MINISTRY OF ECONOMY OF RA

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REPUBLIC OF ARMENIA
MINISTRY OF ENVIRONMENT

ESAC
"Environmental Sustainability Assistance Center" NGO

Գերմանական համագործակցություն
DEUTSCHE ZUSAMMENARBEIT

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Socio-economic survey on the heating energy and related issues in the pilot communities of Lori, Shirak and Kotayk Marzes of Armenia

Survey Report

May 2021

Executive summary

The programme "Management of natural resources and safeguarding of ecosystem services for sustainable rural development in the South Caucasus" (ECOserve) is implemented by GIZ jointly with the partner Ministry of Territorial Administration and Infrastructures, Ministry of Environment and Ministry of Economy. In Armenia the program aims at improving the precondition for sustainable and biodiversity-friendly management of pastures and grasslands, with particular attention to the energy security of the rural population.

The big demand for fuelwood as heating fuel in households (HH) especially in rural areas has resulted in continuous forest degradation and deforestation in Armenia. Dung is often used as an alternative fuel, which instead could be used as a valuable organic fertilizer. The current heating practices and approaches related to the use of natural resources cause various problems and inconveniences for the families including women.

This socio-economic survey was implemented in the frameworks of ECOserve to identify and analyze the energy behaviors of rural HHs with particular focus on the heating energy related to the use of natural resources, in particular fuelwood and dung. The special focus was on the gender aspects related to the survey topics. The survey covered the issues of heating fuel and devices, approaches, preferences, alternatives and related topics, the needs and priorities, socio-economic aspects, gender and health issues linked to the heating energy. The survey covered 5 pilot community clusters of ECOserve energy component in Lori, Shirak and Kotayk marzes. The survey included 380 respondents who use fuelwood as the main fuel for heating, more than 50% of respondents were female. The methodology included individual questionnaires and focus group discussions. The survey results and recommendations were used to further plan and adjust the ECOserve energy pilot and awareness raising activities.

The survey was implemented in collaboration between the GIZ Armenia, the University of Hohenheim and the American University of Armenia's Acopian Center for the Environment in the frames of ECOserve and GAtES projects. Environmental Sustainability Assistance Center NGO (ESAC) was involved in all the survey works and implemented the field data gathering, data analysis and preparation of this summary report.

The main results and conclusions of the survey show that the fuelwood and dung are widely used as heating fuels in the surveyed rural communities. In the forest adjacent communities wood is used more and dung is less preferred. The level of thermal insulation of houses is rather low. The main factors for choosing fuelwood and dung as the heating fuel are affordability, lack of alternatives and easy access. The use of straw briquettes at household level for heating is very limited. The respondents save fuel as much as possible by different methods. The main reason for not changing the heating practices towards more sustainable approaches is the lack of financial resources to make initial investment for changing the heating system or shifting to alternative fuel as well as the lack of reliable information.

The heating with fuelwood and dung cause certain inconveniences to rural households including fuel preparation/storage and heating maintenance. More males deal with the heating maintenance than females, however the females spend more time than males on heating maintenance. More men deal with fuelwood preparation and storage than women and men spend slightly more time for that than women. Women are almost equally engaged in dung preparation and storage as men. According to the respondents the preparation of dung is very work- and time-consuming. Regarding the health impact the respondents mainly think that use of fuelwood has less negative impact on health than use of dung. Overall the males think that fuelwood and dung has more negative impact and the females assess the impact is less. However, women highlight more the importance of fuel to be clean and safe for health. The most common health problems linked to the heating with fuelwood and dung are respiratory system irritation and eye irritation followed by respiratory diseases and skin irritation.

The majority of respondents would like to participate in group discussions on energy efficiency in

their home or community. Many respondents are interested in new technologies in the field of energy, men are slightly more interested than women. Meanwhile, not many are not among the first who apply the new technologies. Almost all men are engaged in the energy related decision-making in their families and women are engaged less.

Thus there is a need for accessible and affordable alternative fuel and efficient heating devices to reduce the use of fuelwood and dung in rural areas. There is a need for affordable financing and financial mechanisms to encourage rural population to go for the energy efficiency and alternative energy changes in their households. There should be a differentiated approach for the low-income segment of rural population. Awareness raising and capacity building should be an important component of the rural energy activities, they should be based on the proven and reliable information and successful examples to be followed and replicated. Informing and educating women on the energy related issues can have impact on the household and community level. The actions towards increasing the energy efficiency and alternative energy and reducing the use of fuelwood/dung imply the benefits for the families and in particular women. Therefore, all possibilities should be explored and used to reduce the household burden related to the current heating practices with solid biofuels.

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1. Introduction

The programme "Management of natural resources and safeguarding of ecosystem services for sustainable rural development in the South Caucasus" (ECOserve) is implemented by GIZ jointly with the partner Ministry of Territorial Administration and Infrastructures (MoTAI), Ministry of Environment (MoEnv) and Ministry of Economy (MoEc). In Armenia the program aims at improving the precondition for sustainable and biodiversity-friendly management of pastures and grasslands, with particular attention to the energy security of the rural population.

Various studies conducted during recent years and statistics show that fuelwood has been largely used as a heating fuel in household (HH), especially in rural areas. The great demand for fuelwood resulted in continuous forest degradation and deforestation in Armenia. Dung is often used as an alternative fuel, which instead could be used as a valuable organic fertilizer. Some studies mention that the applied heating approaches cause various problems and inconveniences for the families including women (A. Pasoyan, N. Sakanyan, Baseline data collection and analysis: energy demand, supply and efficiency in rural Armenia, 2019, in the frames of ECOserve).

This socio-economic survey was initiated to research the rural HH heating energy issues linked to the use of natural resources and with special focus on gender issues. The survey covered the selected communities in Lori, Shirak and Kotayk marzes, which are the pilot communities of ECOserve energy pilot component.

