures. One detailed recommendation is therefore to drop the PBT as an indicator and to show the lifetime of the interventions and the yearly saved energy and money, as is currently done in the Danish procedure.

This consequence is, for the expert, not as easy as it seems. When presenting a measure, the expert should now inform the owner about savings, costs, practical details, visible consequences, comfort, environmental consequences, etc... An entire list of different characteristics of the measure has to be addressed. As much as possible, the decision of the owner of course should not be steered in a certain direction.
In technical descriptions or evaluations, only a limited amount of indicators are taken into account to decide about the value of a measure. If the expert is used to this approach, the presentation of the energy-saving measures to the owner will seem quite odd for the expert. 'Normal' valuable indicators, like the economical indicators and theoretical explanations, are almost not mentioned whereas other indicators like visibility, comfort or colours gain importance.
The last variables are mostly stressed by non-technical vendors who try to convince owners about a specific technique by using all kinds of secondary characteristics, leaving out the 'pure' technical parts.

The expert will have to avoid both extremes. He cannot be too technical, but cannot be too commercial either for he then runs the risk of losing his objectivity. Presenting results therefore requires some social capacities, which are as important as the technical capacities.

Owners do not invite experts into their house daily. Often, they will fire all sorts of building-related questions to the experts. These can concern humidity problems, draught problems, lighting, acoustics, prices etc... Thus, an experts needs to have a much larger technical baggage than solely energy-related topics. In this light, the importance of an elaborated and thorough education for the experts cannot be stressed enough.

### *12.4.2 Consequences for supporting agencies and authorities*

The system of officially accredited experts requires a strong framework within which these experts can operate. This system is not implemented by providing the right technical software. Other decisions need to be taken on guidance, quality control, limits of responsibility, social aspects and personalisation.

Owners do expect a lot from the energy experts. When owners implement the recommended measures, they expect the results exactly as described in the results of the EAP-audit. For instance, when walls are insulated, they expect a decrease of their consumption as described in the report. Other effects on inner climate and health are obviously important, as several measures can induce health risks. So, if the result in reality is worse then calculated or explained, what is the liability of the energy expert? These are questions which still need to be clarified.

Working in the residential sector is completely different from the tertiary or the industrial sectors. This should be clear for the energy expert; he or she has to consider behaviour effects, place effects, rebound effects, etc. He or she has to adapt different ways of explaining for each specific household.
This difference should also be clear for the supporting administrations and authorities. Social capacities and skills are as important as technical skills. When the central aim of the authorities is to reduce energy demand, the experts will have to be able to convince and motivate people. This should be addressed during trainings and tests for energy experts.
The actual tools provided by the authorities, should also be adapted to increase the effect of the audit results. For instance, the software can be adapted to include other indicators, to personalise the report and to condense the report to the most important parts, depending on the wishes of the household.

Audits are quite common in the industrial and tertiary sector. They are quite rare in the residential sector. Most households will not often invite energy experts for an audit. For many households, the expert is the only person which can give objective information about their house. Owners will often ask questions concerning related fields like health, inner climate, stability, etc. The system of residential audits will be strongly enhanced if the auditors can fall back on a guidance or helpdesk for these related fields too.

# 13. POLICY RECOMMENDATIONS

This chapter is based on the perceptions about energy policies that are shared in the Belgian public and that are summarised in the previous chapter. Additional recommendations are derived from the analyses presented earlier in this report.

## *13.1 At the federal level*

### *13.1.1 Centralisation and legitimacy*

Energy is a partly federal and a partly regionalised competence. Measures thus may vary whether they come from the authorities from Brussels, Wallonia, or Flanders. The discrepancy between regional energy policies as well as the fragmented sources of information, both noted by many interviewees, call for initiatives between regions and/or at the federal level to ensure a higher federal consistency between regions and between time periods, a stronger political support for energy policies towards policy-makers at all administrative levels and an increased legitimacy of these policies towards the citizens-consumers.
Increasing the political support for policies aiming at reducing residential energy consumption appears to be highly necessary even in the present context of rising energy prices: financial arguments are neither sufficient nor unique.

### *13.1.2 Coordination and communication on Belgium's achievements on the Kyoto-protocol objectives*

Furthermore, Belgian and regional authorities should show more often that efforts for energy savings in Belgium are framed within the United Nations climate change convention and the Kyoto Protocol; they should as well communicate yearly to the public Belgium's achievements concerning the Kyoto-protocol objectives. This communication should ensure a stronger legitimacy and political support for energy policies and show the citizens that they are part of a larger movement and not the only ones – as some interviewees felt it – making efforts to reduce energy consumption and to protect the environment.
The achievements obtained for decreasing residential energy consumption should be compared with the results obtained by the industry, the services, and the transportation sector as these figures appear to be largely unknown to the public.

### *13.1.3 Rationales for policies aimed at energy savings*

For an approved and respected energy policy, citizens have to feel concerned by the problems that the policy tends to solve and they have to think that the policy goes into the direction of their well-being. The values linked to these policies have to be socially shared but it is important to remember that these values are quite varied (chapter 3). Some people do not feel concerned about climatic changes or pollution because it sounds very far away from their daily life. It is worthwhile to note that a dramatisation of the problems can lead to the contrary effect: people wanting to hide from it and denying the situation, by 'fear'. To protect their health and well-being as well as their children's can be an argument for them to be more conscious about the problem. Other people dislike wasting: to compare energy consumption between households can be a good way to make them more conscious about their own situation (chapter 5). Energy savings can further be associated with improved comfort, citizen action, children's future... and should not always be reduced to money savings, as this can be counter-productive (chapter 8).

### *13.1.4 Visible development of an energy service*

After having compared electricity consumption in Denmark and in Belgium, where it is much higher (chapter 4), it is clear that Belgian authorities should promote and support the development of organisations, companies and services that have activities related to energy saving. These activities can include the collection of data on appliances sales, the promotion of energy labels, the obligation for electricity suppliers to save energy and the control of these on this matter, the information of the population and companies, the participation to European campaigns, and so forth.
An example of such a centralised instance is the Danish Electricity Saving Trust whose activities and funding are described in chapter 4 of this report. The Belgian authorities and administrations involved in the matter currently deliver a lot of this work. Improving the visibility and enlarging the scope of these centres would certainly show more clearly the strategy for collective action. It could help to support the intention of Belgians to act in a more energy-efficient manner and to inform the public about fiscal deductions that are largely unheard of, as shown in chapter 9 (about half of the citizens do not know about Belgian deduction and rebates).
To rely on consortia of governments, non-governmental organisations, universities, com-panies and other institutions connected in energy-efficiency networks would also boost the sector and its potential (throughout media, exhibition, documentation, demons-tration, training, networking, etc. ) in order to develop this market while it is still time.

## *13.2 On a federal and regional level*

Synergies between federal and regional levels should improve the importance, the relevance and the political support for energy savings. Several examples of coordinated policies are described below.

### *13.2.1 Exemplar collective action at all political levels*

Personal efforts made by individuals in the field of residential energy consumption can seem vain if they are not followed in other sectors like transportation or if they are not adopted as well by larger entities, like industries, administrations or services. Several interviewees have spontaneously spoken about examples of wasting at their workplace that could, in their eyes, easily be avoided (like overheated buildings, lights, computers and screens always switched on).
It is also important that public authorities do not only give advices or regulations about that topic, but also act upon it: municipal buildings, schools and other public buildings seem to be good places to show the good example and to take advantage of the proximity to citizens to show energy savings in practice.

### *13.2.2 Let's talk about energy and experience low-energy buildings!*

Energy consumption concerns everyone's everyday life! Despite this, it is not a very widespread conversational topic. "Only" people interested in topics like ecology or new technologies are keen to speak about that. If energy consumption was presented throughout the media and information spots as a serious topic, but in a light and fresh way, heating practices, insulation tips or energy-windows could become fashionable topics for daily discussion, at home, at the office or at a bus stop.

By talking about it, energy consumption becomes more present and in a way more 'real', and this could enhance social support for motivating people, companies and services to act more on energy savings.
This could be for instance another argument for campaigns targeting behaviour-related ways to reduce energy consumption at the workplace. Potentially, technical measures could provide a larger saving potential, but these campaigns can bring the topic into the daily conversation.

Furthermore, opportunities should be given to more consumers to individually experience the comfort of low-energy buildings. As said by one of our interviewee, "during the winter, it was a cold place, so, yes, the usefulness of the insulation, you feel it!".

### *13.2.3 Positive feedbacks*

Positive feedbacks seem to be important measures for environmental policies. To congratulate individuals, groups or communities who have made energy savings, to valorise their actions and to show that their efforts are done for the well-being of the community can motivate others to continue or to start doing it. It is important that people have the positive feeling that their efforts are not in vain and that they make a difference, even on a small scale.
Subsidies and rebates are also positive feedbacks!

### *13.2.4 Support the social diffusion of technological progress*

Technological appliances and techniques that allow more efficient conservation and sustainable supply do exist. The Belgian population seems ready for that; indeed 69% of the population claim to be ready to pay more for an electrical appliance that consumes less, while almost 20% says that they already do (chapter 9). Motivation is certainly not only economical but it can also be related to the environment, to the interest for new technologies... We can thus conclude that saving energy will generally be desirable, as one interviewee said: "at the moment, economy and ecology are going well together".
For this reason, all these new efficient technologies need to be boosted with public policies and private investments (which may be influenced by public policies) in order to ensure their diffusion and to gain time on global warming.

#### *13.2.4.1 Insulation and heating*

Policy measures to encourage insulation and efficient heating system should be undertaken with the highest priority. 58% of Belgian citizens say that they would agree to improve the insulation (28% do it already), 59% say that they would agree to install a more efficient heating system, the current ones being indeed quite old in Belgium (as shown in chapters 2, 3, 8 and 9). There is an opportunity here to provide third party financing, standards, procurement practices, better information and incentives to significantly increase energy efficiency in buildings and appliances.

The "young elderly" householders (aged 50 – 69 years) appear to be an especially interesting group to target in terms of potential energy savings as they have developed consumerist habits (high indoor temperature, for example) with (very) old heating systems (Chapter 3).

#### *13.2.4.2 Substitution of primary energy sources*

The use of renewable energies would be supported (completely or rather well) by 80% of the population! With regards to the need in terms of new heating systems (chapters 2, 3, 8 and 9), it might be an opportunity to invest in those favouring renewable energy. Authorities should allow all consumers to purchase power from renewable sources and ensure that it is really working.

#### *13.2.4.3 Promote existing low energy appliances*

Some of these new technologies are already available and should be promoted here and now. For instance, Belgian authorities should develop campaigns that motivate and help people to install (more) efficient light bulbs: such measures would be (completely or rather well) appreciated by 68% of the population (21% are already involved in this action) (Chapter 9). Other efficient appliances such as refrigerators, freezers, TVs, washing machines, dishwashers, microwaves, etc., are available and should be promoted as well.

### *13.2.5 Economic instruments*

Fiscal deductions and regional subsidies are quite appreciated by the consumers but they are not well known in the public: this is especially true for the fiscal deductions (chapter 9). Furthermore, these instruments are not targeting do-it-yourself householders. There is a clear need for policy measures in this area for developing know-how transfer, advices diffusion (such as the "Energy offices" in the Walloon Region) and financial rebates on do-it-yourself materials aimed at energy savings.

### *13.2.6 Information*

There is undoubtedly a need for information, which has to be:

- Clear: technical factors are interesting, but people first want practical and 'ready-to-do' information!
- Easy to get, even for people who are not especially interested in energy savings.
- Centralised: there is a need for a central information point, which concentrates information or dispatches it to other information services.
- Consistent: if different sources of information have divergent opinions or give different advices, the information legitimacy will obviously decrease.
- Adapted for different publics: this study points to the variety of behaviours and the complexity of levers to changes in the field of energy consumption (chapter 10). According to this result, a standardised communication to a hypothesised uniform public does not seem adequate (Bartiaux and Selnæs, 2005).
- Personalised: general advices are easily overlooked, tailor-made advices are more readily accepted.
- On different media: not all households do have Internet!

At the same time, this research also shows that precise, professional and customised information does not necessarily bring about many changes in energy consumption (chapter 7 and 8). Furthermore, the openness to environmental information appears to be related to the presence of an agency feeling, which partly depends on the social position of the individual (chapters 3 and 12).

## *13.3 On a regional level*

### *13.3.1 Improving the energy-assessment software*

The three Regions should agree on a revised version of the energy-advice software that was tested in this research (chapter 8). This software should not include anymore payback periods for their value is currently quite overestimated (chapter 8). We recommend instead giving for each recommendation the corresponding total cost and annual saving in the units of consumption and money together with the lifetime of the product, as they currently do in Denmark. The underlying hypothesis for calculating the monetary annual savings should be clearly mentioned.

In addition to the recommended measures, the software should also provide the situation of the reviewed dwelling on an environmental scale showing the total amount of $CO_2$ released per year to heat the dwelling and to produce hot sanitary water, as it is already done in Denmark (chapter 8). Here again, underlying hypotheses on heating spaces, periods and temperature should be made clear to the dweller. Furthermore, each recommendation should be presented with the corresponding tons of $CO_2$ saved yearly if the recommendations are implemented.

Further options to propose the advice according to the priorities of the household should be considered. For instance, customised priorities in the advised renovation work could be mentioned. And if the labelling system is seen by the regional authorities as an important incentive to save energy, different paths to upgrade labels should be presented to the dweller (chapter 8).

## 13.4 On a community and/or a regional level: education and training

### *13.4.1 Professionals and intermediaries*

During this research, we have met or heard of an architect who has completely remodelled his house while keeping the old single-glass windows; of an adviser on environmental matters who keeps developing the old electrical heating system of his house; of a consultant who has worked in bio-climatic construction who will insulate his 4-façades dwelling (a traditional farm) after all the other renovation works that he plans to do; and of several engineers owning a poorly insulated house… These situations call for two interpretations. On one hand, even for knowledgeable professionals, environmental awareness and technical knowledge are not sufficient levers to bring about actions for saving energy and there are brakes that are powerful enough to counterbalance this technical knowledge. On the other hand, energy-related matters such as envelope insulation, energy windows or standby consumption are not known enough, even among professionals.

Therefore, efforts should be made to include or enhance energy-related topics in the education scheme of professionals and intermediaries, as well as in their continuous training.

### *13.4.2 Other training programs*

Several interviewees who are teachers have stressed the role of the schools for the education on environmental matters and for their translation into practice at school while pointing at the same time to the difficulty of doing so if children or teenagers are not encouraged to behave in a consistent manner at home.

## 13.5 On a communal level

To implement and develop energy-savings policies, municipalities can play an important role as intermediaries between higher political levels and households. Each municipality has a social centre through which aid in the field of energy consumption is given. These activities are most often focused on the least affluent inhabitants of the municipality and this situation may well contribute to the parallel made between energy savings and socio-economic marginalisation, as suggested by several affluent interviewees (chapter 8).

Municipalities are therefore good potential actors to give a better and renewed image of energy savings. Actions on the scale of the communes can be positive, both for the citizens – these small-scale actions can also reinforce their agency feeling – and for the authorities of the commune – it is a sign that they are acting on that topic and supporting federal and regional energy policies.

Synergies on energy matters between all political levels would enhance the relevance and the legitimacy of these energy policies, as well as their acceptability.

# 14. CONCLUSIONS

To meet its Kyoto objective, Belgium has committed itself, for the period of 2008-2012, to reduce its emissions of six greenhouse gasses by 7.5% compared to its emissions of 1990. In 2003, residential energy consumption represented 25.6% of the total Belgian energy consumption. But between 1990 and 2002, the residential sector improved its energy efficiency by less than 5%, a lower percentage than in other Belgian sectors or than in the residential sector of other European countries.

This multidisciplinary research focuses on residential energy consumption, excluding transportation, and attempts to identify the "Socio-technical factors influencing Residential Energy Consumption" (SEREC) in Belgium. This research has shown that Belgian households can save, on average, 32% of their energy use for heating and hot sanitary water production (chapter 8). On the other hand, the representative survey that we performed on thousand households gives, among many others results, the following insights: only 21% of the respondents estimate that they have done the uttermost to make energy savings in their households while more than six respondents out of ten would agree to decrease the temperature of the dwelling by one degree, to improve the insulation of their dwelling or to install a more efficient heating system (chapter 9). Therefore, the question is: how can we combine this high technical energy-saving potential, this (probably) realistic self-evaluation and these largely-shared intentions to save energy? The main topic throughout the report is thus the following: which are the factors that lead to action, to change of behaviours or to reluctance to changes in residential energy consumption? Both technical and behavioural brakes and levers for implementing energy savings at the household level are to be clarified.

**An environmental concern as a first step?**

At the beginning of the research, a first hypothesis was that an important brake for this implementation was an insufficient awareness of environmental problems and especially of environmental consequences, such as climate change, that are related to energy consumption. A previous study had indeed found that in 1998, the mean score of knowledge on global warming and its causes was low, with an average of 4.9/10 (Bartiaux, 2004). To raise the awareness of energy consumers appeared to be an important challenge.

This hypothesis has proved to be wrong or, at least, quite insufficient. Indeed, the Belgian public is now much more knowledgeable on global warming – our survey has enabled us to calculate the corresponding score of knowledge, which is now equal to 7/10 (chapter 3) whereas the savings in residential energy consumption have not increased accordingly. Secondly, we have demonstrated that a good environmental knowledge is not often associated with a strong environmental concern: most of the time, people's knowledge is not consistent with environmentally friendly practices (chapter 3). Last but not least, the four methods that we have set up during this research in order to provide household members with accurate and customised information on their energy consumption have led, until now, to minor energy savings. Before showing how and why, we first summarise the potentials for energy savings that were calculated in this research.

**Possible savings**

Following a socio-technical approach (Bijker *et al.*, 1987, Guy and Shove 2000, Diamond and Moezzi, 2000) that shows the technical limitations and possibilities for reducing residential energy consumption, we have shown that dwellings in Belgium are rather old, especially in Wallonia, that their heating system is usually also quite old – at least 15% of all dwellings have a boiler that is aged 20 years and over – and that only two dwellings out of three have double-glass windows everywhere (chapter 2). Another study has indicated that dwellings in Belgium are the least insulated in comparison with other European countries (EURIMA, 2005). This situation is echoed by the fact that among the 40 households who volunteered to have a complete assessment of their dwelling, at least half of them received recommendations on windows and doors and/or on the insulation of the distribution pipes, of the outer walls and/or of the roof as well as advices to replace the boiler and/or

to install a solar one. Each of these recommendations would lead to a yearly saving of primary energy of 1000 to 6000 kWh (chapter 8).

When it comes to electricity consumption, a possible average saving of 18.7% was calculated, with a maximum of 46%, on the basis of our electrical audit of the same 40 households during one year. The electricity consumption of these households is estimated to represent 27% of their total primary energy use, after all electricity needs for the heating of the house or for domestic hot water have been subtracted (chapter 7). This average ratio is likely to increase in the future, as more attention should be paid to better insulation and to driving heating energy needs down as well as an increased number of electrical appliances is pushing electricity needs up. A major potential for reduction can be found in lighting as well as with cooling and heating appliances (the replacement and the removal of old fridges and freezers can be recommended).

**Tools to provide advices and support**

In line with the awareness hypothesis, half of the respondents to our large-scale survey call for more information and sensitisation campaigns towards the households (chapter 3). Our "energy testers" who participated to one of the four methods were provided with up-to-date and customised information that was related to their energy consumption (chapters 5 to 8). It has to be stressed that due to the recruitment methods we used, all participants were interested in the topic of energy savings. Two tests undertaken during this research with (more) randomly selected samples brought about much less interest.

Participants to the Quick Scan were interested in comparing their own electrical consumption with others having the same 'profile', but the advices given on other websites were not always practical enough to make them change their actual consumption.

The interviewed participants of the energy diary were already paying attention to their consumption and did not really want to change their practices, as they thought that they were already doing all they could. The list of advices did not really help them because they already knew of these tips.

The electrical audit has broken some wrong ideas, according to the participants, and it has made them more conscious about their effective consumption. But once again, most of the interviewees have expressed the difficulty to change the equipment or their habits in order to reduce the now visible consumption. They mostly agreed to pay attention to the labels of electrical appliances and white goods for their next purchases. Residential electric consumption appears to be more easily reduced by householders' investments in efficient appliances rather thanby changing daily routines.

The participants to the energy assessment were very pleased with the customised advices coming from 'neutral' experts, but generally, no change or solely minor changes have been accomplished.

To sum up, the more the advices are customised, the more the participants appreciate them: more general advices are not really used by the participants who seek information relative to their own energy consumption. This does not imply however that the participants use this customised information by implementing the recommendations that they have received.

**Between awareness and action**

Indeed, this research clearly establishes that precise, professional and customised information does not often bring about many changes in energy consumption (chapters 7 and 8). The results show that only some 11% of all proposed measures have actually been implementedone year after the assessment. In general, these measures were the smaller interventions: insulation of distribution pipes or installation of saving showerheads. However, the households were still planning some additional 23% of the proposed measures. These measures could result in much larger energy savings, but they equally required larger interventions in the house (chapter 8).

