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GENERAL DIRECTORATE OF STATISTICAL SURVEYS

DIVISION OF POPULATION AND

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HOUSEHOLDS' SURVEYS UNIT

Development of detailed statistics on Energy consumption in Households-2011/2012

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Quality Report

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INTRODUCTION

The **"Development of detailed statistics on Energy consumption in Households (SECH)"** is part of a broader community statistical program in which Member States of the European Union participate. The name of the survey is "Survey on the energy consumption in households - SECH". The **SECH** aims to study and provide valuable information as regards the household energy consumption.

Specifically, the survey collects data on the type of final energy (heating / cooling, lighting, cooking, hot water, appliances) and the sources of energy (liquid and solid fuels, electricity, renewable sources) used from the households, compared with demographic and economic characteristics.

The data collected would assist to asses the final energy consumption per type of end-use of the Greek households as well as the penetration of the energy saving and the renewable energy technologies.

SECH belongs to above program and *is* a sequence of the pilot survey took place during July 2011 in a sample of 100 households within ELSTAT's personel. More specifically in 51 households in the Prefecture or Attiki and 49 from other capitals of the country where regional offices exist.

This document provides general and methodological information, basic concepts and definitions used and a general description of questionnaires used both in the pilot and in the main survey.

The report is divided in six chapters:
➢   General information
➢   Methological information
➢   Comparability
➢   Questionnaire – other survey documents
➢   Overview of the main conclusions and recommendations
➢   Annexes

GENERAL INFORMATION

1.1. Legal basis

The Survey on the energy consumption in households is conducted upon the decision of Ministry of Economy and on the basis of the contract with the joint endorsement of Commission (Eurostat) and the Hellenic Statistical Authority (ELSTAT).

1.2. Scope of the collected information

The exercise of the data collection of the final energy consumption in households will provide valuable information in energy consumption profiles, energy efficiency and energy saving estimations, as well as the renewable energy technologies penetration in the housing sector.

The expected outcomes of the survey will provide detailed energy data both on a qualitative and quantitative basis, i.e. focusing not only on data concerning the energy consumption of households (in uses such as heating, DHW, cooking, cooling, etc., and types of systems) but also potential energy efficiency interventions and behavioral aspects.

The analysis of provided data of the survey, will contribute to monitor the improvement of energy efficiency, to assess the level of implementation of measures and policies, to establish an updated stock of energy related products, especially for the use of domestic RES systems both for electricity and heat production, at the household sector and to identify specific profiles of use for heating and electricity at the domestic sector. Furthermore, it will be utilized to evaluate the effectiveness of the implemented measures for the increase of energy efficiency in the end-use sectors, in this case the household sector, taking into consideration the achieved savings, as well as other behavioural aspects.

The expected outcomes of the project will assist to the establishment of an updated energy profile and stock of products at the household sector, as well as to the more demanding measurement of the achieved energy savings at end-use. The analysis of the project's results will contribute significantly to the monitoring procedure of the progress towards the indicative national energy saving target for 2016 (as set by L.3855/10, which transposed Directive 2006/32/EC) and the binding national RES targets for 2020 (as set by L.3851/10, in accordance with Directive 2009/28/EC).

1.3. Coverage

The survey covers a sample of 3.643 private households within the country. The sample covers all the households at national level, regardless of their size or any other financial or social traits of them.

Excluded are:

- Collective households (e.g. hotels, pensions, hospitals, military camps, approved schools, etc.). Households having five lodgers or more are considered as collective households.
- Households having as their members foreign citizens serving in foreign diplomatic missions.

The survey is being done simultaneously and in the same households with the Household Budget Survey of the time period October 2011 – June 2012. By exception and because of the fact that HBS's sample is rotating, the Survey on the energy consumption in households during the time period July – September 2012 will be conducted separately. The sample of the SECH for the pre-mentioned period consisted of that of the HBS for January – March 2011.

1.4. Period and mode of data collection

Data collection started since October 2011 and ended in the 31rst September 2012, that is for the time period of twelve months. The primary mode of data collection in the interview is the face-to-face interview with paper assistance (PAPI). After the survey conduct the data entry of the collected questionnaires is being done in electronic questionnaires.

1.5. Organization of the survey

1.5.1. Coordination of the project

The coordination -monitoring and evaluation of the survey, data checking and data analysis, reporting- of the whole project is centralized, and being done from the Hellenic Statistical Authority and more specifically from the Household surveys' Unit in charge.

Due to limited human resources, the ELSTAT is obliged to use except for the permanent staff and external staff as interviewers. The interviewers are external and permanent staff of our service, experienced with other household surveys.

Because of the specialized topic of the survey, experts from the Centre for Renewable Energy Sources and Saving (CRES) cooperate with the staff in charge (in the phases of the questionnaire design, the training of the interviewers, the analysis of the results, etc.).

1.5.2. Source of the external collaborators - interviewers

As pre-menitoned due to limited human resources, the ELSTAT is obliged to use external collaborators as interviewers.

The ELSTAT maintains a register of persons that collect data via interview (interviewers) for most of the surveys. The procedure for applying to the register is electronic and open to the public. Every year there is an advertisement in the press for the submission of applications. The Unit responsible for the conduct of a survey chooses from this register the number of persons required. The criteria for the selection are:

1. The overall assessment of the quality of the interviewer on the basis of his /her work in the past. For the ELSTAT the interviewers selected were already involved in interviewing in other household social surveys.
2. The qualifications (studies, experience etc) of the interviewers.
3. The personality of the interviewers.

It was our intention to use interviewers with studies in engineering, however those were very limited in the registers.

The interviewers of the HBS are women aged 40+, so are the interviewers of the SECH survey.

1.5.3. Interviewer training

The training was done from the CRES technical experts and from staff of the Unit responsible for the survey, experienced also in other household surveys as well as in training.

Two training courses took place in Athens, in the central service, each one lasting for one day. The interviewers were given analytical guidelines both on concepts/definitions used as well as on the ways of survey conduct (call backs, treatment of denials/ temporary absenses, etc.).
Written guidelines were also provided concerning the data entry in the electronic questionnaires.

1.6. Data entry and data management

Data entry was done in the regional offices, as well as in the central service, from the permanent or the external staff. In cases where difficulties were met with the data entry the questionnaires were sent in the Central Office (Athens) and were entried from the Informatics Division. Software used is ORACLE based forms for the electronic questionnaires and ACCESS for the data processing.

Data entry procedure was completed approximately two months after the end of the data collection.

METHODOLOGICAL INFORMATION

2.1. Sample design
2.1.1. Target population

The surveyed units are the private households. The total target population size accounts to 4.166.567 private households according to data from the EU-SILC with reference period the year 2010.

 2.2. Sampling frame

The sampling technique that was applied in this survey was the multi-stage stratified area sampling. The primary units are the areas (one or more unified city blocks) and the ultimate sampling units selected in each sampling area are the households.

The sampling frame of the primary units was based on the data from the general population census of the year 2001.

The sampling frame containing the secondary units (households) in the selected sampling primary units is a list of households *updated* before the selection of households.

2.3. Sampling method

The multi-stage stratified sampling method was applied with stratification variables the (a) Region (NUTS 2) and (b) the degree of the urbanization

In each Region (NUTS 2), the stratification of primary units was conducted by allocating the Municipalities and Communes according to the degree of urbanization (urban, semi-urban, and rural regions). Except for the two Major City Agglomerations (Athens and Thessaloniki) the produced strata according to the degree of urbanization are:

Urban	Stratum	1	Municipal Communities with 10.000 inhabitants or more
Semi-urban	"	2	Municipal and Local Communities with 2.000 to 9.999 inhabitants
Rural	"	3	Local Communities up to 1.999 inhabitants

The Greater Athens Area was divided into 31 strata of about equal size (equal number of households) on the basis of the lists of city blocks of the Municipalities that constitute it and taking into consideration socio-economic criteria. Similarly, the Greater Thessaloniki Area was divided into 9 equally sized strata. The two Major City Agglomerations account for 40% of total population and for even larger percentages in certain socio-economic variables.

The total number of strata is equal to 79.

2.3.1. Sample size

The initial sample size is 3.643 households (sampling fraction $\cong 0,085\%$). This fraction was, approximately, the same in each Region. The Regions (NUTS 2) in Greece are 13 in number. However, throughout this survey the 2nd Region (Central Macedonia) was considered without the former Greater Thessaloniki and the 9th Region (Attiki) without the former Greater Athens area, while either of these two major agglomerations were treated as geographical regions.

2.3.2. Sample selection schemes

1st stage of sampling

In this stage, from any ultimate stratum (crossing of Region with the degree of urbanization), say stratum h, n_h primary units are drawn, where the number n_h of draws is approximately proportional to the population size X_h of the stratum (number of households according to the general population census of the year 2001).

Each area unit (primary unit) of stratum h has a selection probability proportional to its size. So, if X_{hi} is the number of households (according to the 2001 population census) of the unit of order i in the sample of stratum h, then the inclusion selection probability of the unit i is:

$$P_{hi} = \frac{X_{hi}}{n_h \cdot X_h} \quad (1)$$

The total number of primary sampling units is $n = \sum_{h=1}^{79} n_h = 612$ areas.

2nd stage of sampling

In this stage from each primary sampling unit (selected area) the sample of ultimate units (households) is selected. Actually, in the second stage we draw a sample of dwellings. However, in most cases, there is one to one correspondence between household and dwelling. If the selected dwelling consists of one or more households then all of them are interviewed.

Let M_{hi} is the number of households during the survey period in the selected area i of stratum h. Out of them a systematic sample of m_{hi} households is selected with equal probabilities. Each of m_{hi} households has the same chance to be included in the survey, equal to: $\dfrac{m_{hi}}{M_{hi}}$

The sample size m_{hi} is determined as follows: The total number of households to be interviewed from the n_h selected primary sampling units of stratum h is:

$$m_h = \sum_{i=1}^{n_h} m_{hi} \quad (2)$$

In repeated sampling, the numerator of this fraction will vary from sample to sample; more precisely, the fraction $\dfrac{m_h}{M_h}$ is a random variable. Within each primary sampling unit the calculation of the sampling interval $\delta_{hi} = \dfrac{M_{hi}}{m_{hi}}$ is carried out, so that the following two desired conditions are satisfied.

a. The expected value of $\dfrac{m_h}{M_h}$ is the predetermined over sampling fraction $\dfrac{1}{\lambda}$ in each Region (NUTS 2): $E\left(\dfrac{m_h}{M_h}\right) = \dfrac{1}{\lambda} \cong 0{,}085\%$

b. The estimator of the total Y_h (for any characteristic y) in stratum h should be self-weighting. In other words, the calculated estimator is the result derived from the sum of the values of the characteristic y over the m_h sample households by the overall raising factor λ, which is the same in each Region.

The conditions (a) and (b) are satisfied when:

$$\frac{1}{n_h} \cdot \frac{1}{P_{hi}} \cdot \frac{M_{hi}}{m_{hi}} = \lambda \ \Rightarrow$$

$$\frac{1}{n_h} \cdot \frac{1}{P_{hi}} \cdot \delta_{hi} = \lambda \ \Rightarrow$$

$$\delta_{hi} = \frac{M_{hi}}{m_{hi}} = \lambda \cdot n_h \cdot P_{hi} \quad (4)$$

2.4. Substitution of sampling households

- Dwellings being substituted

Main dwellings being occupied were substituted if the cooperation with the household became impossible due to any of the following reasons:

a) Incapacity of the interviewee

b) Refusal

c) Temporary absence

d) Other reasons

Dwellings with which contact was not possible due to objective incapacity (ill, deaf-mute, etc.) or due to temporary absence were substituted. In the cases of refusal any possible effort was made in order to persuade the household to cooperate. In case the interviewers did not succeed the dwelling was substituted. Finally in the cases of temporary absence the interviewee was consulted to visit the households at least three times.

