Fuel and Energy Consumption in Households in the Republic of Kazakhstan

QAZSTAT

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Bureau of National Statistics of the Agency for Strategic

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Introduction

The expected consequences of global climate change pose new challenges to mitigate negative consequences both for the global community and for individual countries. According to the US National Aeronautics and Space Administration (NASA), the past 9 years have been the warmest years on record, while the year 2023 has the potential to enter the list of ten hottest years on record. The efforts of each individual unit of the world community are needed to achieve the common goal of leveling the effects of climate change. Thus, in 2023, the government of Kazakhstan approved an ambitious Strategy for achieving carbon neutrality of the Republic of Kazakhstan until 2060.

The main strategic goal of Kazakhstan is to reduce national net greenhouse gas emissions to zero by 2060. The main challenge for achieving this goal for Kazakhstan is to reduce emissions in the energy sector, which in 2022 amounted to 77% of the total. One of the challenges to achieving a reduction in the contribution of the energy sector is posed by the role of the fossil energy sector in the Kazakh economy and the baseline for the use of fossil fuels for energy generation both in industry and for household consumption.

As part of the International Renewable Energy Agency (IRENA) project to strengthen bioenergy data for monitoring the SDGs and NDCs in Kazakhstan, the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan conducted a sample household survey on the nationwide statistical observation "Survey of Energy Consumption in Households" (index – H-010, frequency – every five years). The main objective of conducting a survey is to collect information on fuel and energy consumption in households in Kazakhstan. The main goal of the survey is to improve understanding of the processes and practices associated with household energy consumption, including improving the understanding of the availability and use of biofuels and renewable energy sources among the population.

Understanding and characterizing household practices can help to estimate the current energy demand and forecast future needs. Also, studying household energy consumption can help to assess the energy efficiency and energy saving measures used in households. Analyzing fuel consumption data can help identify areas where energy losses can be reduced, and energy can be used more efficiently.

Therefore, it seems important to study the characteristics of fuel consumption and energy sources by households in Kazakhstan. As part of this survey, the patterns of fuel and energy consumption in households were examined by end-use category. Following energy consumption categories were included:

- Total energy consumption
- Space and water heating
- Cooking
- Electricity use
- Space cooling and ventilation
- Lighting
- Transport

The survey was conducted in all regions and the cities of Astana, Almaty and Shymkent by interviewer-led household visits. The survey involved 11,944 households, of which 6,520 live in urban areas and 5,424 live in rural areas. The survey was conducted based on a questionnaire consisting of 11 modules and containing 38 questions.

The survey results are presented in the following sections: characteristics of households and dwellings, data on fuel and energy consumption, household fuel and energy domestic use, and household vehicle use. Based on the collected data, we aim to formulate conclusions and recommendations that can

contribute to future development and decision-making in the field of energy policy and sustainable development.

Glossary

A household is an economic entity consisting of one or more individuals living together, pooling all or part of their income and property, and jointly consuming goods and services.

Centralized heating system - an apartment/house is equipped with heating from the centralized network when the heat source is provided by a boiler house, CHP, multi-apartment pumps and/or several units (collective system).

Autonomous system - an apartment/ house is equipped with heating from an autonomous network when the heat source is accumulated by low-power pumps on wood, wood waste, agricultural waste or coal, on electricity or whether it is connected to a central gas pipeline.

Natural gas is a mixture of gaseous hydrocarbons, predominantly methane, but also includes ethane, propane and other hydrocarbons in much smaller proportions, and some non-flammable gases such as hydrogen and carbon dioxide.

Coal is a combustible black or brownish-black sedimentary rock, usually found in layers or veins in rock strata, friable, forming an accumulation of dead plant residues, and consisting mainly of carbon used as fuel.

Firewood is roundwood used as fuel for cooking and heating.

Wood waste is another by-product of wood processing. This term includes wood waste not suitable for use as commercial timber, such as defective lumber, slabs, wood trimmings, pencils left after peeling plywood logs, substandard plywood, sawdust, carpentry and joinery waste, and wood waste used to produce pellets, other agglomerated goods or used directly for power generation.

Agricultural waste is organic materials of non-fossil biological origin that can be used as fuel to produce heat or electricity. This category includes materials resulting from the processing of agricultural waste, such as straw, rice husks, nut shells, grape grounds, etc.

Wood pellets and briquettes are agglomerates produced from by-products (such as cuttings, sawdust or wood chips) of the mechanical woodworking industry, the furniture industry or other wood processing industries.

Electricity - electricity produced by thermal power plants (CHP), nuclear power plants, gas turbine power plants, diesel power plants, hydroelectric power plants and other energy from renewable sources.

Diesel - distillate fuel oil, is primarily a middle distillate with a distillation range of 180-380°C.

Charcoal, including agglomerated – wood converted into coal as a result of partial combustion or treatment with heat from external sources.

Biofuel is a fuel obtained directly or indirectly from biomass. This category includes firewood, wood pellets and briquettes, wood waste, straw, other fuels from agricultural and forestry waste, animal waste (manure), biogas, and charcoal, including agglomerated.

Liquefied propane and butane are gaseous hydrocarbons (propane and butane) that have undergone a liquefaction process for easy transportation and storage.

Kerosene is a combustible liquid, a mixture of hydrocarbons, which boils away in the temperature range of 150-250°C. Kerosene is obtained by distillation (rectification) of oil.

Thermal insulation is the use of building materials or structures to reduce heat loss from walls, roofs, floors, windows, pipes, doors, and other things.

A heat pump is a device that extracts heat from the environment – earth, air, or water. The two main types of heat pumps used in the residential sector are air source heat pumps and ground source heat pumps.

A solar collector is a device that collects the thermal energy of the Sun and heats the circulating coolant material: water, air, oil, or antifreeze.

Incandescent lamps are lamps based on the principle of thermal radiation. Inside incandescent lamps is a thin filament (incandescent), usually made of tungsten, through which an electric current is passed.

LED lamps are lamps that use light emitting diodes as a light source.

Halogen lamps – incandescent lamps, with a buffer gas added to the cylinder: halogen vapors (bromine or iodine). A distinctive design feature of the lamp is a gas-filled halogen capsule.

Fluorescent lamps are a gas-discharge light source in which an electrical discharge in mercury vapor generates ultraviolet radiation, which is re-emitted into visible light using a phosphor - for example, a mixture of calcium halophosphate with other elements.

1. Survey methodology

1. Survey Methodology

This chapter summarizes the methodological explanations for the design and implementation of a sample survey, including a description of the stages of sampling, survey tools, conducting a preliminary survey, training of field staff, as well as the data collection and analysis.

1.1 Sampling

The main source for forming the sample of households is the information system "Statistical register of housing stock", a component of the integrated information system "e-Statistics" (hereinafter - SRHF). The database is used is due to several advantages, which include the following:

- Availability of a ready-made sampling frame, which eliminates one of the significant cost items associated with the compilation of the sampling frame.
- Availability of a constantly updated database, which is necessary for the implementation of the rotation of households.
- Availability of information about households by area and type of locality.

The general population included households living in all types of dwellings, except for those living in shared communal apartments, dormitories, nursing homes for the elderly and disabled, orphanages, prisons, hotels, religious communities, and other similar dwellings.

The final sampling unit is the household, which is also the survey unit.

The sample set of households is formed by the method of two-stage probabilistic (random) sampling using stratification and random selection procedures at each sampling stage. The stratification procedure is aimed at forming a representative sample of households that adequately reflects the territorial features of the population stratification.

At the first stage, the general population is stratified by geographical characteristics, including the distribution into urban and rural areas. Thus, 37 strata are formed – these are selected urban and rural areas in twenty regions of the country (Fig. 1) (a total consists of 37 strata, considering that there are no rural areas in the cities of Shymkent, Astana and Almaty)

400 territorial units are selected as primary sampling units (hereinafter - PSU), which represent urban and rural areas and are determined by the first six (6) characters of the Classifier of Administrative Territorial Objects (hereinafter – CATO) codes.

The first stage of sampling includes two consecutive procedures. The initial procedure provides for the determination of PSUs within each stratum with a probability proportional to size, that is, the number of PSUs in a stratum is formed depending on the number of households present in the stratum. The following procedure is aimed at reaching the optimal value of the relative standard error for each of the strata.

At the second stage of sampling, 30 households are randomly selected in each PSU. The basis for the sampling at the second stage is the list of individual dwellings in the PSU. The cluster (or clusters) of dwellings to be visited during the survey is selected with equal probability from among the eligible dwellings in the PSU.

There are cases during the survey when it is not possible to interview households because the dwelling is not found, or not occupied, or the household refuses to participate in the survey. Non-response is undesirable because it reduces the sample size and mainly because it is a source of potential sample bias and may lead to skewed statistical results. An effective preventive measure to overcome the problem of non-response is careful documentation of each case.

If there was difficulty in complying with the no-replacement principle, a reserve list of one third of the number of households in each cluster (10 households per interviewer) was envisaged.

A total of 40 dwellings are selected in each cluster: 30 in the nominal sample and 10 substitutes. These 40 dwellings were selected from among all eligible dwellings in the PSU by systematic equiprobability sampling and then randomly selected cyclic permutation of the numbers 0, 1, 2 and 3 repeated ten (10) times to divide the cluster into four groups of 10 dwellings. The dwellings in groups 1, 2 and 3 then constituted the nominal sample, while dwellings in group 0 were held in reserve for possible replacement.

The selection of reserve households from the additional list was carried out on a bottom-up basis. That is, out of 10 households, households were sequentially selected for replacement: from the beginning – the tenth in a row (the last in the list), then – the ninth, and so on.

1.2 Survey toolkit

The statistical form “Survey of Energy Consumption in Households” (index – H-010, frequency – every five years) was used as the main sample survey tool (see Appendix). The questions of this statistical form are combined into sections: information about the household and housing conditions; on fuel and energy consumption by households. Fuel and energy consumption are divided into main end-uses: heating, water heating, cooking, lighting, and transport. The questionnaire consists of 38 questions that make up the following 11 modules:

- Characteristics of households and their living conditions
- Space heating
- Water heating
- Electricity use
- Use of solar collectors and heat pumps
- Cooking
- Space cooling and air conditioning
- Power consumption
- Other household appliances
- Lighting
- Transport

The statistical form has been developed by the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan to collect baseline data on fuel and energy consumption among households in the Republic of Kazakhstan and was approved in two languages. Instructions as well as explanations for each question were attached to the questionnaire and detailed the procedure for filling out the statistical form.

1.3 Carrying out preliminary testing

Before the start of the main data collection phase, a pilot cognitive testing study was conducted. The preliminary testing had the following main objectives:

- Identification of difficulties in understanding and perceiving questions in the statistical form "Survey of Energy Consumption in Households" (index H-010) during the survey.
- Approbation of questions on the heating, water heating, cooking, air conditioning, lighting, transport modules.
- Estimating survey timing
- Piloting questions on modules to prepare detailed survey instructions for interviewers.

To ensure efficient organization of work and high-quality collection of primary data within the framework of the pilot survey, the territorial divisions of the Bureau compiled a list of households from the existing

household living standards survey network, considering urban and rural areas, and identified responsible employees as supervisors. A total of 60 households were selected for pilot testing - 30 in the Kyzylorda region (in urban/rural proportion of 10/20 households) and 30 in the Pavlodar region (in urban/rural proportion of 15/15 households). The pilot survey on energy consumption in households in the Kyzylorda region was conducted from October 18 to 20, 2022, and from November 14 to November 17, 2022 in the Pavlodar region.

1.4 Staff training

The training of personnel on data collection during field work was conducted for 4 days from March 27 to March 30, 2023. The seminar program focused primarily on ensuring the efficient organization of work, timely and quality sampling. In accordance with the program of the seminar, methodological materials, survey toolkit, presentation materials on the collection of data on fuel and energy consumption by households in the Republic of Kazakhstan by categories of end-use were presented. Further, the interviewers were instructed on how to fill out the form and conduct an interview and were also trained on the basic principles and objectives of the survey.

1.5 Data collection and processing

Data collection in all regions of the country started on April 12 and finished on April 25, 2023. The collection of primary statistical data was conducted in accordance with the Schedule of conducting nationwide statistical observations by interviewers. Interviews with household representatives were conducted according to the Survey of Energy Consumption of Households.

Data processing procedures include editing, imputation, and aggregation. The first stage of processing involves editing the database and making it operational. For this, the following types of controls are performed:

- Control for detection of outliers. The boundaries for outlier identification are determined by the deviation from the average value of indicators by the value of the standard deviations.
- The maximum and minimum values of quantitative indicators are analyzed.
- Evaluation of the quality of information received from respondents through logical control, which allows to eliminate both input errors and registration errors on the part of households.
- Control based on the logical relationship of information obtained from various sources. By means of cross-queries, the interrelation between them is checked, and the completeness of filling in statistical forms is controlled.

The third stage of data processing is aggregation – grouping data and summarizing. Aggregation is the basis for all further work with the database. In this process, survey data are organized by household identification code and grouped into major groups: by region and type of locality.