To identify the factors leading to changing behaviours or to reluctance to changes in residential energy consumption, we have followed the participating households that were provided with customised information through in-depth interviews and specific questionnaires. The role of several factors has been underlined: energy policies (and their absence, as in Belgium as compared to Denmark, see chapter 4 of this report), market pressure, social pressure to consume, value of comfort, daily routines, social networks influence, income, agency feeling, environmental values, identity factors and technical aspects. The impacts on energy consumption of all these potential levers and brakes are discussed in chapter 10.

It is important to underline three points. Firstly, there is always a combination of several lever factors: none will thus be sufficient by itself. However, one brake factor will be sufficient. Secondly, the weight that is given to the different lever factors also depends on the action to be undertaken or on the practice to be changed. This process of priorities-setting is often non conscious, except of course in situations where explicit advices are given, for example by an energy expert. Thirdly, the same factor can be experienced as a brake or as a lever; there is thus no straightforward solution. These findings shed light on the minor changes undertaken by the participating households by revealing how their initial wish of energy savings is paradoxical because they are social agents who operate within a cultural and a socio-technical framework and whose practices and choices are shaped by existing networks, consumerist norms and infrastructures. Strategies for changing behaviour must take into account these social, institutional, and cultural factors (Shove, 2003). Therefore, this paradoxical demand also calls for energy policies in this respect.

The openness to environmental information appears to be related to the presence of an agency feeling (as opposed to a sense of helplessness) that is related to the actions made by the individuals to protect the environment or to save energy. Information is therefore not to be seen as a precondition for action but, on the contrary, as embedded in a virtuous circle made of action, information and more action. In addition, the agency feeling partly depends on the social position of the individual and on his/her social networks (chapters 3 and 12).

Other factors than awareness do interplay and we have shown in chapter 3 that energy-related practices and representations have complex and multi-dimensional meanings. They are namely defined by the presence or not of reflexive practices that appear to be related to a sense of agency and a confidence in voluntary measures in the field of eco-policies. Furthermore, energy-related practices and representations are also socially constructed by a consumerist society, the access of which is stratified by household income. As emphasised by Anker-Nilssen (2003), the discrepancy between attitudes (awareness of environmental problems and of energy-related issues) and real energy spending behaviours is common. This discrepancy is linked to the paradoxical demand for energy savings mentioned above.

To answer the question of why people do not save energy, we need to view people as active, knowledgeable social agents and we should pay attention to the culturally specific meanings of energy-related practices that are related to comfort, convenience and cleanliness (*Shove* 2003).

**Saving energy is broader than saving money**

It appears that it would be an error to promote energy savings by associating them only with economic savings as only one person out of seven primarily makes this relationship (chapter 3) and as most renovation works of existing dwellings are not necessarily seen as economically profitable (chapter 8). This is not strictly necessary either for a large part of the households.
We have thus recommended for the energy assessment to suppress all payback periods and to give for each recommendation the corresponding total cost and annual saving in the units of consumption and money together with the lifetime of the product, as is done in Denmark. The underlying hypothesis for calculating the monetary annual savings should be mentioned. Another recommendation is to qualify the importance of the economic factor in the decision process by also presenting each recommendation with the corresponding tons of $CO_2$ yearly saved if the

recommendation is implemented. Indeed, our in-depth interviews have shown that some dwellers are interested in energy savings more for environmental than for economic reasons. Therefore, we would also recommend adding on the report of the reviewed house an indicator showing the dwelling position in a scale of tons of $CO_2$ emitted yearly by the dwelling. Here again, underlying hypotheses on heating spaces, periods and temperature should be made clear to the dweller (chapter 8).

This recommendation is also motivated on an ethical basis: indeed, it may appear unfair that two different houses may have the same labels and the same saving potentials in relative terms (30% for example) whereas their yearly energy consumption differ with a factor 3 or 4 (chapter 8). The same concern led to avoid keeping the household income as a relevant variable in the comparison of the electricity consumption performed by the Quick Scan (chapter 5).

Energy assessments are quite common in the industrial and tertiary sectors whereas they are rare in the residential sector. This project shows that elaborate education of energy experts is necessary for the residential sector. This education should include related fields to energy saving. The supporting agencies and administrations should also try to improve the current procedure. The improvements should allow the technical results to be presented in a clearer and more personalised manner. The system of residential audits will be strongly enhanced if the auditors can fall back on a guidance or helpdesk for these related fields too (chapter 11).

Many other recommendations are drawn from this research. Increasing the political support for policies aiming at reducing residential energy consumption appears to be highly necessary even in the present context of rising energy prices: financial arguments are neither sufficient nor unique.

**There is sufficient support in the public for energy-saving policies**

Belgian dwellers seem quite open to the idea of improving their home in a more energy-efficient manner, as they expressed during the SEREC large-scale survey and the in-depth interviews. Of course, these intentions to improve the insulation, to install a more efficient heating system or to use renewable energies are just intentions which will not necessary be followed by corresponding behaviours and actions. In this respect, a large ignorance of the fiscal measures has been observed among the respondents of the SEREC survey. However, the high intensity of the agreement to improve energy efficiency and probably energy consumption diminution indicates a high potential for the acceptability of policies aiming at lowering residential energy consumption (chapter 9).

Indeed, most interviewees consider that the role of public environmental policies is essential to face the current environmental situation and that it is the duty of the public authorities to protect the environment for the actual collective well-being and for the well-being of the next generations. Our respondents also point to the need for consistency between private and public energy-related practices both in the residential sector and in public buildings: this desired consistency calls for an energy policy that frames and supports individual and collective efforts toward a reduction of energy consumption (chapter 12).

**Regional cooperation on energy issues and discursive consciousness**

The interviewed persons regret the scattered character of information on residential energy consumption and they plead for a centralised source of information that should be practical. Some respondents also point the lack of control of environmental regulation (chapter 12).

Energy is a partly federal and a partly regionalised competence. The discrepancy between regional energy policies as well as the fragmented sources of information, both noted by many interviewees, call for initiatives between regions and/or at the federal level. This cooperation would ensure a higher federal consistency between regions and between time periods, a stronger political support for energy policies towards policy-makers at all administrative levels as well as an increased legitimacy

of these policies towards the citizens-consumers. Synergies on energy matters between all political levels as well as a yearly communication of Belgium's achievements concerning the Kyoto-protocol objectives would enhance the relevance and the legitimacy of these energy policies, as well as their acceptability (chapter 13).

Finally, opportunities should be given to more consumers to individually experience the comfort of lower-energy buildings. Positive feedbacks seem to be important measures for encouraging households to save energy; subsidies and rebates are also positive feedbacks! Furthermore, we have recommended talking about energy consumption throughout the media and information spots as a serious topic but in a light and fresh way: heating practices, insulation tips or energy-windows could become fashionable topics for daily discussion, at home, at the office or at a bus stop! By talking about it, energy consumption becomes in a way more 'real', and this could enhance social support for motivating people, companies and services to act more on energy savings. Discursive consciousness is indeed a major factor of changes toward a more sustainable consumption, according to K. Hobson (2003).

# 15. REFERENCES


Abric J.-C. (1976), *Jeux, conflits et représentations sociales*, Thèse d'Etat, Université de Provence, Aix-en-Provence.

Abric J.-C. (1987), *Coopération, compétition et représentations sociales*, Cousset (Suisse), ed° Delval.

Abric J.-C. (1994), "Les représentations sociales: aspect théoriques", in *Pratiques sociales et Représentations,* Abric J.-C. (dir.), Presses Universitaires de France, pp 11-37.

Ajzen I. (1985), « From intentions to actions: A theory of planned behaviour », in *Action control: From cognition to behaviour*, Kuhl J. & Beckman J. (eds.), Heidelberg: Springer, 11-39.

Ajzen I. & Fishbein M. (1980), *Understanding Attitudes and Predicting Social Behaviour*, Prentice-Hall (NJ): Englewood Cliffs.

Aliaga C. & Winqvist K. (2003), "How women and men spend their time: results from 13 European countries", *Statistics in Focus (Population and social conditions*), Eurostat, 12/2003, 8 p. Available on http://epp.eurostat.cec.eu.int/cache/ITY_OFFPUB/KS-NK-03-012/EN/KS-NK-03-012-EN.PDF read on 17/1/05.

Anker-Nilssen P. (2003), "Household energy use and the environment: a conflicting issue", *Applied Energy*, vol. 76, pp. 189-196.

Aune M. (1997): "Nøktern eller nyttende": Energiforbruk og hverdagsliv i norske husholdninger. Rapport nr. 34, Senter for Teknologi og Samfund, Trondheim.

Barr S., Gilg A.W. & Ford, N. (2005), "The household energy gap: examining the divide between habitual- and purchased-related conservation behaviours", *Energy Policy* vol. 33, pp. 1425-1444.

Bartiaux F. (2002), « Relégation et identité : les déchets domestiques et la sphère privée », in *Les déchets ménagers, entre privé et public. Approches sociologiques*, Pierre, M. (coord.) : Paris, L'Harmattan (Dossiers Sciences Humaines et Sociales), pp.123-146.

Bartiaux F. (2003), "A socio-anthropological approach to energy-related behaviours and innovations at the household level", *Time to turn down energy demand*, ECEEE 2003 Summer Study, vol. 3, pp. 1239-1250.

Bartiaux F. (2004), « Les Belges et l'environnement : quels liens entre connaissances, percep-tions et pratiques ? », in *Onze ans de vie en Belgique : analyses socio-économiques à partir du Panel Démographie Familiale*, R. Doutrelepont, D. Mortelmans and M.-Th. Casman (eds), Gent, Academia Press, Brussels, SPP PS (Serie 'Science et Société), pp. 539-559.

Bartiaux F. (2005), "Fragmented rationales and euphemistic behaviours in every day consumption", paper presented at the Seminar "Double Standards and Simulation: Symbolism, Rhetoric and Irony in Eco-Politics" organised by the International Sociological Association (Research Committee 24: Environment and Society), University of Bath, 1st – 4th September 2005, 10 p.

Bartiaux F. & Gram-Hanssen K. (2005), "Socio-political factors influencing household electricity consumption: A comparison between Denmark and Belgium", Energy savings: what works and who delivers?, ECEEE 2005 Summer Study, vol. 3, pp. 1313-1326.

Bartiaux F. & Selnæs A. G. (2005), "Introduction to Panel 6", Energy savings: what works and who delivers?, ECEEE 2005 Summer Study, vol. 3, pp. 1187-1189.

Beck U. (1999), *World Risk Society*, Cambridge, Polity Press.

Belgium, Socio-economic Survey (2001): www.statbel.fgov.be/census/results4_fr.asp?q=1a

Berger P. & Luckmann Th. (1966), *The Social Construction of Reality*, Garden City (NY): Doubleday.

Biel A. (2004), "From habitual to value-guided environmental behaviour, and back again", School of the Environment, workshop of 'Driving forces and barriers to sustainable development', Leeds, UK, pp. 82-86.

Bijker W.E., Hughes T.P. & Pinch T., eds, (1987), *The Social Construction of Technological Systems. New Directions in the Sociology and History of Technology*, Cambridge, Massachusetts, MIT Press.

Boardman B., Palmer J., Lane K. *et al.* (2003), *4CE: Consumer choice and carbon conscious-ness: Electricity disclosure in Europe*, Final project report, Environmental Change Institute, University of Oxford. ECI research report number 28 ISBN 1-8734370 360.

Boltanski L. & Thévenot L. (1991), *De la justification. Les économies de la grandeur*, Paris: Gallimard.

Bourdieu P. (1979), *La distinction*, Paris: Minuit.

Bourdieu P. (1994), *Raisons pratiques. Sur la théorie de l'action*, Paris: Seuil

Bruel R. & Hoekstra P. (2005), "How to stimulate owner-occupiers to save energy?", Energy savings: what works and who delivers?, ECEEE 2005 Summer Study, vol. 3, pp. 1197-1204.

Burnay N. & Bartiaux F. (2005), « Deux exemples d'articulation de méthodes qualitatives et quantitatives dans une recherche », in *Les approches qualitatives dans les études de population. Théorie et pratique*, M. de Loenzien & S.-D. Yana (dir.), AUF, sous presse.

Cames M. & Brohmann B. (2003), "Options and potentials of energy diaries: energy diaries as a tool for identifying potential energy savings through behavioural changes", Time to turn down energy demand, ECEEE 2003 Summer Study, vol. 3, pp. 1079-1090.

Caradec, V. (2004), « Les 'supports' de l'individu vieillissant. Retour sur la notion de 'déprise' », in Matériaux pour une sociologie de l'individu. Perspectives et débats, V. Caradec & D. Martuccelli (eds), Villeneuve d'Ascq, Presses Universitaires du Septentrion, pp. 25-42.

Caradec V. & Martuccelli D., eds., (2004), *Matériaux pour une sociologie de l'individu. Perspectives et débats*, Villeneuve d'Ascq, Presses Universitaires du Septentrion.

Chartier C. (2000), *Perceptions de l'effet de serre*, Etudes ADEME, Paris.

Chartier C. (2002), *Perceptions de l'effet de serre*, Etudes ADEME, Paris.

Corcuff Ph. (1996), « Théorie de la pratique et sociologies de l'action. Anciens problèmes et nouveaux horizons à partir de Bourdieu », in *Actuel Marx*, n° 20, pp. 29-38.

Corcuff Ph. (2001), « Le collectif au défi du singulier : en partant de l'habitus », *in Le travail sociologique de Pierre Bourdieu : Dettes et critiques*, B. Lahire (dir.), Paris, La Découverte/Poche (Sciences humaines et sociales), pp. 95-120.

Dansk Energi (2003), *Elforsyningen. Ti-års statistic*, Frederiksberg: Dansk Energi.

Darby S. (2005), "Learning about energy – how will low-impact energy use become a way of life?", *Energy savings: what works and who delivers?*, ECEEE 2005 Summer Study, vol. 3, pp. 1335-1342.

Descola Ph. (1999), « Ecologiques », in *La production du social. Autour de Maurice Godelier*. Colloque de Cerisy, P. Descola, J. Hamel & P. Lemonnier (dirs), Paris, Fayard, pp. 117-130.

Devine-Wright H. & Devine-Wright P. (2005), "Representing the demand side: 'deficit' beliefs about domestic electricty users", Energy savings: what works and who delivers?, ECEEE 2005 Summer Study, vol. 3, pp. 1343-1348.

Dhondt J. (2004), "Description of the present situation and estimation of the future trends concerning renovation and construction", [Dutch text]; *De Grote Vlaamse [Ver]bouwenquête*, Oktober 2003, Vlaamse confederatie Bouw.

Diamond R. & Moezzi M. (2000), "Revealing Myths about People, Energy, and Buildings", LBNL-45917, Lawrence Berkeley National Laboratory, Berkeley CA, *Energy Efficiency in Buildings*. 2000 ACEEE Summer Study Asilomar, CA.

Dortier J.-F. (1998), « L'individu dispersé et ses identités multiples », in *L'identité, l'individu, le groupe, la société,* J.-C. Ruano-Borbalan (coord.), Paris, éd° Sciences Humaines, pp. 51-56.

Douglas, M. (1975), "Do Dogs Laugh?", In *Implicit Meanings: Essays in anthropology*, London, Routledge and Kegan Paul ed°.

Douglas M. (1999), *Implicit meanings*, 2nd ed°, London, Routledge,

Douglas M. & Isherwood B. (1996), *The world of goods. Toward an anthropology of consumption*, London, Routledge.

Dubar C. (2000), *La crise des identités : l'interprétation d'une mutation*, Paris, PUF.

EURECO (2002), SAVE Programme, Demand-Side Management, End-use metering campaign in 400 households of the European Community, Assessment of the Potential Electricity Savings.

EURIMA (2005), L'importance fondamentale de l'isolation des bâtiments pour l'environ-nement, Bruxelles, 12 p., available on www.eurima.org, read on 28/10/05.

Eurobarometer (2002), Eurobarometer 58.0, The European Opinion Research Group (EORG), The attitudes of Europeans towards the environment, December 2002, 42 p., read on www.europa.eu.int/comm/environment/barometer/barometer_2003_en.pdf (17/1/05)

European Commission (2002), Council Decision 2002/358/CE of April the 25th 2002, concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder, *Official Journal of the European Communities* of 15.05.2002, L 130/1.

European Commission (2003), Council Directive 2002/91/EC of 16 December 2002 on the energy performance of buildings, *Official Journal of the European Communities*, N° L 1 of 04/01/2003, pp. 65 – 71.

Eurostat (2003), *Time use at different stages of the life: results from 13 European countries*, 77 p, available on www.epp.eurostat.cec.eu.int/cache/ITY_OFFPUB/KS-CC-03-001/EN/KS-CC-03-001-EN.PDF read on 17/1/05.

Eurostat, (1991), *Occupied conventional dwellings by date of construction*.

FOD Economie (2005), Federale Overheidsdienst Economie, KMO, Middenstand en Energie, *Statistieken, Energie en Water*, www.statbel.fgov.be/figures/d64_nl.asp#1 read on 18/08/2005.

Giddens A. (1990), *The consequences of modernity*, Cambridge, Polity Press.

Goffman E. (1973), *La mise en scène de la vie quotidienne*, Paris, éd° de Minuit.

Goffman E. (1974), *Les rites d'interaction*, Paris, éd° de Minuit.

Gram-Hanssen K. (2002), "Technology and Culture as Explanations for Variations in Energy Consumption", *Proceedings of ACEEE 2002 Summer Study*, Washington, D.C.

Gram-Hanssen K. (2003), *Boligers energiforbrug - sociale og tekniske forklaringer på forskelle*, By og Byg resultater 029.

Gram-Hanssen K. (2004), Domestic electricity consumption - Consumers and appliances. In: Lucia Reisch and Inge Røpke: *The ecological economics of consumption*, Camberley: Edward Elgar publishing.

Gram-Hanssen K. (2005), "Teenage consumption of information and communication technology", Energy savings: what works and who delivers?, ECEEE 2005 Summer Study, vol. 3, pp. 1237-1248.

Gram-Hanssen K., Bartiaux F., Jensen O.M. & Cantaert M. (2005), "Energy Expert Advices: A comparative study on the Danish energy labelling scheme and the Belgian Energy Assessment Procedure", paper presented at the 7th Conference of the European Sociological Association, Torun (Poland), 9th -12th September, 15 p.

Gram-Hanssen K., Bartiaux F., Jensen O.M. & Cantaert M. (forthcoming), "Do home owners use energy labels? A comparison between Denmark and Belgium", 14 p.

Gram-Hanssen K., Kofod C. & Nærvig Petersen, K. (2004), "Different Everyday Lives - Different Patterns of Electricity Use", *Proceedings of the 2004 American Council for an Energy Efficient Economy Summerstudy,* Washington, D. C.

Greening L. A., Greene D. L., & Difiglio C. (2000), "Energy efficiency and consumption– the rebound effect – a survey", *Energy Policy,* Vol. 28, p. 389 – 401.

Gronow J. & Warde A. (2001), *Ordinary Consumption*, Routledge Press, London, New York.

Guy S. & Shove E. (2000), *A sociology of Energy, Buildings and the Environment*, *Constructing knowledge, designing practice*, London, Routledge Press.

Haas R., Biermayr P. (2000), "The rebound effect for space heating, Empirical evidence from Austria", *Energy Policy,* Vol. 28, pp. 403-410

Haas W., Hertwich E., Hubacek K., Korytarova K., Ornetzeder M. & Weisz H. (2004), "Investigating household consumption: combining quantitative and qualitative methods", School of the Environment, workshop of 'Driving forces and barriers to sustainable development", Leeds, UK, pp. 302-314.

Hackett B. & Lutzenhiser L. (1991), "Social Structures and Economic Conduct: Interpreting Variations in Household Energy Consumption", *Sociological Forum*, Vol. 6, pp. 449-470.

Hens H., Verbeeck G., Verdonck B. (2001), "Impact of energy efficiency measures on the $CO_2$ emissions in the residential sector, a large scale analysis", *Energy and Building*s Vol. 33, pp. 275-281.

Hertwich E. & Katzmayr M. (2004), "Examples of sustainable consumption: Review, Classifi-cation and Analysis", Industrial Ecology Programme NTNU, rapport 5, Norway.

Higgins, E. T. (1987), "Self-discrepancy: A theory relating self and affect", in *Psychological Review, 94*, 319-340

Hobson, K. (2003), "Thinking Habits into Action: the role of knowledge and process in questioning household consumption practices", *Local Environment*, Vol. 8, No. 1, 95-112.

Holm Pedersen L. & Broegaard E. (1997), *Husholdningernes elforbrug: En analyse af attituder og adfærd på energi- og miljøområdet*, København: AKF Forlaget.

Hunter L.M. & Toney M.B (2005), "Religion and attitudes toward the environment: a comparison of Mormons and the general U.S. population", *The Social Science Journal*, vol. 42, pp. 25-38.

IEA (2001), *Energy Policies of IEA Countries, Belgium 2001 Review*, (read on 8-3-2005) available on www.iea.org/textbase/nppdf/free/2000/belgium2001.pdf.

IEA (2002), *Energy Policies of IEA Countries, Denmark 2002 Review*, (read on 8-3-2005) available on www.iea.org/textbase/nppdf/free/2000/denmark2002.pdf.

IEA, International Energy Agency (2004), *World Energy Outlook 2004*, ISBN 92-64-10817-3.

