

# 2012

## **Household Energy Consumption Survey**

### **FINAL REPORT**

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## INTRODUCTION

The objective of this project was to carry out a survey on households' final energy consumption in Estonia. For collecting relevant data, a special questionnaire was prepared by Statistics Estonia in cooperation with the Ministry of Economic Affairs and Communications.

In accordance with the Eurostat recommendations the survey aimed to obtain data on the following aspects of households' energy consumption:

- housing stock characteristics;
- household characteristics;
- energy consumption (by type of fuels and energy);
- space heating;
- domestic hot water;
- air-conditioning;
- penetration of electrical appliances in households;
- behavioural practice in households towards efficient use of energy;
- utilisation of renewable energy sources in households.

The survey was carried out using questionnaire based personal interviews in households. The questionnaire consisted of 13 topical sections with the total of 117 questions. In addition to data collection about the direct energy use, several questions on attitude and behavioural practice of households towards more efficient use of energy were included into the survey questionnaire.

All data collected refer to the year 2010.

The brief analysis of the major results is presented in the following report. The tables with detailed results are included in appendices.

## 1. Methodology

### 1.1. Population

The population of the Household Energy Consumption Survey (HECS) consisted of dwellings occupied as primary residence in Estonia. For the sampling frame of HECS an address list, obtained from the Estonian Land Board for the purposes of carrying out the 2011 Population and Housing Census, was used. The purpose of the list was to collect the addresses of all dwellings in Estonia. The sampling frame contained 740,952 addresses.

However, as the sampling frame contained no information on whether the address referred to a primary residence or not, ineligible housing units could not be excluded from the frame before data collection. It is called overcoverage of the frame (Table 2).

### 1.2. Sample

The HECS is a survey based on a probability sample, i.e. population characteristics are estimated using data collected from the sample units and applying survey sampling theory. The sample was drawn using stratified systematic sampling design. In case of this sampling procedure, the population is divided into non-overlapping subpopulations or strata, and independent subsamples are drawn separately from every subpopulation following the systematic sampling procedure and by applying different inclusion probabilities.

To ensure a geographically even distribution of the sample, records in the strata were sorted by address: first by the county code; within the county, by the rural municipality code; within the rural municipality, by the village municipality code.

The original sample included 7,000 addresses. Among the sampled addresses were also two nursing home addresses and some imprecise addresses which were left out from the survey. In addition, households already participating in some other survey carried out by Statistics Estonia were also excluded from HECS to reduce their response burden. The final sample contained 6,626 addresses. Table 1 presents the population and sample sizes, as well as the inclusion probabilities in the strata.

Table 1 **Population, sample sizes and inclusion probabilities**

Stratum no.	Region	Population	Sample	Inclusion probability
1	Tallinn	206 374	1 693	0.0082
2	Harju, Ida-Viru, Pärnu and Tartu counties	314 253	2 833	0.0090
3	Jõgeva, Järva, Lääne, Lääne-Viru, Põlva, Rapla, Saare, Valga, Viljandi, Võru and Hiiu counties	220 325	2 100	0.0095
	Total	740 952	6 626	

Although the inclusion probability is smaller in the first stratum than in other strata, the result gives a relatively large sample for Tallinn.

Data collection was performed through face-to-face interviews during which interviewers entered data directly into laptop computer. In rare cases, paper questionnaire was filled out. Interview was conducted with one member of the household who answered on behalf of the whole household. Usually it was a member responsible for the dwelling.

In case there were several households living in the same housing unit, it was considered one household if there was no separate accounting of the costs of heating.

### 1.3. Response rate

On the basis of the information obtained from the survey, the sample units were divided into three groups: respondents, non-respondents and ineligible units. The initial quality indicator, i.e. the response rate is found by taking into consideration the sizes of these groups.

The HECS is a sample survey and therefore several types of errors like frame errors, non-response, measurement and processing errors may occur. While planning a survey, different procedures are put in place to avoid or at least to reduce the number of errors occurring. Frame errors occur when sampling frame differs from the target population. If the unit belongs to the sampling frame but not to the target population, then the frame has overcoverage. On the other hand, if a unit belongs to the target population but is missing from the sampling frame, the frame has undercoverage. In the HECS the following overcoverage cases appeared:

- imprecise address,
- no dwelling existed on the address (condemned or demolished),
- not occupied or vacant,
- non-residence,
- not a primary residence.

Of the 6,626 addresses included in the HECS sample, 1,560 addresses or 23.5% of the sample units were ineligible. The main reason accounting for the largest proportion of ineligibility rate was not primary residences (e.g. seasonally vacant dwellings) – 12.3% of the sample and 52.3% of frame error. This and other reasons contributing to the ineligibility rate are given in Table 2. The same table also gives an idea of the size of the overcoverage of the frame.

Table 2 **Ineligibility reasons contributing to the frame errors, absolute numbers and relative measures as percentage of the whole sample and percentage of all frame errors**

Reason for ineligibility	Number of sample units	% of ineligible units	% of sample units (% of sample)
Non-residential housing unit	124	7.9	1.9
Imprecise address or no dwelling on given address	180	11.5	2.7
Vacant or not occupied housing unit	440	28.2	6.6
Not primary residence	816	52.3	12.3
Total	1 560	100.0	23.5

The primary quality indicator of the survey is the response rate

$$\frac{v}{n-l} \cdot 100\%,$$

where  $v$  is the number of respondents,

$n$  stands for the initial sample size and

$l$  denotes the number of ineligible units.

In HECS, the sample size without frame error is 5,066 and after data collection 3,690 responses were obtained. Consequently, the response rate was 72.8%.

Response rates by county are presented in Table 3. Valga county was the county with the highest response rate and Tallinn and Harju county without Tallinn – with the lowest response rates.

Table 3 **Response rate by county**

County	Sample size without frame error	Respondents	
	Number	Number	%
Tallinn	1 519	832	54.8
Harju (except Tallinn)	531	369	69.5
Hiiu	34	31	91.2
Ida-Viru	649	514	79.2
Jõgeva	121	110	90.9
Järva	126	109	86.5
Lääne	113	90	79.6
Lääne-Viru	252	197	78.2
Põlva	97	87	89.7
Pärnu	339	291	85.8
Rapla	140	125	89.3
Saare	124	113	91.1
Tartu	555	416	75.0
Valga	121	112	92.6
Viljandi	211	183	86.7
Võru	134	111	82.8
Total	5 066	3 690	72.8

**Non-response**

Not all sample units participated in the survey. There were different reasons for non-response. In HECS, non-response occurred because household could not be contacted, household refused from participation, household was not able to participate due to the illness or some other reason, etc. In order to reduce the non-response additional efforts from the interviewers and national statistical institutes needed to be implemented.

Table 4 **Number of non-respondents by the cause of non-response in absolute and relative measures**

Reason for non-response	Total	%
Non-contact	764	55.5
the sample person is temporarily residing elsewhere	16	1.2
the sample person is not residing in his/her place of residence during the survey period	5	0.4
having entered the house, the interviewer was unable to locate the person to be interviewed because he/she was not at home	628	45.6
unable to enter house/stairwell	113	8.2
other reason why the person to be interviewed could not be found	2	0.1
Refusal	482	35.0
refusal (categorical) to answer	364	26.5
refusal due to lack of time	76	5.5
disappointment in the state, statistics or the benefit of surveys	15	1.1
refusal due to poor economic situation	2	0.1
lack of trust, suspicion regarding the ability to ensure the confidentiality of data	18	1.3
the survey is too complicated / requires additional work	4	0.3
the respondent has already participated in surveys	3	0.2
Other reasons	130	9.5
not responding due to exceptional circumstances in the household	15	1.1
health problems, invalidity, disability, etc., due to which the respondent is unable to participate in the survey	10	0.7
senior age, cannot cope by oneself, and therefore cannot participate in the survey	13	1.0
the respondent was not in the agreed place at the agreed time or contact was avoided	50	3.6
other	42	3.1
Total	1 376	100.0

Table 4 reveals that over a half of the non-response was due to the inability to establish contact with the household. This was mainly because the respondent was not at home (628 cases). Among the refusals, the largest group was categorical refusal and refusal without justification. This occurred in 364 cases, which was 26.5% of the loss.