- Dwellings not being substituted

The dwellings that have been selected for the survey and have not been substituted, are:

a) Empty dwellings

b) Secondary or country dwellings, whether occupied or not

c) Dwellings with members persons in diplomatic missions (e.g. ambassadors, other countries' armed forces personnel, etc.)

- Way of substitution

The substitution of households not co-operating was as less arbitrary as possible. The interviewees were instructed to substitute, whenever possible, the non-responding households with other having similar basic characteristics, e.g. similar synthesis, same type of ownership, same household's head profession. That is, each non-responding household was substituted with the next household, from the list, having, as much as possible, similar characteristics, except for the last household in the list.

2.5. Non-response rates

Totally, 256 households have not been interviewed. More specifically:

- 99 households have not been interviewed and have not been substituted, as the survey was never conducted. These cases mainly concern islands with limited interviewers and staff, and a few cases that an interviewer undertook the job and never returned it done.

- 157 households have not been interviewed due to :

- being ineligible to provide data as not having stayed in the dwelling at least 3 winter and at least 3 summer months (23 households)
- refusal, incapacity of the interviewee or temporary absence of the whole household (134 households).

2.6 Grossing-up procedures

2.6.1. Grossing-up procedure for households

Let w_{hij} (>0) stand for the survey weight attached to the sample ultimate element (household) of order j ($j = 1,...,m_{hi}$), belonging to the selected cluster of order i, belonging to the stratum h. The w_{hij} is the product of three factors: a) the inversion of the inclusion probabilities of the ultimate sampling units, b) the inversion of the response rate r_h in the stratum h and c) a factor t_{hij}, which makes weighted sample estimates to conform to external total values (values from known totals from censuses, administrative sources, population projections etc). The weight w_{hij} is defined as follows:

$$w_{hij} = p_{hij}^{-1} \cdot r_h^{-1} \cdot t_{hij}$$

where:

p_{hij} : Inclusion probability of the hij ultimate unit

r_h :   Response rate of the ultimate units in the stratum h

t_{hij} : Factor that adjusts the total of households and individuals to external data

2.6.2. *Inclusion probabilities of households*

A two-stage sampling scheme was applied, according to which in the final strata the clusters were selected with probabilities proportional to their sizes and within the selected clusters the ultimate units were selected with equal probabilities. Then the inclusion probabilities of households are defined, as follows:

$$p_{hij} = n_h \cdot P_{hi} \cdot \frac{m_{hi}}{M_{hi}} \Rightarrow p_{hij}^{-1} = \frac{1}{n_h} \cdot \frac{1}{P_{hi}} \cdot \frac{M_{hi}}{m_{hi}}$$

where:

$P_{hi} = \dfrac{X_{hi}}{X_h}$: Selection probability of the hi cluster

X_{hi} : The number of households that belong to the hi cluster, according to the population census of 2001

X_h : The number of households that belong to the h stratum, according to the population census of 2001

M_{hi} : The number of households that are recorded in the <u>updated</u> sampling frame of the hi cluster

m_{hi} : The initial sample size of households that was selected from the M_{hi} units of the hi cluster

2.6.3. *Non-response adjustments*

Within each final stratum non-response adjustment of the responding households was carried out by the inverse of the response rate, so as to make up for non-responding cases in that stratum.

2.6.4. *Adjustment to external data*

The adjustment to external data was conducted, which involves the calibration of the household weights in conjunction with external sources. It enables the distribution of auxiliary variables at both household and individual level to coincide with the corresponding population distribution of the external data. The auxiliary variables used at household level are the household size and at individual level the gender and age (five years age groups).

By applying calibration: a) the estimated households by size conform to the number of households of the reference period resulting from the projection of the trend observed between the population censuses of 1991 and 2001 and b) the estimated population by gender and age conforms to the population projections for the reference period. These projections come from vital statistics (population census, births, deaths, migration).

2.6.5. **Estimation of the survey characteristics**

Let w_{hijk} (>0) stand for the survey weight attached to the sample individual k ($k = 1$, as one individual is surveyed, in each sampling household) belonging to the sampling household of order j ($j = 1,...,m_{hi}$), belonging to the selected cluster of order i, of the stratum h.

Let y_{hijk} be the value of the characteristic y of the ultimate unit (individual) of the household of order j, belonging to the hi primary sampling unit (cluster). Moreover, Y stands for the total population characteristic, which is derived by adding the characteristic y of all ultimate units included in all strata h. The form of the estimator on the basis of the two-stage design is:

$$\widehat{Y} = \sum_{h=1}^{H}\sum_{i=1}^{n_h}\sum_{j=1}^{m_{hi}} w_{hijk} \cdot y_{hijk}$$

2.6.6. Estimation of a ratio

Let x_{hijk} be the value of the characteristic x of the ultimate unit of the household of order j, belonging to the hi primary sampling unit (cluster). Moreover, X stands for the total population characteristics, which is derived by adding the characteristic x of all ultimate units included in all strata h. The form of the estimator $\widehat{R}$ on the basis of the two-stage design is:

$$\widehat{R} = \frac{\widehat{Y}}{\widehat{X}} = \frac{\sum_{h=1}^{H}\sum_{i=1}^{n_h}\sum_{j=1}^{m_{hi}} w_{hijk} \cdot y_{hijk}}{\sum_{h=1}^{H}\sum_{i=1}^{n_h}\sum_{j=1}^{m_{hi}} w_{hijk} \cdot x_{hijk}}$$

2.6.7. Variance estimation

In order to calculate the variance of the estimated characteristics, the following steps should be followed:

a) For every selected primary sampling unit (cluster) i of the stratum h, we calculate the quantity T_{hi} using the following formula:

$$T_{hi} = n_h \cdot \sum_{j=1}^{m_{hi}} w_{hijk} \cdot y_{hijk}$$ Since T_{hi} has been calculated for every primary sampling unit

(cluster) i ($i = 1,...,n_h$) of the stratum h, then $V(\widehat{Y})$ is calculated as:

$$V(\widehat{Y}) = \sum_{h=1}^{H} \frac{1}{n_h \cdot (n_h - 1)} \cdot \left[\sum_{i=1}^{n_h} T_{hi}^2 - \frac{\left(\sum_{i=1}^{n_h} T_{hi}\right)^2}{n_h} \right]$$

For the estimation of the variance and the coefficient of variation of a ratio $R = \dfrac{\widehat{Y}}{\widehat{X}}$ additional steps should be followed, below:

a) For every selected primary sampling unit (cluster) i of the stratum h, we calculate the quantity F_{hi} using the following formula:

$$F_{hi} = n_h \cdot \sum_{j=1}^{m_{hi}} w_{hijk} \cdot x_{hijk}$$ Since T_{hi} and F_{hi} have been calculated for every primary

sampling unit (cluster) i ($i = 1,2,...,n_h$) of the stratum h, then $V(\widehat{X})$ is calculated as:

$$V(\widehat{X}) = \sum_{h=1}^{H} \frac{1}{n_h \cdot (n_h - 1)} \cdot \left[\sum_{i=1}^{n_h} F_{hi}^2 - \frac{\left(\sum\limits_{i=1}^{n_h} F_{hi} \right)^2}{n_h} \right]$$

The variance of $\widehat{R}$ can be calculated using the following formula:

$$V\left(\hat{R} \right) = \frac{V(\widehat{Y}) + \widehat{R}^2 \cdot V(\widehat{X}) - 2 \cdot \widehat{R} \cdot Cov(\widehat{Y}, \widehat{X})}{\widehat{X}^2}$$

where:

$$Cov(\widehat{Y}, \widehat{X}) = \sum_{h=1}^{H} \frac{1}{n_h \cdot (n_h - 1)} \cdot \left[\sum_{i=1}^{n_h} T_{hi} \cdot F_{hi} - \frac{\left(\sum\limits_{i=1}^{n_h} T_{hi} \right) \cdot \left(\sum\limits_{i=1}^{n_h} F_{hi} \right)}{n_h} \right]$$

The coefficient of variation of $\widehat{Y}$ is defined as:

$$CV(\widehat{Y}) = \frac{\sqrt{V(\widehat{Y})}}{\widehat{Y}} * 100$$

The coefficient of variation of $\widehat{R}$ is defined as:

$$CV\left(\hat{R} \right) = \frac{\sqrt{V\left(\hat{R} \right)}}{\hat{R}} *100$$

COMPARABILITY

The following concepts and definitions have been used in the survey:

3.1 Concepts used

3.1.1. Dwelling

As dwelling is considered a separate and independent structure, which has been built or converted to cover the habitation needs of a family (household). As dwelling is also considered every space neither constructed nor converted for the purpose of habitation, used, however, as a dwelling during the reference period.

As dwellings considered are:

- A detached house, semi-detached house or groups of similar dwellings, apartment or flat in a building
- A room or more rooms, where the household lives
- A storagehouse, hut, shack, etc. used as main dwelling during the survey conduct.

As dwellings are not considered:

As dwelling *is not considered* the space which although fulfilling the above definition is used for other purposes (i.e. office, warehouse, collective household, laboratory etc.)

3.1.2. Household

Household is defined as either one person living alone or a group of persons, not necessarily related, living at the same address with common housekeeping. The household members share household's expenses or benefit from them due to lack of income.

More specifically:

One – person household

- One person living alone in one dwelling or in one room of the latter and does his own housekeeping
- Two or more persons living at the same address, related or not, without common housekeeping and each one of them has the exclusive use of at least one room.

Multi-person household

- One couple or parents with their children or one parent with children
- One couple with or without children, parents of the couple and the resident servant, if any, under the condition that they will stay for more than 12 months
- Two or more persons, not necessarily related, living at the same address with common housekeeping
- One or less than 5 boarders residing within a private household.

3.1.3. Household members

Household members can either usually reside in the household or being temporarily absent.

Individuals usually residing in the household are considered the individuals that during the last 12 months have spent most of their time in the specific household. Individuals having

moved in the household would be considered as usual residents if they intend to stay for more than 12 months. Similarly, individuals planning to move out for more than 12 months, in another private household or in a collective household, wouldn't be considered as usual resident, hence household members.

Individuals temporarily absent from the household, **either** because they were in another private household **or** in a collective household (e.g. hospital, elderly house, etc.) will be considered as household members and will be registered in the questionnaire EEY.1, according to the conditions mentioned below:

- **Persons usually resident, related to other members** (unmarried or married children, parents, grandchildren, etc.) sharing expenses or benefiting from them due to lack of income (e.g. under-aged children, persons with no income).
- **Persons usually resident, not related to other members** (partners, etc.) sharing expenses or benefiting from them due to lack of income (e.g. under-aged children, persons with no income).
- **Resident boarders, lodgers, tenants** sharing expenses or benefitting from them due to lack of income and which during the survey conduct either have no private address elsewhere or their actual or intended duration of stay is more than 6 months.
- **Visitors, relatives or not,** sharing expenses or benefiting from them due to lack of income and which during the survey conduct either either have no private address elsewhere or their actual or intended duration of stay is longer than 6 months. Visitors not intending to stay for more than 6 months from the day they came are not considered household members and are not being interviewed.
- **Live-in domestic servants, au-pairs residing in the household,** during the survey conduct, and which during the survey conduct have no private address elsewhere or their actual or intended duration of stay is longerthan 6 months. Daily woman for domestic help is not considered as household member and hence not being interviewed.
- **Persons usually resident, but temporarily absent from the dwelling** (for reasons of holiday travel, work, education or similar) sharing expenses or benefiting from them due to lack of income and which during the survey conduct have no private address elsewhere and their actual or intended duration of absence from the household must be less than 6 months.
- **Children of the household being educated away from home and children in military service**, living in campuses sharing expenses or benefiting from them due to lack of income, irrespective of the actual or intended duration of absence, such persons must currently have no private address elsewhere, must be the partner or child of a household member and must continue to retain close ties with the household and must consider this address to be his/her main residence. Children educated away from home residing in a private address –not in

student residences, **won't** be recorded as household members, and so will children in military service not residing in the camp having a private address, as long as they retain close ties with the household and consider this address to be their main residence.