Jensen O.M. (2005), "Consumer inertia to energy saving", *Energy savings: what works and who delivers?*, ECEEE 2005 Summer Study, vol. 3, pp. 1327-1334.

Jones E.E. & Gerard H.B. (1967), *"Foundations of Social Psychology"* John Wiley, New York.

Kasemir B., Dahinden U., Gerger Å, Schüle R., Tabara D., & Jaeger, C.C. (2000), "Citizens' Perspectives on Climate Change and Energy Use" , *Global Environmental Change*, 10(3), pp. 169-184. http://www.envlib4.harvard.edu/gea/people/cv_bk.pdf

Kaufmann, J.-C. (1992), *La trame conjugale : analyse du couple par son linge*, Paris, éd° Nathan.

Kaufmann, J.-C. (1993), *Sociologie du couple*, Paris, P.U.F. (Que sais-je n° 2787).

Kaufmann, J.-C. (1997), *Le cœur à l'ouvrage : théorie de l'action ménagère*, Paris, éd° Nathan.

Kaufmann, J.-C. (2001), *Ego. Pour une sociologie de l'individu*, Paris, A. Collin.

Kaufmann, J.-C. (2004), *L'invention de soi. Une théorie de l'identité*, Paris, A. Collin.

Keirstead K. (2005), "Photovoltaics in the UK domestic sector; a double-dividend?", *Energy savings: what works and who delivers?*, ECEEE 2005 Summer Study, vol. 3, pp. 1249-1258.

Kestemont M.-P., Bartiaux F., Fraselle N. & Yzerbyt V., dirs. (2001), *Points d'ancrage pour une politique de développement durable : production et consommation*, Bruxelles, Services fédéraux des Affaires scientifiques, techniques et culturelles.

Knapen D. (1997), *Vue sur l'énergie au Danemark*, Brussel, Bond voor Beterleefmilieu.

Kuehn S. (1998), *Livsstilens betydning for energiforbruget*, Sociologisk Institut, København.

Lovins A. (1990), "The Negawatt Revolution", The *Conference Board Magazine,* Vol. 27, N° 9.

Lutzenhiser L. (1993), "Social and Behavioral Aspects of Energy Use", *Annual Review of Energy and Environment,* Vol. 18, pp. 247-89.

Macq C. (2005), *Constitution et transmission des valeurs au sein de la famille sur trois générations. Approche par les pratiques et les valeurs dites écologiques*, Mémoire présenté à l'UCL, faculté de psychologie.

Managhten P. et Urry J. (1998), *Contested Natures*, Sage.

Marbaix P. & van Ypersele J.-P. (dirs), (2004), *Impacts des changements climatiques en Belgique*, Greenpeace, Brussels. Also available on www.greenpeace.be

Martuccelli D. (2002), "Sociologie et posture critique", in *À quoi sert la sociologie?,* B. Lahire (dir), éd° La découverte (textes à l'appui), Paris, pp. 137-154.

Martucelli, D. (2002), *Grammaires de l'individu*, Paris, Folio essais

McCarthy J.J., Canziani O.F., Leary N.A., Dokken D.J., & White K.S. (2001), IPCC, Intergovernmental Panel on Climate Change, *Climate Change 2001: Impacts, Adaptation & Vulnerability,* Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), ISBN 0 521 80768 9, Cambridge University Press.

Mineco (2005), Federale Overheidsdienst Economie, KMO, Middenstand en Energie, Statistieken, Energie en Water, [http://statbel.fgov.be/figures/d64_nl.asp#1] as last reviewed on 18/08/2005.

MIRA (2004), *Milieu- en natuurrapport Vlaanderen, Klimaatverandering*, Achtergrond-document, Brouwers J., Claes K., Briffaerts K., Moorkens I., Van Rompaey H., De Groote W., Boeckx P., van Wesemael B., Vlaamse Milieumaatschappij, available on http://www.milieurapport.be

MIRA (2005), *Milieurapport Vlaanderen, Klimaatverandering*, Achtergronddocument,Brouwers J., Claes K., Briffaerts K., Moorkens I., Van Rompaey H., De Groote W., Boeckx P., van Wesemael B., Vlaamse Milieumaatschappij, available on www.milieurapport.be

Moezzi M. (1998), "The Predicament of Efficiency", *Energy Efficiency in Buildings,* ECEEE 1998 Summer Study.

Moreau L. & Wibrin A.-L. (2005), "Energy-related practices, representations and environ-mental knowledge: A sociological study", *Energy savings: what works and who delivers?*, ECEEE 2005 Summer Study, vol. 3, pp. 1301.

Moscovici S. (1976), *"Social Influence and Social Change,"* London, New York and San Francisco, Academic Press.

Moscovici S. & Mugny G. (1987), *"Psychologie de la conversion. Etude sur l'influence inconsciente"*, Cousset (Suisse), ed° Delval.

Nærvig Petersen K. & Gram-Hanssen K. (2005), *Husholdningers energi- og vandforbrug - Afhængighed af socio-økonomiske baggrundsvariable*, to be published at SBI.

Næsje P.C., Andersen T.K. & Sæle H. (2005), "Customer response on price incentives", *Energy savings: what works and who delivers?*, ECEEE 2005 Summer Study, vol. 3, pp. 1259-1270.

NIR (2005), Federal Public Service for Public Health, Food Chain Safety and Environment, DG Environment - Climate Change Section, *Belgium's Greenhouse Gas Inventory (1990-2003), National Inventory Report*, submitted under the United Nations Framework Convention on Climate Change, April 2005.

Noorman K.J. & Uiterkamp T.S. (1998), "Household Consumption, Quality of Life, and Environmental Impacts: A psychological Perspective and Empirical Study", In: Noorman KJ. & Uiterkamp TS. (eds.) *Green Household: Domestic Consumers, Environment and Sustainability*, pp. 141-181, Earthscan Publications Ltd., London.

O'Neill B.C. & Chen B.S. (2002), "Demographic Determinants of Household Energy Use in the United States", Population *and Development Review*, vol. 28, pp. 53–88.

Odyssee (2000), *Data Base, European Energy Efficiency Indicators*.

Odyssee (2004), *ODYSSEE Database, Energy Efficiency Profile: Belgium*, read on www.odyssee-indicators.org; September 2004.

Odyssee (2004), *ODYSSEE Database, Energy Efficiency Profile: Denmark*, read on www.odyssee-indicators.org; September 2004

Odyssee (2004), *ODYSSEE Database, Energy Efficiency Profile: EU-15*, read on www.odyssee-indicators.org; September 2004.

Odyssee (2004), *ODYSSEE Database, Energy Efficiency Profile: The Netherlands*, read on www.odyssee-indicators.org; September 2004.

Palmer J., Boardman B., Herbert W., Lörx S., Persson A. & Suvilehto H.M. (1998), *DELight*, the Environmental Change Unit, University of Oxford, Oxford.

Petrolfed (2005), Belgium Petroleum Federation, *"Evolutie van de maximumprijzen van Petroleumproducten in 2005"*, as last reviewed on 26/08/2005 http://www.petrolfed.be/htdocs/updates/document/evolutiemaximumprijzen2005.xls

Puraye P. (2005), *Analyse exploratoire des modalités pratiques et masculines de réflexitivité. Approche par les travaux de bricolage*, Mémoire présenté à l'UCL, faculté de psychologie.

Røpke I. (2004), "Analysing long-term changes of everyday life in an environmental perspective", paper for the workshop 'Driving forces and barriers to sustainable development', Leeds, UK.

Salomon T. & Bedel S. (2001), *La maison des négawatts : le guide malin de l'énergie chez soi*, Terre Vivante, 155 p.

Sartor F. (2004), *La surmortalité en Belgique au cours de l'été 2003*, Rapport IPH/EPI N° 2004-009, Institut scientifique de Santé Publique, Section d'Epidémiologie, Brussels, 48 p. Available on http://www.iph.fgov.be

Sheppard, S.K., Beckmann, M., Lloyd, D. (2005), "The effect of temperature on methane dynamics in soil and peat cores: calculations from membrane inlet mass spectrometry", *Applied Soil Ecology* (Under review).

Shipworth D. (2005), "Synergies and conflicts on the landscape of domestic energy consumption: beyond metaphor", *Energy savings: what works and who delivers?*, ECEEE 2005 Summer Study, vol. 3, pp. 1381-1392.

Shove E. (2003), *Comfort, cleanliness and convenience: the social organisation of normality*, Berg, Oxford and New York.

Shove E., Lutzenhiser L., Guy S., Hackett B., and Wilhite H. (1998), "Energy and social systems" in Rayner & Malone, *Human choice & climate change*,Volume 2, Resources and technology, Ohio, Battelle Press.

Spaargaren G. (1997), *The ecological modernisation of production and consumption. Essays in environmental sociology*, Wageningen: Dissertatie Landbouwuniversiteit Wageningen

Spaargaren G. (2003), Sustainable consumption: a theoretical and environmental policy perspective, *Society and Natural Resources,* vol. 16, pp. 687-701.

Statistics Denmark (2005), (read on 20/2005) available on http://www.statistikbanken.dk/

Stead D. (2005), "Shifting attitudes towards energy efficiency in Europe?", *Energy savings: what works and who delivers?*, ECEEE 2005 Summer Study, vol. 3, pp. 1211-1220.

Tap P. (1998), « Marquer sa différence », in *L'identité, l'individu, le groupe, la société*, J.-C. Ruano-Borbalan (coord.), Paris, éd° Sciences Humaines, pp. 65-68.

Throne-Holst H. (2005), "From energy efficiency to efficiency of consumption?", *Energy savings: what works and who delivers?*, ECEEE 2005 Summer Study, vol. 3, pp. 1205-1210.

Ueno T., Inada R., Saeki O. & Tsuji K. (2005), "Effectiveness of displaying energy consumption data in residential houses. Analysis on how the residents respond", *Energy savings: what works and who delivers?*, ECEEE 2005 Summer Study, vol. 3, pp. 1289-1300.

UNDP (2005), *Human Development Report 2005*.

Vaillancourt J.-G. (1996), « Sociologie de l'environnement : de l'écologie humaine à l'écosociologie », in *La recherche sociale en environnement. Nouveaux paradigmes*, R. Tessier & J.-G. Vaillancourt (dirs), Montréal, Les Presses de l'Université de Montréal, pp. 19-47.

Varone F. & Aebischer B. (2001), "Energy efficiency: the challenges of policy design", *Energy Policy,* 29:615-629.

Vekemans G. (2003), "Towards a common European approach for energy labeling and assessment of existing dwellings?", Proceedings of the ECEEE Summer Study 2003, *Time to Turn down energy demand*, Volume 1, pp. 352 - 358.

Vekemans G., Loncour X., Bradfer F., Crabbé C. (2001), *National report of the SAVE project, BELGIUM: Final Report* (contract: XVII/4.1031/Z/99-261), June.

Viklund M. (2004), "Energy policy opinions – from the perspective of public attitude and risk perceptions", *Energy Policy*, vol. 32, pp. 1159-1171

von Weiszäcker E.-U., Lovins A. B. & Lovins L. H. (1997), *Factor Four*, The new report to the Club of Rome, London, Earthscan Publication Ltd.

Wilhite H., Nagakami H., Masuda T., Yamaga Y. & Haneda H. (1996), "A cross-cultural analysis of household energy use behaviour in Japan and Norway", *Energy Policy*, vol. 24, n° 9, pp. 795-803.

World Commission on Environment and Development (WCED) (1987), *Our Common Future*, Oxford University Press, 400 p. (The Brundtland Report).

Young W., Hwang K., McDonald S. & Oates C. (2004), "Understanding individual decision-making for sustainable consumption", paper for the workshop 'Driving forces and barriers to sustainable development', Leeds, UK, pp. 77-82.

# 16. APPENDIX

## *16.1 Appendix 1: Description of the residential sector in Belgium*

**Table 16.1 Type of dwelling by region according to household income (N and %)**

| **FLANDERS** | < 1510 | < 2260 | < 3380 | > 3380 |
|---|---|---|---|---|
| Detached house (4 façades) | 27 | 47 | 56 | 73 |
| | 22.7 | 33.8 | 40.0 | 48.3 |
| Semi-detached house (3 façades) | 22 | 32 | 30 | 33 |
| | 18.5 | 23.0 | 21.4 | 21.9 |
| Semi-detached house (2 façades) | 31 | 31 | 35 | 29 |
| | 26.1 | 22.3 | 25.0 | 19.2 |
| Apartment | 33 | 26 | 19 | 16 |
| | 27.7 | 18.7 | 13.6 | 10.6 |
| Studio | 2 | 3 | 0 | 0 |
| | 1.7 | 2.2 | 0.0 | 0.0 |
| Other | 4 | 0 | 0 | 0 |
| | 3.4 | 0.0 | 0.0 | 0.0 |
| Total | 110 | 139 | 140 | 151 |
| | 100.0 | 100.0 | 100.0 | 100.0 |

| **WALLONIA** | < 1510 | < 2260 | < 3380 | > 3380 |
|---|---|---|---|---|
| Detached house (4 façades) | 16 | 20 | 32 | 40 |
| | 18.4 | 25.6 | 41.6 | 58.8 |
| Semi-detached house (3 façades) | 17 | 21 | 20 | 12 |
| | 19.5 | 26.9 | 26.0 | 17.6 |
| Semi-detached house (2 façades) | 25 | 23 | 19 | 13 |
| | 28.7 | 29.5 | 24.7 | 19.1 |
| Apartment | 28 | 11 | 5 | 3 |
| | 32.2 | 14.1 | 6.5 | 4.4 |
| Studio | 1 | 2 | 0 | 0 |
| | 1.1 | 2.6 | 0.0 | 0.0 |
| Other | 0 | 1 | 1 | 0 |
| | 0.0 | 1.3 | 1.3 | 0.0 |
| Total | 87 | 78 | 77 | 68 |
| | 100.0 | 100.0 | 100.0 | 100.0 |

| **BRUSSELS** | < 1510 | < 2260 | < 3380 | > 3380 |
|---|---|---|---|---|
| Detached house (4 façades) | 0 | 0 | 0 | 1 |
| | 0.0 | 0.0 | 0.0 | 4.5 |
| Semi-detached house (3 façades) | 1 | 1 | 2 | 2 |
| | 2.9 | 4.2 | 8.0 | 9.1 |
| Semi-detached house (2 façades) | 4 | 4 | 7 | 9 |
| | 11.4 | 16.7 | 28.0 | 40.9 |
| Apartment | 26 | 18 | 15 | 10 |
| | 74.3 | 75.0 | 60.0 | 45.5 |
| Studio | 4 | 1 | 1 | 0 |
| | 11.4 | 4.2 | 4.0 | 0.0 |
| Other | 0 | 0 | 0 | 0 |
| | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 35 | 24 | 25 | 22 |
| | 100.0 | 100.0 | 100.0 | 100.0 |

**Table 16.2 Distribution of dwellings according to the area type and according to the region**

| | Flanders | | | Wallonia | | | Brussels | Total (Belgium) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rural | Other urban | Large city | Rural | Other urban | Large city | Large city | Rural | Other urban | Large city |
| Apartment | 2.4 | 4.0 | 3.6 | 1.4 | 3.1 | 0.8 | 7.7 | 3.8 | 7.1 | 12.1 |
| House (2 F) | 2.9 | 7.0 | 3.0 | 3.8 | 3.1 | 1.5 | 2.4 | 6.7 | 10.2 | 6.9 |
| House (3 F) | 5.9 | 5.1 | 1.5 | 4.1 | 2.3 | 0.7 | 0.5 | 9.9 | 7.4 | 2.7 |
| House (4 F) | 14.2 | 5.4 | 1.5 | 9.0 | 1.9 | 0.3 | 0.1 | 23.2 | 7.3 | 1.9 |
| Other | 0.4 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 |
| Total (%) | 25.9 | 21.6 | 9.5 | 18.4 | 10.5 | 3.4 | 10.8 | 44.3 | 32.0 | 23.7 |
| N | 247 | 206 | 91 | 176 | 100 | 32 | 103 | 423 | 306 | 226 |

**Table 16.3 Distribution of dwellings according to the area type and according to the region**

| | Flanders | | | Wallonia | | | Brussels |
|---|---|---|---|---|---|---|---|
| | Rural | Other urban | Large city | Rural | Other urban | Large city | Large city |
| Apartment | 4.2 | 7.0 | 6.3 | 4.2 | 9.7 | 2.6 | 71.8 |
| Semi-detached house (2 façades) | 5.1 | 12.3 | 5.3 | 11.7 | 9.7 | 4.5 | 22.3 |
| Semi-detached house (3 façades) | 10.3 | 9.0 | 2.6 | 12.7 | 7.1 | 2.3 | 4.9 |
| Detached house (4 façades) | 25.0 | 9.6 | 2.6 | 27.9 | 5.8 | 1.0 | 1.0 |
| Other | 0.7 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 |
| Total (%) | 45.4 | 37.9 | 16.7 | 57.1 | 32.5 | 10.4 | 100.0 |

**Table 16.4 Distribution of dwellings according to the household incomes and according to the region**

| | Flanders | | | | Wallonia | | | | Brussels | | | | Total (Belgium) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | < 1510 | < 2260 | < 3380 | > 3380 | < 1510 | < 2260 | < 3380 | > 3380 | < 1510 | < 2260 | < 3380 | > 3380 | < 1510 | < 2260 | < 3380 | > 3380 |
| Large city | 2.2 | 2.4 | 1.3 | 3.7 | 1.8 | 0.6 | 0.6 | 0.3 | 3.7 | 2.5 | 2.5 | 2.2 | 7.6 | 5.5 | 4.4 | 6.2 |
| Other urban | 4.6 | 5.1 | 6.8 | 5.0 | 3.5 | 2.8 | 2.5 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 8.1 | 8.0 | 9.3 | 6.6 |
| Rural | 5.1 | 6.9 | 6.5 | 7.2 | 3.9 | 4.7 | 4.8 | 5.1 | 0.0 | 0.0 | 0.0 | 0.0 | 9.0 | 11.6 | 11.3 | 12.4 |
| Total (%) | 11.9 | 14.5 | 14.6 | 15.9 | 9.1 | 8.2 | 8.0 | 7.0 | 3.7 | 2.5 | 2.5 | 2.2 | 24.7 | 25.1 | 25.0 | 25.1 |
| N | 114 | 138 | 139 | 152 | 87 | 78 | 76 | 67 | 35 | 24 | 24 | 21 | 236 | 240 | 239 | 240 |

**Table 16.5 Tenure according to household income (N and %)**

| **BELGIUM** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| Owned | 155 | 197 | 198 | 216 | 766 |
| | 20.2 | 25.7 | 25.8 | 28.2 | 100.0 |
| Rented | 83 | 44 | 41 | 25 | 193 |
| | 43.0 | 22.8 | 21.2 | 13.0 | 100.0 |
| Other | 0 | 0 | 0 | 0 | 0 |
| Total | 238 | 241 | 239 | 241 | 959 |
| | 24.8 | 25.1 | 24.9 | 25.1 | 100.0 |

| **BELGIUM** | < 1510 | < 2260 | < 3380 | > 3380 |
|---|---|---|---|---|
| Owned | 65.1 | 81.7 | 82.8 | 89.6 |
| Rented | 34.9 | 18.3 | 17.2 | *10.4* |
| Total (%) | 100.0 | 100.0 | 100.0 | 100.0 |
| N | 238 | 241 | 239 | 241 |

| **FLANDERS** | < 1510 | < 2260 | < 3380 | > 3380 |
|---|---|---|---|---|
| Owned | 75.2 | 85.6 | 84.8 | 86.8 |
| Rented | *24.8* | *14.4* | *15.2* | *13.2* |
| Total (%) | 100.0 | 100.0 | 100.0 | 100.0 |
| N | 117 | 139 | 138 | 152 |

| **WALLONIA** | < 1510 | < 2260 | < 3380 | > 3380 |
|---|---|---|---|---|
| Owned | 61.6 | 83.3 | 84.2 | 95.7 |
| Rented | 38.4 | *16.7* | *15.8* | *4.3* |
| Total (%) | 100.0 | 100.0 | 100.0 | 100.0 |
| N | 86 | 78 | 76 | 69 |

| **BRUSSELS** | < 1510 | < 2260 | < 3380 | > 3380 |
|---|---|---|---|---|
| Owned | *41.2* | *54.2* | *69.6* | *85.7* |
| Rented | *58.8* | *45.8* | *30.4* | *14.3* |
| Total (%) | 100.0 | 100.0 | 100.0 | 100.0 |
| N | 34 | 24 | 23 | 21 |