#### 1.4. Calculating estimations

In the sample survey only a part of the population is observed. Survey results are expanded to the whole population by calculating weights for every responded household. The calculation of weights consisted of the following stages:

- calculation of design weights;
- weights adjustment for non-response;
- calibration.

##### Design weights

The design weight is the inverse of the inclusion probability (see Table 1). Inclusion probabilities can be computed after sample selection for all sampled units. For unit  $i$  in stratum  $h$  the probability of being selected into sample, i.e. the inclusion probability is

$$\pi_{hi} = \frac{n_h}{N_h},$$

where  $N_h$  is the total number of addresses in the sampling frame in stratum  $h$  and  $n_h$  is the sample size in stratum  $h$ .

The design weight was calculated for all sampled households: the responded and non-responded households.

##### Adjusting for non-response

A certain amount of non-response is typical in the sample surveys. As with any errors, they can affect the final estimates resulting in biased estimates. Therefore, procedures to measure the effect of errors and to reduce the bias need to be in place. Here, weight correction to adjust for non-response bias was used. This is done in two steps. Firstly, household's response probability  $r_{hi}$  was estimated by applying logistic regression model with the independent variables of county and urbanized area type. Secondly, the weight adjustment for non-response was calculated using the following formula:

$$w_{hi}^* = w_{hi} / r_{hi}.$$

##### Calibration

The final estimates were calculated by using the weights calibrated onto known data from other sources in order to diminish the bias caused by non-response and frame errors. In calibration, the household's weight  $w_{hi}^*$  was adjusted by a suitable coefficient  $f_i$ , determined so that the population distributions, amount of electricity, heat energy and natural gas and total number of cars estimated with the help of new weights coincided with the known population quantities.

The following characteristics were used to calibrate:

- total population size
- population size by counties
- population size in urban and rural areas
- total number of households by household's size (one, two, three, four and five and more person households)
- total electricity consumption in the population
- total heat energy consumption in the population
- total natural gas consumption in the population
- total number of cars in the population

In HECS, the population size published in the statistical database of Statistics Estonia (as of 1 January 2011) served as the basis for calibration. The number of institutionalized persons (e.g. living in prisons, orphanages or care homes) is deducted according to the data of the Ministry of Social Affairs and Ministry of Justice. Inasmuch the activeness in answering the Questionnaire depended on the place of residence, the distribution of households by county of residence and by degree of urbanisation are used in calibration for the purpose of correcting the bias.

The total consumption of electricity, heat energy (including thermal energy for heating water) and natural gas used for calibration were taken from the reports of electricity and thermal energy sellers. The total number of cars was obtained from the register.

SAS macro Calmar developed by INSEE was used to carry out calibration.

The final weight of household is calculated using the formula

$$w_i = w_{hi}^* \cdot f_i.$$

The final weight of household was used to calculate household estimates. In addition, the weight for each dwelling was computed, as inference about housing units was also of interest. The weight of dwelling was obtained by dividing the weight of the household by the number of households living in that dwelling.

Generalized regression estimator (GREG) was used for computing the final estimates:

$$\hat{Y} = \sum_{i=1}^m w_i \cdot y_i,$$

Where  $\hat{Y}$  is the estimated population total,  $m$  is the number of responded households,  $w_i$  is the final weight of household  $i$  and  $y_i$  is the observed value of the study variable for the household  $i$ .

The quantities calculated on the basis of sample data are estimates of the actual value of the population. The difference from the population value is called random error or sampling error of the estimator. It is not possible to specify the sampling error exactly, but it can be estimated statistically by taking the variability or dispersion of the statistics that is used for parameter estimation as the basis for the sample design used in the survey. In addition to the sample design, the sampling error depends on the sample size. A smaller sampling error can be expected in case of larger sample sizes.

An important group of quality indicators consists of the accuracy estimates of parameters calculated on the basis of the survey. The accuracy estimates provided by Statistics Estonia are estimates of the sampling error, i.e. these estimates do not reflect other possible error sources. Estimates of sampling error are calculated for more important indicators.

The standard error is the most used measure of the sampling error. The standard error is a mathematical quantity that characterizes the variability of the estimate calculated on the basis of the sample. Due to the randomness of the sample, the estimated value of the parameter is also a random quantity, with its own variability. The smaller the variance or standard error, the more accurate the parameter estimates. The size of the standard error depends on the sample size and sampling design.

The reliability of the results is characterized by a relative standard error or coefficient of variation (CV), which is calculated using the formula

$$CV = \frac{st.err(\hat{Y})}{\hat{Y}},$$

where  $\hat{Y}$  is the estimated population parameter and  $st.err(\hat{Y})$  is the standard error of the estimate.

The relative standard error shows the proportion that the estimate's standard error forms of the estimated value. It is often presented as a percentage. The relative standard error is independent from measuring units, allowing comparison between different parameter estimates irrespective of their measurement units. The relative standard error is an operative measure enabling a quick overview of the accuracy of estimates.

The calibration was taken into account when calculating the standard errors of the parameters presented in Table 5.

Table 5 **Estimates and relative standard errors of the energy consumption by households (incl. economic activity at home) in Estonia as a whole and by degree of urbanisation**

Indicator	Unit	Total		Urban area		Rural area	
		Estimate	CV, %	Estimate	CV, %	Estimate	CV, %
Electricity	GWh	2 049	0.0	1 291	0.0	758	0.0
Heat for space heating (purchased)	GWh	3 579	0.3	3 212	0.3	367	0.9
Heat for tap water (purchased)	GWh	591	1.9	567	1.9	24	14.2
Natural gas	thousand m <sup>3</sup>	70 600	0.0	55 783	0.0	14 817	0.0
LPG	tons	2 646	7.7	1 131	12.5	1 515	9.8
LFO	tons	10 731	21.5	5 344	29.6	5 387	31.2
Hard coal	tons	11 767	20.4	7 689	27.2	4 078	28.8
Firewood	thousand m <sup>3</sup> st	2 916	1.9	1 065	3.9	1 851	2.1
Wood waste	thousand m <sup>3</sup> st	109	11.8	42	17.7	67	15.7
Wood briquettes	tons	36 072	12.6	21 789	15.8	14 283	20.7
Wood pellets	tons	5 828	44.6	1 554	92.6	4 274	50.7
Peat briquettes	tons	14 104	13.4	8 730	18.5	5 374	18.0
Petrol	tons	200 942	2.4	125 130	3.1	75 811	3.8
Diesel oil	tons	71 701	5.1	44 392	7.0	27 308	6.8

## 2. Dwelling stock

In Estonian statistics a dwelling is defined as a one-family house or a section of a two-family or terraced house or flat, which consists of one or more rooms and meets sanitary engineering requirements and is suitable as a permanent residence. The total number of dwellings was 567,800, of which 72.5% were in urban areas and 27.5% in rural areas (Table 6 and A1-1<sup>a</sup>).

Table 6 **Dwelling stock by ownership**

Ownership	Total	In urban areas	In rural areas
Total	567 769	411 520	156 249
Owner-occupied	474 142	336 908	137 234
Rented	93 627	74 612	19 015

In Estonia, the share of home-ownership is high – the tenure analysis of survey results indicated that 83.5% of dwellings are owner-occupied and 16.5% rented.

As to types of dwellings, in urban areas the housing stock is dominated by multi-flat buildings (84.6 %), in rural areas family houses account for 56.2% of dwellings (Table 7 and A1-2).

Table 7 **Dwellings by type of building**

Type of building	Total	In urban areas	In rural areas
Total	567 769	411 520	156 249
Single-family house	139 616	51 799	87 817
Two-family house	9 555	5 116	4 439
Terrace house	6 778	3 149	3 629
Apartment in a house with less than 10 dwellings	41 907	27 801	14 106
Apartment in a house with 10 or more dwellings	366 351	320 756	45 595
Dormitory (hostel)	2 132	1 966	166
Other	1 430	933	497

The age distribution of housing stock shows that the majority (69.5%) of dwellings have been built in the period 1946–1990 (Table 8 and A1-3).