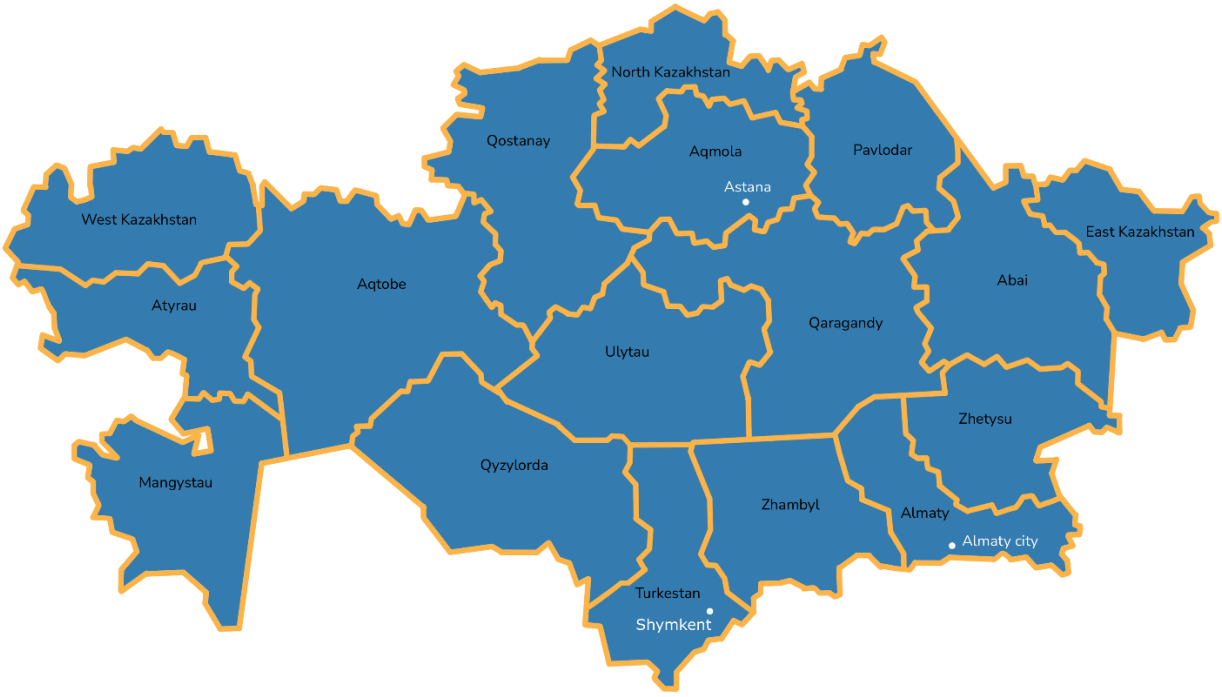
The results of the survey are statistically weighted in to obtain data that are generalizable to the general population. The weighting is carried out by assigning a statistical weight to each surveyed household, which characterizes the total number of households represented by the part of the sample.

To calculate the weights, data on the distribution of surveyed households was analyzed separately for urban and rural populations in each region. The sum of the "base" weights provides an estimate of the number of all households in each region and the country. The use of weights allows the sample population to remain consistent with the original sampling principles. Change of place of residence and refusal to participate in the survey violate the compliance.

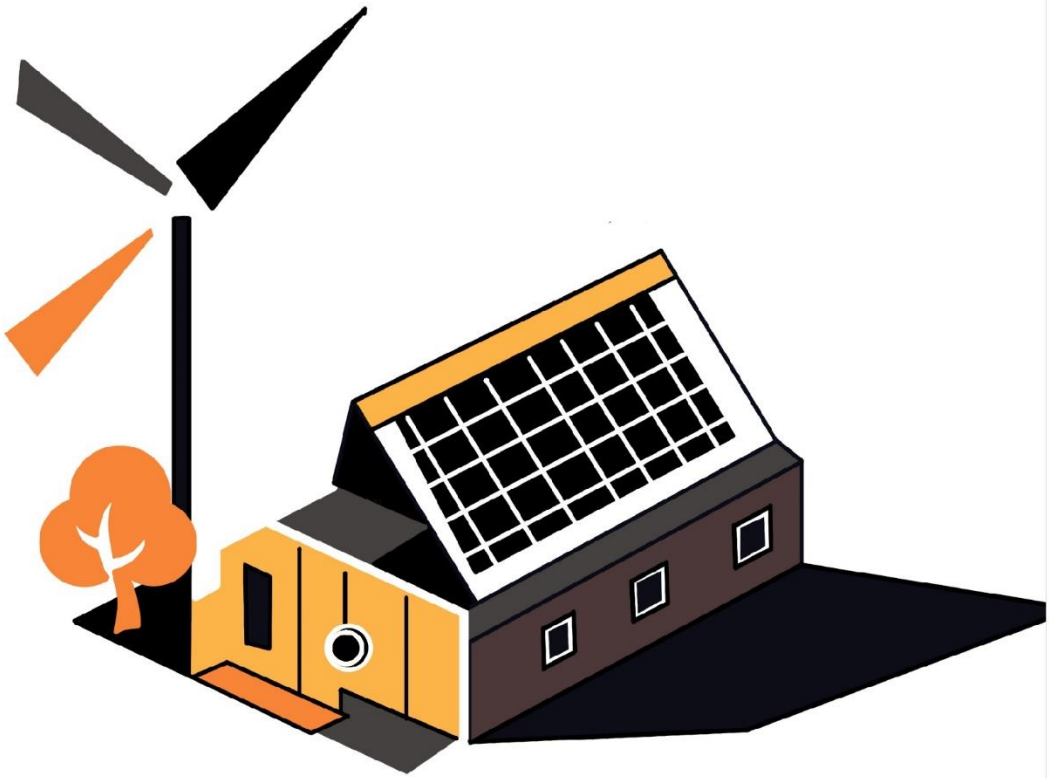
The survey data were adjusted to the general population according to demographic statistics using adjustment factors. This final database contains data on the results of a sample survey of fuel and energy

consumption of 11,944 households, of which 6,520 are in urban areas and 5,424 in rural areas, with the aggregation of the obtained data and extrapolation to the general population.

Figure 1. Map of the Republic of Kazakhstan



2. Survey results



2. Survey results

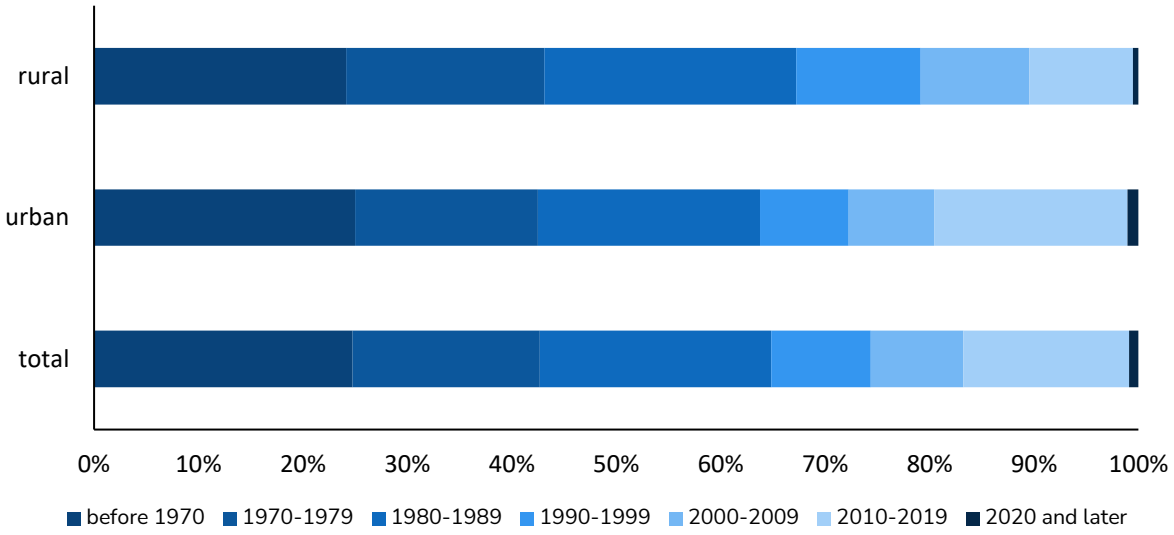
2.1 Characteristics of households and dwellings

Households in urban area are evenly distributed in terms of household size. Households consisting of 1 person are the least common rural area – such households make up 11.4%, while households with 4 or more people are most common. Most households in villages are represented by households with 5 or more people and make up 32.1% of the total number of households. In towns and cities, the opposite situation is observed – 42.7% of households in cities consisted of 1 or 2 people (Fig. 2).

Figure 2. Distribution of households by size and area of residence, %.

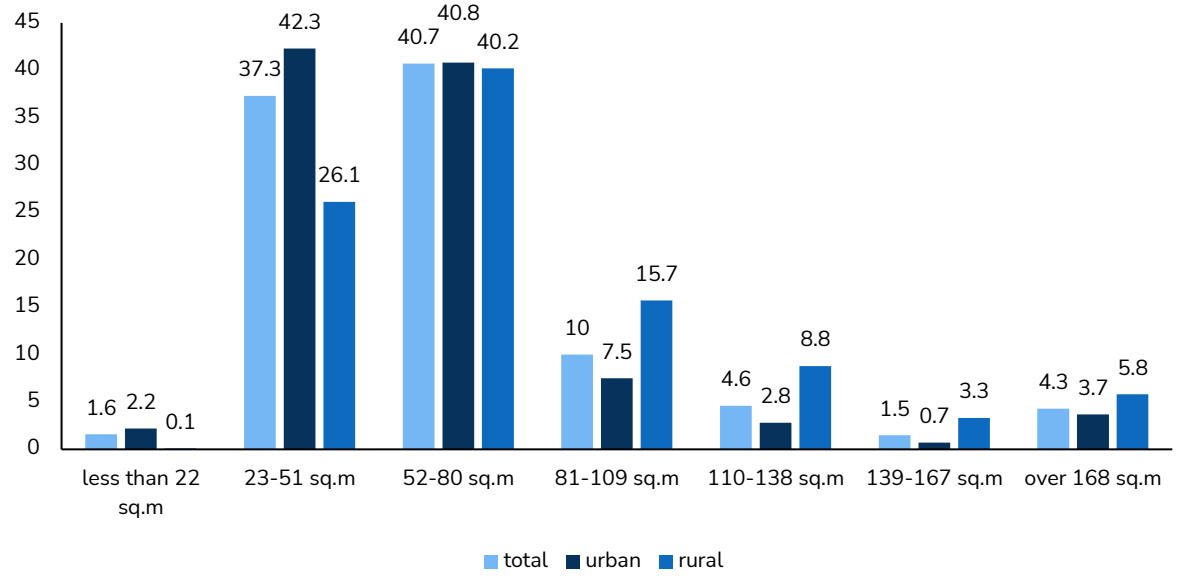
By the beginning of 2023, 63.8% of all residential buildings in cities and 67.3% of residential buildings in rural areas were built before 1990. At the same time, 24.2% of all dwellings in rural areas and 25% in urban areas were built before 1970. About a third – 35.2% of all households live in houses built during the period of independence of Kazakhstan. Only 8.5% and 11.9% of all urban and rural households lived in a dwelling built between 1990 and 1999, while 8.2% and 10.4% lived on premises built between 2000 and 2009. Since 2010, there have been built four times more housing in cities compared to rural areas. Thus, at the beginning of 2023, 19.5% of all households in urban areas lived in residential premises not older 14 years, while in rural areas this figure constitutes only 10.4% (Fig. 3).

Figure 3. Structure of dwellings by year of construction by area of residence.



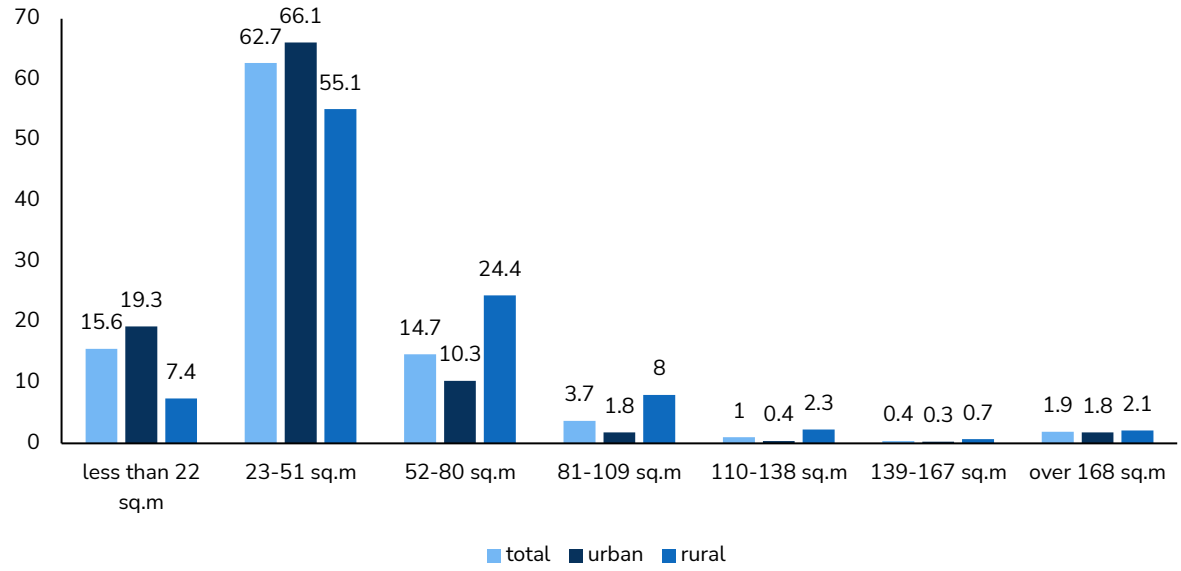
Four out of five households in Kazakhstan live in dwellings with a total area of less than 80 m^2. The average total area available for households in urban areas is 62.4 m^2, which is 19.5% less than in rural areas. It is interesting to note that about 40% of all households, both in cities and in rural areas, live in dwellings with a total area of 52 to 80 m^2, while only 10.4% of have a space with an area of more than 110 m^2 (Fig. 4).

Figure 4. Structure of dwellings by the size of the total area by area of residence, %.