This survey was done in collaboration between the GIZ Armenia, the American University of Armenia's Acopian Center for the Environment, and the University of Hohenheim in the frames of ECOserve and GAtES projects. Environmental Sustainability Assistance Center NGO (ESAC) was involved in all the survey works.

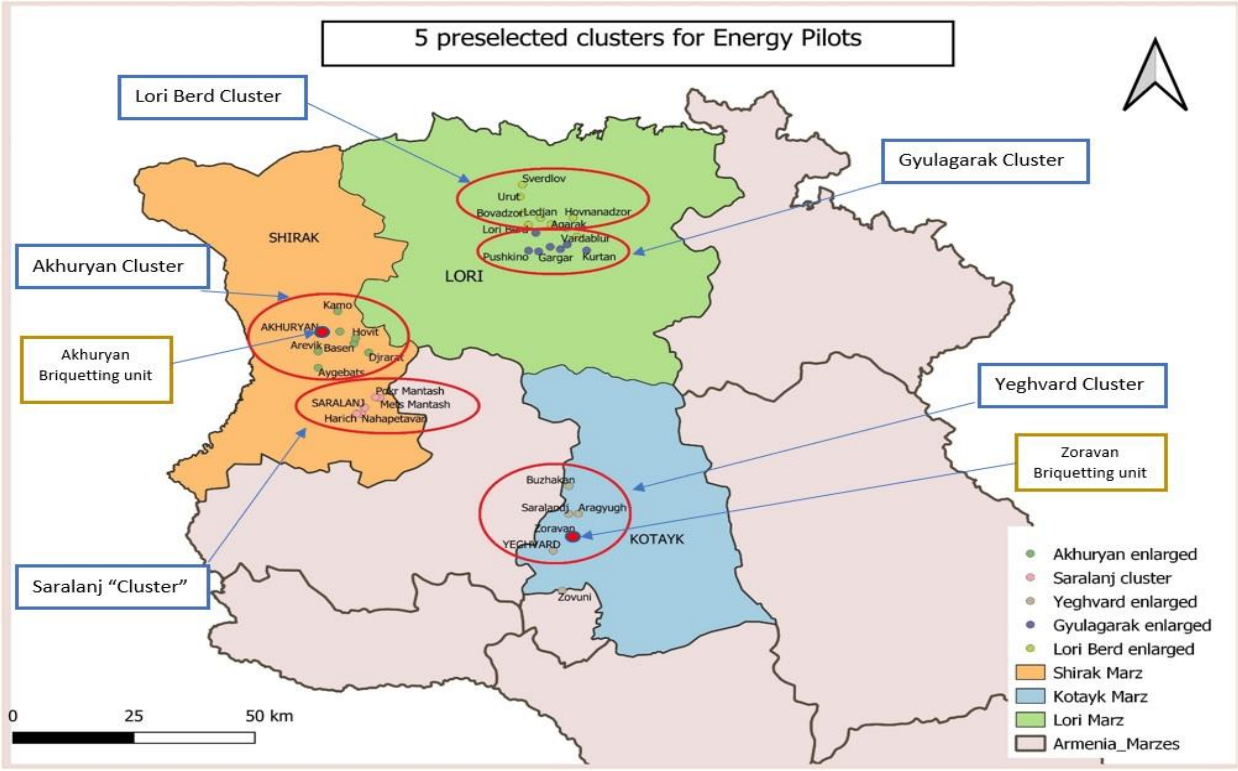
All the survey partners contributed to preparation of the survey including the development of the survey questionnaires. ESAC NGO implemented the field data gathering, collected data analysis and preparation of this summary report. The works were implemented by the ESAC key expert team: Tigran Mkrtchyan (PhD, team leader), Davit Iskandaryan (PhD, senior researcher, co-author of the report), Arevik Hambartsumyan (coordinator of surveys and focus group discussions, co-author of the report), Hrachya Harutyunyan (coordinator of surveys and focus group discussions) and the field interviewers Liana Harutyunyan, Davit Davtyan, Karen Tonoyan and Lena Sargsyan. Siranush Galstyan (ECOserve adviser) provided general back-stopping to the survey preparation and implementation as well as contributed to the data analysis and report writing. The collected field data was provided to the University of Hohenheim Master's student Alyssa Bougie to use for the MS thesis on the topic "Energy cultures and their link to gender and natural resources in Armenia".

2. Aim and methodology

The aim of this socio-economic survey was to identify and analyze the energy behaviors of rural HHs with particular focus on the heating energy related to the use of natural resources, in particular fuelwood and dung. The special focus was to identify possible gender aspects related to the survey topics. The survey covered the issues of heating fuel, approaches, preferences, alternatives and related topics, in particular the use of fuelwood/dung and other fuels, HH's preferences on heating devices and methods, the factors influencing the choice of heating fuel and method, the needs and priorities, socio-economic aspects as well as gender and health issues linked to the heating energy.

The survey covered 5 pilot community clusters of ECOserve energy component in Lori, Shirak and Kotayk marzes of Armenia (see Map 1).

Map 1. Surveyed communities in Lori, Shirak and Kotayk Marzes



The community clusters were selected based on two main criteria: the distance from forest and availability of alternative fuel (straw briquettes). The enlarged communities Gyulagarak and Lori Berd in Lori marz are adjacent to forests. The enlarged community Yeghvard in Kotayk marz, enlarged community Akhuryan and the cluster of 5 non-enlarged communities (Saralanj, Mets Mantash, Poqr Mantash, Nahapetavan, Harich) in Shirak marz are far from forest. There are briquetting units in Yeghvard (Kotayk marz) and Akhuryan (Shirak marz) communities, the one in Akhuryan community started to function in August 2020. Five non-enlarged communities in Shirak marz ("Saralanj" cluster) are not very far from Akhuryan (briquetting unit).