- **Persons absent for long periods**, persons working away from home e.g. sailors, working in railways, in buses, bublic servants away from office for work in other region sharing expenses or benefiting from them due to lack of income, Irrespective of the actual or intended duration of absence, such persons must currently have no private address elsewhere, must be the partner or child of a household member and must continue to retain close ties with the household and must consider this address to be his/her main residence.

- **Persons temporarily absent**, persons in hospital, nursing homes or other institutions, sharing expenses or benefiting from them due to lack of income. Such person must have clear financial ties to the household and must be actually or prospectively absent from the household for less than 6 months.

Finally, children living in more than one household (e.g. children of divorced families) will be considered members of the household in which they live the longer time during the year. In case they live in the households equal time then will be considered as member of that household in which they were found the day of the survey conduct.

Guidelines to interviewers have been given on the order of registering the household members in the Members' Register section of the Questionnaire. More specifically, the proposed order is as following:

- Responsible person of the household
- Spouse/partner
- Children of the responsible (from the elder to younger one)
- Parents of the responsible
- Other relatives
- Live-in domestic servants
- Visitors whose actual stay is longer than 6 months during the day of survey or their intended stay will be longer than 6 months.

3.1.4. Household head

Household head is a household member who is recognized as head of its members and which has the primary responsibility to make important decisions regarding the household. As head of household is:

- In most cases, where households consist of parents with children (married or unmarried) the father.

- In households consisting of persons related or not, the oldest working member (male or female) or, if noone works, the most senior member.

3.1.5. Economically active members

As economically active members are the ones aged 14 years old and above, which during the preceding the survey conduct week, had a job or if they didn't looked for a job, that is employed and unemployed persons.

3.1.6. Income

Household income is the total remuneration in cash or in kind of all household members resulting from employment or other sources.

Income are wages, pensions, earnings from agricultural, livestock, commercial businesses, etc., income from renting property, interest and dividends, social benefits, regular inter-household transfers, etc.

3.2.Reference period

The time period, in which the collected survey data is reported, is being called reference period. In the survey, the reference period varies and depends on the question. Reference period was considered the day for the survey for household characteristics, building characteristics, income, etc., while for any other data recorded the specific reference period is being also recorded.

COHERENCE
4.1. HBS – SECH

Administrative data do not exist, hence the only comparisons that made are the ones with the HBS data collected in the year 2010, being available.

Table 4.1

HBS 2010		%	SECH 2011-2012		%
Total households	4131264		**Total households**	4166567	
Cooking equipment			**Cooking equipment**		
Hobs (electricity)	3738439	90,5	Hobs (electricity)	3882670	93,2
Hobs (LPG)	339536	8,2	Hobs or oven (LPG)	380559	9,1
Hobs (natural gas)	5340	0,1	Hobs or oven (natural gas)	14913	0,4
Firewood	16134	0,4	Fireplace	216898	5,2
Heating system – energy source			**Heating system – energy source**		
Oil heater	2722332	65,9	Oil as energy source /heating system any	2502746	60,1
Natural gas	298182	7,2	Natural gas	356530	8,6
Oil stove	207911	5,0	Oil stove for main or additional space heating system	124236	3,0
LPG stove	58253	1,4	LPG stove for main or additional space heating system	2144	0,1

Firewood stove	224034	5,4	Biomass stove for main or additional space heating system	262069	6,3
Electric thermal storage heater	108810	2,6	Electric thermal storage heater	76548	1,8
Electric heating appliances (stove, fan, heater)	194834	4,7	Electric heating appliances (stove, fan, heater)	214329	5,1
Air condition	200236	4,8	Air condition	213019	5,1
No heating system in the dwelling	21529	0,5	No heating system in the dwelling	47471	1,1
Possession of:			**Possession of:**		
Private car	2683215	64,9	Private car	2649279	63,6
Motorcycle	583328	14,1	Motorcycle	488075	11,7
Colour TV	4105189	99,4	TV	4128338	99,1
Home cinema	265590	6,4	Home cinema	229365	5,5
DVD	2579485	62,4	DVD or VCR	1833415	44,0
Video game console	668079	16,2	Video game console	366001	8,8
Stereo	2010975	48,7	Stereo	1475157	35,4
Fridge	4114392	99,6	Fridge freezer of fridge without freezer	4161219	99,9
Freezer	1083508	26,2	Feezer or fridge freezer	3522828	84,6
Cloth washer	3946271	95,5	Cloth Washer (without tumble dryer)	3970586	95,3
Dishwasher	1571134	38,0	Dishwasher	1384385	33,2
Solar thermosiphon system	1653444	40,0	Solar thermosiphon system	1542952	37,0
Computer	2073645	50,2	Computer	2108191	50,6

The SECH project gave qualitative data, in coherence with available data from the HBS survey. Small deviations existing in specific items can be attributed to the different concepts used in each survey.

QUESTIONNAIRES STRUCTURE
5.1. Recommended Coverage

As prementioned the questionnaire has been made in collaboration with experts from the Centre for Renewable Energy Sources and Saving (CRES).

The questionnaire structure was based on the recommended coverage of the data collection exercise, as described in the technical specifications of the project, taking into account national priorities arising from policies pursued at national level and current national practices.

The basic sections of the Questionnaire are:
- Housing stock characteristics
- Household characteristics
- Consumption/expenditure of energy commodities
- Space Heating
- Domestic Hot Water production
- Cooking
- Electrical appliances
- Air- conditioning
- Penetration of energy efficiency technologies
- Energy Service Demand
- Penetration of renewable energy sources
- Energy consumption by end-use (based on modelling)
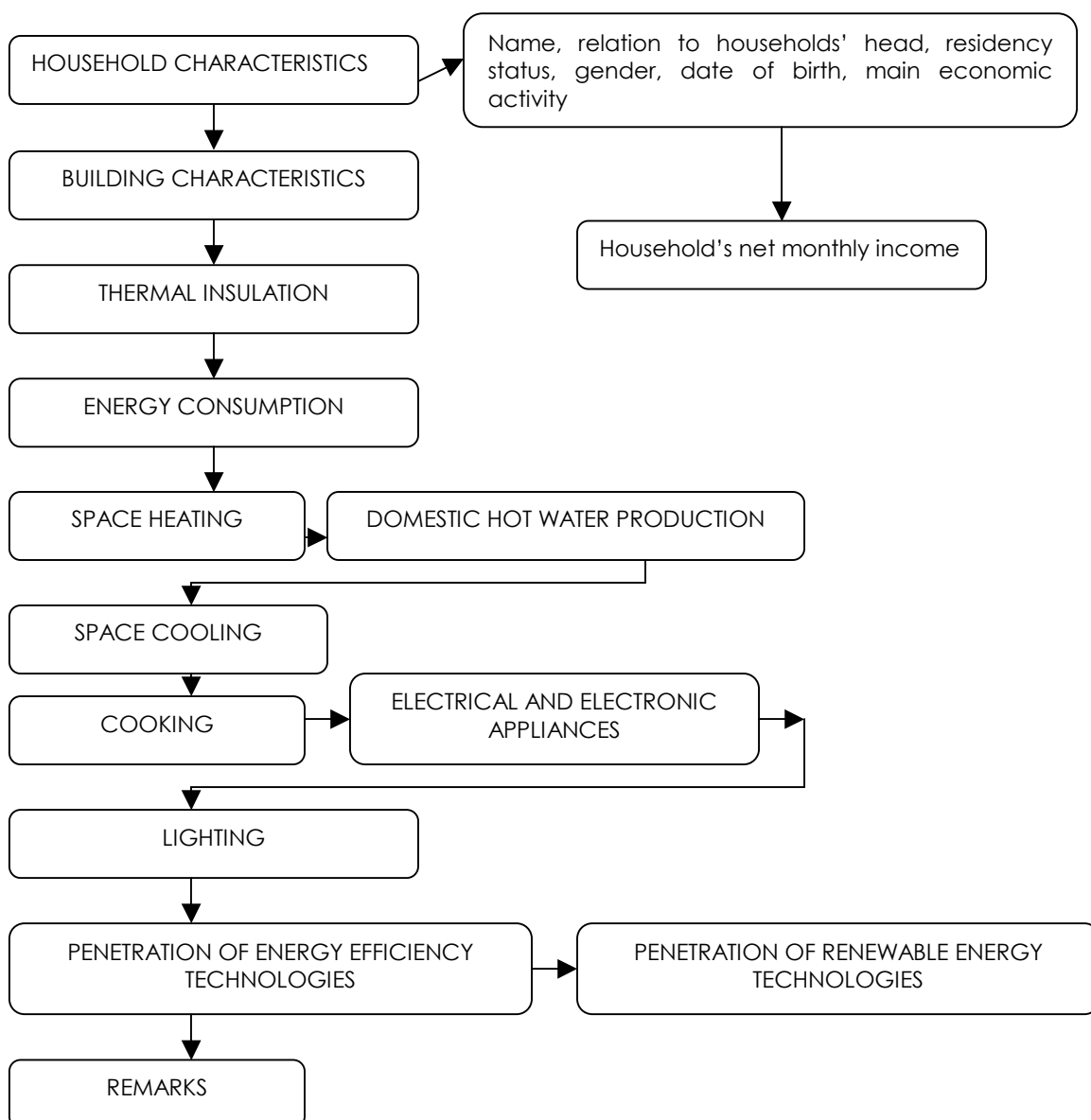
5.2. Pilot survey

According to contract a pilot survey has been carried out during July 2011. Initial sample consisted of 100 households (51 households in the Prefecture of Attiki and 49 from other capitals of the country where regional offices exist).

The pilot questionnaires, together with guidelines on basic concepts were forwarded via e-mail to all sample households (households of ELSTAT's personnel), while any questions arisen were immediately answered from our expert collaborators.

Finally, and due to the fact that the Censuses of 2011 were in progress, 80 questionnaires consisted the final pilot sample (38 households from personnel of regional offices and 42 from personnel of central service in Athens).

5.3. Pilot Questionnaire

Following is schematically presented the structure of the pilot questionnaire (Annex 1.1- in Greek), and the main sections that constituted it.

```
HOUSEHOLD CHARACTERISTICS ────► Name, relation to households' head, residency
       │                          status, gender, date of birth, main economic
       ▼                          activity
BUILDING CHARACTERISTICS                      │
       │                                      ▼
       ▼                          Household's net monthly income
THERMAL INSULATION
       │
       ▼
ENERGY CONSUMPTION
       │
       ▼
SPACE HEATING ────► DOMESTIC HOT WATER PRODUCTION
       │                          │
       ▼                          │
SPACE COOLING ◄───────────────────┘
       │
       ▼
COOKING ────► ELECTRICAL AND ELECTRONIC
       │        APPLIANCES
       ▼
LIGHTING
       │
       ▼
PENETRATION OF ENERGY EFFICIENCY ────► PENETRATION OF RENEWABLE ENERGY
       TECHNOLOGIES                          TECHNOLOGIES
       │
       ▼
REMARKS
```

During the pilot phase questions received and clarifications asked led us to changes either in wording or structural modifications, for an improved and more effective version of the questionnaire.