**Table 16.6 Distribution of dwellings per floor area by region and household income (N and %)**

| **FLANDERS** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| < 50m² | 2 | 5 | 0 | 0 | 7 |
| | 1.7 | 3.5 | 0.0 | 0.0 | 1.3 |
| 50 to 99 m² | 28 | 27 | 20 | 22 | 97 |
| | 23.9 | 19.1 | 14.3 | 14.6 | 17.7 |
| 100 to 149 m² | 20 | 32 | 35 | 12 | 99 |
| | 17.1 | 22.7 | 25.0 | 7.9 | 18.0 |
| 150 to 199 m² | 15 | 27 | 20 | 29 | 91 |
| | 12.8 | 19.1 | 14.3 | 19.2 | 16.6 |
| 200 to 249 m² | 6 | 16 | 23 | 38 | 83 |
| | 5.1 | 11.3 | 16.4 | 25.2 | 15.1 |
| > 250m² | 6 | 7 | 15 | 34 | 62 |
| | 5.1 | 5.0 | 10.7 | 22.5 | 11.3 |
| Does not know | 40 | 27 | 27 | 16 | 110 |
| | 34.2 | 19.1 | 19.3 | 10.6 | 20.0 |
| Total (N) | 117 | 141 | 140 | 151 | 549 |
| % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| **WALLONIA** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| < 50m² | 3 | 0 | 0 | 0 | 3 |
| | 3.4 | 0.0 | 0.0 | 0.0 | 1.0 |
| 50 to 99 m² | 21 | 13 | 6 | 1 | 41 |
| | 23.9 | 16.5 | 7.8 | 1.5 | 13.1 |
| 100 to 149 m² | 15 | 25 | 20 | 12 | 72 |
| | 17.0 | 31.6 | 26.0 | 17.6 | 23.1 |
| 150 to 199 m² | 11 | 9 | 14 | 10 | 44 |
| | 12.5 | 11.4 | 18.2 | 14.7 | 14.1 |
| 200 to 249 m² | 4 | 5 | 14 | 14 | 37 |
| | 4.5 | 6.3 | 18.2 | 20.6 | 11.9 |
| > 250m² | 2 | 5 | 9 | 21 | 37 |
| | 2.3 | 6.3 | 11.7 | 30.9 | 11.9 |
| Does not know | 32 | 22 | 14 | 10 | 78 |
| | 36.4 | 27.8 | 18.2 | 14.7 | 25.0 |
| Total (N) | 88 | 79 | 77 | 68 | 312 |
| % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| **BRUSSELS** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| < 50m² | 6 | 0 | 0 | 0 | 6 |
| | 17.6 | 0.0 | 0.0 | 0.0 | 5.8 |
| 50 to 99 m² | 13 | 11 | 9 | 2 | 35 |
| | 38.2 | 45.8 | 37.5 | 9.5 | 34.0 |
| 100 to 149 m² | 6 | 7 | 8 | 7 | 28 |
| | 17.6 | 29.2 | 33.3 | 33.3 | 27.2 |
| 150 to 199 m² | 1 | 1 | 3 | 5 | 10 |
| | 2.9 | 4.2 | 12.5 | 23.8 | 9.7 |
| 200 to 249 m² | 0 | 1 | 1 | 3 | 5 |
| | 0.0 | 4.2 | 4.2 | 14.3 | 4.9 |
| > 250m² | 0 | 1 | 0 | 3 | 4 |
| | 0.0 | 4.2 | 0.0 | 14.3 | 3.9 |
| Does not know | 8 | 3 | 3 | 1 | 15 |
| | 23.5 | 12.5 | 12.5 | 4.8 | 14.6 |
| Total (N) | 34 | 24 | 24 | 21 | 103 |
| % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

**Table 16.7 Distribution of dwellings by period of construction, region and household income (N and %)**

| **FLANDERS** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| Before 1919 | 6 | 10 | 14 | 10 | 40 |
| | 5.1 | 7.2 | 10.0 | 6.6 | 7.3 |
| 1919 to 1945 | 16 | 14 | 19 | 18 | 67 |
| | 13.7 | 10.1 | 13.6 | 11.9 | 12.2 |
| 1946 to 1960 | 20 | 17 | 12 | 12 | 61 |
| | 17.1 | 12.2 | 8.6 | 7.9 | 11.2 |
| 1961 to 1975 | 24 | 37 | 18 | 14 | 93 |
| | 20.5 | 26.6 | 12.9 | 9.3 | 17.0 |
| 1976 to 1990 | 13 | 37 | 26 | 35 | 111 |
| | 11.1 | 26.6 | 18.6 | 23.2 | 20.3 |
| In 1991 or after | 16 | 18 | 36 | 54 | 124 |
| | 13.7 | 12.9 | 25.7 | | |
| Does not know | 22 | 6 | 15 | 8 | 51 |
| | 18.8 | 4.3 | 10.7 | 5.3 | 9.3 |
| Total (N) | 117 | 139 | 140 | 151 | 547 |
| % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| **WALLONIA** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| Before 1919 | 16 | 19 | 13 | 16 | 64 |
| | 18.4 | 24.7 | 16.9 | 23.5 | 20.7 |
| 1919 to 1945 | 11 | 10 | 10 | 10 | 41 |
| | 12.6 | 13.0 | 13.0 | 14.7 | 13.3 |
| 1946 to 1960 | 12 | 9 | 6 | 4 | 31 |
| | 13.8 | 11.7 | 7.8 | 5.9 | 10.0 |
| 1961 to 1975 | 14 | 13 | 10 | 6 | 43 |
| | 16.1 | 16.9 | 13.0 | 8.8 | 13.9 |
| 1976 to 1990 | 13 | 14 | 15 | 17 | 59 |
| | 14.9 | 18.2 | 19.5 | 25.0 | 19.1 |
| In 1991 or after | 2 | 5 | 17 | 14 | 38 |
| | 2.3 | 6.5 | 22.1 | 20.6 | 12.3 |
| Does not know | 19 | 7 | 6 | 1 | 33 |
| | 21.8 | 9.1 | 7.8 | 1.5 | 10.7 |
| Total (N) | 87 | 77 | 77 | 68 | 309 |
| % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| **BRUSSELS** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| Before 1919 | 4 | 1 | 1 | 4 | 10 |
| | 11.8 | 4.2 | 4.2 | 19.0 | 9.7 |
| 1919 to 1945 | 3 | 3 | 4 | 4 | 14 |
| | 8.8 | 12.5 | 16.7 | 19.0 | 13.6 |
| 1946 to 1960 | 5 | 5 | 4 | 7 | 21 |
| | 14.7 | 20.8 | 16.7 | 33.3 | 20.4 |
| 1961 to 1975 | 10 | 8 | 5 | 1 | 24 |
| | 29.4 | 33.3 | 20.8 | 4.8 | 23.3 |
| 1976 to 1990 | 4 | 4 | 3 | 2 | 13 |
| | 11.8 | 16.7 | 12.5 | 9.5 | 12.6 |
| In 1991 or after | 1 | 1 | 3 | 2 | 7 |
| | 2.9 | 4.2 | 12.5 | 9.5 | 6.8 |
| Does not know | 7 | 2 | 4 | 1 | 14 |
| | 20.6 | 8.3 | 16.7 | 4.8 | 13.6 |
| Total (N) | 34 | 24 | 24 | 21 | 103 |
| % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

**Table 16.8 Main energy source used for heating by region and household income(N and %)**

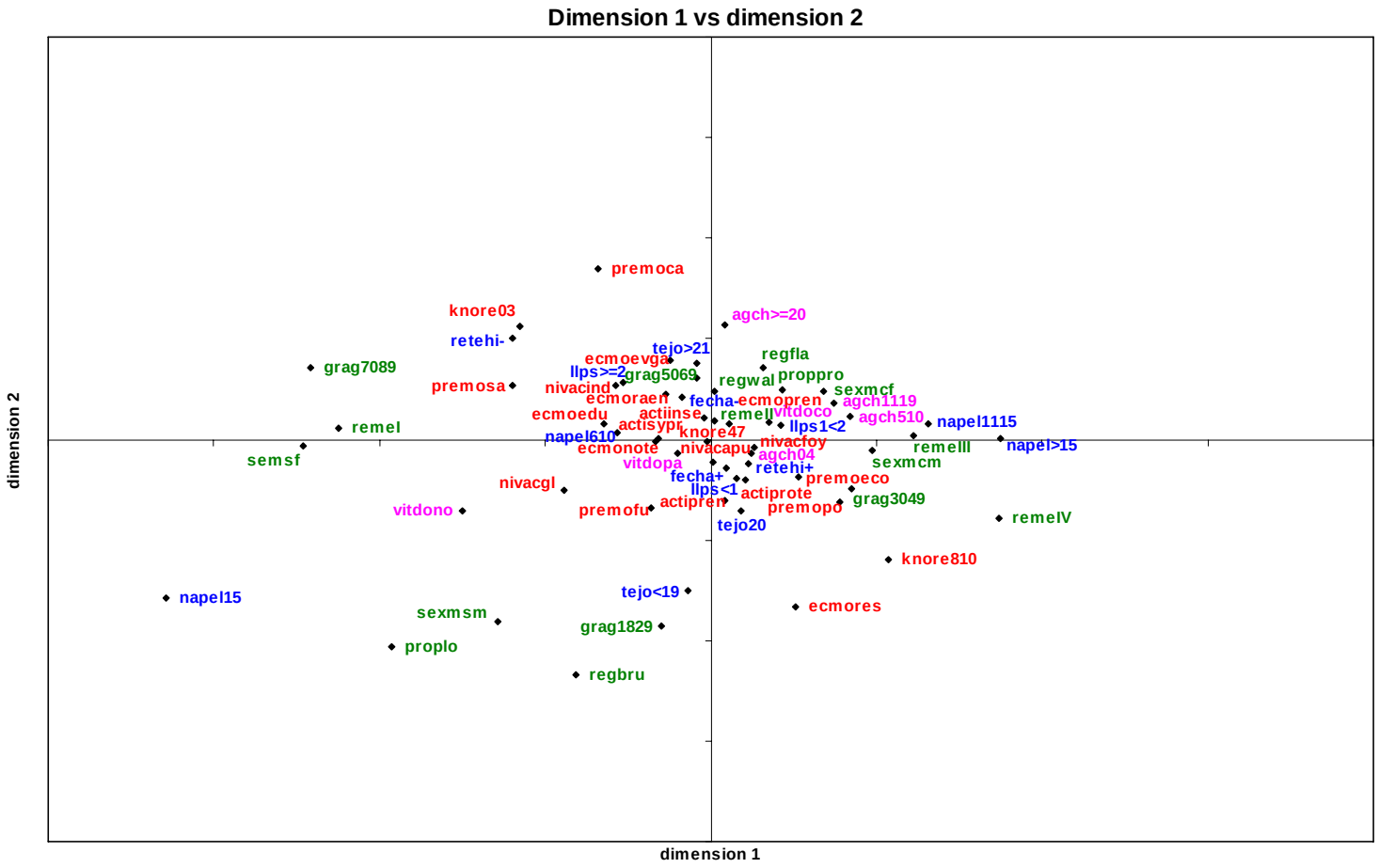
| **FLANDERS** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| Oil | 45 | 49 | 57 | 39 | 190 |
| | 38.5 | 35.3 | 41.0 | 25.8 | 34.8 |
| Electricity | 14 | 8 | 8 | 18 | 48 |
| | 12.0 | 5.8 | 5.8 | 11.9 | 8.8 |
| Gas | 55 | 77 | 71 | 94 | 297 |
| | 47.0 | 55.4 | 51.1 | 62.3 | 54.4 |
| Butane | 1 | 1 | 0 | 0 | 2 |
| | 0.9 | 0.7 | 0.0 | 0.0 | 0.4 |
| Coal | 1 | 3 | 0 | 0 | 4 |
| | 0.9 | 2.2 | 0.0 | 0.0 | 0.7 |
| Wood | 1 | 1 | 3 | 0 | 5 |
| | 0.9 | 0.7 | 2.2 | 0.0 | 0.9 |
| Total (N) | 117 | 139 | 140 | 151 | 547 |
| % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| **WALLONIA** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| Oil | 47 | 35 | 44 | 37 | 163 |
| | 54.7 | 46.1 | 57.1 | 56.9 | 53.6 |
| Electricity | 3 | 7 | 4 | 7 | 21 |
| | 3.5 | 9.2 | 5.2 | 10.8 | 6.9 |
| Gas | 32 | 32 | 27 | 19 | 110 |
| | 37.2 | 42.1 | 35.1 | 29.2 | 36.2 |
| Butane | 0 | 0 | 0 | 0 | 0 |
| | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Coal | 2 | 1 | 1 | 0 | 4 |
| | 2.3 | 1.3 | 1.3 | 0.0 | 1.3 |
| Wood | 2 | 1 | 1 | 2 | 6 |
| | 2.3 | 1.3 | 1.3 | 3.1 | 2.0 |
| Total (N) | 87 | 77 | 77 | 68 | 309 |
| % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| **BRUSSELS** | < 1510 | < 2260 | < 3380 | > 3380 | Total |
|---|---|---|---|---|---|
| Oil | 8 | 5 | 5 | 5 | 23 |
| | 23.5 | 20.0 | 20.8 | 22.7 | 21.9 |
| Electricity | 1 | 2 | 1 | 1 | 5 |
| | 2.9 | 8.0 | 4.2 | 4.5 | 4.8 |
| Gas | 23 | 17 | 18 | 15 | 73 |
| | 67.6 | 68.0 | 75.0 | 68.2 | 69.5 |
| Does not know | 2 | 1 | 0 | 1 | 4 |
| | 5.9 | 4.0 | 0.0 | 4.5 | 3.8 |
| Total (N) | 34 | 25 | 24 | 22 | 105 |
| % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

# *16.2 Appendix 2: Multiple Correspondence Analysis*

Appendix to chapter 3. Multiple Correspondence Analysis (energy-related practices, representations and socio-economic characteristics)

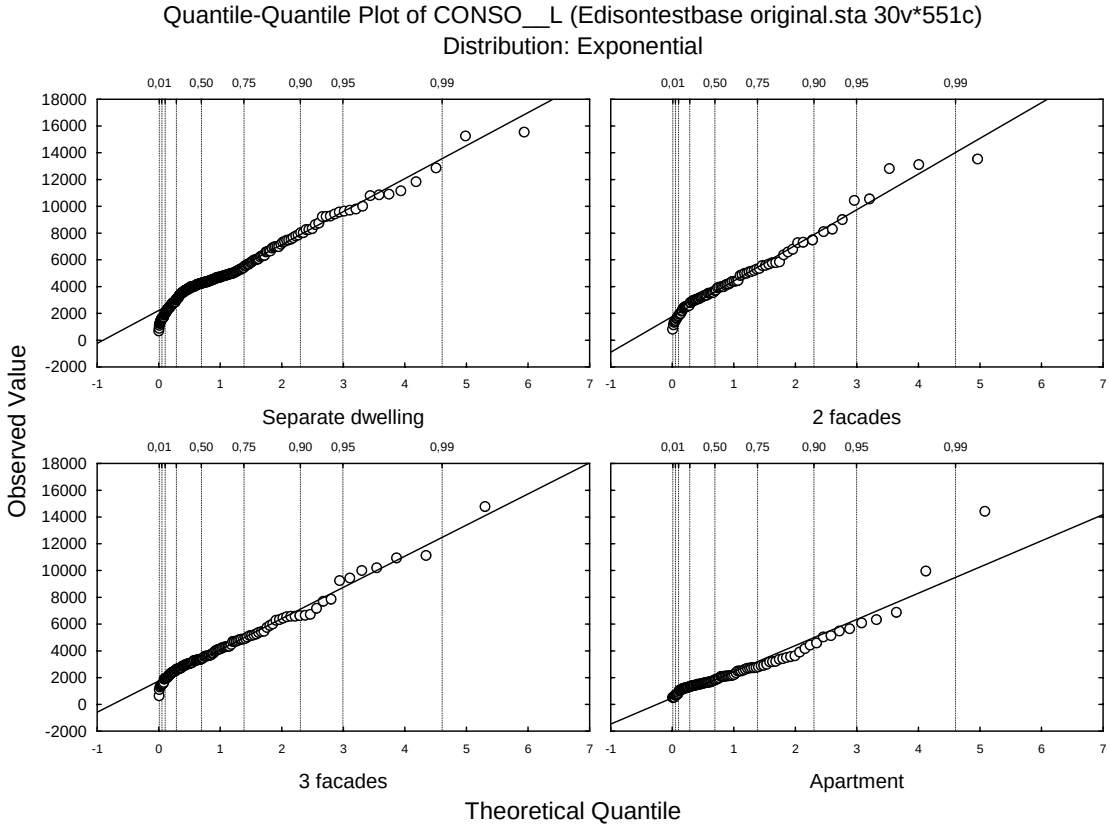


| | | |
|---|---|---|
| **actiinse**<br>**actipren**<br>**actiprote**<br>**actisypr** | Campaigns of information and sensitisation of households<br>By increasing the prices of energy<br>Creation of new technological projects<br>By improving the systems of industrial production | Principal solution to save energy |
| **agch>=20**<br>**agch04**<br>**agch1119**<br>**agch510** | Boiler age greater than 20 years<br>Boiler age between 0 and 4 years<br>Boiler age between 11 and 19 years<br>Boiler age between 5 and 10 years | Boiler age (estimated) |
| **ecmoedu**<br>**ecmoevga**<br>**ecmonote**<br>**ecmopren**<br>**ecmoraen**<br>**ecmores** | By education<br>To avoid wasting<br>By interest for new technologies<br>To protect the environment<br>For economic reasons<br>By a collective responsibility sense | Principal motivation to save energy |
| **fecha -**<br>**fecha +** | No<br>Yes | Lowers the temperature when airing |
| **grag1829**<br>**grag3049**<br>**grag5069**<br>**grag7089** | Age group of 18 to 29 years<br>Age group of 30 to 49 years<br>Age group of 50 to 69 years<br>Age group of 70 to 89 years | Age group |
| **knore03**<br>**knore47**<br>**knore810** | Score between 0 and 3<br>Score between 4 and 7<br>Score between 8 and 10 | Score of knowledge on renewable energy (score / 10) |
| **llps<1**<br>**llps>=2**<br>**llps1<2** | Less than once per week /person<br>Twice or more per week /person<br>Once to less than twice per week /person | Weekly use of washing machine/ person |
| **napel>15**<br>**napel1115**<br>**napel15**<br>**napel610** | 1 – 5 large appliances<br>11 – 15 large appliances<br>> 15 large appliances<br>6 – 10 large appliances | Number of large appliances in usage |
| **nivacapu**<br>**nivacfoy**<br>**nivacgl**<br>**nivacind** | Public authorities<br>Each family<br>Local groups<br>Manufacturers | Who should mainly undertake actions for reducing energy consumption? |
| **premoca**<br>**premoeco**<br>**premofu**<br>**premopo**<br>**premosa** | Countryside<br>Ecosystem<br>Future<br>Politics<br>Health | First word associated with environment |
| **proplo**<br>**proppro** | Renter<br>Owner | Tenure status |
| **regbru**<br>**regfla**<br>**regwal** | Brussels<br>Flanders<br>Wallonia | Region of residence |
| **remel**<br>**remelI**<br>**remelII**<br>**remelV** | Income quartile 1 (less than 1510 €)<br>Income quartile 2 (between 1510 € and 2259 €)<br>Income quartile 3 (between 2260 € and 3379 €)<br>Income quartile 4 (more than 3380 €) | Total net household income, per quartile |
| **retehi -**<br>**retehi +** | No<br>Yes | Lowers the temperature during absences of several hours in the winter |
| **sexmcf**<br>**sexmcm**<br>**sexmsf**<br>**sexmsm** | Couple, female respondent<br>Couple, male respondent<br>Alone, female respondent<br>Alone, male respondent | Household structure and gender of respondent |
| **tejo<19**<br>**tejo>21**<br>**tejo20** | < 19 °<br>20 °<br>> 21 ° | Estimated temperature in the living-room in a winter day |
| **vitdoco**<br>**vitdono**<br>**vitdopa** | Everywhere<br>Nowhere<br>Partially | Double glasses windows in the dwelling |

## *16.3 Appendix 3: Distributions for the Edisontest*

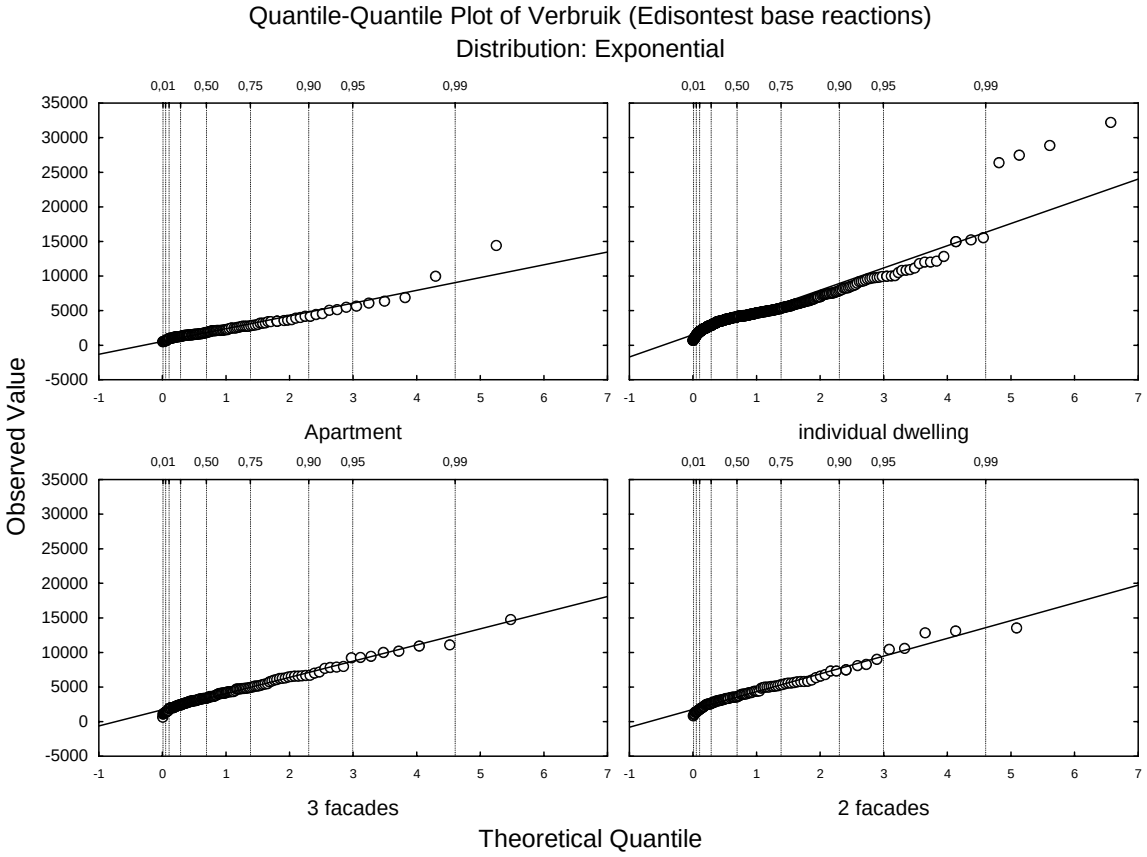
The Edisontest assumes for the distribution of the electricity consumption a lognormal distribution. This distribution is best suited for the representation of the consumptions, as can be seen in the different quantile-quantile plots for the original database in Figure 16.1.