Living space available for households is, on average, 37% less than the total space. Two thirds of households in urban and 55.1% in rural areas have a living area of 23-51 m^2. The living space area of only 4.3% of households in cities and 13.1% in rural areas exceed eighty-one m^2 (Fig. 5).

Figure 5. Structure of dwellings by the size of the total living space by area of residence, %.



By the beginning of 2023, 38.4% of households with 4 people and 24.8% of households with 5 or more people lived in dwellings with a living area of less than 52 m^2; the average living area for such households was 42.5 m^2 and 51.5 m^2 respectively. About a third of households with four people and more than half of households with 5 or more people lived in one-family individual houses (Table 1).

Table 1. Structure of dwellings by type of housing and available area (by household size).

	Total	By household size				
		1 person	2 people	3 people	4 people	5 or more people
By type of housing, %						
single-family (individual) house	36.6	21.4	32.2	37.1	36.1	51.0
semi-detached house	5.5	4.8	5.6	5.3	5.6	6.2
three-family house	1.1	1.3	1.8	0.5	1.7	0.5
four or more apartment buildings	56.8	72.5	60.4	57.1	56.6	42.3
By total area, %						
less than 22 m^2	1.6	3.7	1.4	1.7	1.0	0.5
23-51 m^2	37.3	48.6	40.7	39.7	37.4	24.3
52-80 m^2	40.6	37.1	41.0	40.4	42.0	42.1
81-109 m^2	10.1	5.2	9.7	8.8	9.7	14.8
110-138 m^2	4.6	1.0	3.8	3.6	4.1	9.1
139-167 m^2	1.5	0.4	0.4	0.8	1.7	3.8
over 168 m^2	4.3	4.0	3.0	5.0	4.1	5.4
By total living area, %						
less than 22 m^2	15.6	25.4	15.2	17.4	14.7	8.5
23-51 m^2	62.7	63.8	67.6	65.7	64.4	53.7
52-80 m^2	14.7	6.7	13.5	11.1	14.1	24.5
81-109 m^2	3.7	1.1	1.9	3.1	3.3	8.1
110-138 m^2	1.0	0.4	0.6	0.4	1.2	2.2
139-167 m^2	0.4	0.2	0.2	0.2	0.4	0.8
over 168 m^2	1.9	2.4	1.0	2.1	1.9	2.2
Average total area, m^2	67.1	57.3	63.1	63.4	69.2	79.3
Average living area, m^2	42.3	35.3	39.8	39.8	42.5	51.5

Most of the Kazakhstan's population lives in areas with a sharp continental climate and, as a result, severe winters. In such climatic conditions, home insulation is one of the important tools for maintaining heat and saving energy. Despite this, the share of insulated residential buildings remains low both in cities and in the villages. Only 17.7% of all dwellings have at least one type of thermal insulation installed, this share is even lower in urban areas and amounts to 13.2%. In rural areas, 27.7% of dwellings are insulated with at least one type of insulation.

The most common type of insulation is the insulation of the walls and facades of buildings – they are found in 49.3% of all insulated houses: in 52% of dwellings in cities and 46.4% in villages. Among households with at least one type of thermal insulation installed, 21.4% live in dwellings with insulated floors and foundations, and 17.2% live in houses with insulated roofs. In rural areas, the proportion of houses with insulated floors and foundations was 21.9% and 22.5% had their roofs insulated. Among urban households whose dwellings were insulated, 20.9% had insulated floors or foundations, and 12.2% had insulated roofs (Fig. 6).

Figure 6. Distribution of dwellings by types of insulation by area of residence, %.

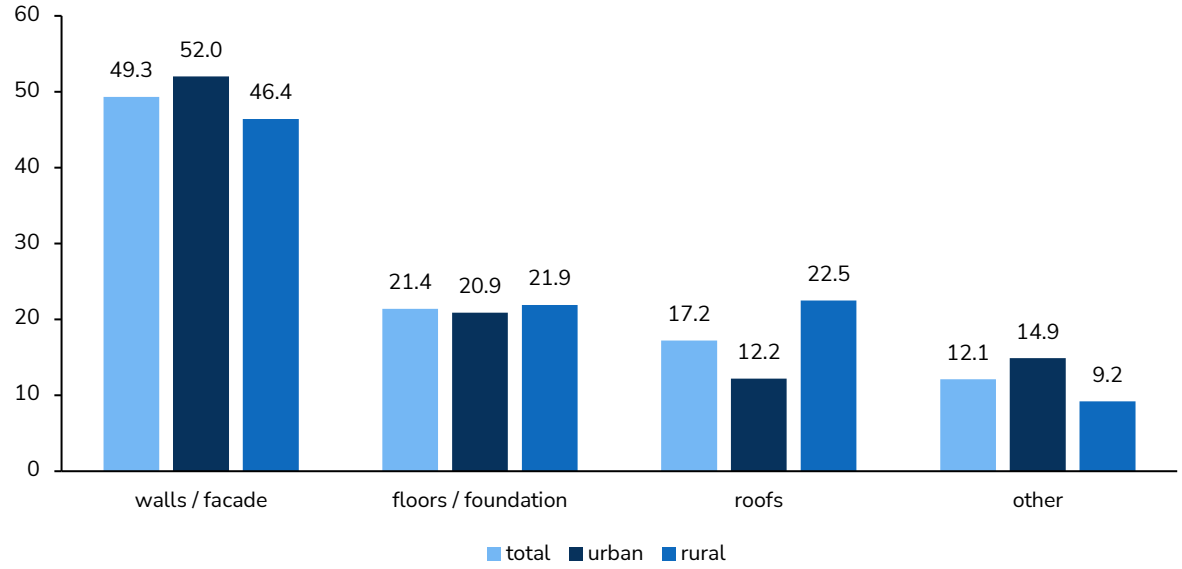


Table 2 presents additional characteristics of the living conditions of the population by the type of windows and indoor temperature. It should be noted that 90.2% and 80.2% of dwellings in cities and villages, respectively, have metal-plastic windows, which have higher thermal insulation compared to wooden windows, installed.

Table 2. Structure of dwellings by type of installed insulation, type of windows and indoor temperature (by area of residence).

	Total	By area of residence	
		urban	rural
Share of households with thermal insulation installed, %	17.7	13.2	27.7
walls / facade	49.3	52.0	46.4
floors / foundation	21.4	20.9	21.9
roofs	17.2	12.2	22.5
other	12.1	14.9	9.2
By type of windows, %			
wooden	13.2	10.0	20.4
metal-plastic	87.1	90.2	80.2
By indoor temperature[1], %			
below 18 °C	1.1	1.3	0.8
18-20 °C	9.9	10.1	9.4
21-22°C	32.1	30.9	34.8
23-24°C	36.8	36.8	36.7
above 24°C	20.1	20.9	18.3

[1] *Average indoor temperature during the last winter .*

Table 3. Structure of dwellings by year of construction and material of external walls (by area of residence).

	Total	By area of residence	
		urban	rural
By year of construction, %			
before 1970	24.7	25.0	24.2
1970-1979	17.9	17.5	19.0
1980-1989	22.1	21.3	24.1
1990-1999	9.6	8.5	11.9
2000-2009	8.9	8.2	10.4
2010-2019	15.9	18.5	9.9
2020 and later	0.9	1.0	0.5
By type of material of external walls, %			
brick, stone	32.0	32.0	32.0
large panel	8.3	11.5	1.2
frame-panel	0.4	0.2	0.8
volume-block	0.1	0.1	0.0
large block	0.8	0.9	0.6
monolithic concrete (reinforced concrete)	16.6	21.6	5.3
cellular concrete	0.2	0.1	0.5
adobe	9.6	3.5	23.3
other materials	32.0	30.1	36.3

Table 4. Structure of dwellings by year of construction and material of outer walls (by household size), %.

	Total	By household size				
		1 person	2 people	3 people	4 people	5 or more people
By year of construction						
before 1970	24.7	24.3	29.5	22.7	25.8	21.3
1970-1979	17.9	21.4	18.3	17.7	17.4	15.7
1980-1989	22.1	25.2	21.1	28.8	18.4	18.4
1990-1999	9.6	9.5	11.0	7.1	8.2	11.2
2000-2009	8.9	5.4	7.2	7.9	9.8	13.0
2010-2019	15.9	13.8	12.3	15.4	19.6	18.5
2020 and later	0.9	0.4	0.6	0.4	0.8	1.9
By type of material of external walls, %						
brick, stone	32.0	32.2	34.0	30.8	29.6	32.3
large panel	8.3	11.7	10.3	7.9	7.5	5.0
frame-panel	0.4	0.3	0.5	0.5	0.2	0.4
volume-block	0.1	0.2	0	0.1	0	0.1
large block	0.8	1.3	0.9	0.8	0.9	0.4
monolithic concrete (reinforced concrete)	16.6	21.5	15.9	16.9	21.2	10.1
cellular concrete	0.2	0.1	0.2	0.6	0.1	0.1
adobe	9.6	4.2	8.6	9.3	7.8	16.1
other materials	32.0	28.5	29.6	33.1	32.7	35.5

Table 5. Structure of dwellings by household size, type of housing and area (by area of residence).

	Total	By area of residence	
		urban	rural
By household size, %			
1 person	17.0	19.5	11.4
2 persons	22.9	23.2	22.4
3 persons	19.0	18.5	20.1
4 people	17.1	18.6	13.9
5 people or more	24.0	20.4	32.1
By type of housing, %			
single-family (individual) house	36.5	23.4	65.8
semi-detached house	5.5	2.0	13.5
three-family house	0.6	0.3	1.3
four or more apartment building	57.4	74.3	19.4
By total area, %			
less than 22 m^2	1.6	2.2	0.1
23-51 m^2	37.3	42.3	26.1
52-80 m^2	40.7	40.8	40.2
81-109 m^2	10.0	7.5	15.7
110-138 m^2	4.6	2.8	8.8
139-167 m^2	1.5	0.7	3.3
over 168 m^2	4.3	3.7	5.8
By total living area, %			
less than 22 m^2	15.6	19.3	7.4
23-51 m^2	62.7	66.1	55.1
52-80 m^2	14.7	10.3	24.4
81-109 m^2	3.7	1.8	8.0
110-138 m^2	1.0	0.4	2.3
139-167 m^2	0.4	0.3	0.7
over 168 m^2	1.9	1.8	2.1
Average total area, m^2	67.1	62.4	77.6
Average living area, m^2	42.3	38.3	51.3

2.2 Household fuel and energy consumption

According to the survey, electricity is the most common source of energy, with almost 100% of households in Kazakhstan connected to electricity. However, fossil fuels are still a preferred source to power autonomous space and water heating systems both among households and in industrial use. Thus, for residential heating, natural gas is the most common throughout the country – it is used by 40% of all households equipped with an autonomous heating system. Hard coal is the second most widespread – it is used by 28% of all households. It is also worth noting that 30% of households combine several types of fuel – coal with biofuels or natural gas with electricity.

2.2.1 Total fuel consumption

The annual consumption of hard coal by households in Kazakhstan in 2022 amounted to 7,312 thousand tons. Of these, 3,533 thousand tons (48.3%) were used in households in urban areas, and 3,780 thousand tons (51.7%) in rural areas.

The volume of natural gas consumption by households in 2022 amounted to 5,160.5 million cubic meters. More than half of natural gas was used in households in rural areas - about 54.1%, and 45.9% – by households in urban areas, which may be explained with the wide availability of central heating in urban areas.

Electricity consumption by households for the reporting year amounted to 14,328.2 mln. kWh. The majority of electricity consumption in 2022 (66.3%) was in urban area at 9,500.8 mln. kWh, while households in rural areas used half as much electricity (4,827.4 mln. kWh).

Liquefied propane and butane consumption by households in 2022 was 507 million liters, two thirds of which were used by residents in rural areas. A comparable situation is with the consumption of biofuels – 59.3% of firewood consumption and 82.5% of the wood waste was used in rural areas. Charcoal consumption occurs in households in urban areas (1.7 tons), while consumption of animal waste and straw – in households in rural areas – 20.1 thousand tons and 9.9 tons, respectively.

Table 6. Total annual fuel and energy consumption in households by area of residence.

	Total	By area of residence	
		urban	rural
Coal, thousand tons	7 312	3 533	3 780
Natural gas, million cubic meters	5 161	2370	2790
Liquefied propane and butane, million liters	507	170	337
Electricity, mln. kWh	14 328	9 501	4 827
Firewood, thousand cubic meters	3 549	1445	2 103
Wood waste, thousand tons	7.9	1.4	6.5
Charcoal, including agglomerated, tons	1.7	1.7	-
Animal waste (manure), thousand tons	20.1	-	20.1
Straw, tons	9.9	-	9.9

Table 7. Total household consumption of fuel and energy per year by number of apartments in the building.

	Total	By the number of apartments in the building			
		1-apartment (individual) house	2-apartment building	3-apartment building	4 or more apartment building
Total consumption of fuel and energy					
hard coal, thousand tons	7 312	5 561	1 273	71	407
natural gas, million cubic meters	5 161	3491	353	69	1 247
liquefied propane and butane, million liters	507	215	36	5	251
electricity, mln. kWh	14 328	6 302	836	137	7053
firewood, thousand cubic meters m.	3 549	2744	581	32	192
wood waste, thousand tons	7.9	7.4	0.5	-	-
charcoal, including agglomerated, tons	1.7	-	-	-	1.7
animal waste (manure), thousand tons	20.1	16.6	3.5	-	-
straw, tons	9.9	6.6	3.3	-	-
Average fuel and energy consumption per household					
coal, kg	6 849	6 619	8 427	6 880	6 164
natural gas, cubic meters m.	2437	3471	3 133	3606	6 348
propane and butane liquefied, liter	259	259	233	189	738
electricity, kWh	2548	3069	2687	2159	6 479
firewood, cubic meters	5	5	4	4	12
wood waste, kg	133	136	95	-	-
charcoal, including agglomerated, kg	4	-	-	-	4
animal waste (manure), kg	1 155	1442	593	-	-
straw, kg	120	133	100	-	-

Table 8. Total household fuel and energy consumption per year by household size.