The outcome of the pilot phase was the final questionnaire.

5.4. Survey Questionnaire

5.4.1. Modifications in the pilot questionnaire

The changes made in the pilot questionnaire concern changes in wording –for explicity and in order not to allow misunderstanding, in wording for completeness of the question, in wrong routing, in the sequence of questions as well as in the addition of transport section.
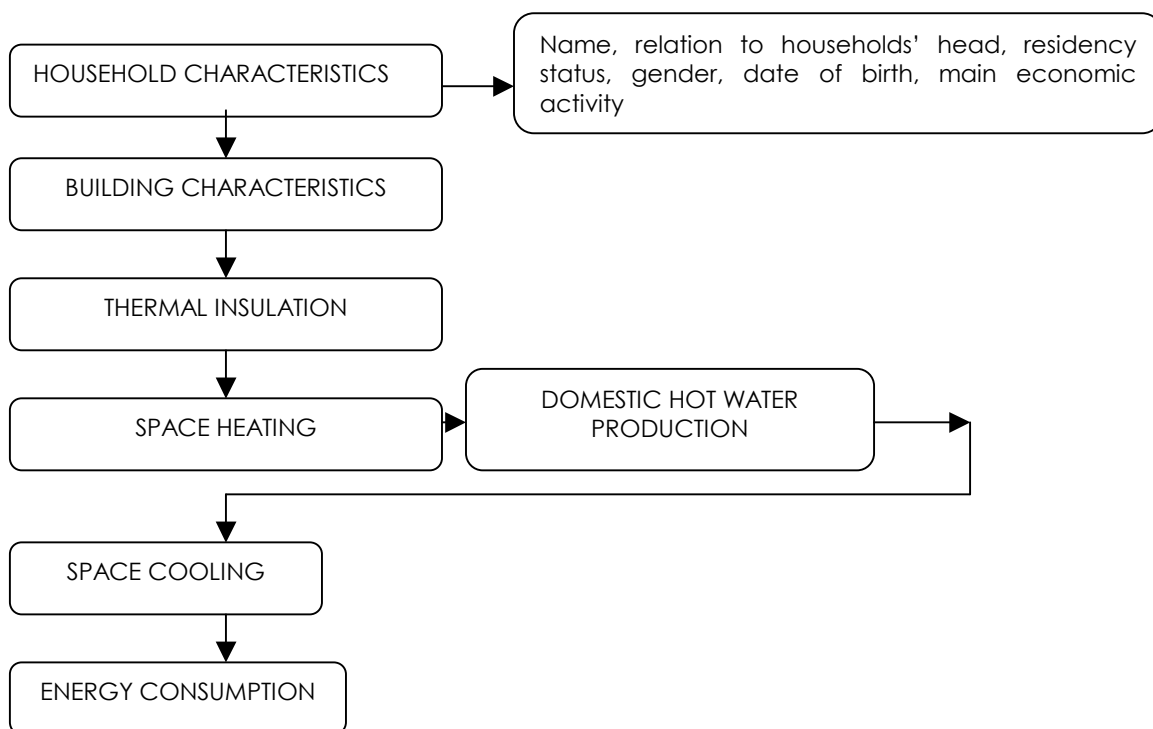
After carefully studying all comments received from respondents the major changes made concern / were:
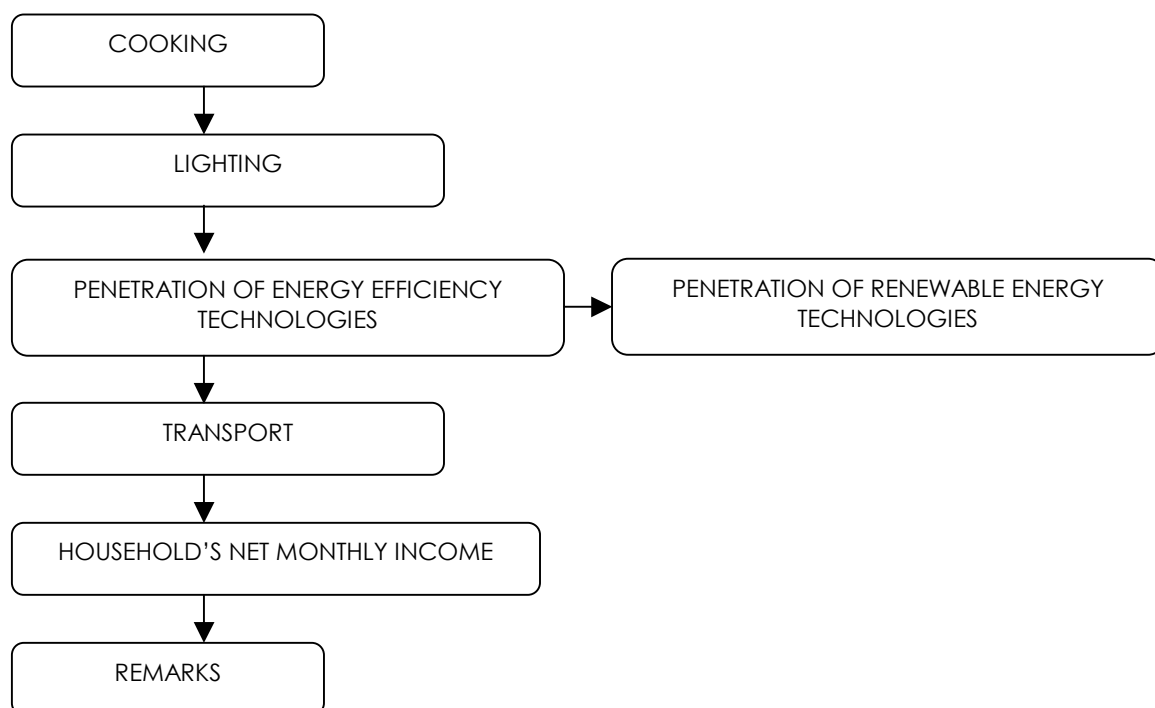
- Households' income asked together with the demographic characteristics of the households' members has moved to the end of the questionnaire, as respondents usually are negatively predisposed when income is asked.
- An initial question has been added in order to ensure that the household to be surveyed is capable of providing requested information on energy consumption for at least 3 summer and 3 winter months.
- It was clarified that when we ask for the construction year we mean the completion year of the dwelling (Question 6).
- The pilot showed that questions on dwellings floor/s didn't satisfactorily depict information needed and also didn't cover all existing types of dwelling. Thus, question 8 dully changed and a sub question was added on penthouse existence.
- Space heating section, followed by domestic water heating and space cooling moved forward, before energy consumption. The change in the sequence of sections was considered necessary in order the respondent first to understand and answer questions on systems used and then reply on energy consumption questions.
- Continuous (24 hours) use of space heating has been added as an option (question 20).
- Section on domestic water heating was considered to be among the most difficult ones, obviously due to terminology, and an effort was made to be as much simplified as possible.
- A question on parts of the day when cooling system is usually used has been added for completeness.

- The question on electricity comsumption was considered to be among the most difficult ones, mainly due to the unavailability of actual electricity bills, thus a sub question on average charges of electricity consumed in the dwelling as added (question 32.2). Also, option for different electricity providers was added.

- For completeness, hours of charge were added in the questions on purchased heating oil and natural gas, for space heating.

- Proportional charge for the apartment has been deleted from the question 35 on purchased natural gas for other use apart from space heating.

- In question 37 on purchased other fuel for space heating or cooking, an extra column has been added on quantity of fuels provided for free, for completeness.

- Decoder has been added in electrical appliances.

- Question 40 on handling of electronic devices (standby mode or off) changed, specific devices and frequency of leaving them in the standby mode have been included.

- Lighting question from the start problemized us on whether it was feasible to be filled in, and it proved to be if not the most difficult one of the first three. However, in the final questionnaire more lamp types have been added (question 41).

- Extra section on transport was added (questions 47, 47.1). This due to lack of data on transport energy consumption in the household sector.

5.4.2. Final Questionnaire

The structure of the final questionnaire (annexes 1.2 and 1.3 / greek and english version) as it resulted after taking into consideration all comments received during the pilot survey is schematically presented below.

```
┌─────────────────────────┐
│         COOKING         │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│         LIGHTING        │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐        ┌─────────────────────────────┐
│ PENETRATION OF ENERGY   │───────▶│ PENETRATION OF RENEWABLE     │
│ EFFICIENCY TECHNOLOGIES │        │ ENERGY TECHNOLOGIES          │
└─────────────────────────┘        └─────────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│        TRANSPORT        │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│ HOUSEHOLD'S NET MONTHLY │
│         INCOME          │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│         REMARKS         │
└─────────────────────────┘
```
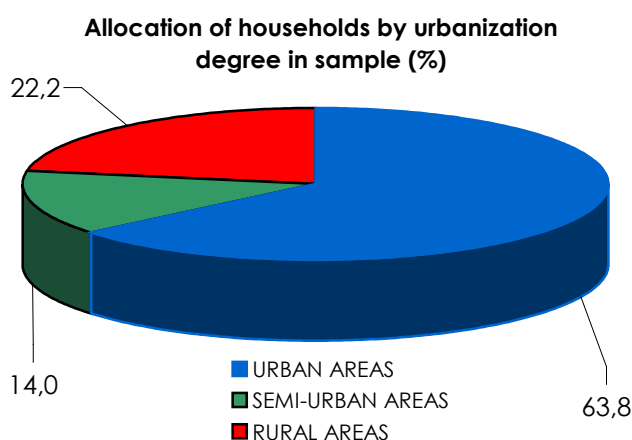
5.5. Auxiliary survey documents

Concerning the Survey on energy consumption in households, the following auxiliary documents are used:

- The map of the sampling area.
- The Sampling Frames (constructed and updated). The updating of the Sampling Frames takes place approximately 1 month before the survey conduct.
- Introductory/ informative letter (Annex 1.5) is being sent almost one month before the survey conduct in order the surveyed households to be informed of having been selected for the survey, asking for cooperation.
- Leaflet of CRES "Smart solutions for saving energy at home" (Annex 1.6) sent to the households together with the introductory letter.
- Letter of notification (Annex 1.7) notifying the date of the next visit and interviewees' telephone number for contact.
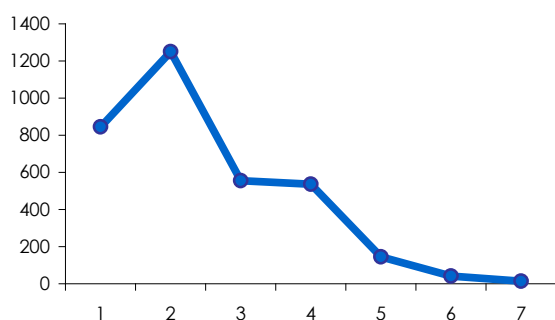- Interviewers' guidelines (Annex 1.4)

Additional guidelines were provided to the interviewers during the first three months of the survey conduct and upon checking received filled in questionnaires.