Table 8 **Dwellings by year of construction**

Year of construction	Total	In cities	In rural areas
Total	567 769	411 520	156 249
before 1946	77 035	34 582	42 453
1946–1990	394 485	310 011	84 474
1991–2000	24 542	16 156	8 386
2001–2005	15 355	8 938	6 417
2006–2011	27 134	17 098	10 036
Building in progress	1 352	450	902
Not known	27 866	24 285	3 581

There is a significant difference in the share of old (built before 1946) buildings between urban (8.4%) and rural areas (27.2%). One third (33.6%) of dwellings are habited by one person only.

<sup>a</sup> The tables with index A refer to the Appendix.

### 3. Households

Household is a group of people who live in a common main dwelling (at the same address) and share joint financial and/or food resources and whose members consider them to be one household. Household can also consist of one member only.

In 2010, the total number of households in Estonia was 585,786. As the number of dwellings was smaller (567,769), it means that 3.1% of households shared their dwelling with another household. 81.7% of households had up to three members (Table 9 and A2-1), the average size of a household was 2.3 persons.

Table 9 **Households by size**

Number of members	Total	In urban areas	In rural areas
Total	585 786	423 399	162 387
1	204 037	154 095	49 942
2	173 994	127 346	46 648
3	100 832	74 317	26 515
4	74 908	52 774	22 133
5	22 202	11 249	10 953
6 or more	9 814	3 619	6 195

The survey revealed that a small number of households (2.7% in urban areas, 6.2% in rural areas) were engaged in domestic economic activities (Table 10 and A2-3).

Table 10 **Households by economic activity**

Economic activity	Total	In urban areas	In rural areas
Total	585 786	423 399	162 387
economic activity at home	21 345	11 305	10 040
no economic activity at home	564 441	412 094	152 347

The comparative analysis of households' energy consumption with and without involving domestic business activities indicates the minor difference. Therefore, the major analyses of households' energy use are carried out without taking account the home business use. The detailed tables with the data for both cases are presented in A3-1 and A3-2.

Approximately an half (51.4%) of households lives in dwellings with the heated area of 50–100 m<sup>2</sup>. Data by group of heated area are given in Table 11 (see also A2-2).

Table 11 **Households by heated area of dwelling**

Dwelling heated area, m <sup>2</sup>	Total	In urban areas	In rural areas
Total	585 786	423 399	162 387
less than 20	6 894	5 803	1 091
20–49	226 865	187 106	39 759
50–100	300 866	208 525	92 341
101–150	30 830	12 939	17 891
151 or more	20 331	9 026	11 305

## 4. Energy use

### 4.1. Energy use by households

The energy types used by households are presented in Table 12, here arranged by the share in the total number of households.

The analysis of energy and fuel types consumed (by number of households) indicated that electricity was used in 99.7% of households and 57.5% purchase heat from district heating systems. Regarding combustibles, the firewood was the most widely used fuel – as an average it was used in 37.5% of households, in rural areas the share was even 73%. In urban areas, one fourth (25.9%) of households are connected to the natural gas grid, the average for all households being 19.7%. In rural areas the liquid petroleum gas (LPG) is used by 17.5% of households. The use of motor fuels has been analysed in Chapter 5. The number of households using other fuels is relatively small. The coal and light fuel oil (LFO) are used in 0.9% and 0.8% of households, respectively. As to local fuels other than firewood, wood waste, wood briquettes and peat briquettes were used by 3.8%, 2.5% and 1.9% of households, respectively. The wood pellets, the fuel produced in Estonia in large quantities, are used in 0.2% of households only; the reason for this being the high price level.

Table 12 **Energy consumption by households (the share in the total number of households, %)**

Type of energy	Total	In urban areas	In rural areas
Electricity	99.7	99.6	99.8
Heat for space heating (purchased)	57.5	71.9	19.9
Petrol	52.4	45.7	69.8
Hot tap water (purchased)	47.0	62.5	6.8
Firewood	37.5	23.9	73.0
Natural gas	19.7	25.9	3.4
Diesel oil	16.6	13.8	24.1
LPG	8.8	5.5	17.5
Wood waste	3.8	2.6	7.0
Wood briquettes	2.5	2.2	3.1
Peat briquettes	1.9	1.5	2.8
Hard coal	0.9	0.8	1.2
LFO	0.8	0.6	1.2
Wood pellets	0.2	0.1	0.4

The households' data on consumption level of fuels based on the results of the survey are presented in Table 13. Here, the data cover the consumption in all households, excluding the energy utilised for domestic business activities. The data on total use of energy by households including the part used for domestic entrepreneurship activities are presented in A3-1.

Table 13 **Energy consumption by households (natural units)**

Energy/fuel	Unit	Total	In urban areas	In rural areas
Electricity	GWh	2 023	1 291	738
Heat (purchased)	GWh	3 571	3 212	367
Hot tap water (purchased)	GWh	589	567	24
Natural gas	thousand m <sup>3</sup>	70 258	55 783	14 817
LPG	tons	2 634	1 131	1 504
LFO	tons	10 571	5 344	5 295
Hard coal	tons	11 622	7 689	3 975
Firewood	thousand m <sup>3</sup> st	2 914	1 065	1 849
Wood waste	thousand m <sup>3</sup> st	109	42	67
Wood briquettes	tons	36 060	21 789	14 283
Wood pellets	tons	5 828	1 554	4 274
Peat briquettes	tons	13 755	8 730	5 032
Petrol	tons	194 185	125 130	72 515
Diesel fuel	tons	67 984	44 392	23 940

The total energy consumption by households was calculated using the average calorific values of fuels. The survey indicated that the greatest amount of energy used by households is based on wood fuels: 17.29 PJ (40.2% of non-motor fuels) comes from wood, incl. 16.26 PJ of firewood (Table 14). The total share of wood fuels in non-motor fuel consumption is 40.2% as average, being even 68.2% in rural areas.

Table 14 **Energy consumption by households (TJ)**

Type of energy	Total	In urban areas	In rural areas
Electricity	7 282	4 647	2 657
Heat (purchased)	12 854	11 563	1 321
Hot tap water (purchased)	2 120	2 042	85
Natural gas	2 361	1 874	498
LPG	120	51	68
LFO	447	226	224
Hard coal	316	209	108
Firewood	16 257	5 943	10 315
Wood waste	320	124	197
Wood briquettes	610	369	242
Wood pellets	99	26	72
Peat briquettes	220	140	81
Total (excl. motor fuels)	43 006	27 214	15 868
Petrol	8 544	5 506	3 191
Diesel oil	2 876	1 878	1 013
Total – motor fuels	11 420	7 384	4 204
Grand total	54 426	34 598	20 072

For analysing the consumption amount of every source of energy by a household the total amount was divided by the number of households that consumed this particular source (Table 15).

Table 15 **Annual average consumption by a household<sup>a</sup>**

Type of energy	Unit	Total	In urban areas	In rural areas
Electricity	kWh	3 465	3 061	4 553
Heat (purchased)	kWh	10 608	10 555	11 361
Hot tap water (purchased)	kWh	2 138	2 144	2 189
Natural gas	m <sup>3</sup>	610.3	508.9	2 693.5
LPG	kg	51	48	53
LFO	tons	2.3	2.0	2.8
Hard coal	tons	2.2	2.3	2.0
Firewood	m <sup>3</sup> st	13.3	10.5	15.6
Wood waste	m <sup>3</sup> st	4.9	3.9	5.9
Wood briquettes	tons	2.5	2.3	2.8
Wood pellets	tons	5.9	6.2	5.9
Peat briquettes	tons	1.2	1.4	1.1
Petrol	litres	844	863	853
Diesel oil	litres	822	897	721

<sup>a</sup> – only the households using this concrete energy source.

## 4.2. Space heating

In Estonia, the central heating systems are widespread for supplying dwellings with heat, especially in urban areas (see A1-5 and A2-4). Nearly 70% of dwellings use the central heating as a heat source, 88.4% of them are connected to a district heating (DH) system. 30% of dwellings have stoves, kitchen ranges or fireplaces for space heating and partially for cooking. 8% of dwellings use electrical heating, but only in 4.3% the stationary electrical heating equipment is installed. 3.1% of dwellings are equipped with heat pumps that in many cases are used in combination with other heat sources.