	Total	By household size				
		1 person	2 people	3 people	4 people	5 or more people
Total consumption of fuel and energy						
hard coal, thousand tons	7 312	806	1 901	1 602	1 353	1 650
natural gas, million cubic meters	5 161	409	876	890	821	2 164
liquefied propane and butane, million liters	507	75	125	86	82	140
electricity, mln. kWh	14 328	1 706	3 040	2 919	2 663	4 000
firewood, thousand cubic meters	3 549	582	759	1 112	501	595
wood waste, thousand tons	7.9	0.1	3.0	0.7	2.1	1.9
charcoal, including agglomerated, tons	1.7	-	1.7	-	-	-
animal waste (manure), thousand tons	20.1	2.1	2.2	3.7	7.1	5.0
straw, tons	9.9	1.6	-	1.6	4.9	1.6
Average fuel and energy consumption per household						
Coal, kg	6 849	6 001	7 081	6 842	6 517	7 398
Natural gas, cubic meters m.	2 437	1 496	2 116	2 450	2 440	2 963
Propane and butane liquefied, liter	259	218	235	225	256	363
Electricity, kWh	2 548	1 787	2 356	2 734	2 765	2 965
Firewood, cubic meters	5	5	4	6	4	4
Wood waste, kg	133	93	102	119	197	161
Charcoal, including agglomerated, kg	4	-	4	-	-	-
animal waste (manure), kg	1 155	1 926	1 304	1 284	889	904
Straw, kg	120	100	-	100	150	100

Table 9. Total annual household consumption of fuel and energy by region.

Region	Coal, thousand tons	Natural gas, million cubic meters	Liquefied propane and butane, million liters	Electricity, mln. KWh
Abai	1 277	-	41	460
Aqmola	472	-	72	1 121
Aqtobe	51	332	8	516
Almaty	114	707	22	935
Atyrau	-	471	-	533
West Kazakhstan	8	413	0	372
Zhambyl	10	375	34	536
Zhetysu	81	51	36	518
Qaragandy	2 606	-	99	1 924
Qostanay	254	132	29	550
Qyzylorda	62	471	20	487
Mangystau	-	381	-	501
Pavlodar	278	-	7	655
North Kazakhstan	341	-	21	418
Turkestan	36	626	52	820
Ulytau	101	-	2	212
East Kazakhstan	1 579	-	27	709
Astana	39	0	30	1 099
Almaty city	0	902	5	1 609
Shymkent	3	298	-	354
Kazakhstan	**7 312**	**5 161**	**507**	**14 328**

Table 10. Average fuel and energy consumption per household by region.

	Coal, kg	Natural gas, cubic meters	Liquefied propane and butane, liter	Electricity, kWh
Abai	6 704	-	230	2 358
Aqmola	6 745	-	299	4 062
Aqtobe	9 365	1 536	210	2 047
Almaty	8 126	4 308	310	2 830
Atyrau	-	2 806	-	3 000
West Kazakhstan	8 625	2 009	332	1 762
Zhambyl	8 793	2 629	285	2 006
Zhetysu	7 862	2 819	212	2 775
Qaragandy	6 864	-	313	4 522
Qostanay	8 081	1 761	290	1 835
Qyzylorda	7 670	3 885	294	2 580
Mangystau	-	1 974	-	2 595
Pavlodar	8 064	-	215	2 401
North Kazakhstan	8 810	-	121	2 099
Turkestan	7 983	2 269	444	2 104
Ulytau	9 014	-	217	2 970
East Kazakhstan	6 024	-	154	2 568
Astana	8 384	810	221	2 522
Almaty city	7 420	3 155	865	2 220
Shymkent	7 000	1 185	-	1 408
Kazakhstan	**6 849**	**2 437**	**259**	**2 548**

2.2.2 Renewable energy sources: consumption of solid biofuels

Biofuels can serve as a greener alternative to fossil fuels both for the private sector and for the use in power plants. In Kazakhstan, the use of solid biofuels constitutes only a small share in the structure of fuel consumption. Less than one percent of households use biofuels to power primary heating systems and 2.6% to power additional equipment. Solid biofuels are also rarely used for cooking on a regular basis – only by a tenth of a percent of households.

The use of solid biofuels is most common in the East Kazakhstan region – residents of the region consume a third of all firewood in the country. This may be because 40% of all timber reserves of the main forest-forming species in Kazakhstan are concentrated in eastern Kazakhstan, which favors to the development of forestry. In Kazakhstan, the sectors of commercial forestry and the processing of forestry and agricultural waste are underdeveloped, which is also reflected in the structure of biofuel consumption. The most used type of biofuel is firewood – its consumption is found in all regions, except for Mangystau and Atyrau regions and in the city of Shymkent. The use of wood waste is observed only in five regions - in Qaragandy (1.5 thousand tons), in Turkestan (1.2 thousand tons), in East Kazakhstan (3.5 thousand tons), in Ulytau (0.8 thousand tons) and in Aqmola (1 thousand tons), while charcoal is used only by households in East Kazakhstan region (1.7 tons). Animal waste is used by households in 6 regions – East Kazakhstan (9.8 thousand tons), West Kazakhstan (1.6 thousand tons), Turkestan (6.5 thousand tons), Qaragandy (1.2 thousand tons), Ulytau (0.4 thousand tons)) and Aqmola (0.6 thousand tons) regions.

The concentration of biofuel use in regions where production takes place can be an indicator of high logistics costs for transporting solid biofuel products, which makes regional exports unprofitable. Kazakhstan has a high potential for the development of the biofuel sector, both at the level of solid fuel production for households and on an industrial scale. The development of this sector can also help achieve the intermediate goals of the carbon neutrality strategy.

The survey did not reveal the use of other renewable energy sources, particularly – solar energy and ambient heat. The consumer questionnaire contained several questions regarding the use of renewable energy, including the use of wind turbines, solar panels and batteries, and heat pumps. However, the sample did not capture any households that used solar, wind, or geothermal energy. In Kazakhstan, however, there are households that use solar panels, portable wind farms, and geothermal energy equipment on a regular basis. To assess the effectiveness and feasibility of using renewable energy sources by such households, it is necessary to conduct a separate focus survey of such practices.

Table 11. Total household biofuel consumption per year by region.

	Firewood, thousand cubic meters m	Wood waste, thousand tons	Charcoal, including agglomerated, tons	Animal waste (manure), thousand tons	Straw, tons
Abai	54	-	`	-	-
Aqmola	260	1	-	0.6	9.9
Aqtobe	12	-	-	-	-
Almaty	33	-	-	-	-
Atyrau	-	-	-	-	-
West Kazakhstan	17	-	-	1.6	-
Zhambyl	1	-	-	-	-
Zhetysu	26	-	-	-	-
Qaragandy	505	1.5	-	1.2	-
Qostanay	453	-	-	-	-
Qyzylorda	78	-	-	-	-
Mangystau	-	-	-	-	-
Pavlodar	145	-	-	-	-
North Kazakhstan	808	-	-	-	-
Turkestan	9	1.2	-	6.5	-
Ulytau	3	0.8	-	0.4	-
East Kazakhstan	1 133	3.5	1.7	9.8	-
Astana	13	-	-	-	-
Almaty city	0	-	-	-	-
Shymkent	-	-	-	-	-
Kazakhstan	**3 549**	**7.9**	**1.7**	**20.1**	**9.9**

Table 12. Average biofuel consumption per household (by region).

	Firewood, cubic meters	Wood waste, kg	Charcoal, including agglomerated, kg	Animal waste (manure), kg	Straw, kg
Abai	3	-	-	-	-
Aqmola	11	150	-	263	120
Aqtobe	3	-	-	-	-
Almaty	2	-	-	-	-
Atyrau		-	-	-	-
West Kazakhstan	3	-	-	2 367	-
Zhambyl	1	-	-	-	-
Zhetysu	2	-	-	-	-
Qaragandy	2	125	-	133	-
Qostanay	9	-	-	-	-
Qyzylorda	10	-	-	-	-
Mangystau		-	-	-	-
Pavlodar	4	-	-	-	-
North Kazakhstan	9	-	-	-	-
Turkestan	2	299	-	630	-
Ulytau	2	99	-	283	-
East Kazakhstan	5	179	4	1 711	-
Astana	3	-	-	-	-
Almaty city	2	-	-	-	-
Shymkent	-	-	-	-	-
Kazakhstan	**5**	**133**	**4**	**1 155**	**120**

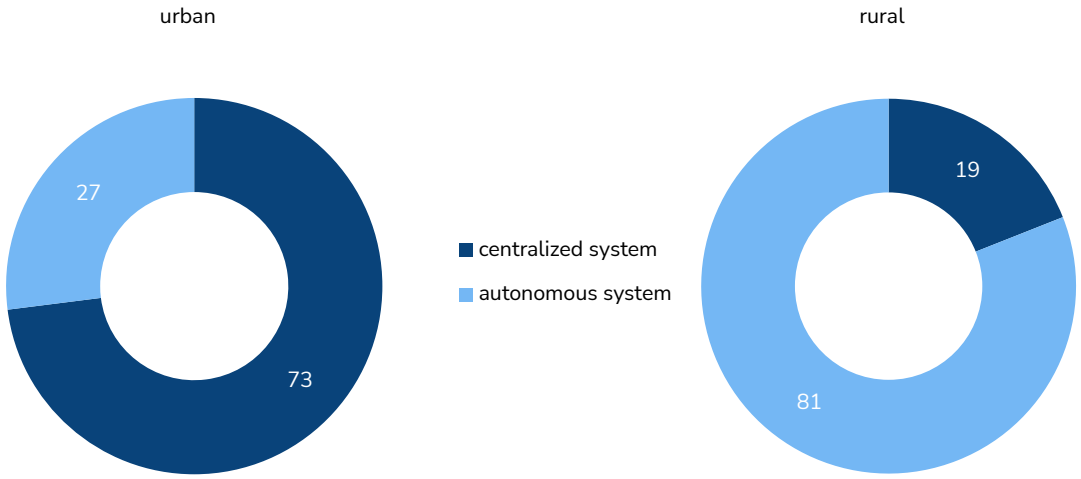
Table 13. Total household biofuel consumption per year by area of residence.

	Total	By area of residence	
		urban	rural
Total consumption of biofuels purchased within a year			
firewood, solid cubic meter	2 893 925	1 166 339	1 727 586
wood waste, kg	1 977 536	147 357	1 830 179
charcoal, including agglomerated, kg	1655	1655	-
animal waste (manure), kg	4 616 263	-	4 616 263
Total consumption of biofuels received free of charge within a year			
firewood, solid cubic meter	378 931	269 816	109 116
wood waste, kg	5 885 787	1 045 257	4 840 530
charcoal, including agglomerated, kg	15 344 659	-	15 344 659
animal waste (manure), kg	9 855	-	9 855
Consumption of biofuels purchased and received free of charge within a year			
firewood, solid cubic meter	275 871	9 279	266 591
wood waste, kg	18 165	-	18 165
animal waste (manure), kg	127 469	-	127 469

2.2.3 Space and water heating systems in households

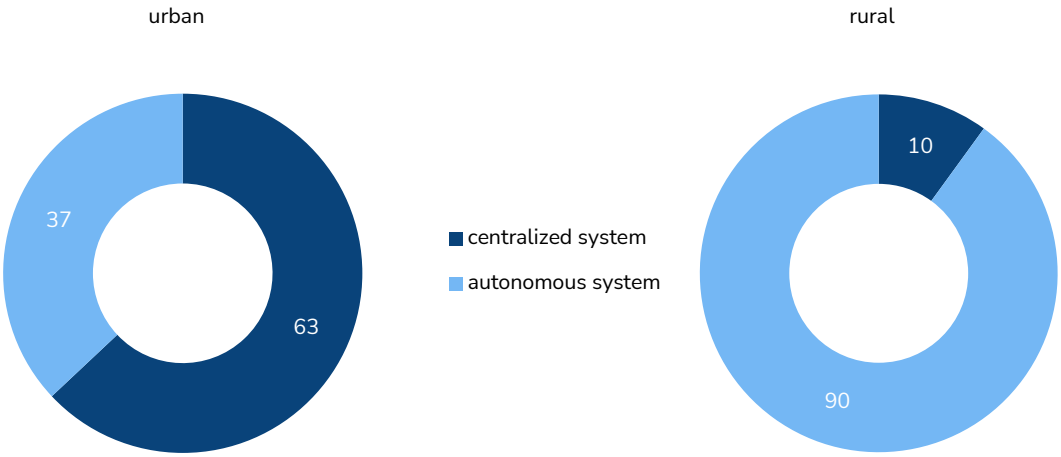
The survey results reveal a high difference between households in urban and rural areas in terms of access to centralized heating systems. Thus, most urban residents have access to a centralized heating system, while rural residents rely more on autonomous systems. Three-quarters of all households in cities are connected to the city system, and only 27% use individual systems. In rural areas, due to low population density, autonomous heating systems prevail. Most households in rural areas – 81% – heat their homes using autonomous systems, while 19% are connected to centralized networks (Fig. 7).

Figure 7. Distribution of households by type of used space heating system by area of residence, %.