The survey was targeted at the respondents who use fuelwood as the main fuel for heating. The survey was aimed at adults, with the aim of having almost equal numbers of male and female respondents. The initial lists of respondents were obtained via the community administrations to pre-select the HHs as per the above criteria.

The survey included individual questionnaires and focus group discussions. The individual questionnaire consisted on multiple-choice questions and the focus group questionnaire included open questions on related topics. As preparation for the survey both questionnaires were tested separately with male and female groups and accordingly adjusted in terms of the language, duration and other technicalities.

The survey sessions consisted of two parts. In the first part the respondents anonymously answered the printed-out individual questionnaire (with clarification of the questions by facilitators if needed). The second part was in the form of facilitated focus group discussion based on the questionnaire.

The respondents who filled in individual questionnaires, then participated in the focus group discussions. Both the individual questionnaire and focus group discussions were done separately for female and male groups. The focus group discussions were recorded on dictaphone/recorder and then used to summarize the focus group descriptions.

Chapter 3 of this report presents the summary and analysis of individual surveys in all 5 pilot community clusters (quantitative information) and of the focus group discussions (qualitative information). The main conclusions are consolidated in Chapter 4.

3. Main findings of the survey

3.1 Overview of the communities and respondents

The respondents were from 31 settlements out of total 35 settlements in the structure of the enlarged and non-enlarged pilot communities (Table 1).

Table 1. Survey communities and settlements

Community	Area, population	Main occupation	Settlements
Lori marz			
Gyulagarak enlarged community	15.52 km^2 2317 people	Cultivation of potato and corn, cultivation of berries, animal husbandry.	Gyulagarak Gargar Hobardzi Kurtan Vardablur Amrakic Pushkino
Lori Berd enlarged community	170.41 km^2 5691 people	Cultivation of potato and corn, cultivation of vegetables, animal husbandry.	Lori Berd Lejan Agarak Koghes Yaghdan Bovadzor Urut Sverdlov
Kotayk Marz			
Yeghvard enlarged community *Note: Yeghvard and Zovuni settlements were excluded from the survey as the majority of HHs use gas.*	206 km^2 25588 people	Cultivation of corn and forage, gardening, cultivation of berries, animal husbandry	Zoravan Aragyugh Saralanj* Bujakan*
Shirak Marz			
Akhuryan enlarged community *Note: Akhuryan settlement was excluded from the survey as the majority of HHs use gas.*	21,287.54 km^2 17,520 people	Animal husbandry, cultivation of corns, potato, forage	Aygabac Arevik Basen* Kamo Karnut Hovit Jrarat*
Saralanj	19.3 km^2 1037 people	Animal husbandry, cultivation of corns, potato, forage, vegetables	
Mets Mantash	27.6 km^2 2189 people		
Porq Mantash*	8.9 km^2 2320 people		
Harich	149.5 km^2 1930 people		
Nahapetavan	13.5 km^2 830 people		

**Settlements without gas supply. Poqr Mantash community has gas supply partially.*

In the list of 380 respondents there were 193 women and 187 men. From each settlement 10-15 respondents participated in the surveys with almost equal number of male and female respondents.

Table 2. Distribution of respondents by communities, settlements and gender

Settlement	Number of respondents		The average age of the respondents	Gender distribution by settlements				Gender distribution in each settlement		
		Specific weight		Female	Specific weight	Male	Specific weight	Female	Male	Total
Akhuryan	86	22.6%	44.3	45	23.3%	41	21.9%	52.3%	47.7%	100%
Saralanj cluster	83	21.8%	47.3	36	18.7%	47	25.1%	43.4%	56.6%	100%
Gyulagarak	81	21.3%	42.2	43	22.3%	38	20.3%	53.1%	46.9%	100%
Yeghvard	46	12.1%	42.1	28	14.5%	18	9.6%	60.9%	39.1%	100%
Lori Berd	84	22.1%	45.7	41	21.2%	43	23.0%	48.8%	51.2%	100%
Total	**380**	**100%**	**44.3**	**193**	**100%**	**187**	**100%**	**50.8%**	**49.2%**	**100 %**

The analysis of education level by gender shows that 32.6% of female and 33.7% of male respondents have higher education. About 39.4% of female and 46% of male respondents have secondary education. 28% of female and 20.3% of male respondents have secondary vocational education.