Electrical space heating is used also as floor heating in 15.3% of dwellings, water based floor heating is used in 2.8% of dwelling stock.

As the survey was focused on households, in Table 16 the shares of space heating options are presented for both, dwellings and households.

Table 16 **Heat sources for space heating (%)**

Heat source	Share in dwellings	Share in households
District heating	61.8	61.1
Local central heating	8.1	8.3
Electric heating (built-in)	4.3	4.4
Electric heating (portable heaters)	3.7	3.8
Ovens, stoves, fireplaces	30.4	30.8
Heat pumps	3.3	3.5

### 4.3. Hot tap water supply

The answers on questions about domestic hot tap water indicate that 10.2% of all dwellings lack the hot water supply, in rural areas the respective share is even 22.7% (see A1-6). The majority (46.9%) of dwellings is supplied with hot water from the DH system.

There is a great difference between urban and rural areas: the share of DH in hot water supply is 62.3% in urban areas and only 6.9% in rural areas. In 35.4% of dwellings a hot water meter has been installed.

The shares of domestic hot water by dwellings and households are presented in Table 17 and Table 18, respectively (see also A2-5).

Table 17 **Sources of domestic tap water by dwellings (%)**

Heat source	Total	In urban areas	In rural areas
District heating	46.9	62.3	6.9
Local central heating	6.6	5.5	9.6
Heat exchanger in own dwelling	35.4	26.1	59.4
Heat pump	0.9	0.7	1.4
No domestic hot water supply	10.2	5.4	22.7

Table 18 **Sources of domestic tap water by households (%)**

Heat source	Total	In urban areas	In rural areas
District heating	46.5	62.0	6.8
Local central heating	6.6	5.5	9.4
Heat exchanger in own dwelling	35.8	26.2	60.2
Heat pump	1.0	0.8	1.3
No domestic hot water supply	10.1	5.4	22.3

### 4.4. Behavioural practice towards efficient use of energy in households

The residential sector holds a significant potential for energy saving if the energy consumption habits change. Therefore, in the questionnaire some questions were included to learn households' attitude towards monitoring their energy consumption. Also, households were asked about refurbishment activities, as well as about their motivation and intentions with regard to more efficient energy use.

The answers to the question about monitoring show that 61.1% of households monitor their energy use constantly, 25.3% sometimes, but 13.6% declared that they do not monitor the energy consumption at all. As to monitoring by energy and fuel type, primarily electricity consumption is monitored (85.4%), in case of natural gas the percentage is 12.1%. Regarding consumption of other fuels, only motor fuels are monitored by 20.9% of households.

As a rule, the motivation for a household to conserve energy assumes the possibility to measure and monitor the consumption. 24.3% of households responded that they monitor their heat consumption, i.e. their monthly use of purchased heat from DH or local central heating system. Due to the technical peculiarity (primarily one-pipe systems in apartment houses) of central heating systems in multi-storeyed residential buildings the direct metering of energy consumed for space heating is not possible. Therefore, the heat consumption is allocated between apartments according to their heated floor areas (94.5% of households in DH systems). Nevertheless, in 4.5% of cases there is a direct metering of heat used for space heating. In few cases the heat consumption calculations are based on readings of special allocators mounted on every radiator in the apartment. This possibility is a relatively new one and in use only by 0.8% of households connected to DH systems.

Regarding the metering of other heat consumption, the use of hot domestic water is measured to a large extent in dwellings connected to DH system. For 96.4% of households the consumption measurement is based on readings of hot tap water meters. Only in 3.6% of cases other indicators are used – primarily the number of persons in the household.

The consumption of natural gas is measured for all dwellings connected to gas grid. 53.4% of these dwellings have meters installed directly in the apartment, in other cases the consumption is metered by groups of dwellings in apartment houses.

A general question about possible complaints of households on indoor climate quality of their dwellings was included in the questionnaire. The majority of dwellings (79.9%) were assessed as having normal indoor climate. Only 15.3% of dwellings were considered too cold and 2.2% as too warm.

A special question was about refurbishment activities by households for improving the thermal insulation of their dwellings. The answers revealed that in 61.9% of dwellings some measures to save energy have been taken (see Table 19).

Table 19 **Improvement of thermal insulation in dwellings, %**

Measure	%
Improvement measures taken, total	61.9
incl. windows replacement	88.0
outer walls insulation	62.5
roof insulation	59.0

Most of measures (88%) include windows replacing, the additional insulation of the building envelope (roofs and outer walls) are other improvements made. The additional thermal insulation, especially the new air tight windows, may worsen the indoor climate in dwellings. Therefore, the insulation measures integrated with ventilation improvements are growing popularity. The survey revealed that 12.8% of dwellings have forced (controlled) ventilation systems, but only 8.3% (1.1% of the total dwelling stock) of them have installed the heat recovery equipment reusing the energy from the exhaust air.

38.1% of households had not taken any measures for improving the thermal insulation of their dwellings. There was a question about the main reasons of not doing any refurbishing – the main argument of the respondents was the lack of money (46.4% of this group), 21.9% had other reasons. In 17.1% of cases the insulation was assessed as good enough, and 14.6% of not renovated dwellings were located in new houses. The question about plans for refurbishing was answered as follows: in 58% of dwellings there are no plans, 23.2% have plans to make it after three years and 18.7% have planned to carry out the improvement work during the next three years.

As to energy saving practice, the households were asked also about the use of energy saving lights – compact fluorescent and other types of low-energy light bulbs instead of incandescent light bulbs. 55.4% of households responded that they have installed at least some low-energy light bulbs in their dwellings (for more detailed response see A2-7).

The overview of the energy efficiency level of electrical appliances used by households is given in Chapter 4.

## 5. Electrical appliances in households

Electricity consumption in Estonia has grown during recent years. The studies in several EU countries have shown that the increase of electricity consumption per household does not mean that households do not save electricity. The electricity use is growing primarily due to the increasing number of appliances owned by households. The results of this survey enable to show the present status of electricity consumption for the main appliances and equipment.

In households a large number of electrical appliances are in use, most of them still with a rather small fraction of total electricity consumption.

The average annual use of electricity was 3,465 kWh per household, being higher in rural areas – 4,553 kWh, in cities the average consumption was 3,061 kWh (see Table 15).

The list of major electrical appliances with the highest penetration rate among households in Estonia is presented in Table 20, the full list of appliances with their penetration rates is presented in tables A2-6.1 and A2-6.2.

Table 20 **Use of the most widespread electric appliances**

Type of the appliance	Share, %
Refrigerator	99
Vacuum cleaner	93
TV	97
Washing machine	89
Music centre (with combined radio)	73
Electric cooker	72
Personal computer	68
Microwave oven	61
TV set-top box and SAT-TVs	50

Regarding electrical appliances, refrigerators have the highest penetration rate – 99% of households have a refrigerator. Additionally, 16.5% of households have a standalone freezer. As to other widely owned appliances, for vacuum cleaners the penetration rate is 93% and for washing machines 89%.

Another wide group of appliances is the TV equipment. At least one TV is in 97.3% of households. In 16.5% of households there are two or more TVs. The older type, cathode tube TVs are owned by 62% of households, a LCD or LED TV is in 41% of households and the rate of plasma TV ownership is 9.4%. Additionally, 0.6% of households have already 3D TVs. In 50% of households there are set-top-boxes for receiving digital TV signals and/or SAT-TV antenna equipment. As to other entertainment systems, 73% of households have a music centre (with or without radio), 42% a separate DVD player, 12% have obtained home cinema equipment.

The information technology is developing rapidly – more than two thirds (68%) of households have at least one personal computer. 46% of households have a desktop computer, a portable computer (laptop, notebook, etc.) is also in 46% of households. 2.5% of households have two or more desktop computers and 8.8% have more than one portable computer. A printer is owned by 32% of households.

As to cooking appliances in use, electric cookers are in 72% of households, microwave ovens and electric cooking ovens are in 61% and 19% households, respectively. 46% of households have equipped their kitchens with an electric cooker hood and in 15% of households there is a dishwashing machine.