OVERVIEW OF THE RESULTS

6.1 *Information on achieved sample* *(3387 households)*

Allocation of households by urbanization degree in sample (%)

22,2
14,0
63,8

- URBAN AREAS
- SEMI-URBAN AREAS
- RURAL AREAS

Number of household members per household

Number of household members	Households
1 member	845
2 members	1250
3 members	556
4 members	536
5 members	145
6 members	42
7+ members	13

6.2 *Information on total households – weighted figures* *(4.166.567 households)*

Dwelling characteristics

Dwelling type	%
Detached single –family House	31.52
Semi-detached single –family house or a single-family house in a block of adjoining buildings	8.96
Apartment (in a building with less than 10 apartments in total)	36.04
Apartment (in a building with more than 10 apartments in total)	23.46
Other	0.01

| Dwelling level	%
Basement	4.55
Ground floor	41.99
1st floor (building with pilotis)	7.51
1st floor (building without pilotis)	18.66
Middle floor	15.51
Last floor	8.74
Multi-floor apartment	3.04

Dwelling status	%
Privately owned	60.80
Privately owned but with financial obligations (on loan, on mortgage)	12.41
Granted by the employer	0.50
Granted by a member of the family	6.54
Rented	19.15
Rented from the employer in a lower price	0.21
Rented from a member of the family in a lower price	0.39

Dwelling age –Year of construction	%
Before 1946	5.28
1946-1960	10.62
1961-1980	43.74
1981-1990	15.20
1991-1995	6.56
1996-2000	7.89
2001-2005	5.79
2006-2010	4.81
2011+	0.11

Usage of air conditiong in months
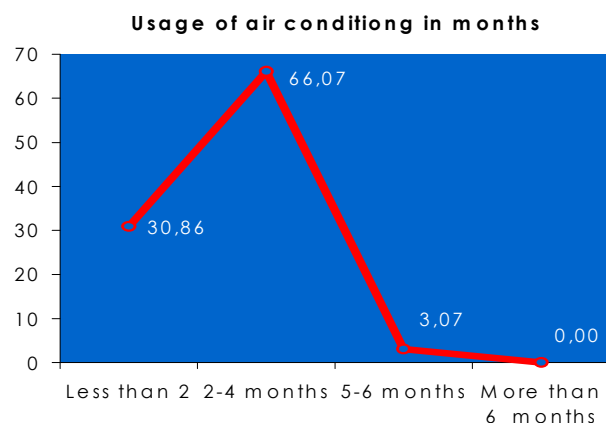
Thermal insulation

Existence of thermal insulation
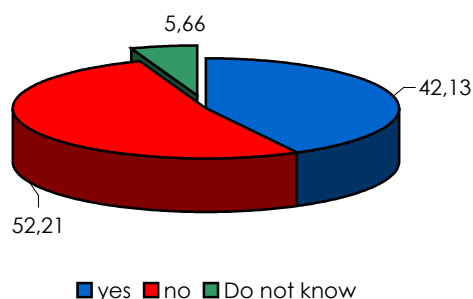
| Thermal insulation	%
Celling/roof	38.54
Floor	2.88
Façade	77.75
Inner surface of the walls	31.28
Supporting Structure	18.29
Elsewhere	0.45
Do not know	1.39

Space heating

Existence of space heating
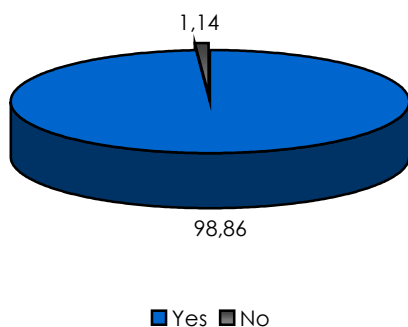
Main space heating system	%
Central heating system equipped with an autonomous heating control unit	33.18
Central heating system not equipped with an autonomous heating control unit	17.62
Independent heating system	48.61
District heating	0.59

Type of main space heating system	%
Burner/boiler	71.12
Heat pump	0.13
Stove	11.61
Fireplace	4.31
Portable electric heaters	5.20
Electric thermal storage heater	1.86
Air conditioning split units	5.17
District heating	0.59

Energy source for space heating
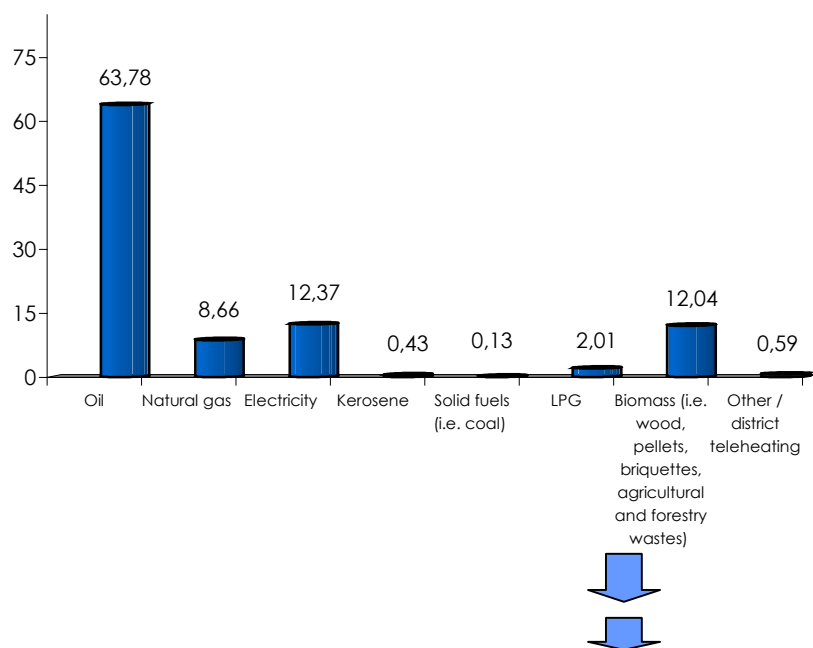
Biomass allocation for space heating

Biomass	%
Firewood	95,41
Wood pellets	3,39
Wood briquettes	0,28
Olive cake	2,34
Other	0,16
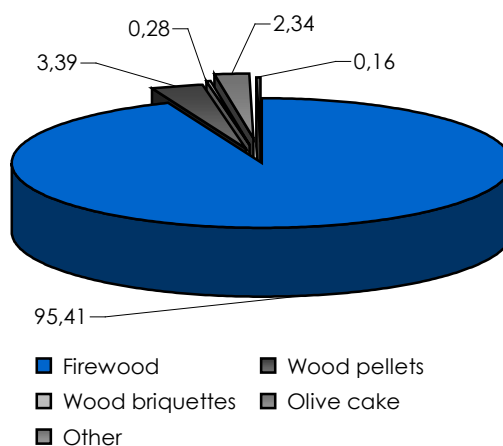
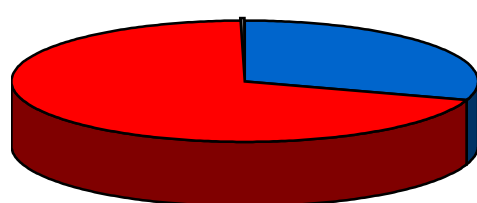| Age of main space heating system	%
Less than 5 years	22,53
6 –10 years	23,72
11 – 20 years	29,05
More than 20 years	20,40
Do not know	5,10

Existence of supplementary space heating system

■ Yes ■ No ■ Do not know

Supplementary space heating system energy source
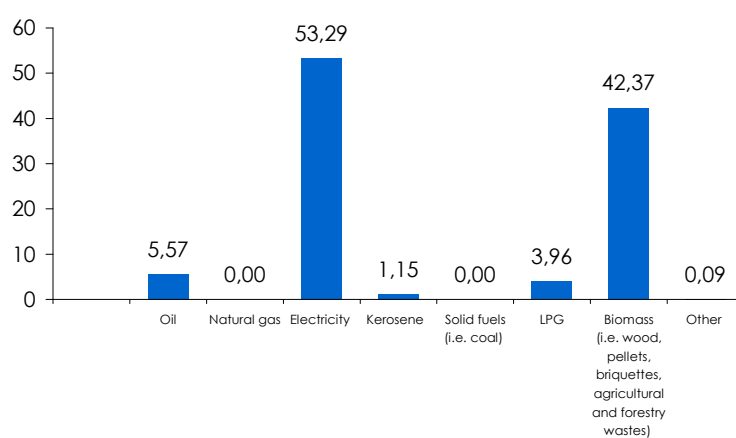
DOMESTIC WATER HEATING

Existence of system/equipment for domestic heat water
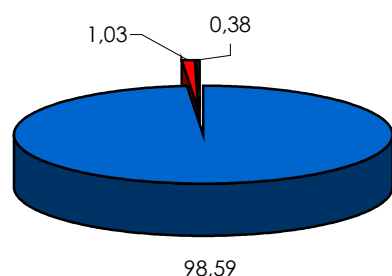
■ Yes ■ No ■ Do not know

System/equipment for DHW	%
System linked to the central heating system	25,17
Solar thermosiphon system	37,56
Electrical thermosiphon system	74,54
Small-scaled electrical thermo-siphon system	1,71
Thermosiphon system with natural gas	1,33
Electrical instant hot water dispenser	0,67
Instant hot water dispenser with natural gas	0,24
District heating	0,46
Other	5,63

SPACE COOLING

Existence of system/units for cooling

- 40,42
- 0,06
- 59,53

■ Yes ■ No □ Do not know
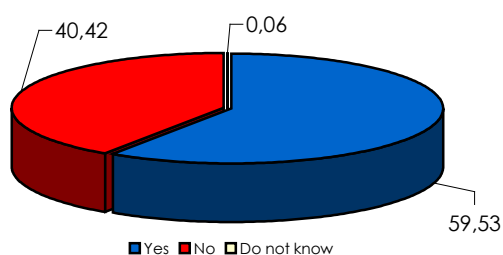
Type of cooling system	%
Independent air conditioning units (split)	99,66
Central cooling system	0,98

Age of air conditioning units

%

- 49,91 — Less than 6 years
- 33,66 — 6-10 years
- 11,09 — 11-15 years
- 5,33 — More than 15 years

Usage of air conditiong in months
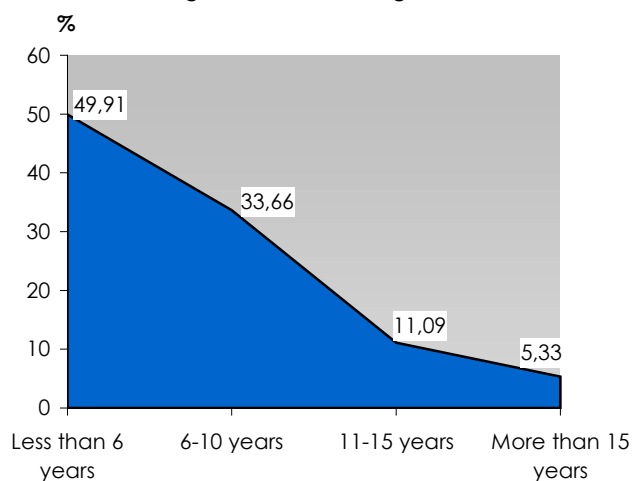
- 30,86 — Less than 2
- 66,07 — 2-4 months
- 3,07 — 5-6 months
- 0,00 — More than 6 months
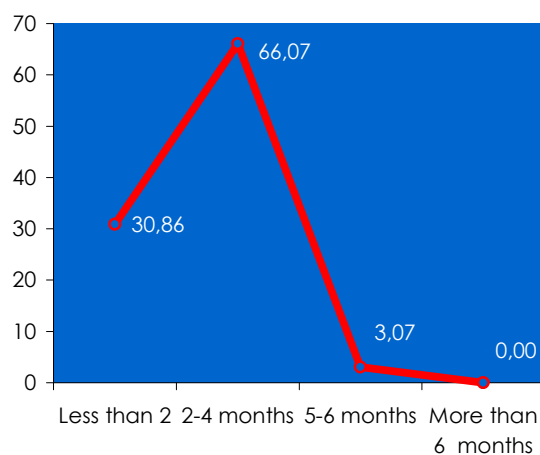
Average use of air conditioning- hours per day