Chart 1. The educational level of respondents by gender

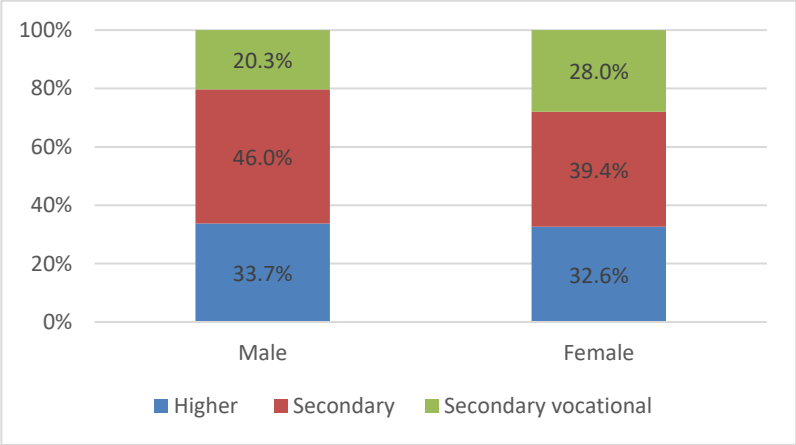
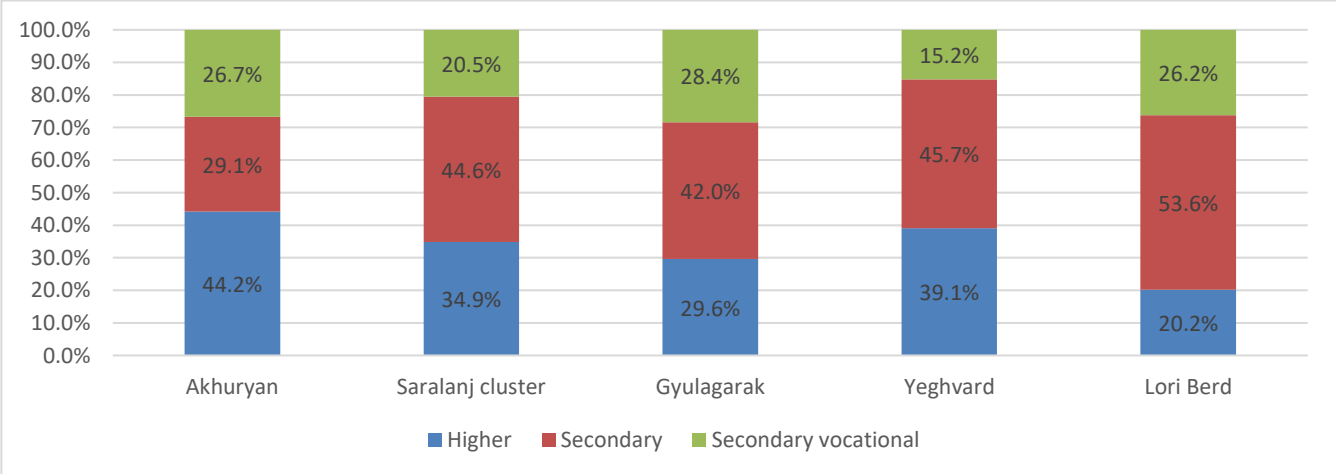
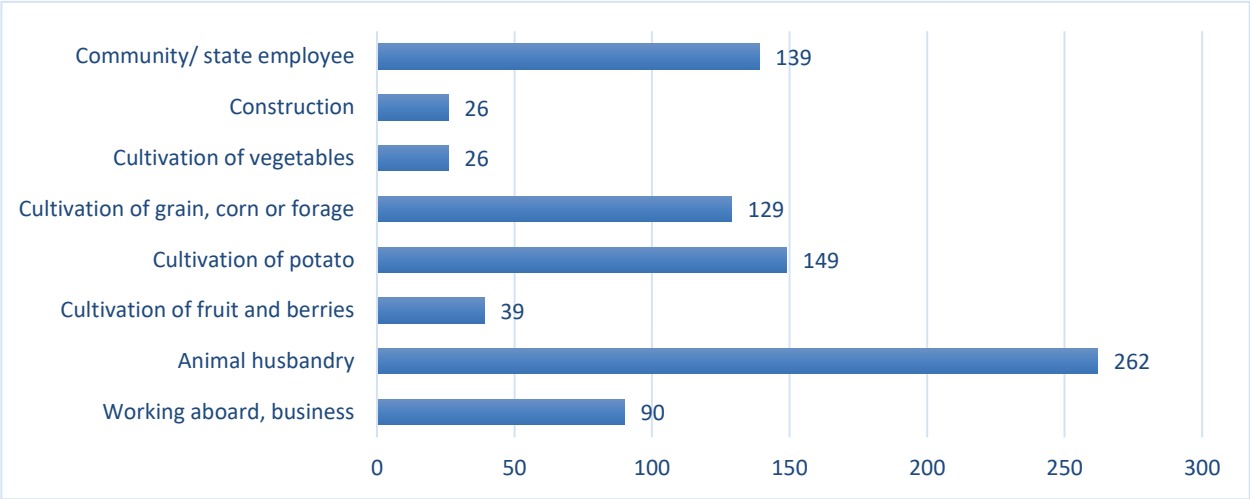


Chart 2. The educational level of respondents by communities



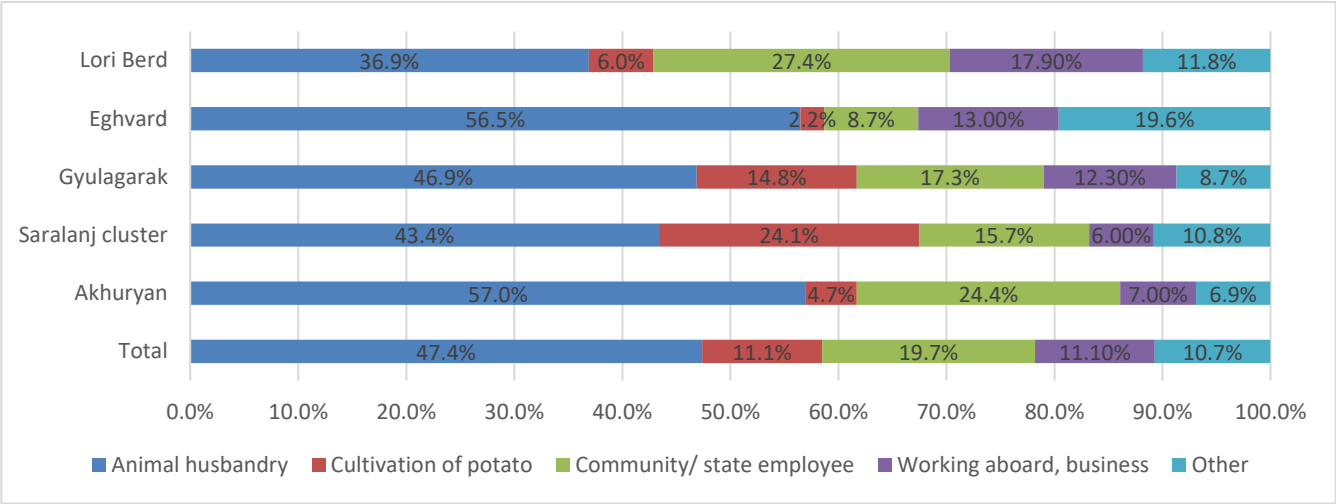
In the survey the respondents could indicate up to 3 family income sources. The analysis showed that the cattle breeding, cultivation of potato and community/state employment are the most common sources of income. The chart below shows the total sum of all responses and the degree of prevalence of each income source.