**Figure 16.1 : QQ-plots for distributions of electricity consumptions according to type of dwelling**




The same distributions are applied when adding the new data entered by the users of the Edisontest. These new data do not jump out of the original distributions, except from some outliers, as can be seen in Figure 16.2. These extreme high consumptions most probably represent houses with electrical heating and can therefore not be considered for the further calculations.

**Figure 16.2 : QQ-plots of the distributions with the new data added**



## *16.4 Appendix 4: Questionnaire for the large-scale survey (in Dutch)*

**SOCIO-TECHNICAL FACTORS**
**INFLUENCING RESIDENTIAL ENERGY CONSUMPTION**
**(SEREC)**

**ENQUETE SOCIO-DEMOGRAPHIQUE**

*QUESTIONNAIRE*

**Mode d'emploi :** Cocher au bic ***une et une seule case à chaque ligne*** commençant et se terminant par une marque. ***Si vous faites une erreur, noircir complètement la case et cocher la bonne case.***

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Enquêteur** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Jour** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **N° feuille de contact** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

---

**Q1.**Deze vragenlijst gaat over uw woning. Daarom zou ik graag willen weten sinds welk jaar u in uw huidige woning woont.:

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Nu zou ik u graag enkele vragen stellen over de leden van uw gezin.

**Q2.** ***(À noter par l'enquêteur)*** ☐ Man ☐ Vrouw

**Q2 bis.** ***(A noter par l'enquêteur)*** Région :

☐ Flandres ☐ Wallonie ☐ Bruxelles
☐ Grote stad ☐ Stad-zone ☐ Platteland-zone

**Q3.** Hoe oud bent u ?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Weigering ☐

**Q4.** Woont u samen met uw partner ? 

☐ Oui ☐ Non

**Q5.** Woont u samen met kinderen ? 

☐ Ja ☐ Neen ➔ **Q8**

**Q6.** Hoeveel ?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| **Q7.** Hoe oud zijn ze ? | 0-2 | 3-9 | 10-14 | 15-19 | 20-25 | 25 + |
|---|---|---|---|---|---|---|
| Kind 1 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Kind 2 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Kind 3 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Kind 4 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Kind 5 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Kind 6 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Kind 7 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Kind 8 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Kind 9 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q8.** Leeft u met andere mensen, met inbegrip van eventuele huurders of medehuurders die op dezelfde elektriciteitsmeter verbonden zijn ?

☐ Ja ☐ Neen ➔ **Q10**

**Q9.** ?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10+ |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q10.** Er zijn dus in totaal ..... personen die in uw woning leven ?

***Q13. Als de respondent met andere mensen leeft.*** **F :**

**Q13.** Schommelt het aantal van aanwezige personen in uw woning gedurende de week?

☐ Ja ☐ Neen ➔ **Q16**

**Q14.** Hoeveel mensen zijn er in uw huishouden op zijn minst?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q15.** Hoeveel mensen zijn er in uw huishouden, ten hoogste?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q16.** Nu zal ik u enkele vragen stellen over uw woning. Is uw woning :

☐ Een eengezinshuis
☐ Un appartement ➔ **Q18**
☐ Ander ; welke : ..... ➔ **Q20**

**Q17.** Hoeveel gevels telt uw woning ? ***(Laat de respondent het spontaan vermelden)***

☐ 2 gevels ➔ **Q20**
☐ 3 gevels ➔ **Q20**
☐ 4 gevels ➔ **Q20**

**Q18.** Is het een studio ? ☐ Ja ☐ Neen

**Q19.** Hoeveel woningen zijn er in het gebouw waarin u woont ? ***(Laat de respondent het spontaan vermelden)***

☐ 1 tot 4 ☐ 5 tot 9 ☐ 10 tot19 ☐ 20 of + ☐ Weet niet

**Q20.** Welk is de bewoonbare oppervlakte (in m²) van uw woning? ***(Laat de respondent het spontaan vermelden)***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

☐ minder dan 50 m² ☐ van 50 tot 99 m² ☐ van 100 tot 149 m²
☐ van 150 tot 199 m² ☐ van 200 tot 249 m² ☐ meer dan 250 m² ☐ Weet niet

**Q21.** In welk jaar werd uw woning gebouwd?
***(Laat de respondent het spontaan vermelden)***

☐ Voor 1919 ☐ Tussen 1919 en 1945 ☐ Tussen 1946 en 1960
☐ Tussen 1961 en 1975 ☐ Tussen 1976 et 1990 ☐ Tussen 1991 of later ☐ Weet niet

**Q22.** Bent u... 🗝 ☐ Eigenaar
☐ Huurder
☐ Ander, welke : .....

**Q23.** Beschikt u over uw eigen elektriciteitsmeter?

☐ Ja ☐ Neen ➔ **Q25** ☐ Weet niet

**Q24.** Is het een elektriciteitsmeter met nachttarief en/of weekendtarief? ☼ ☾

☐ Ja ☐ Neen ☐ Weet niet

***Q25. Si studio ('oui' à Q18), ne demander que 25b et 25c.***

**Q25.** Vindt men de volgende ruimtes in uw woning en indien ja, hoeveel?**F :**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| **a.** Slaapkamer | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** Badkamer met bad | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** Badkamer met enkel een douche | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q26.** ***Als de respondent alleen woont :*** Hoeveel baden neemt u gemiddeld per week?
***Als de respondent met andere mensen woont*** : Hoeveel baden worden er genomen gemiddeld per week door alle gezinsleden?**F :**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q27.** ***Als de respondent alleen woont :*** Hoeveel douches neemt u gemiddeld per week?
***Als de respondent met andere mensen woont :*** Hoeveel douches worden er genomen gemiddeld per week door alle gezinsleden ?**F :**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q28.** Als hoofdverwarming van uw woning, beschikt u over....

☐ Een centrale verwarmingsinstallatie ➔ **Q29**
☐ Een ander verwarmingsmiddel ➔ **Q30**
☐ Weet niet ➔ **Q31**

**Q29.** Is deze installatie ...

☐ Individueel ➔ **Q31**
☐ Gemeenschappelijk ➔ **Q31**

**Q30.** Welk is uw hoofdverwarming**?**
***(Laisser le répondant citer spontanément)***

☐ Haardvuur
☐ Kachel
☐ Convector
☐ Elektrische radiator
☐ Ander, welke : .....

**Q31.** Welk energie of brandstof is voornamelijk door uw verwarmingsinstallatie gebruikt? ***(Laisser le répondant citer spontanément)***

☐ Stookolie, mazout
☐ Elektriciteit
☐ Aardgas
☐ Butaangas, propaangas
☐ Steenkool
☐ Hout
☐ Warmtepomp
☐ Ander energiebron , welke: .....
☐ Weet niet

**Q32.** Hebt u een individuele verwarmingsketel?

☐ Ja ☐ Neen ➔ **Q35** ☐ Weet niet ➔ **Q35**

**Q33.** Vindt u die ...

☐ Heel recent ☐ Recent ☐ Oud
☐ Heel oud ☐ Noch recent, noch oud

**Q34.** Hoe oud is ze ?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Weet niet ☐

**Q35.** Hebt u de mogelijkheid om uw verwarmingsinstallatie zelf uit te schakelen of de temperatuur te regelen?

☐ Ja ☐ Neen ➔ **Q36c puis Q40** ☐ Weet niet

**Q36.** Is uw verwarmingssysteem verbonden aan...

| | Ja | Neen | Weet niet |
|---|---|---|---|
| **a.** Een buitensonde | ☐ | ☐ | ☐ |
| **b.** Een thermostaat | ☐ | ☐ | ☐ |
| **c.** Radiatoren | ☐ | ☐ ➔ **Q38** | ☐ |
| **d.** Thermostaatkranen | ☐ | ☐ ➔ **Q38** | ☐ |

***Q37-39. Als de respondent de mogelijkheid heeft om de verwarmingsinstallatie uit te schakelen of de temperatuur zelf te reguleren ('ja' of 'weet niet' aan Q35). Anders ➔ Q40.***

**F :** 

**Q37.** Hebt u thermostaatkranen op ...

☐ Sommige radiatoren ☐ Alle radiatoren

**Q38.** Tijdens de winter, wanneer uw woning onbewoond blijft voor meerdere uren, vermindert u dan de temperatuur?

☐ Ja ☐ Neen ☐ Weet niet

**Q 39.*Als studio* :** Tijdens de winter, 's nachts, vermindert u de temperatuur van uw woning ?

***Als de respondent in een ander woningtype woont* :** Tijdens de winter, 's nachts, vermindert u de temperatuur van uw woonkamer ?**F :** 

☐ Ja ☐ Neen ☐ Weet niet

**Q40.** ***Als studio :*** Tijdens de winter, over dag, wat is de temperatuur van uw woning als u thuis aanwezig bent? ***(Laisser le répondant citer spontanément)*** **F :** 

***Als andere woontype* :** Tijdens de winter, over dag, wat is de temperatuur van uw woonkamer als u thuis aanwezig bent? ***(Laisser le répondant citer spontanément)***

☐ Minder dan 18°C ☐ 18-19°C ☐ 20°C

☐ 21-22°C ☐ Meer dan 22°C ☐ Weet niet

**Q41.** ***Als studio :*** Tijdens de winter, 's nachts, wat is gewoonlijk de temperatuur van uw woning als u thuis aanwezig bent ? ***(Laisser le répondant citer spontanément)***

***Als ander woontype :*** Tijdens de winter, over dag, wat is de temperatuur van uw woonkamer als u thuis aanwezig bent?

***(Laisser le répondant citer spontanément)*** **F :** 

☐ Minder dan 14°C ☐ 14-15°C ☐ 16°C

☐ 17-18°C ☐ Meer dan 18°C ☐ Ne sait pas

**Q42.** Is uw woning voorzien van dubbelglas?

☐ Ja ☐ Neen ➔ **Q44** ☐ Weet niet

**Q43.** Gedeeltelijk of volledig ?

☐ Gedeeltelijk ☐ Volledig

***Als de respondent de mogelijkheid heeft om de verwarmingsinstallatie uit te schakelen of de temperatuur zelf te reguleren('ja' aan vraag Q35).. Anders ➔ Q46.*****F :** 

**Q45.** Tijdens de winter, wanneer u een ruimte ventileert, zet u dan uw verwarming af ?

☐ Ja ☐ Neen ☐ Weet niet

**Q46.** Nu zal ik u enkele vragen stellen over de elektrische toestellen.
***Als de respondent alleen woont*** **:** Kunt u me zeggen of u de volgende huishoudapparaten bezit **en** gebruikt en indien ja, hoeveel ?**F :**
***Als de respondent met andere mensen woont*** **:** Kunt u me zeggen of uzelf of een lid van uw huishouden de volgende huishoudapparaten bezit **en** gebruikt en indien ja, hoeveel?

| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **a.** koelkast **1.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** diepvriezer **2.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** fornuis | elektrisch fornuis | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Gasfornuis | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Een combinatie van de twee | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** vaatwasmachine **3.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **d.** wasmachine **4.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **e.** droogkast **5.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **f.** televisietoestel **6.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **g.** videorecorder/DVD | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **h.** computer | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **i.** spelconsole | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **j.** ventilator | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **k.** extra - elektrische radiators | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **l.** airconditionning | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

***Q47-52. Si a au moins un des électroménagers suivants : koelkast (Q46a), diepvriezer (Q46b), vaatwasmachine (Q46d), wasmachine (Q46e), droogkast (Q46f). Sinon ➔ Q53.***
**F :**

**Q47.** Bezit u één of meerdere huishoudapparaten van A of B-klasse (energiezuinig)? ***(wasmachine, droogkast, koelkast, diepvries, vaatwasmachine)***

☐ Ja ☐ Neen ☐ Weet niet

***Q48. Als koelkast ('ja' aan Q46a). Anders ➔ Q49.*** **F : 1.**

**Q48.** Hoe oud is uw koelkast? (***degene die u het meest gebruikt***) ?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Weet niet ☐

***Q49-50 Als wasmachine ('ja' aan Q46e). Anders ➔ Q51.*** **F : 4.**

***Q49. Si a un compteur bi-horaire ou tri-horaire ('oui' à Q24). Sinon ➔ Q50.*** **F :**

**Q49.** Gebruikt u uw wasmachine wanneer de elektriciteit op nachttarief staat? Antwoord met 'nooit', 'soms', 'dikwijls' of 'altijd'

☐ Nooit ☐ Soms ☐ Dikwijls ☐ Altijd ☐ Weet niet

**Q50.** Hoe vaak gebruikt u uw wasmachine ?
***(Laat de respondent spontaan antwoorden)***

☐ Meerdere keren elke dag ☐ Eén keer per dag
☐ Meerdere keren per week ☐ Eén keer per week
☐ Minder dan één keer per week ☐ Weet niet

***Q51. .Als de respondent een droogkast ('jai' aan Q46f). Anders ➔ Q52.*** **F : 5.**

**Q51.** Hoe vaak gebruikt u uw droogkast ? ***(Laat de respondent spontaan antwoorden)***

☐ Meerdere keren elke dag ☐ Eén keer per dag
☐ Meerdere keren per week ☐ Eén keer per week
☐ Minder dan één keer per week ☐ Weet niet

***Q52. Als vaatwasmachine ('ja' aan Q46d). Anders ➔ Q53.*** **F : 3.**

**Q52.** Hoe vaak gebruikt u uw vaatwasmachine ? ***(Laat de respondent spontaan antwoorden)***

☐ Meerdere keren elke dag ☐ Eén keer per dag
☐ Meerdere keren per week ☐ Eén keer per week
☐ Minder dan één keer per week ☐ Weet niet

**Q53.** Bij aankoop van grote huishoudapparaten, is hun lage energieverbruik een aankoopcriterium?

☐ Ja ☐ Neen

Nu zou ik u graag enkele vragen stellen over de verdeling van de taken in het huishouden tussen man en vrouw.

**Q54.** ***Als de respondent "alleen" woont ('neen' aan vraag Q4)*** **:** Volgens u, wie moet, in een koppel in het algemeen, zich bezig houden met de volgende taken? De vrouw, de man, de twee samen of gelijk wie van de twee? **F :**

***Als de respondent met zijn/haar partner woont ('ja' aan vraag Q4)*** **:** Volgens u, wie moet, in een koppel in het algemeen en niet noodzakelijkerwijs in uw eigen koppel, zich bezig houden met de volgende taken? De vrouw, de man, de twee tezamen of één of ander, onverschillig?

| | Man | Vrouw | De 2 samen | Gelijk wie van de twee |
|---|---|---|---|---|
| **a.** Over de aankoop van een televisietoestel beslissen | ☐ | ☐ | ☐ | ☐ |
| **b.** Een lampje kopen | ☐ | ☐ | ☐ | ☐ |
| **c.** Een koelkast kopen | ☐ | ☐ | ☐ | ☐ |
| **d.** Een vaatwasmachine kiezen | ☐ | ☐ | ☐ | ☐ |
| **e.** De kosten van het huishouden beheren | ☐ | ☐ | ☐ | ☐ |
| **f.** Het initiatief nemen om de woonkamer opnieuw te schilderen of te behangen | ☐ | ☐ | ☐ | ☐ |
| **g.** De beslissing nemen om het dak te isoleren | ☐ | ☐ | ☐ | ☐ |

**Q55.** ***Als de respondent "alleen" woont ('neen' aan vraag Q4)*** **:** Vind u de volgende situaties aanvaardbaar in een koppel in het algemeen? Antwoord met 'helemaal', 'eerder ja', 'noch ja, noch neen', 'eerder neen' of 'helemaal niet'.

***Als de respondent met zijn/haar partner woont ('ja' aan vraag Q4) )*** **:** Vind u de volgende situaties aanvaardbaar in een koppel in het algemeen en niet noodzakelijkerwijs in uw koppel? Antwoord met 'helemaal', 'eerder ja', 'noch ja, noch neen', 'eerder neen' of 'helemaal niet'.**F :** 

| | Tout à fait | Plutôt oui | Ni oui ni non | Plutôt non | Pas du tout |
|---|---|---|---|---|---|
| **a**.Vindt u dat het de taak van de man is om thuis doe-het-zelf werk te doen ? | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.**Vindt u aanvaardbaar dat de man het initiatief neemt om de wasmachine te laten draaien? | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.**Vindt u aanvaardbaar dat de man aan zijn vrouw zegt dat ze zich anders moet organiseren voor de was? | ☐ | ☐ | ☐ | ☐ | ☐ |
| **d.** Vindt u aanvaardbaar dat de vrouw aan haar man zegt welke werken hij thuis zou moeten uitvoeren? | ☐ | ☐ | ☐ | ☐ | ☐ |

***Q56a. Als een televisietoestel bezit ('ja' aan vraag Q46g). Anders ➔ Q56b.*** **F : 6.** 

**Q56.** De volgende vragen kunt u beantwoorden met 'nooit', 'soms', 'dikwijls' of 'altijd'.

| | Nooit | Soms | Dikwijls | Altijd |
|---|---|---|---|---|
| **a.** Zet u de televisie uit door de afstandsbediening te gebruiken … **F : 6.**  | ☐ | ☐ | ☐ | ☐ |
| **b.** Wanneer u een ruimte gedurende 5 min. verlaat, schakelt u dan het lichtuit | ☐ | ☐ | ☐ | ☐ |

**Q57.** Volgens u, verbruikt het televisietoestel stroom nadat u dit toestel met de afstandsbediening heeft uitgeschakeld?

☐ Ja ☐ Neen ☐ Weet niet

**Q58.** Volgens u, als men een ruimte die door een spaarlamp verlicht is, voor minder dan 20 minuten verlaat, is het beter om het licht uit te doen of aan te laten?

☐ Uit doen ☐ Aan laten ☐ Weet niet

**Q59.** In uw woning, gebruikt u spaarlampen?

☐ Ja ☐ Neen ☐ Weet niet

**Q60.** Hoe denkt u dat het wereldklimaat zal zijn binnen een twintigtal jaren?

☐ Identiek ☐ Warmer ☐ Kouder ☐ Weet niet

**Q61.** Volgens u, wat zou het klimaat kunnen veranderen ? Antwoord met 'ja' of 'neen' aan de volgende voorstellen :

| | Oui | Non |
|---|---|---|
| **a.** Het wegverkeer | ☐ | ☐ |
| **b.** De vervuiling van het grondwater | ☐ | ☐ |
| **c.** De huisverwarming | ☐ | ☐ |
| **d.** De atoomkerncentrales | ☐ | ☐ |
| **e.** De storting van gevaarlijke producten | ☐ | ☐ |
| **f.** De teruggeworpen roken van de fabrieken | ☐ | ☐ |
| **g.** De ontbossing van de Amazonewoud | ☐ | ☐ |

**Q62.** In het volgende lijst, kies twee woorden die voor u aan het milieu verbonden zijn.

| | 1ste woord | 2de woord |
|---|---|---|
| Toekomst | ☐ | ☐ |
| Politiek | ☐ | ☐ |
| Ecosysteem | ☐ | ☐ |
| Gezondheid | ☐ | ☐ |
| Platteland | ☐ | ☐ |
| Buurt | ☐ | ☐ |

**Q63.** Welk is, volgens u, de voornaamste verantwoordelijke voor de milieuvervuiling?

De ondernemingen, door de roken en het afval ☐
De bevolking, door uitlaatgassen en huisverwarming ☐

**Q63 bis.** Denkt u dat u absoluut alles doet om energie te besparen?

☐ Helemaal ➔ **Q65** ☐ Eerder ja ☐ Noch ja, noch neen ☐ Eerder neen ☐ Helemaal niet

***Q64c. Als 'huurder' (Q22). Anders ➔ Q64d.*** **F :** 🗝

**Q64.** Ik zal u enkele redenen opsommen die de mensen weerhouden van meer energie te besparen. Zeg me, a.u.b. of de volgende voorstellingen 'helemaal', 'eerder ja', 'noch ja, noch neen', 'eerder neen', 'helemaal niet' overeenkomen met uw eigen situatie

| | Helemaal | Eerder ja | Noch ja, noch neen | Eerder neen | Helemaal niet |
|---|---|---|---|---|---|
| **a.** Ik weet niet wat ik moet doen | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** Het is geen prioriteit | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** Ik ben geen eigenaar **F :** 🗝 | ☐ | ☐ | ☐ | ☐ | ☐ |
| **d.** Ik vind dat niet nuttig | ☐ | ☐ | ☐ | ☐ | ☐ |
| **e.** Het zou 1 druppel water in de zee zijn | ☐ | ☐ | ☐ | ☐ | ☐ |
| **f.** Het vraagt teveel inspanningen | ☐ | ☐ | ☐ | ☐ | ☐ |
| **g.** Ik wil geen comfort verliezen | ☐ | ☐ | ☐ | ☐ | ☐ |
| **h.** Daarvoor heb ik geen geld genoeg | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q65.** Welk is uw voornaamste motivatie om energie te besparen?