- 4,68
- 1,00
- 17,12
- 26,27
- 50,93

■ Up to 2 hours ■ 3-5 hours ■ 6-8 hours ■ 9-14 hours ■ More than 14 hours

Electricity

Electricity provider

99,52   0,48

■ Public Power Corporation S.A.
■ Other
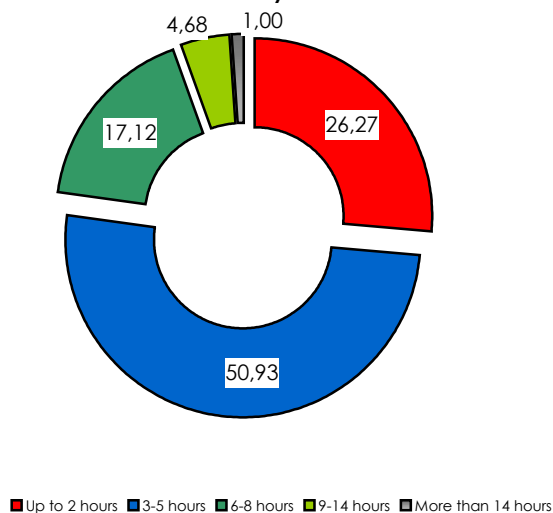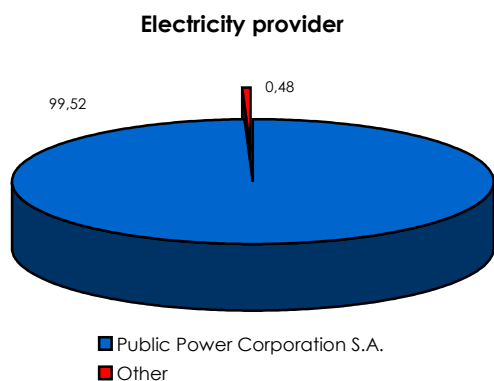
Cooking appliances

Cooking appliances	%
Hobs (electricity)	93,19
Hobs (LPG)	8,90
Hobs (natural gas)	0,36
Oven (electricity)	89,14
Oven (LPG)	1,18
Oven (natural gas)	0,26
Microwave oven	38,62
Woodstove	5,21
Fireplace	10,50

Electrical appliances

Electric and electronic appliances	%
Fridge (with or without freezer)	99,87
Dishwasher	33,23
Washer (with or without tumble dryer)	95,83
Iron	95,58
Vacuum cleaner	81,14
Game console	8,78
TV	99,08
Computer (desktop, laptop)	54,05
Internet devices (modem, rooter etc.)	49,76

Electric appliances on standby mode

	Always	When at home	Never
Peripheral devices (printer, scanner etc.)	18,94	20,31	60,75
Computer (desktop, laptop)	18,88	36,03	45,10
Games console	21,68	18,68	59,65
TV	53,32	25,11	21,56

■ Always ■ When at home ■ Never
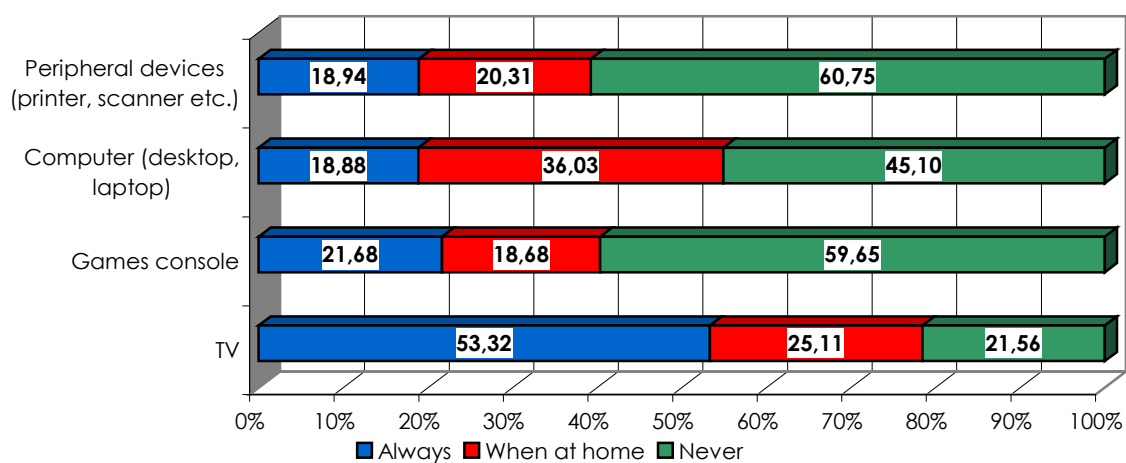
Lighting

Type of lamps used for lighting- total households
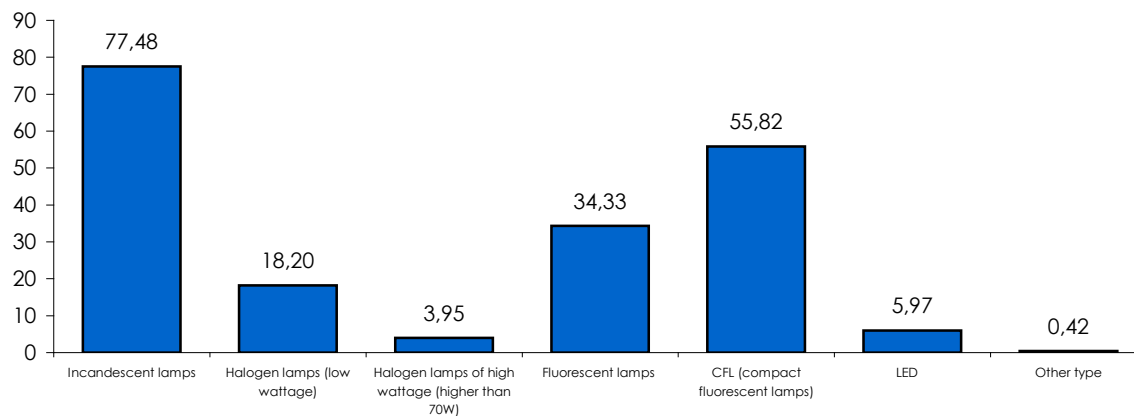
Penetration of energy efficiency technologies

Shading systems

■ Awnings ■ Pergola ■ Shutters □ Other
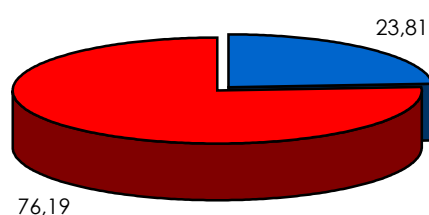
Ceiling /floor fan

■ Yes ■ No
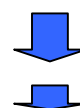
Frequency of ceiling/floor fan

Energy efficiency technologies – total households	%
Indoor atrium	0,20
Sunspace (bioclimatic greenhouse)	0,01
Green roof	0,05
Automatic control system for energy saving	1,08

Behavioural practice towards efficient use of energy

Behavioural practice towards efficient use of energy

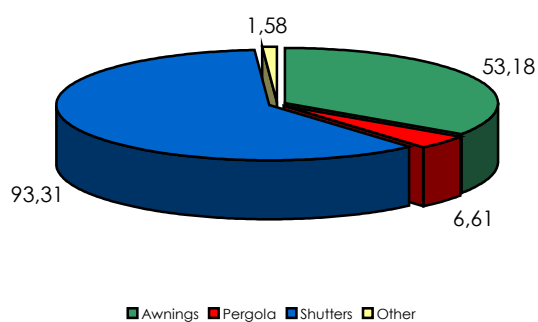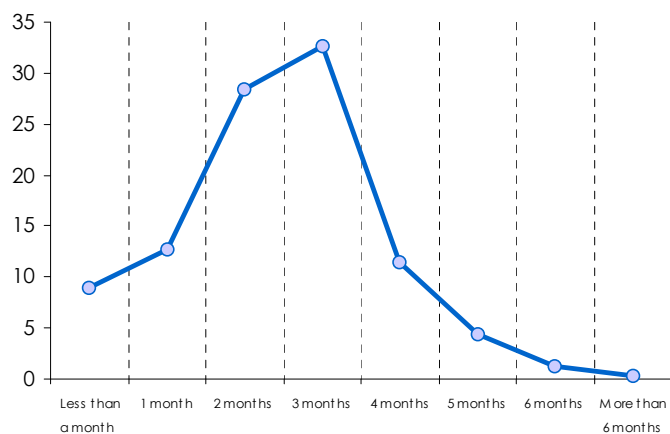|	Yes	No	Don't know/n.a.
Consult energy label when buying a new electrical appliance	60,03	25,98	13,99
Use awnings and other shading systems during the sunshine hours in the summer, for summer sun protection	83,18	9,30	7,52
Open windows, skylights, roof openings during the night in the summer, for natural cooling	87,08	10,51	2,41
Use your laundry/ washing machine at full load	71,69	21,30	7,01
Regularly perform maintenance (according to the manufacturer instructions) of your heating/cooling/air conditioning system	51,16	21,11	27,73
Adjust the cooling thermostat to 26 – 28 oC during the summer period	24,50	36,52	38,98
Adjust the heating thermostat to 18 – 20 oC during the winter period	27,90	25,06	47,04

The analysis of the results concerning the use of the thermostat settings for space heating and cooling, according to a more energy effiecient behavior (pre-set at 18 - 20 ᵒC and 26 - 28 ᵒC, respectively), showed a reduction of the average thermal energy consumption for space heating over 13%, and 15% for space cooling while the respective reduction for the case of the median estimates is about 4% of the thermal energy consumption for both purposes.

Thermal Energy Consumption for Space heating	Q 45_1	Electricity Consumption for Space cooling	Q 45_2
Mean	13%	Mean	15%
Median	4%	Median	4%

Furthermore, the households that prefer the nocturnal natural cooling consume 21% thermal energy for space cooling purposes as shown in the table below.

Electricity Consumption for nocturnal natural cooling	Q 45_5
Mean	21%
Median	26%

Finally, the households that use the full washing cycle and with full capacity, of the appliances present a reduction of 17% of electricity consumption.

Transport

Possession of vehicle (car or motorcycle) for transport - % of households

33,86

66,14

■Yes ■No
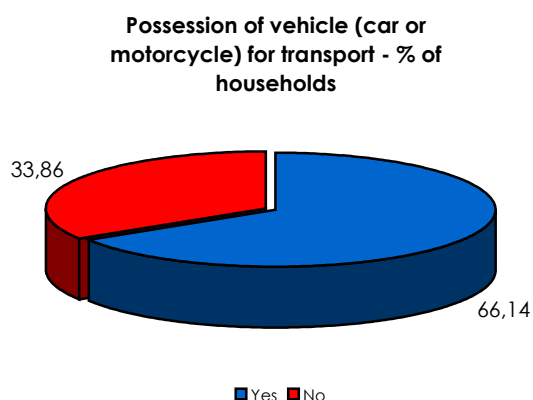
6.3. Energy consumption indices

6.3.1. Annual Thermal energy consumption in residential sector

The process for the calculation of the thermal consumption was mostly based on the corresponding expenditures for each household, as reported in the questionnaires. The calculation was performed under consideration of the average fuel prices for the examined period and the net calorific value of each fuel.