Chart 3. Sources of income by respondents



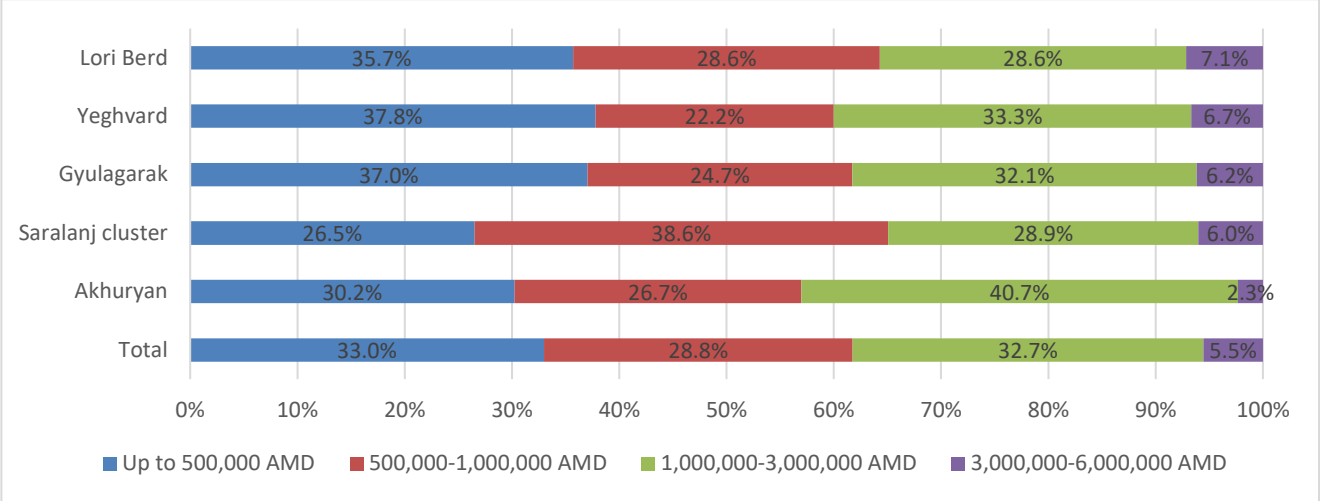
The analysis by the first source of income shows that again the cattle breeding is the most common occupation (47,4%), followed by the state/community employment (19.7%) and cultivation of potato (11.1%). Cultivation of potato showed the highest rate in Saralanj cluster and Gyulagarak, and working aboard and doing business showed the highest rate in Gyulagarak, Lori Berd and Yeghvard.

Chart 4. Sources of income by the first answer



The level of income of the surveyed respondents by communities is presented in the below chart.

Chart 5. Level of HH income



3.2 Housing conditions

The survey results showed that 90.3% of respondents live in stone houses and 8.7 % of respondents live in temporary shelters, there were several cases of people living in multi-apartment buildings.

Table 3. The living conditions of the community respondents

Community Cluster	Multi-apartment building	Temporary shelter	Stone private house	Total
Akhuryan	1.2%	5.8%	93.0%	100%
Saralanj cluster	0.0%	0.0%	100.0%	100%
Gyulagarak	0.0%	13.6%	86.4%	100%
Yeghghvard	0.0%	2.2%	97.8%	100%
Lori Berd	3.6%	19.1%	77.4%	100%
Total	**1.1%**	**8.7%**	**90.3%**	**100%**

In this regard, it is important to consider the analysis of the total and the heated space of respondents' houses, which is directly connected with their heating expenses in winter.

Table 1. The house surface, heated surface and the number of family members of respondents

Settlement	House surface, average, m^2	Heated surface in winter, average, m^2	The ratio of heated surface in winter to the total surface area, %	The number of family members, the average rate
Akhuryan	131.0	105.7	80.7%	4.6
Saralanj cluster	148.8	96.4	64.8%	5.0
Gyulagarag	108.9	78.3	71.9%	4.7
Yeghvard	157.7	119.1	75.5%	5.2
Lori Berd	113.5	70.7	62.2%	4.6

As the table indicates, the community respondents live in considerably big families, with an average conditional rate of 4.5 person. During winter the, respondents heat 62-81% of their houses.

The table below shows that the most common insulated sections of the houses are windows, followed by the ceiling.

Table 5. Thermal insulation by communities

	Akhuryan	Saralanj cluster	Gyulagarak	Yeghvard	Lori Berd	Total
Ceiling	27	27	22	16	23	115
Walls	7	1	9	3	6	26
Windows	40	37	28	18	25	148