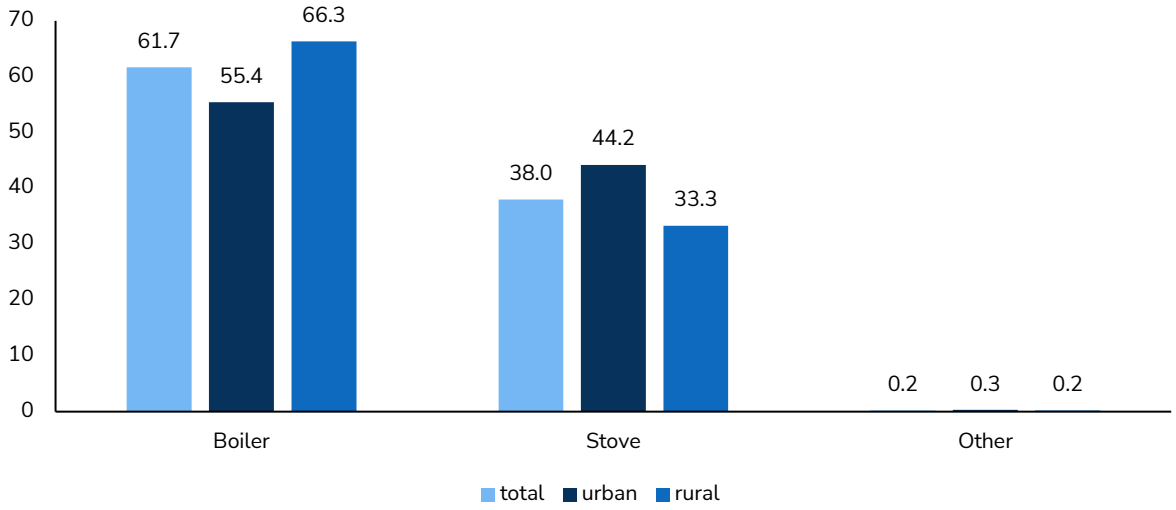
Access to centralized hot water networks has a similar pattern – 63% of all households in cities are connected to centralized distribution networks, while in rural areas only 10% are connected to such networks (Fig. 8).

Figure 8. Distribution of households by type of used water heating system by area of residence, %.



The majority of autonomous space heating systems installed in households, regardless of the area of residence, are heating boilers and individual stoves. Heating boilers are common among 55.4% of urban households and 66.3% in rural areas. Stoves are installed in 44.2% and 33.3% of households in urban and rural areas, respectively. Less than one percent of households use other types of equipment as their primary heating system – 0.3% and 0.2% in urban and rural areas, respectively. Such equipment includes fireplaces, portable heaters, and floor heating (Fig. 9).

Figure 9. Distribution of dwellings by type of primary equipment used as autonomous heating system by area of residence, %.



The most common equipment used for heating houses with natural gas is boilers, while most common equipment fired by coal is stoves. Notably, gas-burning equipment used by households is, on average, 4 years newer than coal-burning stoves. The low efficiency of coal combustion associated with the use of outdated equipment brings additional costs to both households and society. Due to the low energy efficiency combined with the low heat storage capacity of the houses, the population may bear an additional economic burden. Moreover, it may be leading to additional pressure on the local environment and to larger emissions of greenhouse gases.

To compensate for heat losses during particularly severe weather conditions, 7% of all households in the rural areas use additional heating equipment. Of these, three-quarters prefer portable electric heaters. Such heaters are common and affordable for residents. However, the need for their use may be due to the factors described above – low efficiency of the main equipment and high heat losses. The creation of an

environment that encourages households to upgrade their equipment when they switch to cleaner fuels should be encouraged, given the cost of additional heaters and the importance of upgrading key equipment. These measures should also be coupled with efforts to raise awareness of the importance of thermal insulation measures among the population. This combination could be the first step that can potentially have an immediate impact on the reduction of household greenhouse gas emissions.

Table 14. Structure of dwellings by type and age of used heating equipment by area of residence.

	Total	By area of residence	
		urban	rural
Average age of the main heating equipment, years			
boiler	8	9	8
fireplace	5	-	5
stove	14	15	13
portable heater	4	5	3
floor heating	2.8	2.8	-
Share of households using additional equipment for heating, %			
boiler	3.1	3.6	1.8
fireplace	1.8	1.8	1.9
stove	4.8	1.1	12.8
portable heater	74	84.6	51.1
floor heating	16.3	8.8	32.3
Average age of additional heating equipment, years			
boiler	9	10	6
fireplace	3.1	2.9	3.5
stove	4	7	4
portable heater	5	5	3
floor heating	6.3	5.6	6.8

Table 15. Structure of dwellings by type and age of water heating equipment by area of residence.

	Total	By area of residence	
		urban	rural
By type of main water heating equipment,* %	**53.4**	**37.1**	**90.0**
boiler, water heater	77.9	84.9	71.4
stove	11	7.7	14
kettle	11.1	7.4	14.6
Average age of the main water heating equipment, years	**49.9**	**66.6**	**34.4**
boiler, water heater	6	6	6
fireplace	-	-	-
stove	12	13	12
kettle	4	4	4
By type of additional water heating equipment,* in %	**49.9**	**66.6**	**34.4**
boiler, water heater	14.3	19.5	5
stove	2.3	0.1	6.1
kettle	83.4	80.4	88.9
Average age of an additional water heating equipment, years			
boiler, water heater	6	5	8
stove	11	5	11
kettle	3	3	4

**The sum may exceed 100%, because each respondent had the opportunity to select multiple options.*

Since the Kazakhstan is rich in fossil fuels, it is the most affordable source of energy for the population. Most residents still use coal and gas to power individual heating systems. Among the urban population, the use of coal prevails (41.7 %), while only 33.3% of households use natural gas, and 22.7% of dwellings are heated by mixed fuels. Natural gas is the preferred fuel in rural areas – it is used as the main source

of energy for heating in 44.9% of dwellings, while coal is used by only 17.8% of households; 35.6% of households rely on mixed fuels (Fig. 10).

Figure 10. Distribution of households by type of fuel and energy consumed by the primary autonomous space heating equipment by area of residence, %.

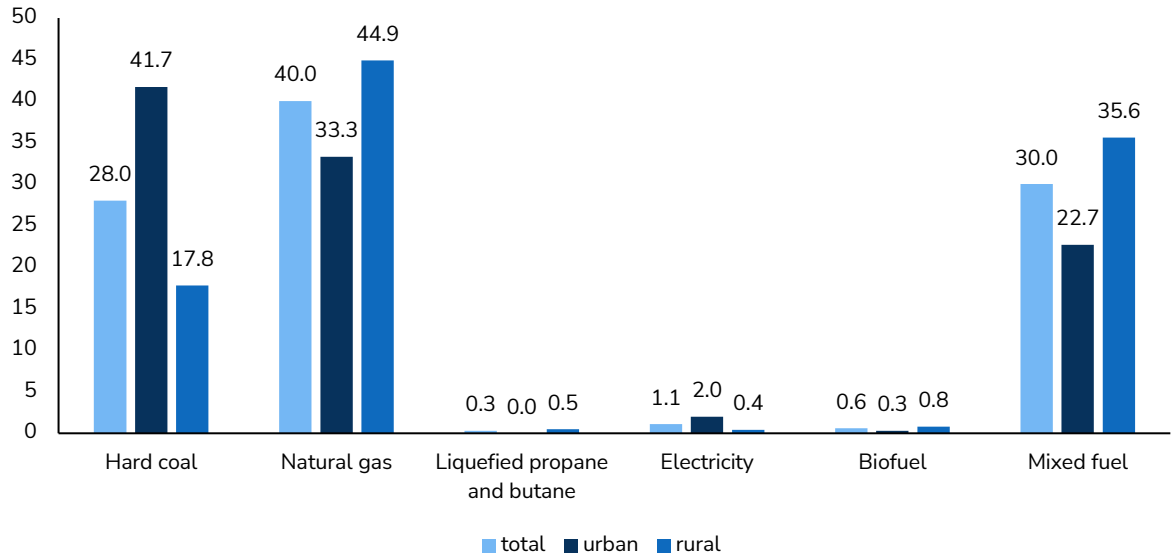


Table 16. Distribution of households by type of fuel and energy consumed by autonomous heating equipment by area of residence.

	Total	By area of residence	
		urban	rural
By type of fuel and energy consumed by the primary autonomous heating equipment, %			
hard coal	28.0	41.7	17.8
natural gas	40.0	33.3	44.9
liquefied propane and butane	0.3	-	0.5
electricity	1.1	2.0	0.4
biofuel	0.6	0.3	0.8
mixed fuel	30.0	22.7	35.6
By type of fuel and energy consumed by additional autonomous heating equipment, %			
natural gas	9.2	8.2	11.3
electricity	87.9	89.9	83.6
biofuel	2.6	1.6	4.8
mixed fuel	0.3	0.3	0.3

Table 17. Distribution of households by types of fuel and energy consumed by water heating equipment area of residence.

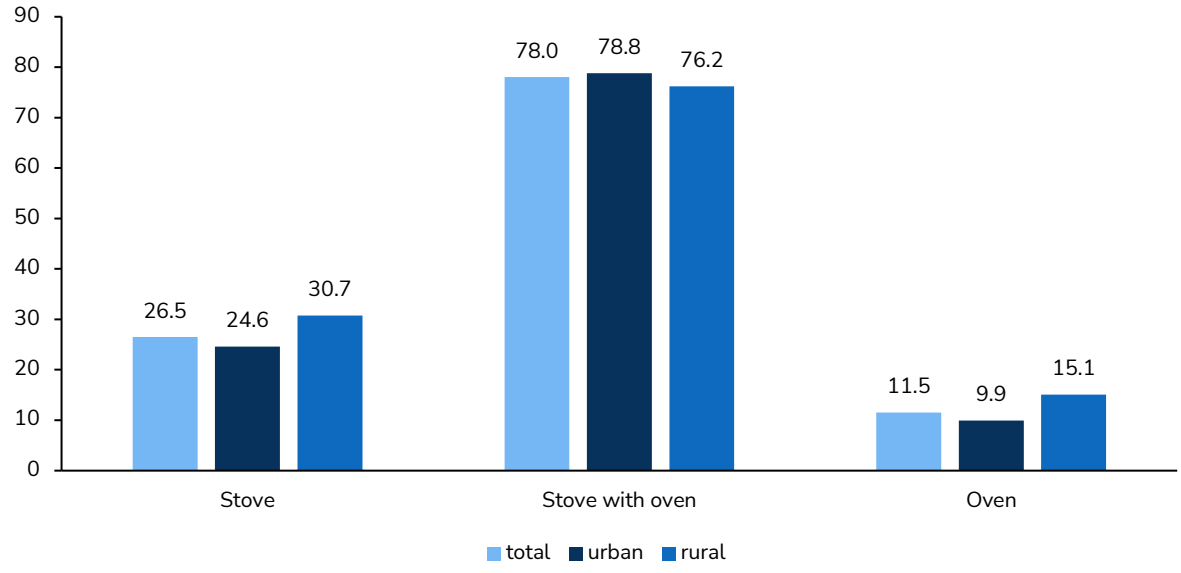
	Total	By area of residence	
		urban	urban
By type of fuel and energy consumed by the primary water heating equipment, %	**53.4**	**37.1**	**90.0**
hard coal	4.4	3.0	5.7
natural gas	25.3	16.3	33.7
liquefied propane and butane	1.2	0.9	1.6
electricity	63.9	74.6	53.9
biofuel	1.0	0.1	1.8
mixed fuel	4.2	5.1	3.3
By type of fuel and energy consumed by additional water heating equipment, %	**49.9**	**69.0**	**32.3**
hard coal	0.5	0.1	1.3
natural gas	11.1	11.1	11.3
liquefied propane and butane	6.1	8.7	0.9
electricity	79.8	76.6	86.2
biofuel	2.3	3.4	0.0
mixed fuel	0.2	0.1	0.3

2.3 Use of fuel and energy for domestic use

2.3.1 Cooking

Most households in both urban and rural areas are equipped with stoves and ovens – 78% of households in the country use them for cooking. Almost a quarter of residents – 24.6% – in urban areas and 30.7% of rural residents use a stand-alone stove, while 9.9% and 15.1% also use stand-alone ovens for cooking in cities and villages, respectively (Fig. 11).

Figure 11. Distribution of households by type of kitchen appliances used for cooking by area of residence, %.



Household cooking also relies heavily on burning fossil fuels – in total, 73.9% of all stoves and ovens are powered by coal, natural gas, and LPG (liquefied propane and butane). At the same time, 35.9% of all cooking equipment is electrical appliances. Such electric stoves and ovens are most common in cities – 46.6% of all appliances, while 50.2% of the equipment used for cooking in rural areas is powered by natural gas. Given that 88.2% of all electricity in the country is produced from fossil fuels, household cooking is practically entirely dependent on coal and gas, either directly or through centralized electricity distribution systems.

Table 18. Distribution of households by type of equipment used for cooking by area of residence.

	Total	By area of residence	
		urban	rural
By type of cooking equipment, %			
stove	26.5	24.6	30.7
stove with oven	78.0	78.8	76.2
oven	11.5	9.9	15.1
Average period of use, years			
stove	7	7	8
stove with oven	8	8	8
oven	7	6	7

Figure 12. Distribution of households by type of fuel used for cooking by area of residence, %.