In order to ensure that the specified reported expenditures correspond to the total quantity for the coverage of thermal demand for space heating, the households, that appear to report expenditures for a period smaller than the 40% of the reported heating period, were excluded from the analysis[2].

---

[2] 144 households were excluded from the analysis using the specific criterion.

The implemented approach includes various other assumptions such as the breakdown of liquefied gas [LPG] and firewood consumption in households with dual use (heating, cooking) was performed being assumed at 50/50 use.

The estimation of thermal consumption for the production of domestic hot water [DHW] was performed implementing the following steps:

- Estimation of the demand for domestic hot water for each climate zone,
- Calculation of the electricity consumption for the production of domestic hot water,
- Estimation of the contribution of solar thermal systems assuming that the coverage of the demand for domestic hot water is equal to 60%,
- Assumption for the case of systems reported as mainly used for central heating that their participation for the production of domestic hot water is equal to zero,
- Allocation of rest of the demand to the other consumed fuel respectively (Natural Gas, LPG etc.)

It should be noted that the consumption of natural gas for cooking is not incorporated in the analysis due to the small number of households that reported such type of usage and the corresponding expenditures (0.3% of the total sample).

The average estimates of the total thermal consumption were calculated excluding 5% of the lower and upper values. The specific threshold was established because extreme values were identified from the analysis of the corresponding distributions and their exclusion leads to the estimation of more realistic and robust figures. The above statement was also confirmed through the comparison of the obtained results with the official data of the energy balance for the year 2011[3]. Specifically, the comparison indicated a deviation of approximately 1% for thermal energy consumption and of 2 % for electricity consumption, which are assessed as satisfactory taking into consideration the various uncertainties. It should be noted that the consumed electricity for space heating is not taken into consideration during the calculation of the thermal energy consumption[4].

The final thermal consumption per household, the final thermal consumption for space heating per household and the specific thermal consumption for space heating per m[2] of heated area are presented in Table 1. for the final sample as modified according to the pre-described calculation methodology, and for the three examined levels of urbanization.

Table 1: Estimated figures for thermal consumption.

Annual thermal consumption per household (kWh)	10,244
Annual thermal consumption per household (kWh) - Urban areas	7,295

---

[3] Source: EUROSTAT energy consumption data
[4] 386 households were excluded from the analysis due to utilization of electricity as primary source for space heating.

Annual thermal consumption per household (kWh) - Semi-Urban areas	13,786
Annual thermal consumption per household (kWh) - Rural areas	16,923
Annual thermal consumption for space heating per household (kWh)	9,926
Annual thermal consumption for space heating per household (kWh) - Urban areas	7,488
Annual thermal consumption for space heating per household (kWh) - Semi-Urban areas	12,824
Annual thermal consumption for space heating per household (kWh) - Rural areas	15,274
Specific thermal consumption for space heating per m^2 of heated area (kWh/m^2)	136.3
Specific thermal consumption for space heating per m^2 of heated area (kWh/m^2) - Urban areas	93.9
Specific thermal consumption for space heating per m^2 of heated area (kWh/m^2) - Semi-Urban areas	180.9
Specific thermal consumption for space heating per m^2 of heated area (kWh/m^2) - Rural areas	237.5

6.3.1.1. Allocation of Thermal Energy Consumption in residential sector

The following tables present the allocation of thermal energy consumption for space heating, domestic hot water and cooking by fuel type.

Table 2: Thermal Energy Consumption Allocation by type of end-use and household

Type of end-use	Allocation
Space Heating	85.9%
Domestic Hot Water [DHW] production	4.4%
Cooking	9.7%
Total	**100.0%**

Table 3: Thermal Energy Consumption Allocation for space heating by fuel type and household

Fuel type for space heating	Allocation
Oil	69.8%
Natural gas	8.5%
District heating	0.8%

Kerosene	0.4%
Olive cake	0.5%
LPG	2.0%
Firewood	17.2%
Wood Pellets	0.8%
Total	**100.0%**

Table 4: Thermal Energy Consumption Allocation for Domestic Hot Water production, by fuel type and household

Fuel type for DHW production	Allocation
Oil	6.9%
Natural Gas	2.8%
LPG	0.4%
Fire Wood	1.8%
Solar thermal Systems	88.2%
Total	**100.0%**

Table 5: Thermal Energy Consumption Allocation for cooking, by fuel type and household

Fuel type for cooking	Allocation
LPG	6.9%
Fire wood	93.1%
Total	**100.0%**

Thermal Energy Consumption allocation by type of fuel

Oil; 60,3%
District Heating; 0,7%
Natural Gas; 7,4%
Kerosene; 0,3%
Olive cake; 0,4%
Firewood; 23,8%
LPG; 2,4%
Solar Thermal; 3,9%
Wood pellets; 0,7%
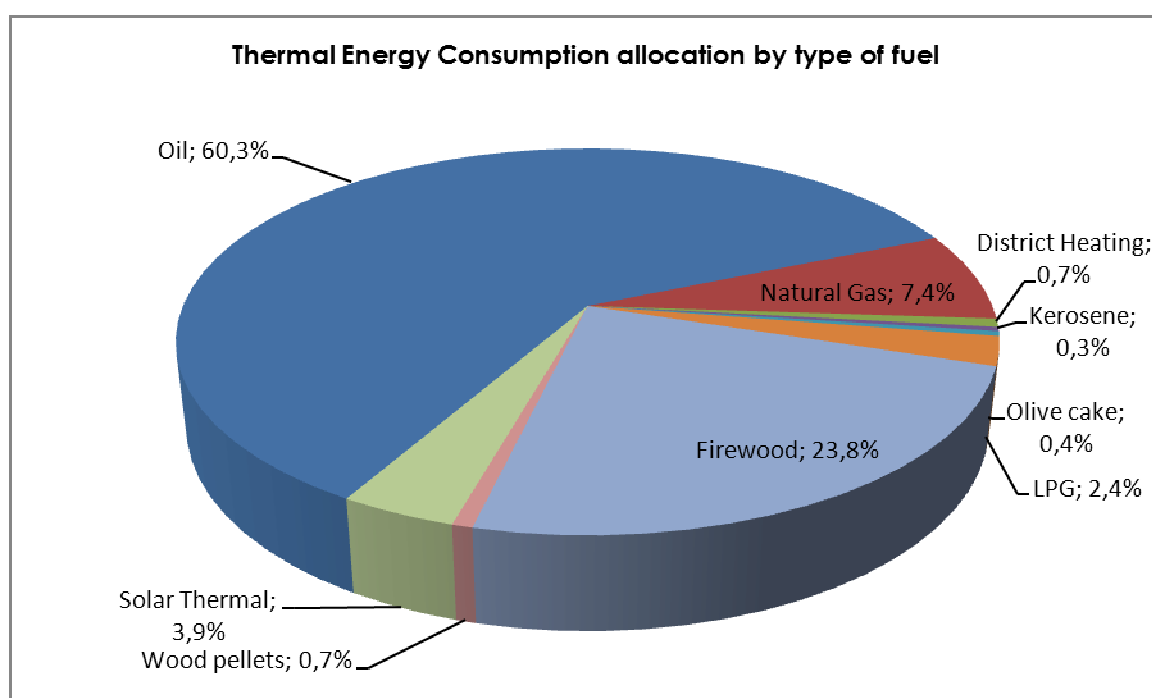
6.3.2. Annual Electricity consumption in residential sector

The methodological approach for the estimation of electricity consumption was mostly based on the utilization of the reported electricity expenditures of each household as reported in the questionnaire as well as the stock and usage characteristics of the electrical appliances.

The first step referred to the process of calculating the overall annual electricity consumption per household. Various assumptions were established in order to estimate the real electricity consumption on an annual basis, considering the fact that the reported electricity expenditures mainly referred to the electricity consumption of a specific fourth month period (domestic energy bills are issued every two months with the first bill having an estimation of the electricity consumption and the second one integrating the actual consumption over a 4month period) and in view of estimating the part of the bill that relates only with the electricity consumption of the examined period, as well as the percentage of taxes, which must be excluded.

Subsequently, the annual electricity consumption was allocated to the different uses of electricity. Firstly, the contribution of cooking, electrical and electronic appliances in the total electricity consumption was estimated by setting technical assumptions regarding their electrical installed power capacity. The electricity consumption of the appliances was then calculated on the basis of the reported data regarding the duration and frequency of the use for each participating household separately. In order to further evaluate the quality of the obtained results, the calculated annual electricity consumption was compared with the corresponding electricity consumption both for the case of new appliances as derived by the manufacturers and the older models as measured within the program Remodece (Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe) and also with the current market values.

The same approach was implemented for the case of split AC units for space cooling and heating assuming various COP and EER values in relation with the age of the units.

The calculation of lighting electricity consumption was based on the total number of lamps and the corresponding power capacity in combination with an assumption on the weighted lighting usage hours on an annual basis.

The calculation of the electricity consumption for the production of domestic hot water was based on a typical power capacity of an electric boiler and on the reported data for the duration and frequency of the use for each participating households separately.

The median estimate of the total electricity consumption was then calculated for the specific household sample. For the assessment of the implemented methodology and sample characteristics, this figure was compared to the national energy consumption of electricity in the households as reported in the most recent energy balance. In specific, it was concluded

that the median estimate of the total electricity consumption resulted from the questionnaire findings led to a realistic and robust estimation according to the official data of the energy balance for the year 2011. Specifically, the comparison revealed only a minor deviation of approximately 1%, which is assessed as a very positive result, taking into account the various uncertainties.

The final electricity consumption per household and the specific electricity consumption per m^2 of resident area for the total sample and for the three examined levels of urbanization are presented in Table 6.

Table 6: Estimated figures for electricity consumption.