Doors	1	0	0	0	1	2
Other	0	0	2	0	1	3

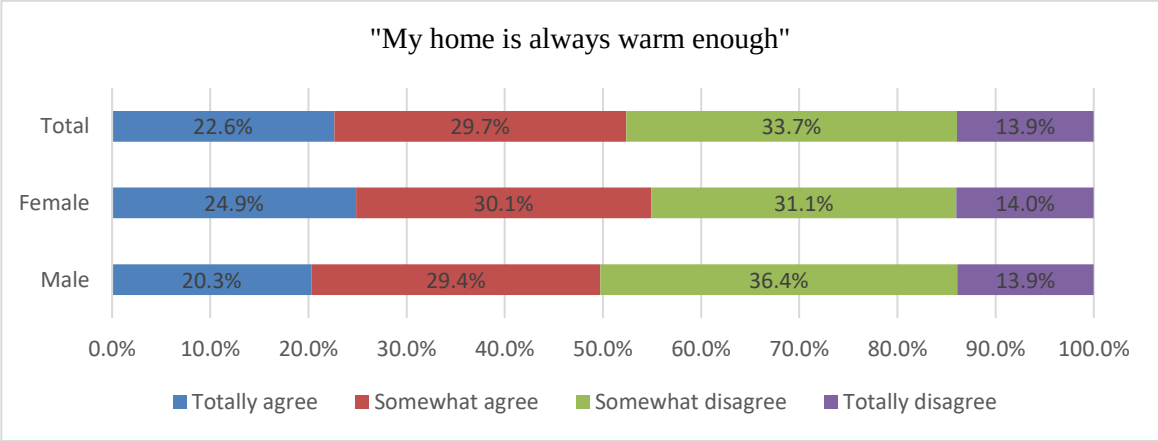
It should be mentioned that out of 380 respondents, about 22 % have no any type of thermal insulation of the house, over 36% mentioned about insulation of only one component, about 26% - 2 components, about 11% - 3 components and only 3.9% - 4 components.

Table 6. Level of thermal insulation

Insulation	1 component	2 components	3 components	4 components	No insulation	Total
Number of respondents	138	99	43	15	85	380
Percentage	36.3%	26.1%	11.3%	3.9%	22.4%	100%

Only the half of respondents is mainly satisfied with the indoor temperature at home and about 15% is strongly dissatisfied.

Chart 6. The satisfaction with the indoor temperature



3.3 Fuel and devices

Fuel for heating

The respondents could mention up to 3 heating fuel options by priority for them. The analysis showed that almost 96% of respondents use fuelwood and 66% of respondents use dung as heating fuel (many respondents use both as fuel). Fuelwood is used by 72.6% of respondents as the first heating fuel option and by 23% as the second and third options. Dung is used by 20.5% of respondents as the first heating fuel option and by 45.5% as the second and third options. Gas is used by 18% of respondents, almost 6% of respondents use gas as the first heating fuel, sometimes combined with the use of fuelwood and dung, and 12% use it as the second or third option.

Chart 7. Use of fuels as the main or additional option for heating.

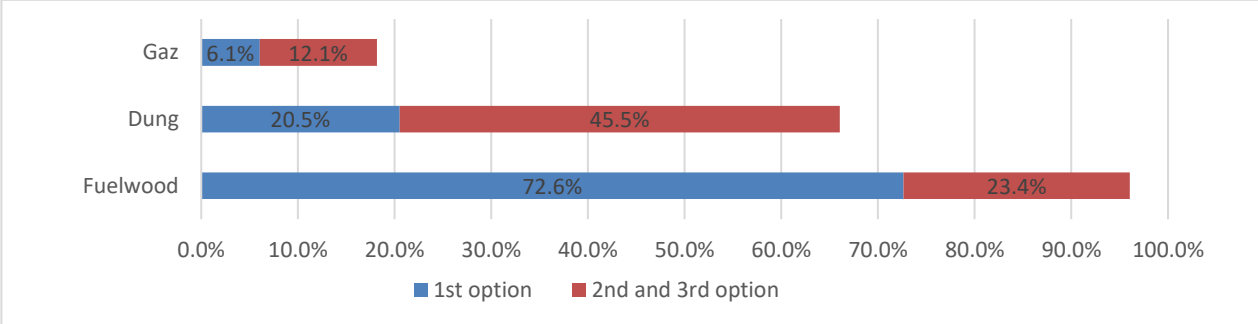
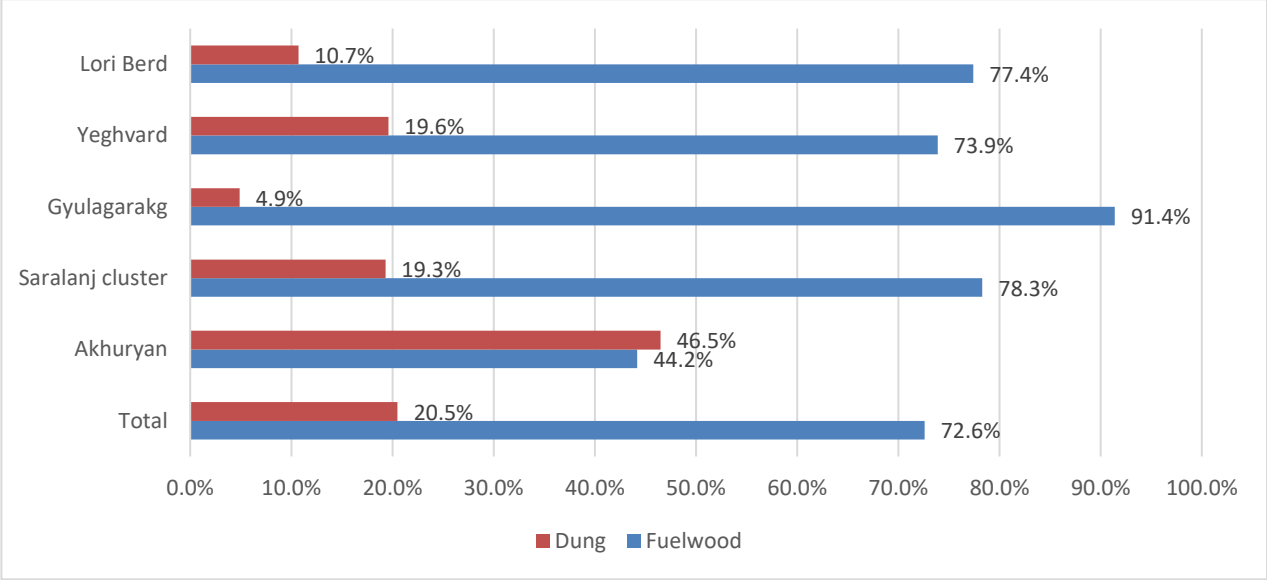


Chart 8. Use of fuelwood and dung as the main heating fuel (first choice), by communities



The analysis showed that among the solid biomass fuel users the fuelwood was the first-choice fuel in all communities except Akhuryan. The fuelwood use rate for Akhuryan was 47% and in all the other communities – more than 70% with the highest rate of 91,4% in Gyulagarak. Dung also showed to be frequently used especially in Akhuryan (46%), Saralanj cluster (19.3%) and Yeghvard (19.6%) conditioned by the widely spread livestock breeding. It is noteworthy that in the forest adjacent communities the use of dung was less preferred: Gyulagarak (4.9%) and Lori Berd (10,7%).