☐ Door opvoeding
☐ Om economische redenen
☐ Door een gevoel voor collectieve verantwoordelijkheid

- ☐ Om het milieu te beschermen
- ☐ Om verspilling te vermijden
- ☐ Door interesse voor nieuwe technologieën
- ☐ ***Geen motivatie***

***Q66c. Als de respondent een droogkast bezit ('ja' aan Q46f). Anders ➔ Q66d.*** **F : 5.**

**Q66.** Zou u akkoord gaan om deze verschillende handelingen te realiseren om minder energie te gebruiken ? Antwoord met 'ik doe het al', 'helemaal', 'eerder ja', 'noch ja, noch neen', 'eerder neen', 'helemaal niet'.

| | Ik doe het al | Helemaal | Eerder ja | Noch ja, noch neen | Eerder neen | Helemaal niet |
|---|---|---|---|---|---|---|
| **a**Meer betalen voor 1 huishoudapparaat dat minder energie gebruikt | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** De temperatuur van de ruimtes met één graad verlagen | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** Geen elektrische droogkast gebruiken **F : 5.** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **d.** Een meer doeltreffende verwarmingsinstallatie installeren | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **e.** Hernieuwbare energie gebruiken | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **f.** (Meer) **spaarlampen** installeren | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **g.** De isolatie verbeteren | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **h.** Spaardouchekoppen installeren (die minder water verbruiken) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q67.** Antwoord op de volgende vragen met , 'helemaal', 'eerder ja', 'noch ja, noch neen', 'eerder neen', 'helemaal niet'. "Zich bekommeren om het milieu is volgens u"…

| | Helemaal | Eerder ja | Noch ja,noch neen | Eerder neen | Helemaal niet |
|---|---|---|---|---|---|
| **a.** Dringend, anders gaan we ons ondergang tegemoet | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b**. Een modeverschijnsel | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** Iets waarmee wij rekening moeten beginnen houden | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q68.** Volgens u, moeten de acties om het energieverbruik te verminderen voornamelijk uitgevoerd zijn

- ☐ Door elk gezin
- ☐ Door plaatselijke groepen (wijk, gemeente, school, jeugdbeweging enz.)
- ☐ Door de publieke overheid
- ☐ Door de industriëlen

**Q69.** Volgens u, wat is de voornaamste oplossing om het energieverbruik te verminderen?

- ☐ Het gebruik van nieuwe technologieën
- ☐ Informatie- en bewustmakingscampagnes voor gezinnen
- ☐ De verbetering van de industriële productiesystemen
- ☐ De prijsverhoging van de energie

**Q70.** Kent u hernieuwbare energie ?

☐ Ja ☐ Neen

| **Q71.** Kent u … | Oui | Non |
|---|---|---|
| **a.** Zonne-energie | ☐ | ☐ |
| **b.** Fotovoltaïsche zonne-energie | ☐ | ☐ |
| **c.** Thermische zonne-energie | ☐ | ☐ |
| **d.** De windmolens | ☐ | ☐ |
| **e.** De biomassa | ☐ | ☐ |

**Q72.** Weet u wat een energie-audit is ?

☐ Ja ☐ Neen

*Een energie-audit bestaat uit een analyse van de energetische situatie van uw woning qua verwarmingsysteem, buitenmuren, dak, bodem en warm water. Daardoor bekomt u specifieke aanbevelingen om de verwarming-, isolatie- en warm watersysteem te verbeteren en om het energieverbruik van het gebouw te verminderen.*

**Q73.** Welk prijs zou u willen betalen voor een dergelijke energie-audit ? ***(als « het zou gratis moeten zijn », schrijf « 0 € »)***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

☐ € ☐ FB

☐ Heeft geen interesse ☐ Weet niet

**Q74.** Heeft u horen spreken over maatregelen genomen door de overheid om de mensen uit te nodigen hun energieverbruik te verminderen ?

☐ Ja ☐ Neen

| **Q75.** Kunt u me zeggen of u de volgende maatregelen kent … | Ja | Neen |
|---|---|---|
| **a.** Premie's | ☐ | ☐ |
| **b.** Belastingaftrek / belastingsvermindering | ☐ | ☐ |

| **Elektriciteit** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **F :** ☾ ☼ | | | | | | | | | | | |
| **Factuur :** ☐**Maandelijks** ☐ **Tweejarig** ☐ **Jaarlijks** | | | | | | | | | | | |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **Verbruik in kWh Dag** | Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | | | | | | | | | | | |
| **Verbruik in kWh Nacht** | Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | | | | | | | | | | | |
| **Totaal Verbruik in kWh** | Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| **Gas** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Factuur :** ☐**Maandelijks** ☐ **Tweejarig** ☐ **Jaarlijks** | | | | | | | | | | | |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **Totaal Verbruik** | Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ **m³** ☐ **kWh** | | | | | | | | | | | |

*Ik zou u graag enkele vragen stellen over persoons- en gezinsgegevens...*

**Q76.** Wat is het hoogste diploma dat u hebt behaald ?

☐ Geen diploma ☐ Lager onderwijs ☐ Lager middelbaar
☐ Hoger middelbaar ☐ Hoger niet-universitair ☐ Universitair

**Q76 bis.** Bent u ...

☐ Loontrekkende of zelfstandige
☐ Werkzoekende ➔ **Q78**
☐ Huisvrouw (huisman) ➔ **Q79**
☐ (Brug)gepensioneerden ➔ **Q78**
☐ Student(e) ➔ **Q79**
☐ Anders, welke: ..... ➔ **Q78 of Q79 volgens de situatie**

**Q77.** Is uw baan... ***(afronden)***

☐ Voltijd ☐ ¾ tijd ☐ Halftijds ☐ ¼ tijd

**Q78.** Welk is (of was) uw beroep? ***( werkzoekenden en (brug)gepensioneerden inbegrepen en beroepsmilitair)***

☐ Landbouwers (exploitants)
☐ Zelfstandige (behalve vrije beroepen), handelaars en ondernemingshoofden van minder dan 10 loontrekkers)
☐ Hogere kaderfuncties, intellectuele beroepen, vrije beroepen en ondernemingshoofden dan meer dan 10 loontrekkenden.
☐ Middenkaders, technici, onderwijzers, regentes, verplegers, maatschappelijke werkers, geestelijkheid
☐ Bedienden
☐ Arbeiders (landbouw arbeiders inbegrepen)
☐ Andere (artiesten, werkzoekenden die nooit gewerkt hebben,...)
+ Nauwkeurige benaming van de functie : .....

***Q79-81. Als samen met partner woont ('ja' aan Q4). Anders ➔ Q82.*** **F :**

**Q 79.** Wat is het hoogste diploma dat uw partner behaald heeft?

☐ Geen diploma ☐ Lager onderwijs ☐ Lager middelbaar
☐ Hoger middelbaar ☐ Hoger niet-universitair ☐ Universitair
☐ Weet niet

**Q79 bis.** is uw echtgenote...

☐ Loontrekkende of zelfstandige
☐ Werkzoekende ➔ **Q81**
☐ Huisvrouw (huisman?) ➔ **Q82**
☐ (Brug)gepensioneerden ➔ **Q81**
☐ Student(e) ➔ **Q82**
☐ Weet niet ➔ **Q81**
☐ Anders, welke: ..... ➔ **Q81 of Q82 volgens de situatie**

**Q80.** Is zijn/haar baan **(afronden)**

☐ Voltijd ☐ ¾ tijd ☐ Halftijds ☐ ¼ tijd ☐ Weet niet

**Q81.** elk is (of was) uw beroep ? ***( werkzoekenden en (brug)gepensioneerden inbegrepen en beroepsmilitair)***

☐ Landbouwers(exploitants)

☐ Zelfstandige (behalve vrije beroepen), handelaars en ondernemingshoofden van minder dan 10 loontrekkers)

☐ Hogere kaderfuncties, intellectuele beroepen, vrije beroepen en ondernemingshoofden dan meer dan 10 loontrekkenden.

☐ Middenkaders, technici, onderwijzers, regentes, verplegers, maatschappelijke werkers, geestelijkheid

☐ Bedienden

☐ Arbeiders (landbouw arbeiders inbegrepen)

☐ Andere (artiesten, werkzoekenden die nooit gewerkt hebben,...)

☐ Weet niet

+ Nauwkeurige benaming van de functie : .....

**Q82.** ***Als de respondent alleen woont*** **:** Kunt u me zeggen of uw totale beschikbare inkomen per maand hoger of lager is dan 2 260 € / 90 400 FB ? **F :**

***Als de respondent met andere mensen woont*** **:** Kunt u me zeggen of het totale beschikbare inkomen van uw huishouden per maand hoger of lager is dan 2 260 € / 90 400 FB ?

☐ Lager ➔ **Q83** ☐ Hoger ➔ **Q84** ☐ Weet niet ➔**einde** ☐ Weigering ➔ **einde**

**Q83.** Is het lager of hoger dan 1 510 € / 60 400 FB ?

☐ Lager ➔ **einde** ☐ Hoger ➔ **einde** ☐ Weet niet ➔**einde** ☐ Weigering ➔ **einde**

**Q84.** Is het lager of hoger dan 3 380 € / 135 200 FB ?

☐ Lager ➔ **einde** ☐ Hoger ➔ **einde** ☐ Weet niet ➔**einde** ☐ Weigering ➔ **einde**

**Einde :** Deze vragenlijst zit erop. Ik dank u hartelijk voor uw medewerking en wens u een heel aangename dag/avond.

## *16.5 Appendix 5: Questionnaire for the large-scale survey (in French)*

**SOCIO-TECHNICAL FACTORS**
**INFLUENCING RESIDENTIAL ENERGY CONSUMPTION**
**(SEREC)**

**ENQUETE SOCIO-DEMOGRAPHIQUE**
**QUESTIONNAIRE**

**Mode d'emploi :** Cocher au bic ***une et une seule case à chaque ligne*** commençant et se terminant par une marque. ***Si vous faites une erreur, noircir complètement la case et cocher la bonne case.***

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Enquêteur** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Jour** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **N° feuille de contact** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

---

**Q1.** Ce questionnaire concernant votre logement, j'aimerais savoir en quelle année vous avez emménagé dans celui-ci :

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Maintenant, je vais vous poser quelques questions sur les personnes de votre ménage.

**Q2.** ***(À noter par l'enquêteur)*** ☐ Homme ☐ Femme

**Q2 bis.** ***(A noter par l'enquêteur)*** Région :

☐ Flandres ☐ Wallonie ☐ Bruxelles
☐ Grande ville ☐ Autre urbain ☐ Rural

**Q3.** Quel âge avez-vous ?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Refus ☐

**Q4.** Vivez-vous en couple ?

☐ Oui ☐ Non

**Q5.** Vivez-vous avec des enfants ?

☐ Oui ☐ Non ➔ **Q8**

**Q6.** Combien ?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| **Q7.** Quel est leur âge ? | 0-2 | 3-9 | 10-14 | 15-19 | 20-25 | 25 + |
|---|---|---|---|---|---|---|
| Enfant 1 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Enfant 2 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Enfant 3 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Enfant 4 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Enfant 5 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Enfant 6 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Enfant 7 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Enfant 8 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Enfant 9 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q8.** Vivez-vous avec d'autres personnes, y compris d'éventuels locataires ou colocataires qui sont branchés sur le même compteur électrique ?

☐ Oui ☐ Non ➔ **Q10**

**Q9.** Combien de personnes ?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10+ |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q10.** Il y a donc ..... personnes qui vivent avec vous ?

***Q13. Si vit avec d'autres personnes.*** **F :**

**Q13.** Le nombre de personnes présentes dans votre logement change-t-il suivant les jours de la semaine ?

☐ Oui ☐ Non ➔ **Q16**

**Q14.** Combien y a-t-il de personnes au minimum dans votre ménage ?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q15.** Combien y a-t-il de personnes au maximum dans votre ménage ?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q16.** Maintenant, quelques questions sur votre logement. Votre logement est-il…

☐ Une maison unifamiliale
☐ Un appartement ➔ **Q18**
☐ Autre, précisez : ..... ➔ **Q20**

**Q17.** Combien a-t-elle de façades ? ***(Laisser le répondant citer spontanément)***

☐ 2 façades (mitoyenne) ➔ **Q20**
☐ 3 façades (jumelée) ➔ **Q20**
☐ 4 façades (séparée) ➔ **Q20**

**Q18.** Est-ce un studio ? ☐ Oui ☐ Non

**Q19.** Combien y a-t-il de logements dans le bâtiment où vous habitez ? ***(Laisser le répondant citer spontanément)***

☐ 1 à 4 ☐ 5 à 9 ☐ 10 à 19 ☐ 20 ou + ☐ Ne sait pas

**Q20.** Quelle est la superficie habitable en m² de votre logement ? ***(Laisser le répondant citer spontanément)***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

☐ moins de 50 m² ☐ de 50 à 99 m² ☐ de 100 à 149 m²
☐ de 150 à 199 m² ☐ de 200 à 249 m² ☐ plus de 250 m² ☐ Ne sait pas

**Q21.** En quelle année votre logement a-t-il été construit ? ***(Laisser le répondant citer spontanément)***

☐ Avant 1919 ☐ Entre 1919 et 1945 ☐ Entre 1946 et 1960
☐ Entre 1961 et 1975 ☐ Entre 1976 et 1990 ☐ En 1991 ou après ☐ Ne sait pas

**Q22.** Etes-vous… 🗝
☐ Propriétaire
☐ Locataire
☐ Autre, précisez : .....

**Q23.** Avez-vous votre propre compteur électrique ?
☐ Oui ☐ Non ➔ **Q25** ☐ Ne sait pas

**Q24.** Ce compteur est-il bi-horaire ou tri-horaire ? ☼ ☾
☐ Oui ☐ Non ☐ Ne sait pas

***Q25. Si studio ('oui' à Q18), ne demander que 25b et 25c.***

**Q25.** Dans votre logement y a-t-il les pièces suivantes et, si oui, combien ? **F :**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| **a.** Chambre à coucher | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** Salle de bain avec baignoire | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** Salle de bain avec seulement douche | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q26.** ***Si seul(e) :*** En moyenne, combien de bains prenez-vous par semaine ?
***Si avec d'autres personnes*** **:** En moyenne, combien de bains sont pris par semaine par l'ensemble des membres du ménage ? **F :**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q27.** ***Si seul(e)*** **:** En moyenne, combien prenez-vous de douches par semaine ?
***Si avec d'autres personnes*** **:** En moyenne, combien de douches sont prises par semaine par l'ensemble des membres du ménage ? **F :**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q28.** Pour chauffer principalement votre logement, avez-vous …

☐ Une installation de chauffage central ➔ **Q29**
☐ Un autre moyen de chauffage ➔ **Q30**
☐ Ne sait pas ➔ **Q31**

**Q29.** Cette installation est-elle … ☐ Individuelle ➔ **Q31**
☐ Commune ➔ **Q31**

**Q30.** Précisez, quel est votre moyen de chauffage principal. ***(Laisser le répondant citer spontanément)***

☐ Feu ouvert
☐ Poêle
☐ Convecteur
☐ Radiateur électrique
☐ Autre, précisez : ……

**Q31.** Quelle énergie ou quel combustible est principalement utilisé pour votre installation de chauffage ? ***(Laisser le répondant citer spontanément)***

☐ Gasoil, mazout
☐ Electricité
☐ Gaz de distribution (gaz naturel)
☐ Gaz butane, propane
☐ Charbon
☐ Bois
☐ Pompe à chaleur
☐ Autre source d'énergie, précisez : ……
☐ Ne sait pas

**Q32.** Avez-vous bien une chaudière individuelle ?

☐ Oui ☐ Non ➔ **Q35** ☐ Ne sait pas ➔ **Q35**

**Q33.** La trouvez-vous…

☐ Très récente ☐ Récente ☐ Vieille
☐ Très vieille ☐ Ni l'un ni l'autre

**Q34.** Quel âge a-t-elle ?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Ne sait pas ☐

**Q35.** Avez-vous la possibilité d'éteindre votre installation de chauffage ou de réguler la température ?

☐ Oui ☐ Non ➔ **Q36c puis Q40** ☐ Ne sait pas

**Q36.** Votre système de chauffage est-il relié...

| | Oui | Non | Ne sait pas |
|---|---|---|---|
| **a.** A une sonde extérieure | ☐ | ☐ | ☐ |
| **b.** A un thermostat | ☐ | ☐ | ☐ |
| **c.** A des radiateurs | ☐ | ☐ ➔ **Q38** | ☐ |
| **d.** A des vannes thermostatiques | ☐ | ☐ ➔ **Q38** | ☐ |

***Q37-39. Si a la possibilité d'éteindre l'installation de chauffage ou de réguler la température ('oui' ou 'ne sait pas' à Q35). Sinon ➔ Q40.*** **F :**

**Q37.** Avez-vous des vannes thermostatiques sur…

☐ Certains radiateurs ☐ Tous les radiateurs

**Q38.** En hiver, quand votre logement est inoccupé pour plusieurs heures, diminuez-vous la température ?

☐ Oui ☐ Non ☐ Ne sait pas

**Q39.** ***Si studio :*** En hiver, pendant la nuit, diminuez-vous la température de votre logement ?
***Si autre type de logement :*** En hiver, pendant la nuit, diminuez-vous la température de votre pièce de séjour ? **F :**

☐ Oui ☐ Non ☐ Ne sait pas

**Q40.** ***Si studio :*** En hiver, pendant la journée, quelle est la température de votre logement lorsque vous êtes chez vous ? ***(Laisser le répondant citer spontanément)*** **F :**
***Si autre type de logement :*** En hiver, pendant la journée, quelle est la température de votre pièce de séjour lorsque vous êtes chez vous ? ***(Laisser le répondant citer spontanément)***

☐ Moins de 18°C ☐ 18-19°C ☐ 20°C
☐ 21-22°C ☐ Plus de 22°C ☐ Ne sait pas

**Q41.** ***Si studio :*** En hiver, pendant le nuit, quelle température avez-vous habituellement dans votre logement lorsque vous êtes chez vous ? ***(Laisser le répondant citer spontanément)***
***Si autre type de logement :*** En hiver, pendant la nuit, quelle température avez-voushabituellement dans votre chambre à coucher lorsque vous êtes chez vous ? ***(Laisser le répondant citer spontanément)*** **F :**

☐ Moins de 14°C ☐ 14-15°C ☐ 16°C
☐ 17-18°C ☐ Plus de 18°C ☐ Ne sait pas

**Q42.** Le logement est-il équipé de double vitrage ?

☐ Oui ☐ Non ➔ **Q44** ☐ Ne sait pas

**Q43.** Est-ce partiellement ou complètement ?

☐ Partiellement ☐ Complètement

***Q45. Si a la possibilité d'éteindre l'installation de chauffage ou de réguler la température ('oui' à Q35). Sinon ➔ Q46.*** **F :**

**Q45.** En hiver, lorsque vous aérez une pièce, fermez-vous le chauffage dans cette pièce ?

☐ Oui ☐ Non ☐ Ne sait pas

**Q46.** Voici maintenant quelques questions sur vos appareils électriques.
***Si seul(e)*** **:** Pouvez-vous me dire si vous possédez **et** utilisez les appareils suivants et, si oui, leur nombre. **F :**

***Si avec d'autres personnes*** **:** Pouvez-vous me dire si vous ou un membre de votre ménage possédez **et** utilisez les appareils suivants et, si oui, leur nombre.

| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **a.** réfrigérateur **1.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** congélateur séparé **2.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** cuisinière | électrique | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | à gaz | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | combiné | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** lave-vaisselle **3.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **d.** lave-linge **4.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **e.** sèche-linge **5.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **f.** télévision **6.** | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **g.** magnétoscope/DVD | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **h.** ordinateur | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **i.** console de jeux vidéo | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **j.** ventilateur | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **k.** radiateur électrique d'appoint | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **l.** système d'air conditionné | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

***Q47-52. Si a au moins un des électroménagers suivants : réfrigérateur (Q46a), congélateur séparé (Q46b), lave-vaisselle (Q46d), lave-linge (Q46e), sèche-linge (Q46f). Sinon ➔ Q53.***
**F :**

**Q47.** Possédez-vous un ou plusieurs électroménagers de classe A ou B, c'est-à-dire économe en énergie ? ***(lave-linge, sèche-linge, réfrigérateur, congélateur, lave-vaisselle)***

☐ Oui ☐ Non ☐ Ne sait pas

***Q48. Si a un réfrigérateur ('oui' à Q46a). Sinon ➔ Q49.*** **F : 1.**

**Q48.** Quel est l'âge de votre réfrigérateur ***(celui que vous utilisez le plus)*** ?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Ne sait pas ☐

***Q49-50. Si a un lave-linge ('oui' à Q46e). Sinon ➔ Q51.*** **F : 4.**

***Q49. Si a un compteur bi-horaire ou tri-horaire ('oui' à Q24). Sinon ➔ Q50.*** **F :**

**Q49.** Utilisez vous votre lave-linge quand l'électricité est en tarif nuit ? Répondez par 'jamais', 'parfois', 'souvent' ou 'toujours'.