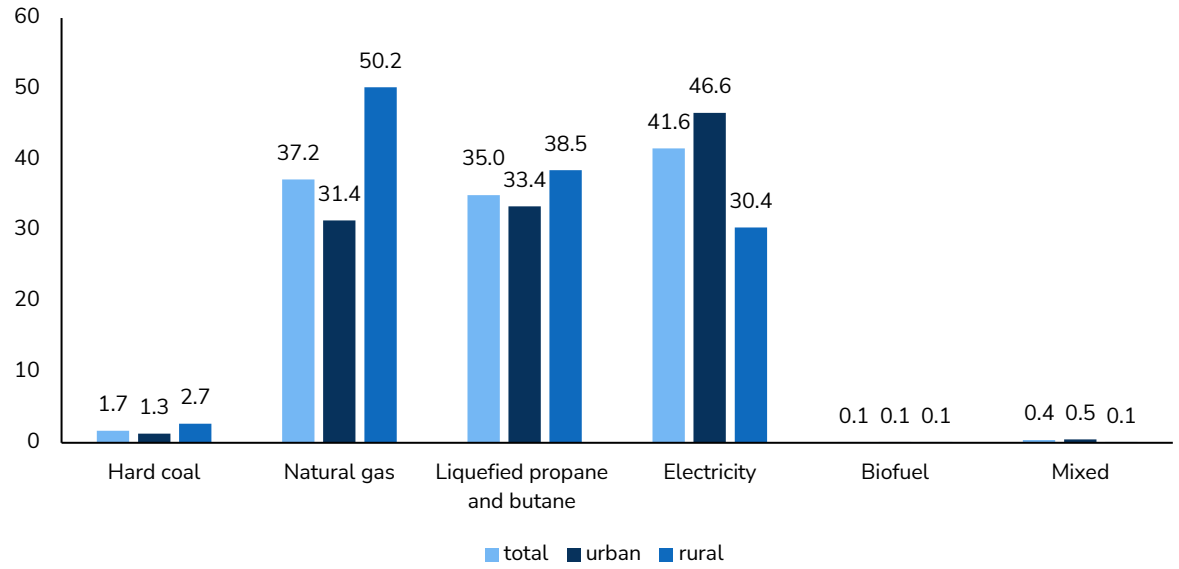


Table 19. Structure of households by type of equipment and types of fuel used for cooking (by area of residence).

	Total	By area of residence	
		urban	rural
By type of fuel, %*			
hard coal	1.7	1.3	2.7
natural gas	37.2	31.4	50.2
liquefied propane and butane	35.0	33.4	38.5
electricity	41.6	46.6	30.4
biofuel	0.1	0.1	0.1
mixed	0.4	0.5	0.1
By type of equipment and type of fuel, %			
stove			
natural gas	22.3	16.1	33.3
liquefied propane and butane	38.9	35.8	44.3
electricity	38.8	48.1	22.4
stove with oven, %			
natural gas	39.1	34.5	49.7
liquefied propane and butane	31.2	30.7	32.5
electricity	29.4	34.4	17.8
mixed	0.3	0.4	-
oven, %			
hard coal	15.1	13.3	17.6
natural gas	7	2.3	13.9
liquefied propane and butane	2.6	3.8	0.9
electricity	73	78	65.7
biofuel	1.1	1.1	1
mixed	1.2	1.5	0.9

**The sum may exceed 100%, because each respondent had the opportunity to select multiple options.*

2.3.2 Use of electrical appliances

The use of energy-saving lighting lamps is one of the first steps to save electricity consumption in households in Kazakhstan. In general, a positive picture is observed throughout the country – 65.8% of all used lamps are energy-saving. Despite efforts to move away from incandescent light bulbs, 42.8% of light in rural areas is still produced by them; in comparison, only 22.9% of all lamps in urban households are incandescent. However, the most common lamps in both cities and villages are LED lamps, which are considered the most energy efficient. They account for 68.7% and 56.4% of all lamps used in cities and villages, respectively (Fig. 13).

Figure 13. Distribution of types of lighting lamps used by households by area of residence, %.

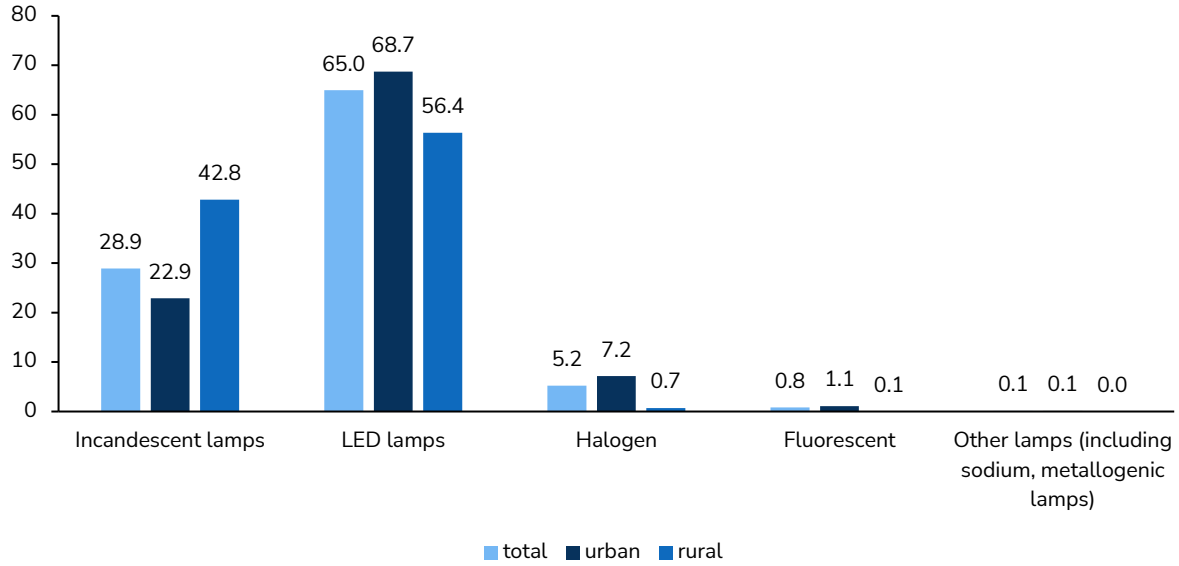


Table 20. Distribution of use of lighting lamps in households* by area of residence.

	Total	By area of residence	
		urban	rural
Total amount of lamps used by households, thousand units	**40 318**	**28 148**	**12 170**
incandescent lamps	11 661	6447	5 214
LED lamps	26 198	19 340	6 858
halogen	2 104	2016	88
fluorescent	322	312	10
other lamps (including sodium, metallogenic lamps)	33	33	0.2
Number of lamps per household, units			
incandescent lamps	5	5	5
LED lamps	7	7	7
halogen	6	6	5
fluorescent	4	4	2
other lamps (including sodium, metallogenic lamps)	2	2	1
Average number of hours of use, hour			
incandescent lamps	6	6	6
LED lamps	6	6	7
halogen	6	7	5
fluorescent	7	7	6
other lamps (including sodium, metallogenic lamps)	4	4	2

**number of lamps in the living room and kitchen*

Table 21. Structure of households by type of equipment used for air conditioning and ventilation by area of residence.

	Total	By area of residence	
		urban	rural
Share of households with an air conditioning or ventilation system, %	**25.9**	**29.2**	**18.6**
By ventilation and air conditioning devices*, %			
air conditioning in rooms	47.2	50.9	34.0
outdoor air conditioner (split system)	36.4	34.5	43.2
mechanical fan	15.1	13.1	21.9
built-in ventilation	3.9	4.2	2.9
Average period of use of the air conditioning or ventilation system, years			
air conditioning in rooms	5	5	5
outdoor air conditioner (split system)	7	7	6
mechanical fan	5	5	4
built-in ventilation	5	6	3
Average power, W			
air conditioning in rooms	2 304	2 297	2 345
outdoor air conditioner (split system)	2 793	2 806	2 756
mechanical fan	152	181	91
built-in ventilation	197	210	130

**The amount may exceed 100%, because Each respondent had the opportunity to select multiple options.*

In general, households in Kazakhstan are well equipped with basic appliances. Most households have got refrigerators (100%) and televisions (96%), 27% of households use freezers, and 88% use a washing machine. It is also worth noting the low share of use of dryers, which are considered a less environmentally friendly way to dry clothes. There is a low prevalence of dishwashers – 6% in urban areas and 2% in rural areas. Two out of five households have a laptop and 17% use a desktop computer. Fifty-eight percent of households use electric kettles to heat water, and only 2% of all households have an electric coffee machine. Additionally, 44% of households have other household appliances.

Although large electrical appliances used in everyday household life can last 10-15 years, their energy efficiency decreases with age. According to the results of the survey, the average age of electrical appliances in households does not exceed 8 years. At the beginning of 2023, the average period of use of refrigerators, washing machines (semi-automatic) and desktop computers was 8 years. The average age of freezers, washing machines, dryers, dishwashers, televisions and laptops was 4 to 7 years. Households have been using electric kettles and coffee machines for 3 years on average.

Table 22. Information about electrical household appliances available in households by area of residence.

	Total	By area of residence	
		urban	rural
Per 100 households, units			
fridge	100	100	100
freezer	27	24	33
washing machine	88	93	76
washing machine (semi-automatic)	9	5	19
dryer	1	1	0
dishwasher	4	6	2
TV	96	96	97
desktop computer	17	16	19
laptop	40	40	40
coffee machine	2	2	1
electric kettle	58	62	51
other	44	47	38
Average age, years			
fridge	8	8	8
freezer	5	5	5
washing machine	6	7	6
washing machine (semi-automatic)	8	9	8
dryer	6	6	6
dishwasher	4	4	8
TV	7	7	7
desktop computer	8	8	7
laptop	5	5	5
coffee machine	3	4	2
electric kettle	3	3	3
other	5	5	5
Average power usage of household devices, W			
fridge	317	307	339
freezer	343	336	354
washing machine	1 713	1 701	1 747
washing machine (semi-automatic)	1 453	1 512	1 418
dryer	1 083	902	1 852
dishwasher	1 722	1 671	2 081
TV	213	201	240
desktop computer	371	373	366
laptop	138	144	125
coffee machine	1 440	1 438	1 445
electric kettle	1 630	1 612	1 679
other	1 423	1 402	1 481

2.3.3 Use of measuring and regulating instruments

According to the results of the survey, households have varying degrees of use of measuring and regulating devices. Thus, all households have installed electricity meters, which is a good practice for controlling energy consumption and optimizing costs. In total, 86.2% of households have cold water meters installed – 90.9% in urban areas and 75.7% in rural areas. The water meters help to control and regulate the use of water, which can affect the energy consumption of water heating. Overall, 38.7% of households use gas meters to regulate gas consumption. In urban areas, this figure is slightly lower (31.0%), while it is higher in rural areas (55.8%). The use of radiator thermostats and central thermostats can help regulate the temperature inside the building more accurately, which can help reduce excess energy consumption. However, only 2.8% of all households have thermostats that allow you to regulate heat on radiators, 2% have a central thermostat that regulates the temperature in the house, and 0.3%

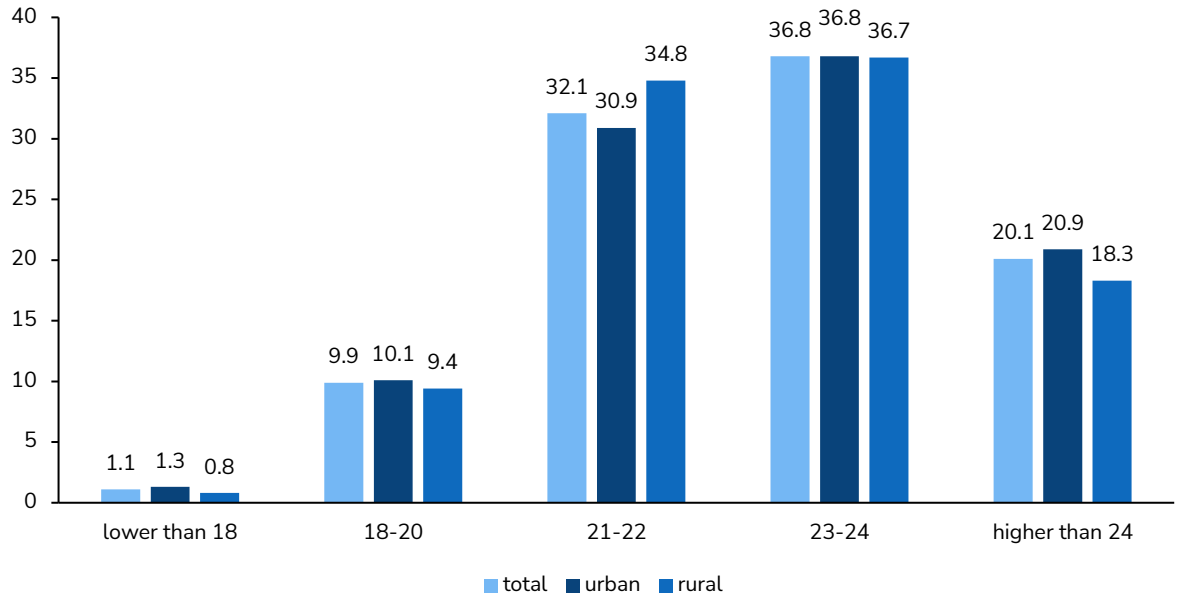
have thermostats that regulate the temperature in each room. Such control devices have an exceptionally low distribution among households in rural areas.

Table 23. Distribution of dwellings by type and number of measuring and regulating devices by area of residence, %.

	Total	By area of residence	
		urban	rural
gas meter	38.7	31.0	55.8
electricity meter	100	100	99.9
cold water meter	86.2	90.9	75.7
thermostats on radiators	2.8	4.0	0.2
central thermostat	2.0	2.9	0.0
thermostats that regulate the temperature in each room	0.3	0.4	0.1

The presence of a thermostat that allows you to regulate the temperature in the house or in a separate room contributes not only to energy-efficient thermoregulation of the premises, but also to maintaining comfortable living and sleeping conditions. The optimum indoor temperature varies depending on the season. Considering the sharply continental climate on the territory of Kazakhstan, the optimum temperature can be 18-20 degrees Celsius in the winter and 23-26°C in the summer months. According to the results of the survey, in 89% of households the average temperature in living spaces during the last winter was above 21°C. In 32.1% of households, the average temperature was 21-22°C, in 36.8% – 23-24°C, and in 20.1% – above 24°C. Less than 10% of households kept the temperature in the house in the range of 18-20°C, and only about 1.1% - below 18°C (Fig. 14).