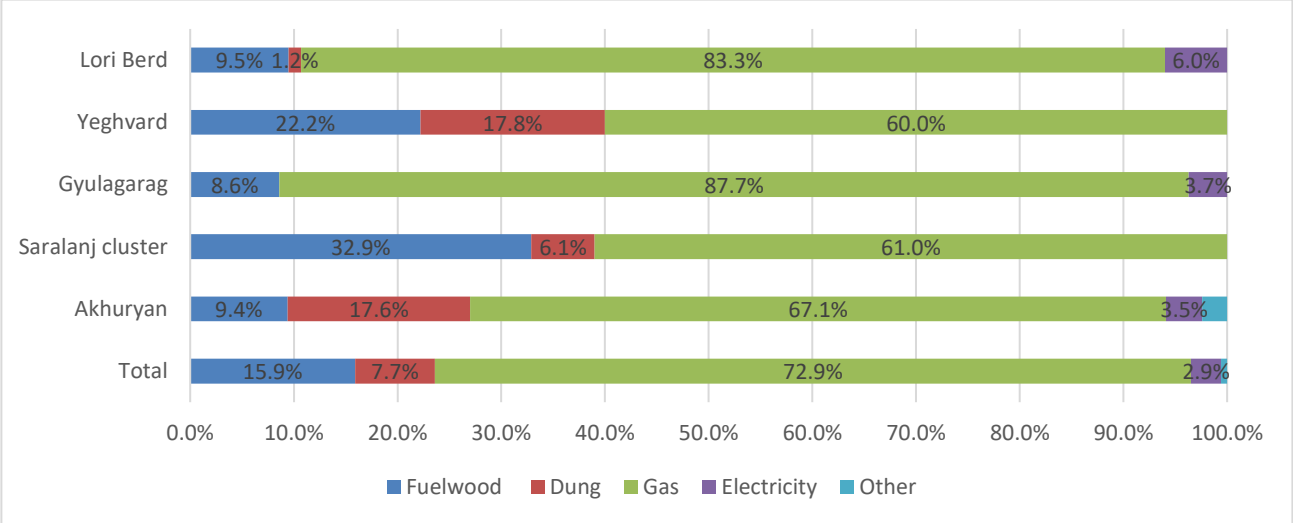
The proportions of different fuels used for heating by communities according to the respondents are presented in Annex 1.

Fuel for cooking and hot water preparation

The respondents could mention several fuel options for cooking and hot water preparation.

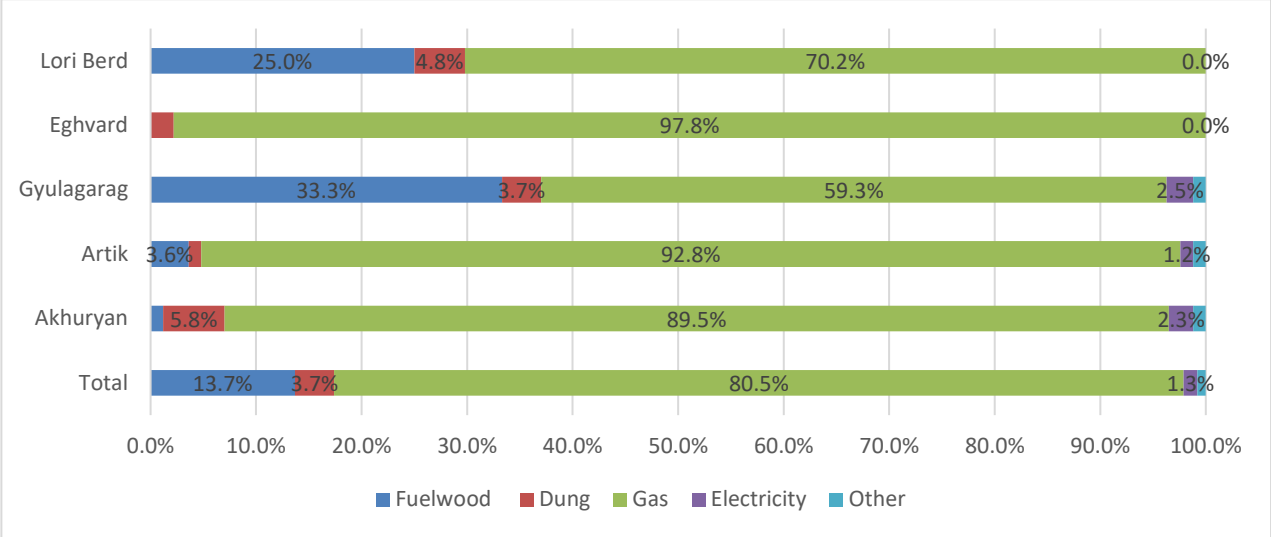
During the heating season for cooking the respondents most frequently use gas (72.9%). Gas has also a leading role in the context of choosing between the 3 most used fuel types.

Chart 8. Use of fuel for cooking in the heating season (first option)



The picture is the same for use of fuel for cooking in non-heating season with the prevalence of gas (80.5%).