The largest by unit capacity (several kW) electricity equipment used by households are electric (stove) heaters for saunas. Sauna has a long tradition and is therefore quite popular in Estonia. In rural areas the sauna is heated by wood, as a rule; in cities primarily electricity is used, wood firing option being in the second position. The survey showed that 4% of households have electrical heaters in sauna.

Regarding the level of energy efficiency of electrical appliances in use by households, the survey indicated that the highest share of the class A or higher level appliances are for plasma TVs (80% of the stock), dish washers (79%) and for LED/LCD TVs (77%). As to larger appliances that are in everyday use, 56% of refrigerators and 52% of freezers have at least efficiency class A (see A2-6.1).

As to use of energy saving light-bulbs and heat pumps, the survey results are described in Chapters 3 (section 3.3) and 6 (section 6.2), respectively.

## 6. Use of cars and consumption of motor fuels

The questionnaire included several questions for households on ownership of cars and use of motor fuels. The results indicate that 60.1% of households own at least one car, about three fourths of them (74%; 44.5% of all households) have one car, and 1.8% of households own three or more cars (see A4-1). The total average ownership is 0.78 cars per household. This indicator is higher for households living in rural areas – 1.01, being in cities 0.69. Among households owning car(s) the average number is 1.3 cars.

The technical specification overview of cars shows that more than a half of the cars (55.8%) have an engine with the capacity in the range of 1,501 – 2,000 cm<sup>3</sup> (see Table 21 and A4-3).

Table 21 **Cars by engine capacity**

Engine capacity, cm <sup>3</sup>	%
Up to 1000	13.5
1001–1500	13.4
1501–2000	55.8
2001 and more	17.3

The analysis of the car stock age revealed that 46.6% were manufactured in years 1991–2000 and 9.8% of cars are older than 20 years (Table 22 and A4-2).

Table 22. Cars by manufacturing year

Year	%
Before 1980	1.9
1981–1990	7.9
1991–2000	46.6
2001–2010	43.7

The cars using petrol as a fuel are dominating, having a share of 78.6%. In 2010, the total distance (mileage) driven by all cars (owned by households) was 5.18 million km. The average annual mileage per car was 11,394 km.

The total consumption of petrol and diesel oil by households was 266.21 and 79.30 million litres, respectively. The annual fuel consumption per car was 745 litres for a petrol car and 863 litres for a diesel car. The use of motor fuels per household who own at least one car was 903 litres of petrol and/or 918 litres of diesel fuel.

## 7. Use of renewable energy sources

### 7.1. Biomass

Estonia holds the fifth place in Europe (after Finland, Sweden, Slovenia and Latvia) for the share of forest land in the total territory – approximately 51%. In 2010, biomass accounted for 14.1% of the primary energy supply of fuels.

Wood-based biomass is widely used by households for heating and cooking, especially in rural areas. Regarding the possibility for using wood fuels by households, the results of the survey show that 30.8% of all households have an oven, stove or a fireplace in their dwelling (see Table 16 and A3-3.2). Also, wood fuel can be fired in boilers of local central heating installed in 8.3% of households' dwellings. Hence, as an average, more than a third of households can use wood as a fuel. The analysis indicated that as to combustibles used by households in Estonia, the firewood is the most widely used fuel – it is used in 37.5% of households, in rural areas the share is even 73%.

The survey results indicate that wood fuels made up 34.8% of total energy (excl. motor fuels) used by households. The Table 23 shows that almost all amount of wood (94%) is used as firewood; the other wood fuels (briquettes, pellets and wood waste) have a minor share.

Table 23 Use of wood fuels by households

Type of fuel	Volume, natural units	Energy, TJ	Share, %
Firewood	2 914 10 <sup>3</sup> m <sup>3</sup> st	16 257	94.0
Wood waste	109 10 <sup>3</sup> m <sup>3</sup> st	320	1.9
Wood briquettes	36 060 t	610	3.5
Wood pellets	5 828 t	99	0.6
Total		17 286	100.0

### 7.2. Other renewable sources and heat pumps

The survey questionnaire contained questions about the use of renewable energy sources other than biomass as well – wind, hydro and solar energy. There were no households with own wind generator in the survey sample. As to hydro and solar energy, the extrapolation from the sample indicated that 94 households (0.02% of all households) were using electricity from hydro energy and 172 (0.03%) households utilizing solar energy for electricity generation (PV electricity).

Additionally, the energy from heat pumps can be partially considered as renewable one as well. Therefore, the use of heat pumps has to be also analysed. Heat pumps can be used for both heating and cooling (air conditioning). 3.5% of households have installed a heat pump in their dwellings. In Estonia, the popularity of heat pumps started to grow some years ago – 74.8% of heat pumps have been installed in years 2008–2010 (see A5-6). Primarily, the air-source heat pumps (mainly air-to-air pumps) were in use. To some extent, also ground-source heat pumps (mainly ground-to-water pumps) have been taken in use (see Table 24).

Table 24 Types of heat pumps in use, %

Type	Share
Air-to-air	69.6
Air-to-water	15.7
Ground-to-air	0.7
Ground-to-water	13.9

It has to be noted that in the climate of Estonia the air source heat pumps are not effective when the outside air temperature is very low (about -20 ...-15 °C), while ground-source heat pumps are not affected.

The majority of heat pumps have the unit capacity in the range of 4–7 kW (see Table 25).

Table 25 **The unit capacity of heat pumps, %**

Capacity, kW	Share
1–3	15.0
4–7	50.0
8–10	18.1
11–15	17.0

28.5% of households used heat pumps both for space heating and tap water heating, the rest of them (71.5%) used the heat pumps only for space heating. Nevertheless, over a half of heat pump owners (52.8%) used the pump for space cooling as well. Still, due to the climate the need for cooling in dwellings is rather rare in Estonia.

## 8. Conclusion

The aim of the project – to collect more detailed data on households' energy consumption – was achieved. Also, the survey gave information about the overall attitude of households towards more efficient use of energy in their dwellings.

As background information, data on dwellings' and households' characteristics were obtained. Specific data on options of space heating and supply of domestic hot tap water in dwellings were acquired. The data on the amount of energy used in every household were collected by type of energy and fuel. The survey examined also penetration share of electrical appliances in households. The stock and use of cars by households was investigated as well. And, last but not least, the survey also covered the use of renewable energy sources.

Currently, the first major results of the survey are being disseminated. Due to the large amount of received data the more detailed analyses will be carried out in the nearest future.

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## Appendix 1. Dwellings

Table A1-1 **Dwelling stock by ownership**

Ownership	Total	Urban areas	Rural areas
Total	567 769	411 520	156 249
owner-occupied	474 142	336 908	137 234
rented	93 627	74 612	19 015
<b>Percentage</b>			
Ownership	Total	Urban areas	Rural areas
Total	100.0	100.0	100.0
owner-occupied	83.5	81.9	87.8
rented	16.5	18.1	12.2

Table A1-2 **Dwelling stock by building type**

Dwelling type	Total	Urban areas	Rural areas
Total	567 769	411 520	156 249
Single-family house	139 616	51 799	87 817
Two-family house	9 555	5 116	4 439
Terrace house	6 778	3 149	3 629
Apartment in a house with less than 10 dwellings	41 907	27 801	14 106
Apartment in a house with 10 or more dwellings	366 351	320 756	45 595
Dormitory (hostel)	2 132	1 966	166
Other types	1 430	933	497
<b>Percentage</b>			
Dwelling type	Total	Urban areas	Rural areas
Total	100.0	100.0	100.0
Single-family house	24.6	12.6	56.2
Two-family house	1.7	1.2	2.8
Terrace house	1.2	0.8	2.3
Apartment in a house with less than 10 dwellings	7.4	6.8	9.0
Apartment in a house with 10 or more dwellings	64.5	77.9	29.2
Dormitory (hostel)	0.4	0.5	0.1
Other types	0.3	0.2	0.3