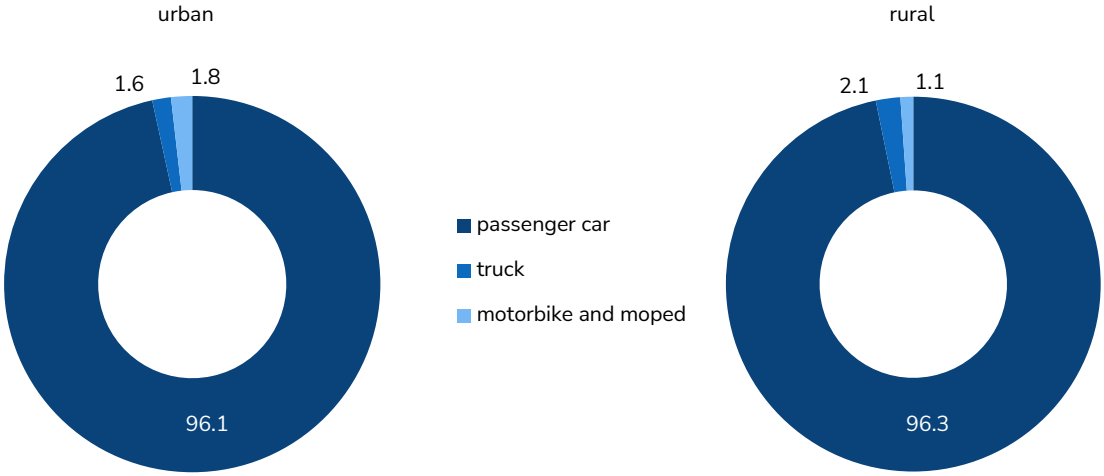
Figure 14. Structure of dwellings by indoor temperature in degrees Celsius, %.



2.4 Use of transport

The most common mode of transport owned by households is the passenger car – their share among all modes of transport was 96.2%. The percentage of truck ownership was 1.8%. Among households in urban areas, this share was 1.6%, and in rural areas – 2.1%. The share of motorcycles and mopeds among all transport was 1.6%. Motorcycles and mopeds were more common among households in urban areas than in rural areas - their share was 1.8% and 1.1% in urban and rural areas, respectively (Fig. 15).

Figure 15. Distribution of households by type of vehicles, in %.



The age of a car in the country on average was 14 years, and of trucks – 23 years. A large number of older vehicles certainly have negative consequences for the environment due to low energy efficiency and high level of emissions of harmful substances, including greenhouse gases. One of the measures implemented in Kazakhstan to stimulate the renewal of the car fleet was preferential car loans. However, given the low percentage of households with cars and at the same time a large number of registered cars (about 4.7 million), such measures are narrowly targeted and have limited potential to improve the situation. Moreover, urban, and intercity transport infrastructure encourages the use of private vehicles. Such measures may force residents to continue to use old cars – two-thirds of all cars owned by households are over 10 years old. While more appropriate policies that can contribute to sustainable development could be the ones targeting the development of public transportation.

Table 24. Structure of vehicles used by households.

	Total	By area of residence	
		urban	rural
Average age, years			
passenger car	14	14	15
truck	23	26	19
motorbike	5	4	9
electric scooter	1	1	-
moped	3	1	5
Average total mileage, thousand km			
passenger car	282.8	268.8	309.3
truck	447.3	427.8	474.8
motorbike	88.9	87.1	94.7
electric scooter	5.4	5.4	-
moped	4.9	5.1	4.7

Mopeds and motorcycles turned out to be the most economical vehicles owned by households in 2022, with average fuel consumption of 2.8 and 3.9 liters per one hundred kilometers, respectively. The average consumption rate of passenger cars was 10.9 liters per 100 km. Trucks were the least efficient and consumed the largest amount of fuel – 19 liters per 100 km. Both trucks and cars in rural areas were more energy efficient than in cities, while urban motorcycles and mopeds consumed relatively less fuel (Fig. 16).

Figure 16. Average consumption of gasoline by household vehicles by area of residence, liters per 100 km.

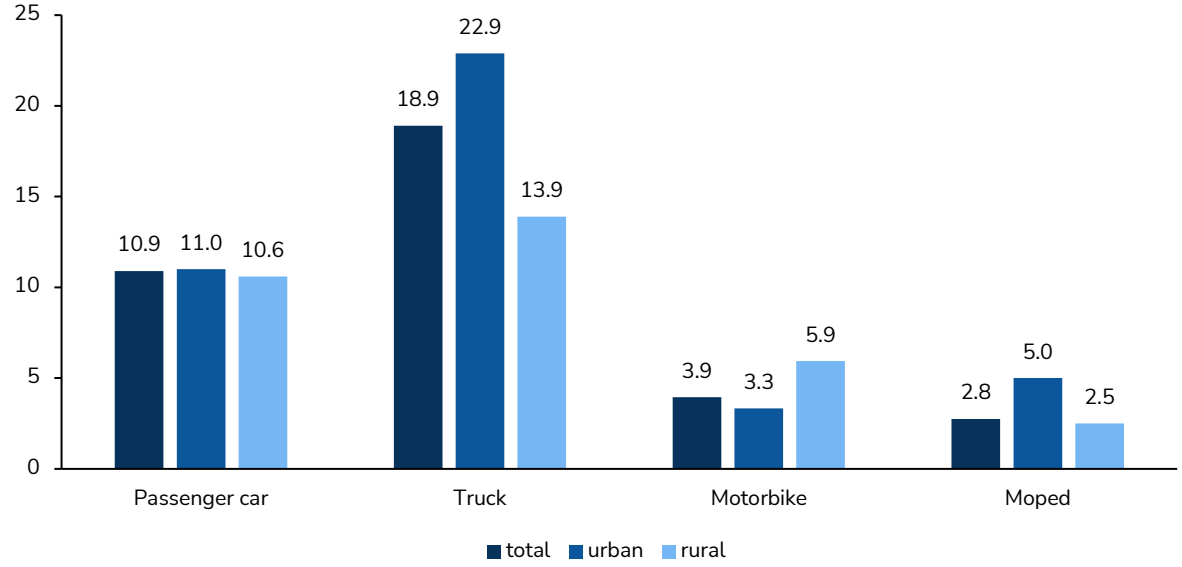


Table 25. Average fuel consumption of household vehicles by area of residence, liters per 100 km.

	Total	By area of residence	
		urban	rural
passenger car			
petrol	10.9	11.0	10.6
diesel fuel	12.1	12.7	8.9
electricity*	3.0	3.0	-
liquefied propane and butane	10.6	10.5	10.9
mixed	10.7	11.5	9.6
truck			
petrol	18.9	22.9	13.9
diesel fuel	20.1	23.3	15.8
liquefied propane and butane	10.8	11.2	9.0
mixed			
motorbike			
Petrol	3.9	3.3	5.9
electric scooter			
electricity*	1.7	1.7	-
moped			
petrol	2.8	5.0	2.5

** in kWh*

Table 26. Distribution of vehicles by type of fuel by area of residence, %.

	Total	By area of residence	
		urban	rural
passenger car			
petrol	95.7	95.7	95.6
diesel fuel	0.4	0.5	0.2
electricity	0.0	0.1	-
gas	1.9	2.0	1.7
mixed	2.0	1.7	2.5
truck			
petrol	45.4	43.0	48.7
diesel fuel	47.8	47.5	48.3
gas	6.8	9.5	3.0
motorbike			
petrol	100	100	100
electric scooter			
electricity	100	100	-
moped			
petrol	100	100	100

3. Conclusion

3. Conclusion

The primary objective of this survey is to gather detailed data on household fuel consumption by households in the Republic of Kazakhstan. This report presents information concerning household characteristics, living conditions, the utilization of various fuel types, heating and water heating systems, household appliance usage, and transportation habits.

The prevalence of numerous houses constructed prior to 1970 implies potential inadequacies in energy efficiency and increased heating costs for buildings. This factor contributes to greenhouse gas emissions and poses challenges to the nation's transition to green energy. Modernizing thermal insulation and energy efficiency becomes paramount to ensuring comfortable living conditions while mitigating environmental repercussions.

It is important to emphasize that merely 17.7% of all households have some form of thermal insulation, underscoring the potential for enhancing energy efficiency within residential spaces. The enhancement of building energy efficiency is not only environmentally conscious but also economically advantageous. Achieving this objective requires not only promoting house insulation but also conducting awareness campaigns and educational initiatives to inform the populace about energy efficiency's significance. Continuing programs aimed at modernizing and replacing outdated housing stock remains crucial. This becomes even more pertinent in rural areas, where a substantial majority of dwellings were erected before 1991. Encouraging the construction of new energy-efficient residential structures, tailored to varying household sizes, will enhance the housing sector's quality, provide comfortable living conditions, and foster energy-saving behaviors.

Fossil fuels stand as the primary energy source for households. Almost three-quarters of urban inhabitants are connected to centralized heating systems, while this proportion drops to 19% among rural residents. Among households lacking access to centralized heating, 40% use natural gas and 28% use coal for heating. This trend similarly applies to water heating systems, where 63% of city households versus 10% of rural households are connected to centralized systems. Furthermore, the survey indicates that equipment utilizing natural gas for water heating is, on average, four years newer compared to coal-fired equipment. The survey also revealed the use of additional heating equipment, with 7% of households employing supplementary devices, of which nearly three-quarters use portable electric heaters. The energy efficiency of dwellings also influences the use of cooling systems, with a quarter of the population resorting to various cooling and ventilation systems (air conditioners, fans, and built-in ventilation systems). Given the global climate change context and the projected temperature rise during Kazakhstan's summer season, heavy reliance on ventilation and cooling systems could lead to increased emissions.

Substantial potential exists for curbing greenhouse gas emissions through behavioral changes. Cooking in households, whether directly or indirectly, remains heavily reliant on fossil fuels. However, only 1.7% of households directly utilize coal for cooking, while 72% depend on natural gas or LPG, and 42% on electricity. Despite the relatively low percentage of coal usage, households exhibit a significant reliance on fossil fuels for cooking. Roughly a third of lamps in households are incandescent lamps. Additionally, households have limited options for energy-efficient temperature control, which could significantly contribute to boosting residential energy efficiency. In this context, just 2.8% of households are equipped with thermostats for radiator heat regulation, 2% possess central thermostats for house-wide temperature control, and 0.3% utilize thermostats for individual room temperature regulation.

To reduce energy consumption and transition towards a low-carbon economy, it is advisable to encourage households to adopt energy-efficient behaviors, utilize energy-efficient appliances, and practice rational heat usage. There is a growing need to expand the use of renewable energy sources and encourage the adoption heating and electricity production technologies, such as solar water heaters and solar panels. In

conclusion, this household fuel consumption report for the Republic of Kazakhstan is a critical undertaking, aiming to identify priority areas within the energy and sustainable development sectors.

The findings of this household fuel consumption survey in Kazakhstan have uncovered significant insights into energy efficiency and sustainable development. The analysis of dwellings underscores the urgency of enhancing energy efficiency within an aging housing stock, particularly in rural areas, and the importance of sustaining modernization and equipment replacement initiatives. The analysis demonstrates that the majority of households rely on fossil fuels, which has environmental consequences. However, the limited usage of biofuels and renewable energy sources offers room for improvement.

To curtail greenhouse gas emissions and ensure a transition to a low-carbon economy, it is recommended to continue developing the biofuel sector, promote energy-efficient appliances and technologies, and expand the adoption of renewable energy sources among households. Emphasis must also be placed on awareness campaigns and educational programs to enlighten the public on the importance of energy efficiency. Such measures will contribute to establishing a more sustainable and environmentally friendly energy landscape in the country.

By focusing on the efficiency of current systems and the gradual shift towards renewable energy sources, Kazakhstan can effectively confront the challenges posed by climate change and provide its residents with comfortable living conditions. This endeavor necessitates the combined efforts of the government, businesses, and the population to achieve sustainable development, thereby benefiting both the environment and the nation's economy as a whole.

Appendix

Household Energy Consumption Survey Questionnaire.

Confidentiality is guaranteed by state statistics authorities

Statistical form of nationwide statistical observation

Household Energy Consumption Survey

Index H-010 once every five years reporting period ☐☐☐☐ year

Households included in the sample take part in the observation.

Submission deadline - April 25 (inclusive) after the reporting period

1. **Code according to the Classifier of administrative-territorial objects (CATO)** ☐☐☐☐☐☐☐☐☐
2. **Area of residence (1- urban, 2- rural)** ☐
3. **Household No.** ☐☐☐☐☐☐☐☐☐☐
4. **Code of the person authorized to conduct the surveu**
   (hereinafter referred to as the interviewer) ☐☐☐☐☐☐☐☐☐
5. **Date of interview day month year** ☐☐☐☐

Hello. My name is _____. I am a representative of the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. We conduct a survey on household fuel and energy consumption across the country. The information received from you will be used by the Government to develop a policy in the field of energy efficiency and ensure the energy security of the country. Your household has been selected for the survey. I would like to ask you some questions about fuel and energy consumption and other characteristics of your home. Questions usually take about 30 minutes. All answers you provide will be kept confidential and anonymous. We hope that you will agree to answer the questions, as your opinion is important. If I ask you any question that you don't want to answer, just let me know and I'll move on to the next question, you can also stop the interview at any time. May I start the interview?