☐ Jamais ☐ Parfois ☐ Souvent ☐ Toujours ☐ Ne sait pas

Je vais maintenant vous poser des questions sur la fréquence d'utilisation de vos électroménagers.

**Q50.** À quelle fréquence utilisez-vous votre lave-linge ? ***(Laisser le répondant citer spontanément)***

- ☐ Plusieurs fois tous les jours
- ☐ Plusieurs fois par semaine
- ☐ Moins d'une fois par semaine
- ☐ Une fois par jour
- ☐ Une fois par semaine
- ☐ Ne sait pas

***Q51. Si a un sèche-linge ('oui' à Q46f). Sinon ➔ Q52.*** **F : 5.**

**Q51.** A quelle fréquence utilisez-vous votre sèche-linge ? ***(Laisser le répondant citer spontanément)***

- ☐ Plusieurs fois tous les jours
- ☐ Plusieurs fois par semaine
- ☐ Moins d'une fois par semaine
- ☐ Une fois par jour
- ☐ Une fois par semaine
- ☐ Ne sait pas

***Q52. Si a un lave-vaisselle ('oui' à Q46d). Sinon ➔ Q53.*** **F : 3.**

**Q52.** A quelle fréquence utilisez-vous votre lave-vaisselle ? ***(Laisser le répondant citer spontanément)***

- ☐ Plusieurs fois tous les jours
- ☐ Plusieurs fois par semaine
- ☐ Moins d'une fois par semaine
- ☐ Une fois par jour
- ☐ Une fois par semaine
- ☐ Ne sait pas

**Q53.** Lors d'achat de gros électroménagers, le fait qu'ils consomment peu d'énergie est-il un critère d'achat ?

☐ Oui ☐ Non

A présent, j'aimerais vous poser quelques questions sur la répartition des tâches ménagères entre hommes et femmes.

**Q54.** ***Si pas en couple ('non' à Q4)*** **:** Selon vous qui doit, dans un couple en général, s'occuper des tâches suivantes, l'homme, la femme, les deux ensemble, ou bien l'un ou l'autre indifféremment ?
***Si en couple ('oui' à Q4)*** **:** Selon vous qui doit, dans un couple en général et pas forcément le vôtre, s'occuper des tâches suivantes, l'homme, la femme, les deux ensemble, ou bien l'un ou l'autre indifféremment ? **F :**

| | Homme | Femme | Les 2 ensemble | L'un ou l'autre indifféremment |
|---|---|---|---|---|
| **a.** Décider de l'achat d'une télévision | ☐ | ☐ | ☐ | ☐ |
| **b.** Acheter une ampoule électrique | ☐ | ☐ | ☐ | ☐ |
| **c.** Acheter un réfrigérateur | ☐ | ☐ | ☐ | ☐ |
| **d.** Choisir une machine à laver | ☐ | ☐ | ☐ | ☐ |
| **e.** Gérer les dépenses du ménage | ☐ | ☐ | ☐ | ☐ |
| **f.** Prendre l'initiative de repeindre ou retapisser la pièce de séjour | ☐ | ☐ | ☐ | ☐ |
| **g.** Décider d'isoler la toiture | ☐ | ☐ | ☐ | ☐ |

**Q55.** ***Si pas en couple ('non' à Q4)*** **:** Trouvez-vous acceptables les situations suivantes dans un couple en général ? Répondez par 'tout à fait', 'plutôt oui', 'ni oui ni non', 'plutôt non' ou 'pas du tout'.
***Si en couple ('oui' à Q4)*** **:** Trouvez-vous acceptables les situations suivantes dans un couple en général et pas forcément le vôtre ? Répondez par 'tout à fait', 'plutôt oui', 'ni oui ni non', 'plutôt non' ou 'pas du tout'. **F :** 🚹 🚺

| | Tout à fait | Plutôt oui | Ni oui ni non | Plutôt non | Pas du tout |
|---|---|---|---|---|---|
| **a.** Que ce soit à l'homme de bricoler dans la maison ? | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** Trouvez-vous acceptable que le mari prenne l'initiative de faire tourner la machine à laver ? | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** Trouvez-vous acceptable que le mari dise à sa femme de s'organiser autrement pour les lessives ? | ☐ | ☐ | ☐ | ☐ | ☐ |
| **d.** Que la femme dise à son mari quels travaux il devrait faire dans la maison ? | ☐ | ☐ | ☐ | ☐ | ☐ |

***Q56a. Si a une télévision ('oui' à Q46g). Sinon ➔ Q56b.*** **F : 6.**📺

**Q56.** Aux prochaines questions, vous pourrez me répondre par 'jamais', 'parfois', 'souvent' ou 'toujours'.

| | Jamais | Parfois | Souvent | Toujours |
|---|---|---|---|---|
| **a.** Eteignez-vous la télévision seulement à partir de la télécommande... **F : 6.**📺 | ☐ | ☐ | ☐ | ☐ |
| **b.** Quand vous quittez une pièce pour 5 minutes, éteignez-vous la lumière ... | ☐ | ☐ | ☐ | ☐ |

**Q57.** Selon vous, une télévision éteinte à l'aide de la télécommande consomme-t-elle du courant ?

☐ Oui ☐ Non ☐ Ne sait pas

**Q58.** Selon-vous, quand on quitte, pour moins de 20 minutes, une pièce éclairée par une ampoule à basse consommation d'énergie, vaut-il mieux éteindre ou laisser allumé ?

☐ Eteindre ☐ Laisser allumé ☐ Ne sait pas

**Q59.** Avez-vous des ampoules à basse consommation d'énergie ?

☐ Oui ☐ Non ☐ Ne sait pas

**Q60.** Pensez-vous que, dans une vingtaine d'années, le climat de la Terre sera...

☐ Le même ☐ Plus chaud ☐ Plus froid ☐ Ne sait pas

**Q61.** Selon-vous, qu'est-ce qui pourrait modifier le climat ? Répondez par 'oui' ou par 'non' aux propositions suivantes :

| | Oui | Non |
|---|---|---|
| **a.** Le trafic automobile | ☐ | ☐ |
| **b.** La pollution des nappes d'eau souterraines | ☐ | ☐ |
| **c.** Le chauffage domestique | ☐ | ☐ |
| **d.** Les centrales nucléaires | ☐ | ☐ |
| **e.** La mise en décharge de produits dangereux | ☐ | ☐ |
| **f.** Les fumées rejetées par les usines | ☐ | ☐ |
| **g.** Le déboisement de la forêt amazonienne | ☐ | ☐ |

**Q62.** Dans la liste suivante, choisissez deux mots qui, pour vous, sont associés à l'environnement.

| | 1er mot | 2ème mot |
|---|---|---|
| Futur | ☐ | ☐ |
| Politique | ☐ | ☐ |
| Ecosystème | ☐ | ☐ |
| Santé | ☐ | ☐ |
| Campagne | ☐ | ☐ |
| Voisinage | ☐ | ☐ |

**Q63.** Quel est, selon vous, le principal responsable de la pollution de l'environnement ?

Les entreprises, à cause des fumées et des déchets ☐
La population, à cause des gaz de voiture et du chauffage domestique ☐

**Q63 bis.** Pensez-vous faire absolument tout pour économiser l'énergie ?

☐ Tout à fait ➔ **Q65** ☐ Plutôt oui ☐ Ni oui ni non ☐ Putôt non ☐ Pas du tout

***Q64c. Si 'locataire' (Q22). Sinon ➔ Q64d.*** **F :** 🗝

**Q64.** Je vais vous présenter plusieurs raisons qui empêchent certaines personnes de faire plus d'économies d'énergie. Pouvez-vous me dire si elles correspondent 'tout à fait', 'plutôt oui', 'ni oui ni non', 'plutôt non' ou 'pas du tout' à votre situation ?

| | Tout à fait | Plutôt oui | Ni oui ni non | Plutôt non | Pas du tout |
|---|---|---|---|---|---|
| **a.** Je ne sais pas ce qu'il faut faire | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** Ce n'est pas une de mes priorités | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** Je ne suis pas propriétaire **F :** 🗝 | ☐ | ☐ | ☐ | ☐ | ☐ |
| **d.** Ce n'est pas utile | ☐ | ☐ | ☐ | ☐ | ☐ |
| **e.** Ce serait une goutte d'eau dans la mer | ☐ | ☐ | ☐ | ☐ | ☐ |
| **f.** Ça demande trop d'efforts | ☐ | ☐ | ☐ | ☐ | ☐ |
| **g.** Je ne veux pas perdre en confort | ☐ | ☐ | ☐ | ☐ | ☐ |
| **h.** Je n'en ai pas les moyens financiers | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q65.** Quelle est, ou serait, votre motivation principale pour économiser l'énergie ?

☐ Par éducation
☐ Pour des raisons économiques
☐ Par sens de la responsabilité collective
☐ Pour protéger l'environnement
☐ Pour éviter le gaspillage
☐ Par intérêt pour les nouvelles technologies
☐ ***N'en a pas***

***Q66c. Si possède un sèche-linge ('oui' à Q46f). Sinon ➔ Q66d.*** **F : 5.**

**Q66.** Seriez-vous d'accord de réaliser ces différentes actions afin de consommer moins d'énergie ? Répondez par 'je le fais déjà', 'tout à fait', 'plutôt oui', 'ni oui ni non', 'plutôt non' ou 'pas du tout'.

| | Je le fais déjà | Tout à fait | Plutôt oui | Ni oui ni non | Plutôt non | Pas du tout |
|---|---|---|---|---|---|---|
| **a.** Payer plus cher pour un appareil électroménager qui consomme moins | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** Diminuer d'un degré la température des pièces | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** Ne pas utiliser de sèche-linge électrique **F : 5.** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **d.** Installer un système de chauffage plus performant | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **e.** Utiliser des énergies renouvelables | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **f.** Installer **des ampoules / plus d'ampoules** économiques | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **g.** Améliorer l'isolation | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **h.** Installer des pommeaux de douche qui consomment moins d'eau | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q67.** Répondez aux questions suivantes par 'tout à fait', 'plutôt oui', 'ni oui ni non', 'plutôt non' ou 'pas du tout'. Selon vous, se préoccuper de l'environnement est …

| | Tout à fait | Plutôt oui | Ni oui ni non | Plutôt non | Pas du tout |
|---|---|---|---|---|---|
| **a.** Urgent sinon on risque de courir à la catastrophe | ☐ | ☐ | ☐ | ☐ | ☐ |
| **b.** Un phénomène de mode | ☐ | ☐ | ☐ | ☐ | ☐ |
| **c.** Quelque chose dont il faut commencer à tenir compte | ☐ | ☐ | ☐ | ☐ | ☐ |

**Q68.** D'après vous, les actions en vue de réduire la consommation d'énergie, doivent-elles être principalement menées…

- ☐ Au sein de chaque foyer
- ☐ Par des groupes locaux (quartier, commune, école, mouvement de jeunesse, etc. …)
- ☐ Par les autorités publiques
- ☐ Par les industriels

**Q69.** D'après vous, quelle est la principale solution pour réduire la consommation d'énergie ?

- ☐ La création de projets technologiques novateurs
- ☐ Des campagnes d'information et de sensibilisation des ménages
- ☐ L'amélioration des systèmes de production industrielle
- ☐ L'augmentation du prix des énergies

**Q70.** Connaissez-vous des énergies renouvelables ?

☐ Oui ☐ Non

| **Q71.** Connaissez-vous … | Oui | Non |
|---|---|---|
| **a.** L'énergie solaire | ☐ | ☐ |
| **b.** Le solaire photovoltaïque | ☐ | ☐ |
| **c.** Le solaire thermique | ☐ | ☐ |
| **d.** Les éoliennes | ☐ | ☐ |
| **e.** La biomasse | ☐ | ☐ |

**Q72.** Savez-vous ce qu'est un audit énergétique ?

☐ Oui ☐ Non

*Un audit énergétique consiste à évaluer la situation énergétique d'un logement pour l'installation de chauffage, les murs extérieurs, le toit et le sol, ainsi que pour l'eau chaude. Il en ressort des conseils pour améliorer les systèmes d'eau chaude et de chauffage ainsi que l'isolation afin de réduire la consommation d'énergie du bâtiment.*

**Q73.** Quel prix accepteriez-vous de payer pour un tel audit énergétique ? ***(si « devrait être gratuit », marquer « 0 € »)***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

☐ € ☐ FB

☐ N'est pas du tout intéressé ☐ Ne sait pas

**Q74.** Avez-vous entendu parler de mesures fiscales prises par les autorités pour aider les gens à diminuer leur consommation d'énergie ?

☐ Oui ☐ Non

| **Q75.** Dites-moi si, oui ou non, vous connaissez … | Oui | Non |
|---|---|---|
| **a.** Des primes | ☐ | ☐ |
| **b.** Des réduction d'impôts / déductions fiscales | ☐ | ☐ |

| **Electricité** F : ☾ ☼ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Facture :** ☐ **Mensuelle** ☐ **Bisannuelle** ☐ **Annuelle** | | | | | | | | | | | |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **Consommation en kWh Jour** | Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | | | | | | | | | | | |
| **Consommation en kWh Nuit** | Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | | | | | | | | | | | |
| **Consommation en kWh Totale** | Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| **Gaz** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Facture :** ☐ **Mensuelle** ☐ **Bisannuelle** ☐ **Annuelle** | | | | | | | | | | | |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **Consommation Totale** | Dizaines de milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Milliers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Centaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Dizaines | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Unités | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ **m³** ☐ **kWh** | | | | | | | | | | | |

*Finalement, je souhaiterais vous poser quelques questions pour mieux connaître votre situation.*

**Q76.** Quel est le niveau du diplôme le plus élevé que vous avez obtenu ?

☐ Aucun diplôme ☐ Primaire ☐ Secondaire inférieur
☐ Secondaire supérieur ☐ Supérieur non universitaire ☐ Universitaire

**Q76 bis.** Etes-vous…

☐ Salarié(e) ou indépendant
☐ Demandeur d'emploi ➔ **Q78**
☐ Au foyer ➔ **Q79**
☐ Pré-pensionné(e) ou pensionné(e) ➔ **Q78**
☐ Etudiant(e) ➔ **Q79**
☐ Autre, précisez : .....➔ **Q78 ou Q79 selon la situation**

**Q77.** Votre emploi est-il… ***(Arrondir)***

☐ A temps plein ☐ A ¾ temps ☐ A ½ temps ☐ A ¼ temps

**Q78.** Quelle est ou a été votre profession ? ***(y compris pour les demandeurs d'emploi et pour les pré-pensionnés, pensionnés et militaires)***

☐ Agriculteurs (exploitants)
☐ Indépendants (sauf professions libérales), commerçants, chefs d'entreprise de moins de 10 salariés
☐ Cadres supérieurs, professions intellectuelles supérieures, professions libérales, chefs d'entreprises de plus de 10 salariés
☐ Cadres moyens, techniciens instituteurs, régents, infirmiers, assistants sociaux, clergé
☐ Employés
☐ Ouvriers (y compris ouvriers agricoles)
☐ Autres (artistes, demandeurs d'emplois n'ayant jamais travaillé, …)

+ Nom exact de la fonction : .....

***Q79-81. Si en couple ('oui' à Q4). Sinon ➔ Q82.*** **F :**

**Q79.** Quel est le niveau du diplôme le plus élevé que votre conjoint a obtenu ?

☐ Aucun diplôme ☐ Primaire ☐ Secondaire inférieur
☐ Secondaire supérieur ☐ Supérieur non universitaire ☐ Universitaire
☐ Ne sait pas

**Q79 bis.** Votre conjoint est-il…

☐ Salarié(e) ou indépendant
☐ Demandeur d'emploi ➔ **Q81**
☐ Au foyer ➔ **Q82**
☐ Pré-pensionné(e) ou pensionné(e) ➔ **Q81**
☐ Etudiant(e) ➔ **Q82**
☐ Ne sait pas ➔ **Q81**
☐ Autre, précisez : .....➔ **Q78 ou Q79 selon la situation**

**Q80.** Son emploi est-il … ***(arrondir)***

☐ A temps plein ☐ A ¾ temps ☐ A ½ temps ☐ A ¼ temps ☐ Ne sait pas

**Q81.** Quelle est ou a été sa profession ? ***(y compris pour les demandeurs d'emploi ainsi que pour les pré-pensionnés, pensionnés et militaires)***

☐ Agriculteurs (exploitants)

☐ Indépendants (sauf professions libérales), commerçants, chefs d'entreprise de moins de 10 salariés

☐ Cadres supérieurs, professions intellectuelles supérieures, professions libérales, chefs d'entreprises de plus de 10 salariés

☐ Cadres moyens, techniciens instituteurs, régents, infirmiers, assistants sociaux, clergé

☐ Employés

☐ Ouvriers (y compris ouvriers agricoles)

☐ Autres (artistes, demandeurs d'emplois n'ayant jamais travaillé, …)

☐ Ne sait pas

+ Nom exact de la fonction : .....

**Q82.** ***Si seul(e)*** **:** Pourriez-vous me dire si vos revenus mensuels nets totaux sont inférieurs ou supérieurs à 2 260 € / 90 400 FB ? **F :**

***Si avec d'autres personnes*** **:** Pourriez-vous me dire si les revenus mensuels nets totaux de votre ménage sont inférieurs ou supérieurs à 2 260 € / 90 400 FB ?

☐ Inférieurs ➔ **Q83** ☐ Supérieurs ➔ **Q84** ☐ Ne sait pas ➔ **fin** ☐ Refus ➔ **fin**

**Q83.** Sont-ils inférieurs ou supérieurs à 1 510 € / 60 400 FB ?

☐ Inférieurs ➔ **fin** ☐ Supérieurs ➔ **fin** ☐ Ne sait pas ➔ **fin** ☐ Refus ➔ **fin**

**Q84.** Sont-ils inférieurs ou supérieurs à 3 380 € / 135 200 FB ?

☐ Inférieurs ➔ **fin** ☐ Supérieurs ➔ **fin** ☐ Ne sait pas ➔ **fin** ☐ Refus ➔ **fin**

***Fin*** **:** Le questionnaire est terminé. Je vous remercie sincèrement pour votre collaboration et je vous souhaite une bonne **journée/soirée**.

## *16.6 Appendix 6: Example of a technical report for an electrical audit*

Note: in the following example, for anonymousness reason, the name and adres are fictitious.

Université catholique de Louvain

# PODO Serec project

## Energiecontrole woningen

**Woninggegevens :** **ID 17**

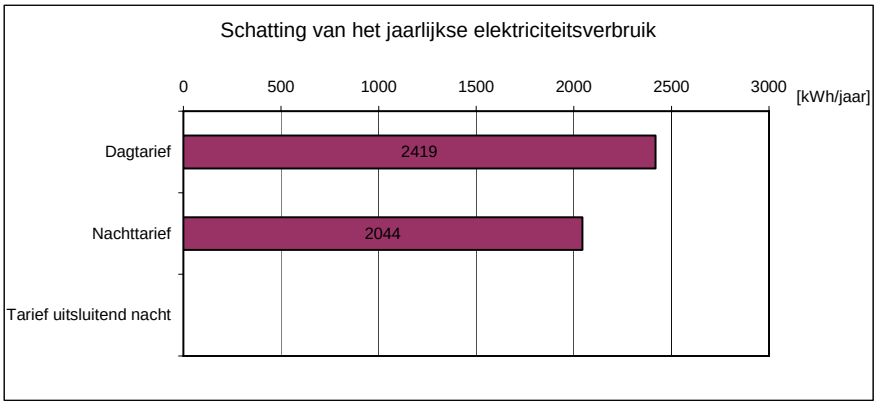
Dhr. J. Jansens
Beekstraat 1
1000 Brussel

## Elektrische Resultaten

Beste Deelnemer,

De volgende bladzijden geven een overzicht van uw elektriciteitsverbruik. Deze resultaten zijn gebaseerd op de metingen die gedurende de laatste maanden bij u thuis gebeurden. Deze resultaten werden herrekend naar een equivalent jaarverbruik.
Dit rapport is dan ook voor uw informatie. Het gaat hier om een voorlopige versie waarvan we hopen dat die interessant is voor u. De geciteerde getallen geven vooral een indicatie van de werkelijke verbruiken en mogelijke besparingen. Deze resultaten hebben echter geen juridische of administratieve waarde. VITO kan dan ook niet verantwoordelijk worden gesteld indien deze resultaten aanleiding zouden geven tot discussie of in een discussie gebruikt zouden worden.