Table A1-3 **Dwellings by construction year**

Building year	Total	Urban areas	Rural areas
Total	567 769	411 520	156 249
before 1946	77 035	34 582	42 453
1946–1990	394 485	310 011	84 474
1991–2000	24 542	16 156	8 386
2001–2005	15 355	8 938	6 417
2006–2011	27 134	17 098	10 036
Building in progress	1 352	450	902
Not known	27 866	24 285	3 581
<b>Percentage</b>			
Building year	Total	Urban areas	Rural areas
Total	100.0	100.0	100.0
before 1946	13.6	8.4	27.2
1946 - 1990	69.5	75.3	54.1
1991 - 2000	4.3	3.9	5.4
2001 - 2005	2.7	2.2	4.1
2006 - 2011	4.8	4.2	6.4
Building in progress	0.2	0.1	0.6
Not known	4.9	5.9	2.3

Table A1-4 **Dwelling stock by heated area**

Dwelling heated area, m <sup>2</sup>	Total	Urban areas	Rural areas
Total	567 769	411 520	156 249
less than 20	5 368	4 586	782
20—49	206 738	173 086	33 652
50—100	300 583	210 045	90 538
101—150	32 716	13 423	19 293
151 or more	22 364	10 380	11 984
<b>Percentage</b>			
Dwelling heated area, m <sup>2</sup>	Total	Urban areas	Rural areas
Total	100.0	100.0	100.0
less than 20	0.9	1.1	0.5
20—49	36.4	42.1	21.5
50—100	52.9	51.0	57.9
101—150	5.8	3.3	12.3
151 or more	3.9	2.5	7.7

Table A1-5 **Dwellings by heat source of space heating**

Heat source	Dwellings	Percentage
District heating	350 845	61.8
Local central heating	46 145	8.1
Electric heating (built-in)	24 333	4.3
Electric heating (portable heaters)	20 798	3.7
Ovens, stoves, fireplaces	172 446	30.4
Heat pumps	18 880	3.3

Table A1-6 **Dwellings by source of hot tap water**

Heat source	Total	Urban areas	Rural areas
District heating	272 050	260 838	11 212
Local central heating	38 344	22 811	15 533
Water heater in own dwelling	205 415	109 261	96 154
Heat pump	5 190	2 975	2 215
Solar water heaters	0	0	0
No domestic hot water supply	59 481	22 729	36 752
<b>Percentage</b>			
Heat source	Total	Urban areas	Rural areas
District heating	46.9	62.3	6.9
Local central heating	6.6	5.5	9.6
Water heater in own dwelling	35.4	26.1	59.4
Heat pump	0.9	0.7	1.4
Solar water heaters	0.0	0.0	0.0
No domestic hot water supply	10.2	5.4	22.7

Table A1-7 **Assessment of dwellings' in-door climate by households**

Assessment	Total	Urban areas	Rural areas
Total	567 769	411 520	156 249
Normal	453 665	327 933	125 732
Too cold	86 678	60 680	25 998
Too warm	12 381	10 182	2 199
Poor ventilation	3 854	3 647	208
High humidity	11 190	9 079	2 112
<b>Percentage</b>			
Assessment	Total	Urban areas	Rural areas
Total households	100.0	100.0	100.0
Normal	79.9	79.7	80.5
Too cold	15.3	14.7	16.6
Too warm	2.2	2.5	1.4
Poor ventilation	0.7	0.9	0.1
High humidity	2.0	2.2	1.4

Table A1-8 **Ventilation of dwellings**

	Yes	No
Forced ventilation	72 460	495 309
Heat recovery from the exhaust air	5 982	561 787
<b>Percentage</b>		
	Yes	No
Forced ventilation	12.8	87.2
Heat recovery from the exhaust air	1.1	98.9

Table A1-9 **Thermal refurbishment of dwellings**

	Yes	No
Total of refurbished dwellings	351 185	216 584
incl. replacing windows	309 134	---
incl. thermal insulation of outer walls	219 491	---
incl. thermal insulation of the roof	207 164	---
<b>Percentage</b>		
	Yes	No
Total of refurbished dwellings	61.9	38.1
incl. replacing windows	88.0	---
incl. thermal insulation of outer walls	62.5	---
incl. thermal insulation of the roof	59.0	---

Table A1-10 **Reasons for not refurbishing dwellings**

	Total	Urban areas	Rural areas
Total of not refurbished dwellings	216 584	159 845	56 739
new dwelling	31 555	22 326	9 230
sufficient insulation	37 142	28 414	8 728
lack of money	100 490	69 457	31 032
other reasons	47 397	39 648	7 749
<b>Percentage</b>			
	Total	Urban areas	Rural areas
Total of not refurbished dwellings	100.0	100.0	100.0
new dwelling	14.6	14.0	16.3
sufficient insulation	17.1	17.8	15.4
lack of money	46.4	43.5	54.7
other reasons	21.9	24.8	13.7

Table A1-11 **Planning thermal refurbishing of dwellings**

Plans	Total	Urban areas	Rural areas
Dwellings needing thermal refurbishing, total	147 887	109 105	38 781
During the next 3 years	27 679	18 845	8 833
After 3 years	34 375	25 598	8 776
No plans	85 833	64 662	21 172
<b>Percentage</b>			
Plans	Total	Urban areas	Rural areas
Dwellings needing thermal refurbishing, total	100.0	100.0	100.0
During the next 3 years	18.7	17.3	22.8
After 3 years	23.2	23.5	22.6
No plans	58.0	59.3	54.6

Table A1-12 **Dwellings by size of households**

Household size, persons	Total	Urban areas	Rural areas
Total	567 769	411 520	156 249
1	190 613	143 970	46 643
2	163 989	121 143	42 846
3	100 482	74 873	25 609
4	77 146	55 001	22 145
5	23 356	12 016	11 340
6 or more	12 183	4 517	7 666

**Percentage**

Household size, persons	Total	Urban areas	Rural areas
Total	100.0	100.0	100.0
1	33.6	35.0	29.9
2	28.9	29.4	27.4
3	17.7	18.2	16.4
4	13.6	13.4	14.2
5	4.1	2.9	7.3
6 or more	2.1	1.1	4.9

## Appendix 2. Households

Table A2-1 **Households by size**

Household size, persons	Total	Urban areas	Rural areas
Total	585 786	423 399	162 387
1	204 037	154 095	49 942
2	173 994	127 346	46 648
3	100 832	74 317	26 515
4	74 908	52 774	22 133
5	22 202	11 249	10 953
6 or more	9 814	3 619	6 195
<b>Percentage</b>			
Household size, persons	Total	Urban areas	Rural areas
Total	100.0	100.0	100.0
1	34.8	36.4	30.8
2	29.7	30.1	28.7
3	17.2	17.6	16.3
4	12.8	12.5	13.6
5	3.8	2.7	6.7
6 or more	1.7	0.9	3.8

Table A2-2 **Households by size of dwelling heated area**

Dwelling heated area, m <sup>2</sup>	Total	Urban areas	Rural areas
Total	585 786	423 399	162 387
less than 20	6 894	5 803	1 091
20–49	226 865	187 106	39 759
50–100	300 866	208 525	92 341
101–150	30 830	12 939	17 891
151 or more	20 331	9 026	11 305
<b>Percentage</b>			
Dwelling heated area, m <sup>2</sup>	Total	Urban areas	Rural areas
Total	100.0	100.0	100.0
less than 20	1.2	1.4	0.7
20–49	38.7	44.2	24.5
50–100	51.4	49.3	56.9
101–150	5.3	3.1	11.0
151 or more	3.5	2.1	7.0

Table A2-3 **Households by economic activity**

Economic activity	Total	Urban areas	Rural areas
Total	585 786	423 399	162 387
economic activity at home	21 345	11 305	10 040
no economic activity at home	564 441	412 094	152 347
<b>Percentage</b>			
Economic activity	Total	Urban areas	Rural areas
Total	100.0	100.0	100.0
economic activity at home	3.6	2.7	6.2
no economic activity at home	96.4	97.3	93.8

Table A2-4 **Households by heat source of space heating**

Heat source	Households	Percentage
District heating	358 069	61.1
Local central heating	48 606	8.3
Electric heating (built-in)	25 490	4.4
Electric heating (portable heaters)	22 067	3.8
Ovens, stoves, fireplaces	180 203	30.8
Heat pumps	20 438	3.5