Module A: Information about the household and living conditions

1. Has your household lived in this dwelling for more than 12 months?

1. Yes	2. No (finish the survey)
☐	☐

2. Is this your main place of residence?

1. Yes	2. No (finish the survey)
☐	☐

3. Enter the number of people living in your household (actual): ☐☐

4. Specify the type of windows in your home

1. Wooden	2. Plastic	3. Metal
☐	☐	☐

5. Does your home have any type of thermal insulation [1]?

1. Yes	2. No (→ 7)	3. Difficult to answer (→ 7)
☐	☐	☐

6. What parts of your home are thermally insulated?

1. Walls/facade	2. Floors/foundations	3. Roof	4. Other
☐	☐	☐	☐

7. What was the average temperature inside your home during the last winter, ° C?

1. below 18	2. 18-20	3. 21-22	4. 23-24	5. above 24
☐	☐	☐	☐	☐

Module B: Heating

8. What heating system is used in your home?

1. Central (→ 10)	**2.** Autonomous
☐	☐

9. The main equipment that you use for heating:

Type of equipment	Age of equipment used, years	Fuel or energy source used for space heating (Mark your answer with a number from the list) 1 - Coal; 2- Natural gas; 3 - Propane and butane liquefied; 4 - Electricity; 5- Gas oils (diesel fuel) ; 6 - Biofuel; 7 - Kerosene; 8 - Other
1. Boiler	☐☐	☐
2. Fireplace	☐☐	☐
3. Stove	☐☐	☐
4. Portable heater	☐☐	☐
5. Floor heating	☐☐	☐
6. Heat pump [2]	☐☐	☐
7. Solar collector [3]	☐☐	☐

Note:
[1] Thermal insulation - the use of building materials or structures to reduce heat loss of walls, roofs, floors, windows, pipes, doors, etc.

10. Do you have any other equipment that uses fuel or electricity for space heating?

1. Yes	2. No (→ 12)
☐	☐

11. The second most important equipment for space heating:

Type of equipment	Age of equipment, years	Fuel or energy source used for space heating (Mark your answer with a number from the list) 1 - Coal; 2- Natural gas; 3 - Liquefied propane and butane; 4 - Electricity; 5- Gas oils (diesel fuel) ; 6 - Biofuel; 7 – Kerosene; 8 - Other
1. Boiler	☐☐	☐
2. Fireplace	☐☐	☐
3. Stove	☐☐	☐
4. Portable heater	☐☐	☐
5. Floor heating	☐☐	☐
6. Heat pump	☐☐	☐
7. Solar collector	☐☐	☐

Note:

[2] A heat pump is a device that extracts heat from the environment - earth, air or water. The two main types of heat pumps used in the residential sector are air source heat pumps and ground source heat pumps.

[3] Solar collector - a device that collects the thermal energy of the Sun and heats the circulating coolant material: water, air, oil, or antifreeze.

Module C: Water heating

12. Do you get hot water from a central or autonomous heating system?

1. Central (→ 15)	2. Autonomous
☐	☐

13. Do you have your own equipment that uses fuel or electricity to heat water?

1. Yes	2. No (→ 17)
☐	☐

14. Indicate the equipment that you use most often to heat water (specify one answer) :

Type of equipment	Age of equipment used, years	Fuel or energy source used for space heating (Mark your answer with a number from the list) 1 - Coal; 2- Natural gas; 3 - Liquefied propane and butane; 4 - Electricity; 5- Gas oils (diesel fuel) ; 6 - Biofuel; 7 - Kerosene; 8 - Other
1. Boiler, column, water heater	☐☐	☐
2. Fireplace	☐☐	☐
3. Stove	☐☐	☐
4. Heat pump	☐☐	☐
5. Solar collector	☐☐	☐
6. Kettle	☐☐	☐

15. Do you have any other equipment that uses fuel or electricity to heat water?

1. Yes	2. No (→ 17)
☐	☐

16. List the second most important equipment (specify one answer) :

Type of equipment	Age of equipment used, years	Fuel or energy source used for space heating (Mark your answer with a number from the list) 1 - Coal; 2- Natural gas; 3 - Liquefied propane and butane; 4 - Electricity; 5 - Gas oils (diesel fuel) ; 6 - Biofuel; 7 - Kerosene; 8 - Other
1. Boiler, water heater	☐☐	☐
2. Fireplace	☐☐	☐
3. Stove	☐☐	☐
4. Heat pump	☐☐	☐
5. Solar collector	☐☐	☐
6. Kettle	☐☐	☐

Module D: Energy use

17. Do you have your own power generation equipment?

1. Yes	2. No (→ 21)
☐	☐

18. What equipment do you use to generate electricity?

1. Electric generator	2. Solar panels (→ 20)	3. Other (→ 21)
☐	☐	☐

19. Specify the characteristics of your electricity generator:

1. Power usage, kW	2. Age, years	3. Number of hours of equipment operation per day	Type of fuel used (Mark your answer with a number from the list) 1- natural gas; 2 - propane; 3 - diesel; 4 - gasoline; 5 - other
☐☐☐	☐☐☐	☐☐☐	☐☐☐

20. Specify the power of solar panels: kW ☐☐☐

Module E: Using a solar collector and a heat pump

21. Do you use a solar collector or a heat pump in your home?

1. Yes	2. None (→ 27)
☐	☐

21.1.

1. Solar collector	2. Heat pump (→ 25)
☐	☐

22. Specify the total area of installed solar collectors in your housing, sq.m ☐☐☐

23. The solar collector is used for:

1. Water heating	2. heating	3. Water heating and heating
☐	☐	☐

24. Specify the type of solar collector:

1. Glazed flat plate	2. Vacuum tube	3. Other	4. Difficult to answer
☐	☐	☐	☐

25. Specify the characteristics of your heat pump:

1. Power usage, kW	2. Age, years
☐☐☐	☐☐☐

26. The heat pump is used for

1. Water heating	2. Heating	3. Water heating and heating
☐	☐	☐

Module F: Cooking

27. What kind of energy or fuel do you use for cooking:

Type of equipment	Equipment age, years	Fuel or energy source used for cooking (Mark your answer with a number from the list) 1 - Coal; 2- Natural gas; 3 - Liquefied propane and butane; 4 - Electricity; 5 - Gas oils (diesel fuel) ; 6 - Biofuel; 7 - Kerosene; 8 - Other	Equipment power usage[4], W
1. Stove	☐☐☐	☐	☐☐☐☐
2. Stove with oven	☐☐☐	☐	☐☐☐☐
3. Oven	☐☐☐	☐	☐☐☐☐

Module G: Cooling and air conditioning system

28. Does your home have an air-cooling or ventilation system?

1. Yes	2. No (→ 30)
☐	☐

29. Specify ventilation and air conditioning devices:

Specification	Use period, years	Average power, W
1. Air conditioning in the rooms	☐☐☐	☐☐☐☐☐
2. Outdoor air conditioner (split system)	☐☐☐	☐☐☐☐☐
3. Mechanical fan	☐☐☐	☐☐☐☐☐
4. Integrated ventilation	☐☐☐	☐☐☐☐☐

Note:

[4] Power is indicated if the equipment uses electricity

Module H: Energy consumption

30. Enter the annual consumption** of fuel in your household

**does not include liquid fuels used in generators and vehicles.
**annual consumption can be calculated as the average amount of consumption for 1 month multiplied by 12

Fuel types	Annual consumption, total
1. Coal, kg	☐☐☐☐☐
2. Natural gas, cubic meters m.	☐☐☐☐☐
3. Liquefied propane and butane, liter	☐☐☐☐☐
4. Electricity, kW	☐☐☐☐☐
5. Gas oils (diesel fuel), liter	☐☐☐☐☐
6. Biofuel, kg	(→ 31) ☐☐☐☐X
7. Kerosene, liter	☐☐☐☐☐
8. Solar energy, kW	☐☐☐☐☐
9. Biogas, cub. m.	☐☐☐☐☐

31. Enter your annual household biofuel consumption (Please mark your answer with a number from the list) (If biofuels are not used, then go to question 32)

Type of biofuel	(Mark your answer with a number from the list) (1-Purchased;2-Received for free; 3-Purchased and received for free)	Annual consumption, total
1. Firewood[5], m3	☐	☐☐☐☐☐
2. Wood pellets and briquettes[6], kg	☐	☐☐☐☐☐
3. Wood waste[7], kg	☐	☐☐☐☐☐
4. Charcoal, including agglomerated[8], kg	☐	☐☐☐☐☐
5. Other fuel from agricultural waste, kg	☐	☐☐☐☐☐
6. Animal waste (manure), kg	☐	☐☐☐☐☐
7. Straw, kg	☐	☐☐☐☐☐
8. Biogas, cubic meters	☐	☐☐☐☐☐

Note:
[5] Firewood - roundwood used as fuel in the process of cooking, heating

[6] Wood pellets and briquettes are agglomerates produced from by-products (such as cuttings, sawdust or wood chips) of the mechanical woodworking industry, the furniture industry or other wood processing industries.
[7] Wood waste - other by-products of wood processing. This term includes wood waste not suitable for use as commercial timber, such as defective lumber, slabs, wood trimmings, pencils left after peeling plywood logs, substandard plywood, sawdust, carpentry and joinery waste, and wood waste used for the production of pellets, other agglomerated goods or used directly for power generation.
[8] Charcoal, including agglomerated - wood converted into coal as a result of partial combustion or treatment with heat from external sources.

Module I: Other household appliances

32. Please list the household appliances used in your household:

Appliance type	Age (years)	Power, W
1. Fridge	☐☐	☐☐☐☐☐
2. Freezer	☐☐	☐☐☐☐☐
3. Washing machine	☐☐	☐☐☐☐☐
4. Combined washer-dryer (semi-automatic)	☐☐	☐☐☐☐☐
5. Dryer	☐☐	☐☐☐☐☐
6. Dishwasher	☐☐	☐☐☐☐☐
7. TV	☐☐	☐☐☐☐☐
8. Desktop computer	☐☐	☐☐☐☐☐
9. Laptop	☐☐	☐☐☐☐☐
10. Coffee machine	☐☐	☐☐☐☐☐
11. Electric kettle	☐☐	☐☐☐☐☐
12. Other	☐☐	☐☐☐☐☐

Module J: Lighting

33. Specify the lamps used in your household (living room and kitchen):

Specification	Number of units	Average Hours of Use
1. Incandescent lamps	☐☐☐	☐☐
2. LED lamps [9]	☐☐☐	☐☐
3. Halogen [10]	☐☐☐	☐☐
4. Fluorescent [11]	☐☐☐	☐☐
5. Other lamps (including sodium, metallogenic lamps)	☐☐☐	☐☐

Note:

[9] LED lamps - lamps that use LEDs as a light source.

[10] Halogen - incandescent lamps, in the cylinder of which a buffer gas is added: halogen vapors (bromine or iodine). A distinctive feature of the lamp design is a halogen capsule filled with gas

[11] Fluorescent - a gas-discharge light source in which an electric discharge in mercury vapor generates ultraviolet radiation that is re-emitted into visible light by a phosphor, such as a mixture of calcium halophosphate with other elements

34. Specify the measuring and regulating devices installed in your dwelling:

1. Gas meter	2. Electricity meter	3. Cold water meter	4. Heat regulators on radiators	5. Central thermostat that regulates the temperature in the house	6. Thermostats that control the temperature in every room
☐	☐	☐	☐	☐	☐

Module K: Transport

35. Is there a vehicle for personal use in your household? [12]

1. Yes	2. No (Survey completed)
☐	☐

Specify quantity, units ☐

Note:

[12] means transport that is in working condition and is actively used

36. Please indicate the main type of vehicle in your household:

Vehicle type	Type of fuel or energy (Mark your answer with a number from the list: 1- gasoline; 2- diesel fuel; 3- electricity; 4- gas; 5-mixed)	Average fuel consumption, in liters per 100 km	Total mileage, thousand km	Age, years
1. Passenger car	☐	☐☐	☐☐☐	☐☐
2. Truck	☐	☐☐	☐☐☐	☐☐
3. Motorbike	☐	☐☐	☐☐☐	☐☐
4. Electric scooter	☐	☐☐	☐☐☐	☐☐
5. Moped	☐	☐☐	☐☐☐	☐☐
6. Other	☐	☐☐	☐☐☐	☐☐

37. Please indicate the second vehicle in your household that you use:

Vehicle type	Type of fuel or energy (Mark your answer with a number from the list: 1- gasoline; 2- diesel fuel; 3- electricity; 4- gas cylinder; 5-mixed)	Average fuel consumption , in liters per 100 km	Total mileage, thousand km	Age, years
1. Passenger car	☐	☐☐	☐☐☐	☐☐
2. Truck	☐	☐☐	☐☐☐	☐☐
3. Motorbike	☐	☐☐	☐☐☐	☐☐
4. Electric scooter	☐	☐☐	☐☐☐	☐☐
5. Moped	☐	☐☐	☐☐☐	☐☐
6. Other	☐	☐☐	☐☐☐	☐☐

38. Please indicate the third vehicle in your household that you use:

Vehicle type	Type of fuel or energy (Mark your answer with a number from the list: 1- gasoline; 2- diesel fuel; 3- electricity; 4- gas cylinder; 5-mixed)	Average fuel consumption, in liters per 100 km	Total mileage, thousand km	Age, years
1. Passenger car	☐	☐☐	☐☐☐	☐☐
2. Truck	☐	☐☐	☐☐☐	☐☐
3. Motorbike	☐	☐☐	☐☐☐	☐☐
4. Electric scooter	☐	☐☐	☐☐☐	☐☐
5. Moped	☐	☐☐	☐☐☐	☐☐
6. Other	☐	☐☐	☐☐☐	☐☐

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Symbols:

- – no value

0.0 – insignificant value

... – data not available

Insignificant discrepancies between the total and the sum of summands may be present due to rounding of data.