Annual electricity consumption per household (kWh)	3,750
Annual electricity consumption per household (kWh) - Urban areas	4,000
Annual electricity consumption per household (kWh) - Semi-Urban areas	3,780
Annual electricity consumption per household (kWh) - Rural areas	3,070
Specific electricity consumption per m^2 of residence area (kWh/m^2)	46.4
Specific electricity consumption per m^2 of residence area (kWh/m^2) - Urban areas	50.0
Specific electricity consumption per m^2 of residence area (kWh/m^2) - Semi-Urban areas	44.4
Specific electricity consumption per m^2 of residence area (kWh/m^2) - Rural areas	40.0

6.3.2.1. Allocation of Electricity Consumption in residential sector

The following figures and tables present the results of the analysis regarding the electricity consumption allocation by type of end-use and fuel.
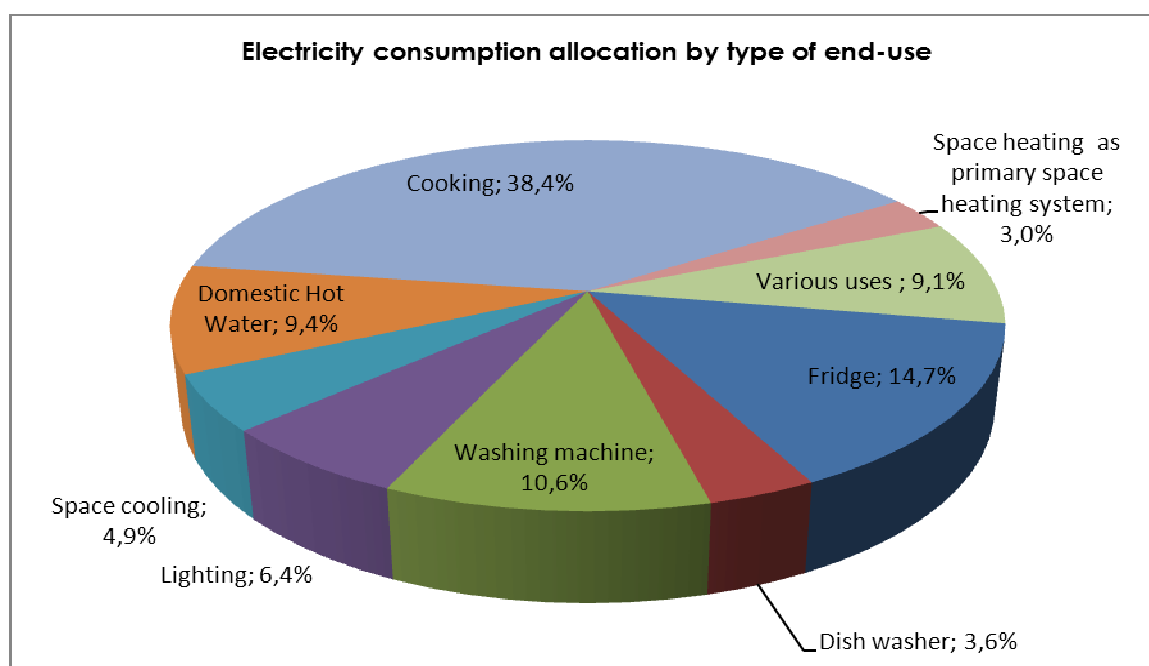
6.3.3. Total Energy Consumption in residential sector

Table 7: Allocation of Electricity and Thermal Energy Consumption by household

Thermal Energy	**10244 [kWh]**	**73.2%**
Electricity	**3750 [kWh]**	**26.8%**

Table 8: Total Energy Consumption by end-use type and household

Type of end-use	
Space Heating	**63.7%**
DHW	**5.7%**
Cooking	**17.3%**
Space Cooling	**1.3%**
Lighting	**1.7%**
Appliances	**10.2%**
Total	**100.0%**

The following figure presents the estimation of the total energy consumption by type of end-use for the whole population.

Table 9: Total Energy Consumption by fuel type and household

Oil	**44.1%**
Natural Gas	**5.4%**
District Heating	**0.5%**
Kerosene	**0.3%**

Olive cake	**0.3%**
LPG	**1.8%**
Firewood	**17.4%**
Wood pellets	**0.5%**
Solar Thermal	**2.9%**
Electricity	**26.8%**
Total	**100.0%**

The following figure presents the estimation of the total energy consumption by type of fuel for the whole population (according to Census 2011).
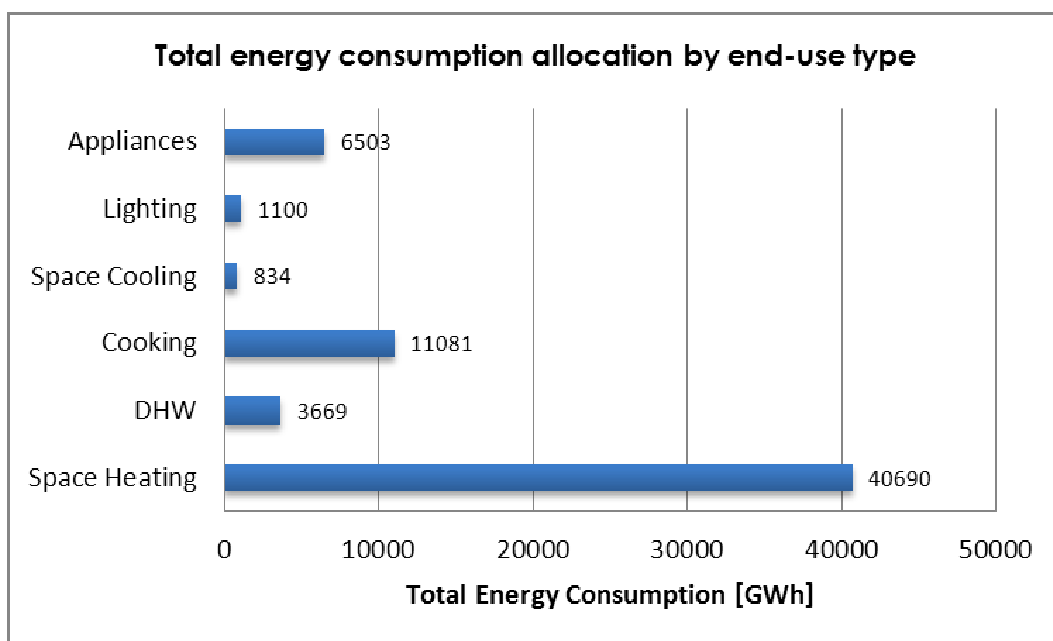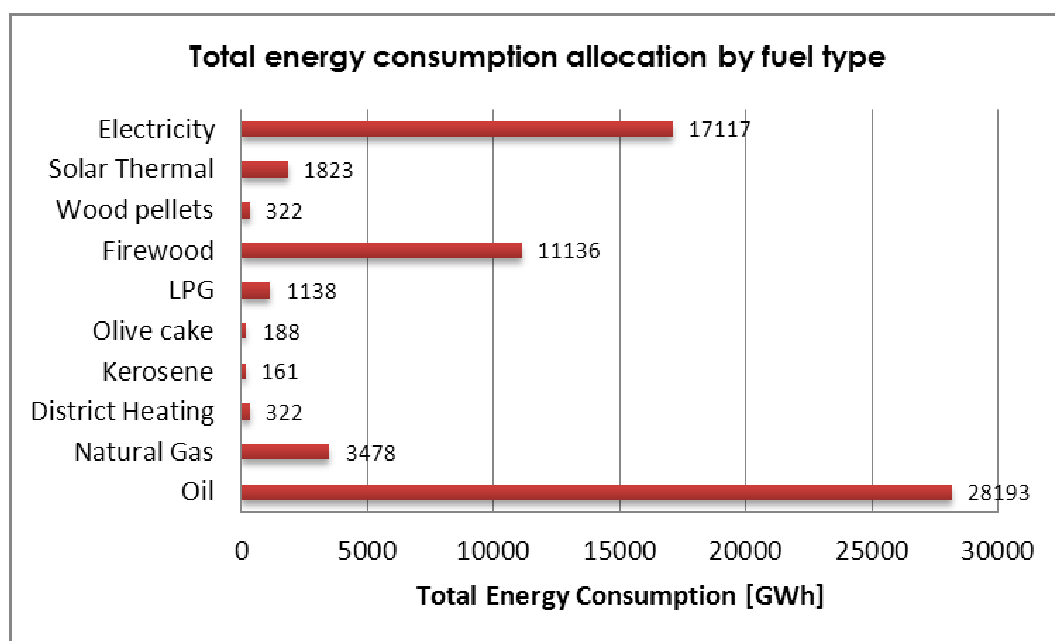

6.3.3.1. Total Energy Consumption in the Residential Sector by urbanization degree

The following tables and figures present the total energy consumption allocation in residential sector by the degree of urbanization

Table 10: Allocation of annual total energy consumption by urbanization degree

	Urban	Semi Urban	Rural
Thermal Energy [kWh]	7,295	13,786	16,923
Electricity [kWh]	4,000	3,780	3,070

Total energy consumption allocation by end-use type and urbanization degree

Legend: Urban, Semi Urban, Rural

End-use	Urban	Semi Urban	Rural
Space Heating	57,5%	68,9%	70,9%
DHW	7,0%	4,1%	3,7%
Cooking	17,6%	15,0%	17,5%
Space Cooling	2,0%	0,8%	0,4%
Lighting	2,1%	1,3%	1,1%
Appliances	13,8%	10,0%	6,4%

Total energy consumption allocation by fuel type and urbanization degree

Legend: Rural, Semi Urban, Urban

Fuel	Rural	Semi Urban	Urban
Electricity	15,4%	21,5%	35,4%
Solar Thermal	0,5%	0,6%	1,0%
Wood pellets	0,1%	0,6%	0,1%
Firewood	36,7%	25,5%	5,2%
LPG	6,8%	5,7%	4,2%
Olive cake	0,9%	0,8%	0,0%
Kerosene	0,1%	0,2%	0,4%
District Heating	0,0%	0,6%	0,6%
Natural Gas	0,5%	0,6%	8,4%
Oil	39,0%	43,9%	44,6%

The households located in urban areas present an increased usage of oil as well as electricity for energy purposes compared to the households located in rural areas. On the contrary, the penetration of the biomass [firewood] usage in is significant higher in rural and semi-urban areas.

MAIN CONCLUSIONS AND RECOMMENDATIONS

Main conclusions and recommendations emerging from the survey experience

A number of problems and difficulties were encountered throughout the data collection phase. Mainly these are:

- Difficulties in obtaining information on types of thermal insulation, as interviewees invoke ignorance. According to the year of dwelling construction checks and imputation were made.

- Maybe the most problematic question was the one on domestic hot water production. Concepts on auxiliary cooperating DHW production systems were unknown to the respondents and minutes/hours used during the winter and/or the summer were among the most difficult to be answered. A more simplified structure of the respective question is recommended in order to facilitate the interviewers to get feedback.

- Difficulties in obtaining the accurate type or model of air conditioning systems, as well as energy class.

- Obtaining detailed data on electricity consumption (amount, reference period, kWh, etc.) proved not to be an easy task, too. The reason for that was that the majority of households either weren't willing to provide the electricity bill or did not kept copies of their electricity bills being absolutely necessary for requested information. An alternative was provided in the questionnaire to give a rough estimate, and was used by approximately 70% of respondents.

- As for electricity consumption information, also for all kind of thermal fuels obtaining detailed information had not proved to be an easy task. Especially for heating oil difficulties were encountered in providing information on operating hours and proportional charge for apartments.

- According to interviewers' feedback difficulties were also encountered in providing energy class for cooking equipment as well as for electric & electronic appliances, and for the last also for providing hours per week used.

- Lighting information proved to be the one out of the two (together with the domestic hot water production) most difficult to obtain. Detailed information (number of units and total wattage) asked for each room separately was proved to be practically inevitable and time consuming. Thus, a simplified structure of the respective question is recommended in order to facilitate the interviewers to get feedback.

- Another question proved to be difficult to answer due to the high technicality involved was the one on total capacity of ceiling/floor fan.

- Respondents were unwilling to provide their annual income. The specific difficulty is well known and expected as this happens also in other household surveys, however to a large degree was solved with the income scale categories.

- As general recommendations for future surveys and in order to have more secure results we note (i) the significance of the availability of all necessary invoices, bills, etc. and for as long a period as possible, that can become feasible by appropriately informing households before the survey conduct and (ii) the significance of the stratification of sampling households according to climate zones, as well as according to characteristics of the building (i.e. age of construction, single family house, multi flat apartment), that can be done with a stand alone survey.

ANNEXES

ANNEX 1.1: Pilot questionnaire (in national language)

ANNEX 1.2: Questionnaire (in national language)

ANNEX 1.3 : Questionnaire (in english)

ANNEX 1.4 : Interviewers' guidelines (in national language)

ANNEX 1.5 : Introductory letter (in national language)

ANNEX 1.6 : Leaflet (in national language)

ANNEX 1.7 : Letter of notification (in national language)

ANNEX 1.8 : Climate zones of Greece