Table A2-5 **Households by sources of hot tap water**

Heat source	Total	Urban areas	Rural areas
District heating	278 921	267 554	11 367
Local central heating	39 728	23 898	15 830
Water heater in own dwelling	214 443	113 266	101 177
Heat pump	5 835	3 620	2 215
Solar water heaters	0	0	0
No domestic hot water supply	60 878	23 310	37 568
<b>Percentage</b>			
Heat source	Total	Urban areas	Rural areas
District heating	46.5	62.0	6.8
Local central heating	6.6	5.5	9.4
Water heater in own dwelling	35.8	26.2	60.2
Heat pump	1.0	0.8	1.3
Solar water heaters	0.0	0.0	0.0
No domestic hot water supply	10.1	5.4	22.3

Table A2-6.1 **Ownership of electric appliances (with efficiency rating) by households**

Appliance	Percentage of households	Energy efficiency rating, %		
		Class A	Lower than class A	Class not known
Washing machine	89.0	62	12	26
Washing machine-drier	1.6	76	11	13
Tumble-drier	0.9	52	25	23
Dish washer	15.0	79	6	15
Refrigerator	99.0	56	15	29
Freezer	16.0	52	16	32
TV (cathode ray tube)	62.0	8	22	70
TV (LED or LCD)	41.0	77	2	21
TV (plasma-)	9.4	80	1	19
TV (3D)	0.6	74	0	26
Electric hob/cooker	72.0	44	17	39
Electric oven	19.0	55	12	33
Air conditioner	2.9	60	3	37

Table A2-6.2 **Ownership of electric appliances by households**

Appliance	Percentage of households
Electric radiator	24.0
Vacuum cleaner	93.0
Cooker hood (electrical)	46.0
Mini kitchen	3.4
Coffee machine	21.0
Microwave oven	61.0
Home cinema	12.0
Radio-music centre	73.0
DVD player	42.0
Desktop computer	46.0
Portable computer	46.0
Printer	32.0
Heat pump	3.5
Sauna (stove) heater	4.0
Whirlpool bath (tubes)	3.2
Water pump	16.0
Set-top box and/or satellite TV	50.0
Halogen lamps	21.0
Fluorescent lamp	17.0
LED lamps	9.1
Electric storage water heater	37.0

Table A2-7 **Use of energy saving light-bulbs in households**

	Total	Urban areas	Rural areas
Total number of households using energy saving bulbs	324 310	236 122	88 188
incl. halogen	123 702	88 473	35 230
fluorescent	99 992	73 660	26 332
LED	53 541	38 409	15 132
type not known	106 437	77 958	28 479
Installed in living rooms	319 441	233 713	85 728
Installed in auxiliary rooms	34 402	16 828	17 575
<b>Percentage</b>			
	Total	Urban areas	Rural areas
Total number of households using energy saving bulbs	100.0	100.0	100.0
incl. halogen	38.1	37.5	39.9
fluorescent	30.8	31.2	29.9
LED	16.5	16.3	17.2
type not known	32.8	33.0	32.3
Installed in living rooms	98.5	99.0	97.2
Installed in auxiliary rooms	10.6	7.1	19.9

## Appendix 3. Energy consumption

Table A3-1 **Energy consumption by households (incl. economic activity at home) (Natural units)**

Energy / fuel	Total	Urban areas	Rural areas
Electricity (GWh)	2 049	1 291	758
Heat for space heating (purchased) (GWh)	3 579	3 212	367
Heat for tap water (purchased) (GWh)	591	567	24
Natural gas (thousand m <sup>3</sup> )	70 600	55 783	14 817
LPG (tons)	2 646	1 131	1 515
LFO (tons)	10 731	5 344	5 387
Hard coal (tons)	11 767	7 689	4 078
Firewood (thousand m <sup>3</sup> stacked)	2 916	1 065	1 851
Wood waste (thousand m <sup>3</sup> stacked)	109	42	67
Wood briquettes (tons)	36 072	21 789	14 283
Wood pellets (tons)	5 828	1 554	4 274
Peat briquettes (tons)	14 104	8 730	5 374
Petrol (tons)	200 942	125 130	75 811
Diesel oil (tons)	71 701	44 392	27 308

### TJ

Energy / fuel	Total	Urban areas	Rural areas
Electricity	7 376	4 647	2 730
Heat for space heating (purchased)	12 883	11 563	1 321
Heat for tap water (purchased)	2 127	2 042	85
Natural gas	2 372	1 874	498
LPG	120	51	69
LFO	454	226	228
Hard coal	320	209	111
Firewood	16 273	5 943	10 331
Wood waste	322	124	198
Wood briquettes	610	369	242
Wood pellets	99	26	72
Peat briquettes	226	140	86
Petrol	8 841	5 506	3 336
Diesel oil	3 033	1 878	1 155
Total	55 056	34 598	20 462
Total excl. motor fuels	43 182	27 214	15 971

### Percentage

Energy / fuel	Total	Urban areas	Rural areas
Electricity	13.4	13.4	13.3
Heat for space heating (purchased)	23.4	33.4	6.5
Heat for tap water (purchased)	3.9	5.9	0.4
Natural gas	4.3	5.4	2.4
LPG	0.2	0.1	0.3
LFO	0.8	0.7	1.1
Hard coal	0.6	0.6	0.5
Firewood	29.6	17.2	50.5
Wood waste	0.6	0.4	1.1
Wood briquettes	1.1	1.1	1.2
Wood pellets	0.2	0.1	0.4
Peat briquettes	0.4	0.4	0.4
Petrol	16.0	15.9	16.3
Diesel oil	5.5	5.4	5.6

Table A3-2 **Energy consumption by households (excl. economic activity at home)( Natural units)**

Energy / fuel	Total	Urban areas	Rural areas
Electricity (GWh)	2 023	1 291	738
Heat for space heating (purchased) (GWh)	3 571	3 212	367
Heat for tap water (purchased) (GWh)	589	567	24
Natural gas (thousand m <sup>3</sup> )	70 258	55 783	14 817
LPG (tons)	2 634	1 131	1 504
LFO (tons)	10 571	5 344	5 295
Hard coal (tons)	11 622	7 689	3 975
Firewood (thousand m <sup>3</sup> stacked)	2 914	1 065	1 849
Wood waste (thousand m <sup>3</sup> stacked)	109	42	67
Wood briquettes (tons)	36 060	21 789	14 283
Wood pellets (tons)	5 828	1 554	4 274
Peat briquettes (tons)	13 755	8 730	5 032
Petrol (tons)	194 185	125 130	72 515
Diesel oil (tons)	67 984	44 392	23 940

**TJ**

Energy / fuel	Total	Urban areas	Rural areas
Electricity	7 282	4 647	2 657
Heat for space heating (purchased)	12 854	11 563	1 321
Heat for tap water (purchased)	2 120	2 042	85
Natural gas	2 361	1 874	498
LPG	120	51	68
LFO	447	226	224
Hard coal	316	209	108
Firewood	16 257	5 943	10 315
Wood waste	320	124	197
Wood briquettes	610	369	242
Wood pellets	99	26	72
Peat briquettes	220	140	81
Petrol	8 544	5 506	3 191
Diesel oil	2 876	1 878	1 013
Total	54 426	34 598	20 072
incl. motor fuels	11 420	7 384	4 204
Total excl. motor fuels	43 006	27 214	15 868

**Percentage**

Energy / fuel	Total	Urban areas	Rural areas
Electricity	13.4	13.4	13.2
Heat for space heating (purchased)	23.6	33.4	6.6
Heat for tap water (purchased)	3.9	5.9	0.4
Natural gas	4.3	5.4	2.5
LPG	0.2	0.1	0.3
LFO	0.8	0.7	1.1
Hard coal	0.6	0.6	0.5
Firewood	29.9	17.2	51.4
Wood waste	0.6	0.4	1.1
Wood briquettes	1.1	1.1	1.2
Wood pellets	0.2	0.1	0.4
Peat briquettes	0.4	0.4	0.4
Petrol	15.7	15.9	15.9
Diesel oil	5.3	5.4	5.0
Total	100.0	100.0	100.0
incl. motor fuels	21	21.3	20.9
Total excl. motor fuels	79	78.7	79.1