De volgende resultaten zijn gebaseerd op het volgende totaalverbruik :



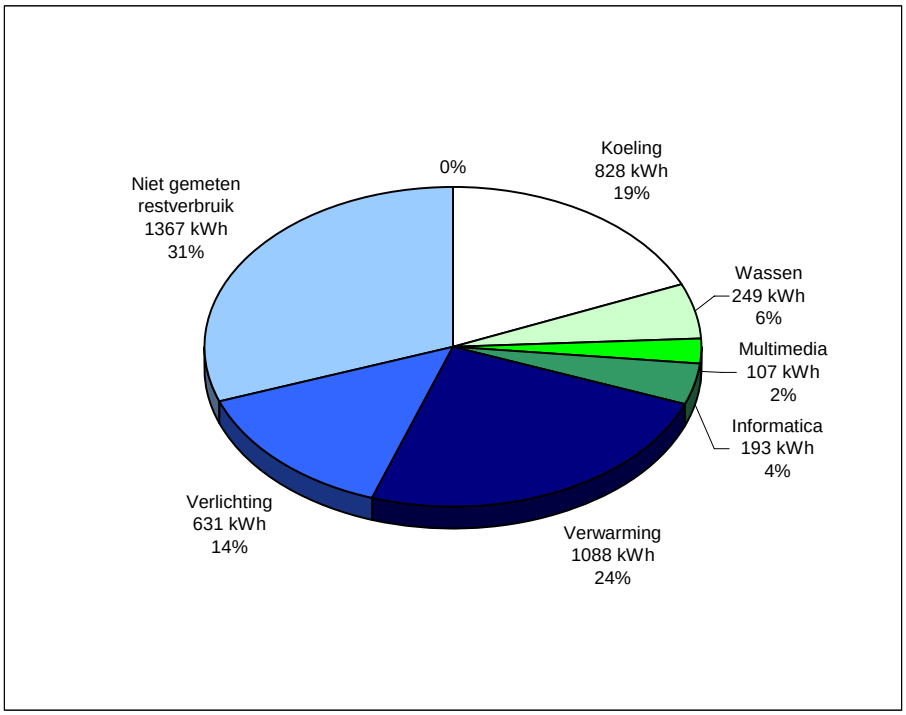

Normaal elektriciteitsverbruik voor een gezin van 2 personen
Rekening houdend met de elektrische boiler voor warm waterproductie.

Note: the name and adres are fictitious.

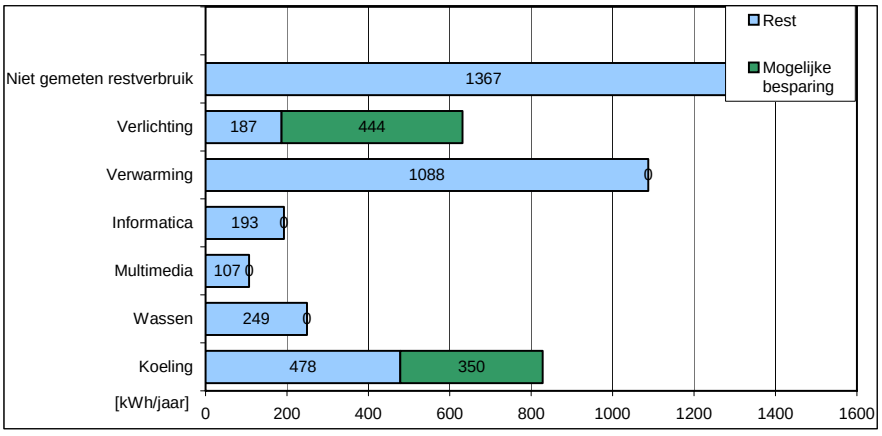
Elektrische Resultaten SEREC PODO - Project

Advies bestemd voor : Dhr. J. Jansens

## Resultaten : huidige verdeling van het Elektriciteitsverbruik




## Resultaten : Waar kan u besparen ?

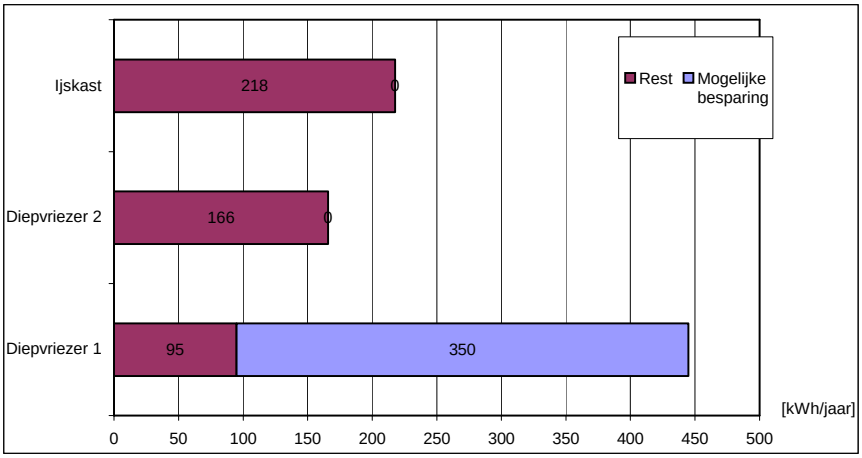


Elektrische Resultaten SEREC PODO - Project

Advies bestemd voor : Dhr. J. Jansens

**Koeling**

In totaal 828 kWh/jaar, dit is 18,6% van het totale verbruik




**Opmerkingen en mogelijke besparingen**

Elektriciteitsverbruiken voor ijskast en diepvriezer 2 blijken normaal te zijn.
Elektriciteitsverbruiken voor diepvriezer 1 (Zanussi) is hoog. Reden is geplaatst in een onverwarmde zone van de woning (= garage). Overschakelen op één diepvries indien mogelijk of indien toestel ouder dan 10 jaar is vervangen door een nieuw toestel met A+ of A label.

**Koel- en vriestips**

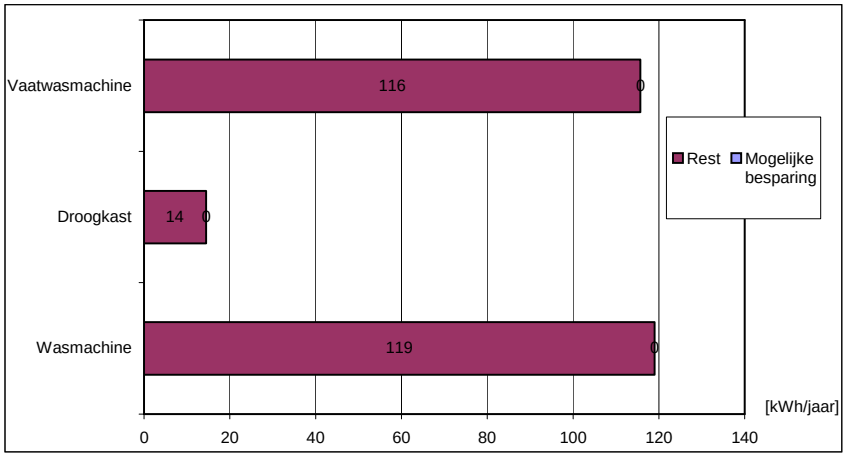
- Kies voor een toestel met A-label.
- Plaats de koelkast en diepvriezer bij voorkeur op een koele plek en zet uw koelkast ver van het fornuis, de verwarming en niet in de zon.
- Open de koelkast en diepvriezer zo kort mogelijk en zet er geen warme gerechten in.
- Kies een koelkast of diepvriezer, aangepast aan uw behoeften.
- Ontdooi uw diepvries regelmatig. Een rijmlaag van 2 mm is al verantwoordelijk voor een meerverbruik van ongeveer 10%.
- Beschikt u over een afzonderlijke diepvriezer, dan kunt u kiezen voor een koelkast zonder vriesvak. Deze toestellen zijn veel zuiniger.
- Een diepvrieskist is zuiniger dan een diepvrieskast.

Elektrische Resultaten SEREC PODO - Project

Advies bestemd voor : Dhr. J. Jansens

**Wassen**

In totaal 249 kWh/jaar, dit is 5,6% van het totale verbruik




**Opmerkingen en mogelijke besparingen**

Elektriciteitsverbruiken voor bovenstaande toestellen blijken normaal te zijn.

**Was-, droog- en strijktips**

- U laat beter één volle dan twee halfvolle machines draaien.
- Wassen op hoge temperatuur (60° -90°C) vraagt meer energie : gebruik dit alleen als het echt nodig is.
- Bij aankoop van een nieuw toestel let u best op het energielabel. Toestellen met een A-label zijn het meest energiezuinig.
- Laat uw linnen eerst goed zwieren, bij voorkeur op 1000 toeren/minuut of meer, voor u het in de wasdroger stopt. Zo bespaart u al snel 20 à 25% energie bij het drogen.
- Gebruik zo veel mogelijk de spaartoetsen op uw wasmachine.
- Extra energiezuinig is een wasmachine waarvan het warm water afkomstig is van een nabij geplaatst gasgestookt warmwatertoestel. Dat noemen we hot fill. De verwachting is dat de komende jaren steeds meer wasmachines worden gemaakt met een hot-fillsysteem.
- Droog de was zo veel mogelijk op een rek of aan een waslijn.
- Koop een wasmachine die aan een hoog toerental kan droogzwieren. De was moet dan minder lang in de wasdroger.
- Een gewone wasdroger met luchtafvoer verbruikt minder dan een condensatiewasdroger.
- Stop niet meer wasgoed in de wasdroger dan in de gebruiksaanwijzing aangegeven is.
- Stel de droogtijd zo juist mogelijk in.
- Strijk met stoom, want dat gaat sneller, vlotter en dus zuiniger.
- Gebruik een reflecterende strijkovertrek, want dat werkt energiebesparend

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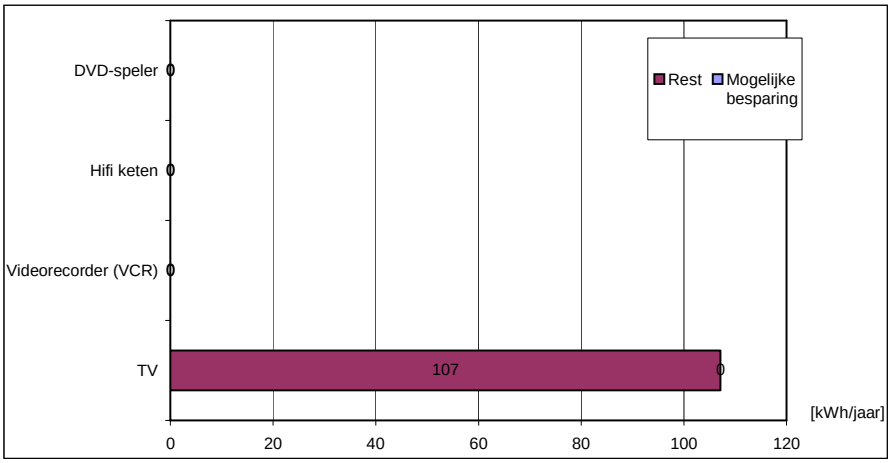
**Multimedia**

In totaal 107 kWh/jaar, dit is 2,4% van het totale verbruik




**Opmerkingen en mogelijke besparingen**

Elektriciteitsverbruiken voor bovenstaande toestellen blijken normaal te zijn.
Let op voor stand-by verbruik van Hifi keten en TV.

**Tips tegen sluipverbruik**

Sluipverbruik is het elektriciteitsverbuik van uw toestel wanneer dit niet gebruikt wordt. Sommige toestellen staan op ‘stand-by’, dwz, ze kunnen aangeschakeld worden met een enkele knop op de afstandsbediening (videorecorders, muziekinstallaties, DVD-spelers...) Andere toestellen gebruiken sowieso energie (adaptors voor computers en modems, dimmers voor gloeilampen, sommige transformators voor halogeenlampen...)
Er is aangetoond dat het verbruik op jaarbasis van vele toestellen hoger is door sluipverbruik dan door het eigenlijke verbruik terwijl het toestel aan staat. Het sluipverbruik maakt momenteel gemiddeld zo’n 10% uit van het jaarlijkse elektriciteitsverbruik van een gezin.

- Koop toestellen met een laag sluipverbruik.
- Schakel toestellen zo veel mogelijk volledig uit als u ze niet gebruikt (tv, video, hifi).
- Toestellen zonder ingebouwde netschakelaar kunt u aansluiten op een stopcontact met schakelaar.

Elektrische Resultaten SEREC PODO - Project

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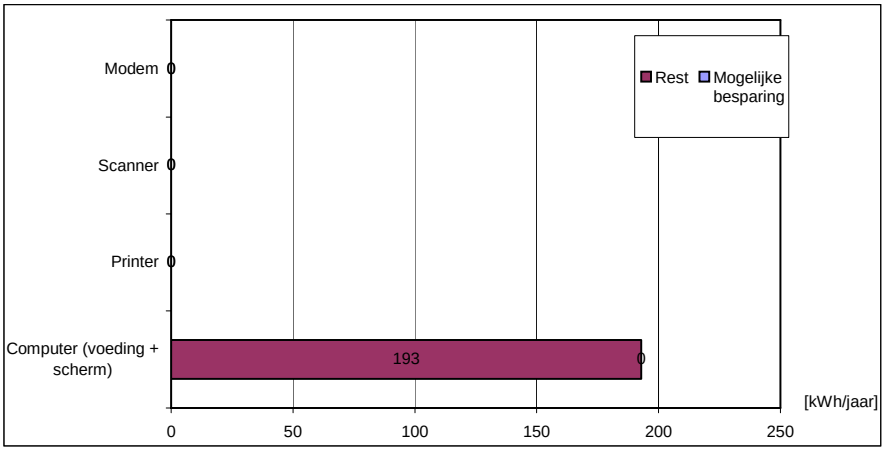
**Informatica**

In totaal 193 kWh/jaar, dit is 4,3% van het totale verbruik




**Opmerkingen en mogelijke besparingen**

Elektriciteitsverbruiken voor bovenstaande toestellen blijken normaal te zijn.
In verbruik computer zit tevens de modem en printer opgenomen.

**Tips tegen sluipverbruik**

Sluipverbruik is het elektriciteitsverbuik van uw toestel wanneer dit niet gebruikt wordt. Sommige toestellen staan op 'stand-by', dwz, ze kunnen aangeschakeld worden met een enkele knop op de afstandsbediening (videorecorders, muziekinstallaties, DVD-spelers...) Andere toestellen gebruiken sowieso energie (adaptors voor computers en modems, dimmers voor gloeilampen, sommige transformators voor halogeenlampen...)
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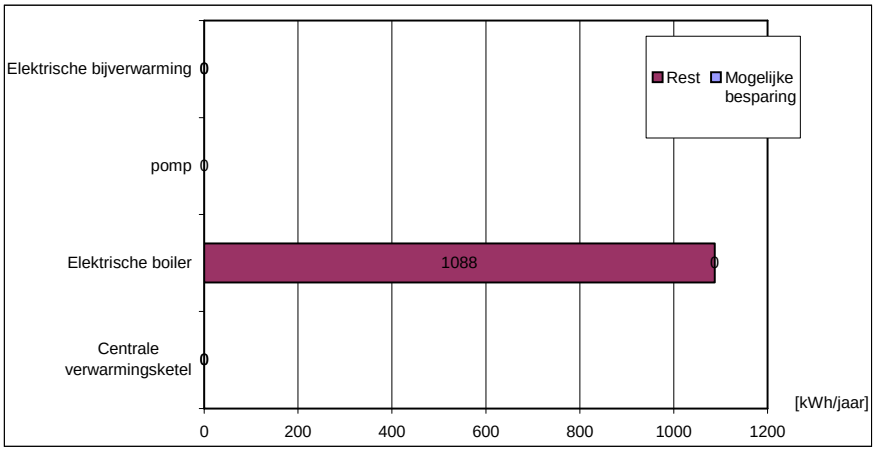
**Verwarming**

In totaal 1088 kWh/jaar, dit is 24,4% van het totale verbruik




**Opmerkingen en mogelijke besparingen**

Het elektriciteitsverbruik van de centrale verwarmingsketel werd niet opgemeten.
Dit verbruik zit in het restverbruik.

**Warm watertips**

- Warm water bereiden met aardgas verbruikt bijna de helft minder energie dan met elektriciteit.
- Douchen i.p.v. een bad nemen, verbruikt minder dan de helft water en energie.
- Een waterbesparende spaardouchekop verbruikt 40% minder water en energie dan een gewone douchekop, terwijl het comfort hetzelfde blijft.
- Laat het warme water alleen maar stromen als het echt nodig is en vang het op in de afgesloten wastafel of spoelbak in plaats van het zo maar te laten wegvloeien.
- Doorstroomtoestellen of geisers zijn energiezuiniger dan een boiler: het water wordt dan alleen opgewarmd op het ogenblik dat de warmwaterkraan wordt opengedraaid.
- De ideale temperatuur voor de afstelling van de boiler is 60 à 65°C.
- Let er ook op warmwatertoestellen dicht bij een aftappunt te plaatsen. Zo vermijdt u warmteverliezen in de warmwaterleidingen en krijgt u sneller warm water aan de kraan.

Elektrische Resultaten SEREC PODO - Project

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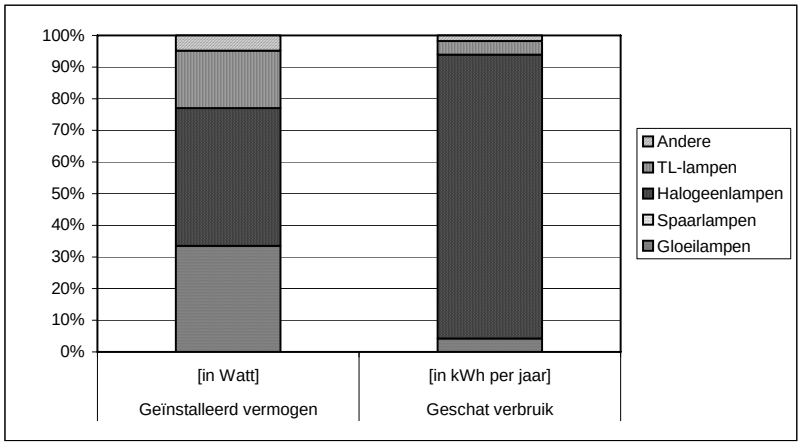
**Verlichting**

In totaal 631 kWh/jaar, dit is 14,1% van het totale verbruik




**Opmerkingen en mogelijke besparingen**

Het verlichtingsverbruik werd niet direct opgemeten en is een schatting op basis van het aantal branduren en het opgesteld elektrisch vermogen. Vervanging van gloeilampen door spaarlampen geeft een aanzienlijke besparing.

**Tips**

Gloeilampen produceren slechts voor 10% licht en voor 90% warmte. Ook normale halogeenspots verbruiken bijzonder veel energie voor de hoeveelheid licht die ze geven. Waar mogelijk worden ze het best vervangen door energiezuinige verlichting, bvb spaarlampen of TL-lampen.
Spaarlampen verbruiken 5 keer minder energie dan een gloeilamp en gaan 10 keer langer mee. De laatste jaren zijn spaarlampen veel goedkoper geworden in aanschaf. Ze zijn nu ook in meerdere vormen en kleuren verkrijgbaar, o.a. in peervorm of in vormen die aangepast zijn voor kroonluchters.

Elektrische Resultaten SEREC PODO - Project

Advies bestemd voor : Dhr. J. Jansens

**Niet opgemeten restverbruik**

| | | |
|---|---|---|
| In totaal | 1367 kWh/jaar, dit is | 30,6% van het totale verbruik |

**Verklaring**

Bij elk deelnemend gezin is een bijzonder wezenlijk deel van het verbruik niet opgemeten. Dit kan op het eerste gezicht vreemd lijken, maar in de praktijk blijkt dat er altijd een hele reeks niet-opgemeten apparaten zijn die samen ook een groot deel verbruiken.
Een eerste deel van dit verbruik wordt gevormd door alle apparaten die niet opgemeten konden worden. Deze zijn bijvoorbeeld ingebouwde koelkasten of andere apparaten waarvan het stopcontact niet toegankelijk is. Andere verbruikers zijn vaak apparaten die niet via een stopcontact aangesloten zijn, maar rechtstreekse verbonden zijn. Bijvoorbeeld accumulatieverwarming of vaatwasmachines en kookvuren zijn vaak in dit geval.
Verder zijn er nog een lange lijst apparaten die occasioneel gebruikt worden, zoals scheermachines, haardrogers, boormachines, grasmaaiers, en alle mogelijke elektrische toestellen op zich slechts een klein verbruik hebben, maar die samen een groot deel uitmaken.

Tenslotte kan ook dit restverbruik bepaald worden door de verlichting. In deze fiches staat er een apart deel over verlichting, en de gegevens zijn hierin gebaseerd op de geïnstalleerde vermogens en op het aangegeven gebruik. Het is echter heel moeilijk om het echte gebruik correct te schatten. Indien u dus vaker de verlichting gebruikt dan oorspronkelijk was geschat, dan is het gedeelte in het onderdeel verlichting een onderschatting van het werkelijke verbruik. De rest zit dan bij het niet-opgemeten deel.