Table A3-3.1 **Types of fuel used for space heating (by dwellings)**

Fuel	Local central heating		Stoves, ovens, fireplaces	
	Number of dwellings	Percentage of dwellings	Number of dwellings	Percentage of dwellings
Total number of dwellings	567 769	100.0	567 769	100.0
Natural gas	6 910	1.22	104 575	18.42
LPG	0	0.00	48 091	8.47
LFO	3 627	0.64	0	0.00
Hard coal	2 617	0.46	0	0.00
Firewood	16 662	2.93	193 620	34.10
Wood briquettes	4 158	0.73	11 061	1.95
Wood pellets	386	0.07	469	0.08
Peat briquettes	1 118	0.20	9 507	1.67
Wood waste	880	0.15	19 912	3.51

Table A3-3.2 **Types of fuel used for space heating (by households)**

Fuel	Local central heating		Stoves, ovens, fireplaces	
	Number of households	Percentage of households	Number of households	Percentage of households
Total number of households	585 786	100.0	585 786	100.0
Natural gas	7 106	1.21	107 294	18.32
LPG	0	0.00	49 922	8.52
LFO	3 809	0.65	0	0.00
Hard coal	3 133	0.53	0	0.00
Firewood	18 264	3.12	201 369	34.38
Wood briquettes	4 895	0.84	11 740	2.00
Wood pellets	386	0.07	602	0.10
Peat briquettes	1 118	0.19	10 265	1.75
Wood waste	1 168	0.20	21 425	3.66

Table A3-4.1 **Types of fuel for tap water heating (by dwellings)**

Fuel	Total	Urban areas	Rural areas
Total number of dwellings with hot tap water supply	520 999	395 885	125 114
Natural gas	18 011	15 962	2 050
LPG	530	179	351
LFO	845	606	239
Hard coal	1 605	750	855
Firewood	12 668	6 094	6 573
Wood briquettes	1 598	582	1 016
Wood pellets	311	161	151
Peat briquettes	741	424	317
Wood waste	1 772	1 177	594
<b>Percentage</b>			
Fuel	Total	Urban areas	Rural areas
Total number of dwellings with hot tap water supply	100.0	100.0	100.0
Natural gas	3.46	4.03	1.64
LPG	0.10	0.05	0.28
LFO	0.16	0.15	0.19
Hard coal	0.31	0.19	0.68
Firewood	2.43	1.54	5.25
Wood briquettes	0.31	0.15	0.81
Wood pellets	0.06	0.04	0.12
Peat briquettes	0.14	0.11	0.25
Wood waste	0.34	0.30	0.47

Table A3-4.2 **Types of fuel for tap water heating (by households)**

Fuel	Total	Urban areas	Rural areas
Total number of households with hot tap water supply	538 927	408 338	130 589
Natural gas	18 403	16 209	2 194
LPG	530	179	351
LFO	845	606	239
Hard coal	2 102	1 247	855
Firewood	13 218	6 591	6 627
Wood briquettes	1 598	582	1 016
Wood pellets	311	161	151
Peat briquettes	741	424	317
Wood waste	1 947	1 353	594

**Percentage**

Fuel	Total	Urban areas	Rural areas
Total number of households with hot tap water supply	100.0	100.0	100.0
Natural gas	3.41	3.97	1.68
LPG	0.10	0.04	0.27
LFO	0.16	0.15	0.18
Hard coal	0.39	0.31	0.65
Firewood	2.45	1.61	5.07
Wood briquettes	0.30	0.14	0.78
Wood pellets	0.06	0.04	0.12
Peat briquettes	0.14	0.10	0.24
Wood waste	0.36	0.33	0.45

## Appendix 4. Cars and motor fuel consumption in households

Table A4-1 **Cars owned by households**

Number of cars	Number of households	Percentage
No car	235 484	39.9
1 car	259 167	44.5
2 cars	80 642	13.8
3 or more cars	10 493	1.8
Total number of households owning at least one car	350 302	60.1

Table A4-2 **Cars in households by manufacturing year**

Manufacturing year	Number of cars	Percentage
Total number of cars in households	454 716	100.0
Before 1980	8 506	1.9
1981–1990	35 856	7.9
1991–2000	211 691	46.6
2001–2010	198 662	43.7

Table A4-3 **Engine capacity of cars in households**

Engine capacity, cm <sup>3</sup>	Number of cars	Percentage
Total number of cars in households	454 716	100.0
Less than 1001	61 522	13.5
1001–1500	60 708	13.4
1501–2000	253 763	55.8
2001 or more	78 723	17.3

Table A4-4 **Cars in households by fuel type**

Type of fuel	Number of cars	Percentage
Total number of cars in households	454 716	100.0
Petrol	357 316	78.6
Diesel	97 400	21.4
LPG	105	0.0

Table A4-5 **Annual fuel consumption by cars, litres**

Type of fuel	Total consumption	Consumption per car
Petrol	266 024 044	745
Diesel	79 301 090	827
LPG	153 202	1 458

Table A4-6 **Annual motor fuel consumption by households, litres**

Type of fuel	Total consumption	Consumption per household
Petrol	266 294 113	936
Diesel	84 034 997	855
LPG	153 202	1 458

## Appendix 5. Utilisation of renewables and use of heat pumps

Table A5-1 **Households using wood fuels for space heating**

Type of fuel	Local central heating		Stoves, ovens, fireplaces	
	Number of households	Percentage of households	Number of households	Percentage of households
Total number of households	585 786	100.0	585 786	100.0
Firewood	18 264	3.12	201 369	34.38
Wood briquettes	4 895	0.84	11 740	2.00
Wood pellets	386	0.07	602	0.10
Wood waste	1 168	0.20	21 425	3.66

Table A5-2 **Use of wood fuels by households**

Type of fuel	Volume, natural units	Energy, TJ	Percentage
Firewood	2 914 thousand m <sup>3</sup> st	16 257	94.0
Wood waste	109 thousand m <sup>3</sup> st	320	1.9
Wood briquettes	36 060 tons	610	3.5
Wood pellets	5 828 tons	99	0.6
Total		17 286	100.0

Table A5-3 **Types of heat pumps in use by households, percentage**

Type of heat pump	Share of heat pumps	Share in households, %		
		Total	Urban areas	Rural areas
Air-to-air	69.6	2.4	1.2	1.3
Air-to-water	15.7	0.5	0.4	0.2
Ground-to-air	0.7	0.0	0.0	0.0
Ground-to-water	13.9	0.5	0.2	0.3

Table A5-4 **Use of heat pumps in households**

	Total	Urban areas	Rural areas
Total number of heat pumps	20 438	10 383	10 055
For heating	19 330	9 785	9 545
For cooling	10 762	6 142	4 620
<b>Percentage</b>			
	Total	Urban areas	Rural areas
Total number of heat pumps	100.0	100.0	100.0
For heating	94.6	94.2	94.9
For cooling	52.7	59.2	45.9

Table A5-5 **Heat pumps in households by capacity range**

Capacity, kW	Total	Urban areas	Rural areas
Total number of heat pumps	20 438	10 383	10 055
1–3	3 065	1 596	1 469
4–7	10 214	5 319	4 895
8–10	3 694	1 452	2 242
11–15	3 465	2 015	1 449
<b>Percentage</b>			
Capacity, kW	Total	Urban areas	Rural areas
Total heat pumps	100.0	100.0	100.0
1–3	15.0	15.4	14.6
4–7	50.0	51.2	48.7
8–10	18.1	14.0	22.3
11–15	17.0	19.4	14.4

Table A5-6 **Heat pumps in households by installation year**

Installation year	Total	Urban areas	Rural areas
Total number of heat pumps	20 438	10 383	10 055
2001–2004	1 622	869	753
2005–2007	3 525	1 065	2 459
2008–2010	15 292	8 449	6 843
<b>Percentage</b>			
Installation year	Total	Urban areas	Rural areas
Total number of heat pumps	100.0	100.0	100.0
2001–2004	7.9	8.4	7.5
2005–2007	17.2	10.3	24.5
2008–2010	74.8	81.4	68.1