Chart 9. Use of fuel for cooking in non-heating season (first option)

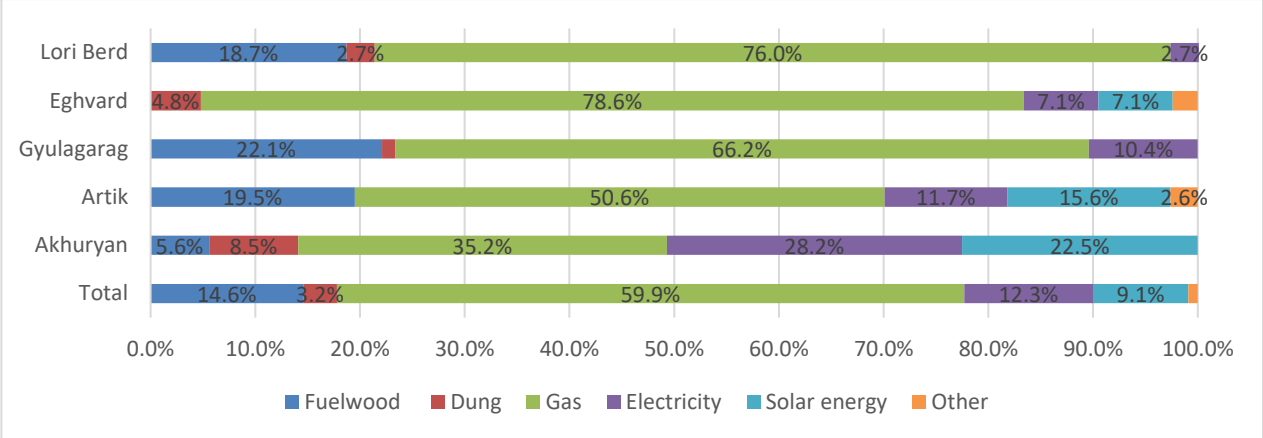


It is notable that 33.3% of respondents in Glyuagarak community and 25% in Lori Berd community use fuelwood for cooking in non-heating season. This can be explained by close distance to the forests and the accesses to cheaper wood.

The main fuel for hot water preparation is also gas in the range of 35.2% in Akhuryan community to 78.6% in Yeghvard community. However, for hot water preparation the respondents use also electricity (almost 12%) and solar energy (9%). Solar energy is used more in Akhuryan community (22.55%) and Saralanj cluster (15.6%). Electricity is also used more in Akhuryan (28.2%) and Saralanj cluster (11.7%).

It is noteworthy that in the forest adjacent communities the use of fuelwood for hot water preparation is rather high – Lori Berd (18.7%) and Gyulagarak (22.1%), meanwhile the use of solar energy for that purpose is very low.

Chart 10. Use of fuel for hot water preparation



The focus group discussion showed that the number of (straw) **briquette users** was very small in the surveyed communities, except for Zoravan. According to the respondents the main obstacle was the lack of information and experience, availability of briquettes and its high price. The scarcity of straw, its demand by other buyers in the market and the technical problems of delivering the straw to the briquetting facilities are the main obstacles for bartering the straw produced by the rural HHs with briquettes. In some settlements, especially **women respondents** would be willing to switch from dung to briquette if it had somewhat the same heating capacity as dung. It was mentioned that the dung preparation requires hard work, while briquette is probably ecologically clean and safe fuel.

The use of **solar energy** is completely acceptable in all the surveyed settlements. Solar water heaters

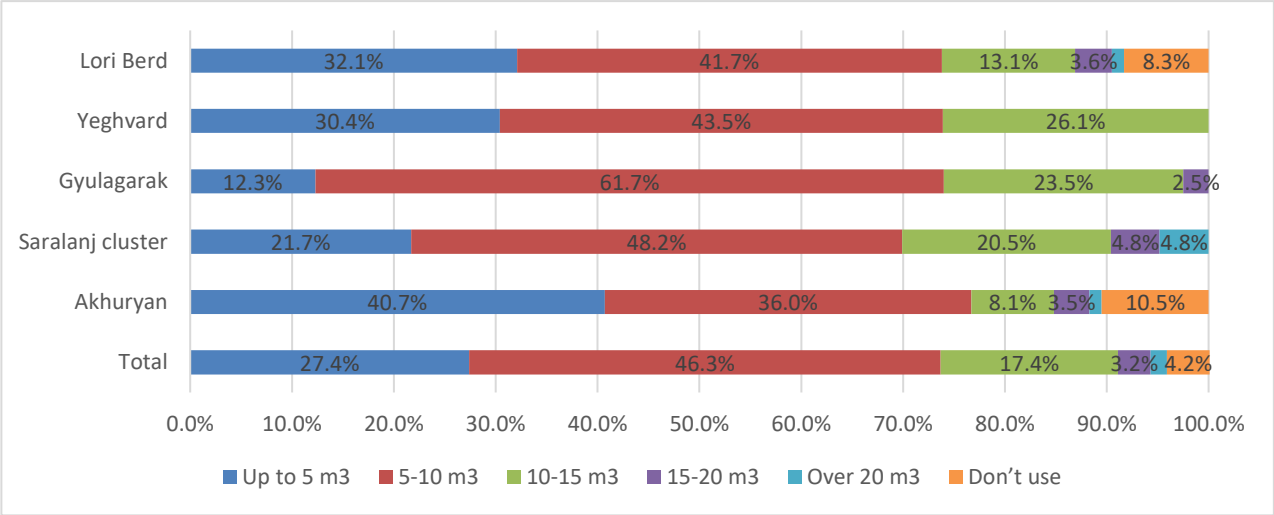
are especially widespread in the surveyed settlements of Shirak and Kotayk regions and comparatively less in the surveyed settlements of Lori region. The problem of making an initial financial investment is the main obstacle for its wider use.

The respondents were mainly not well-informed about **biogas**. There is no use experience, obtaining biogas is difficult and its cost-effectiveness is questionable. Besides, the dung will be insufficient because it is already used as fuel or fertilizer.

The quantity of used fuelwood and dung

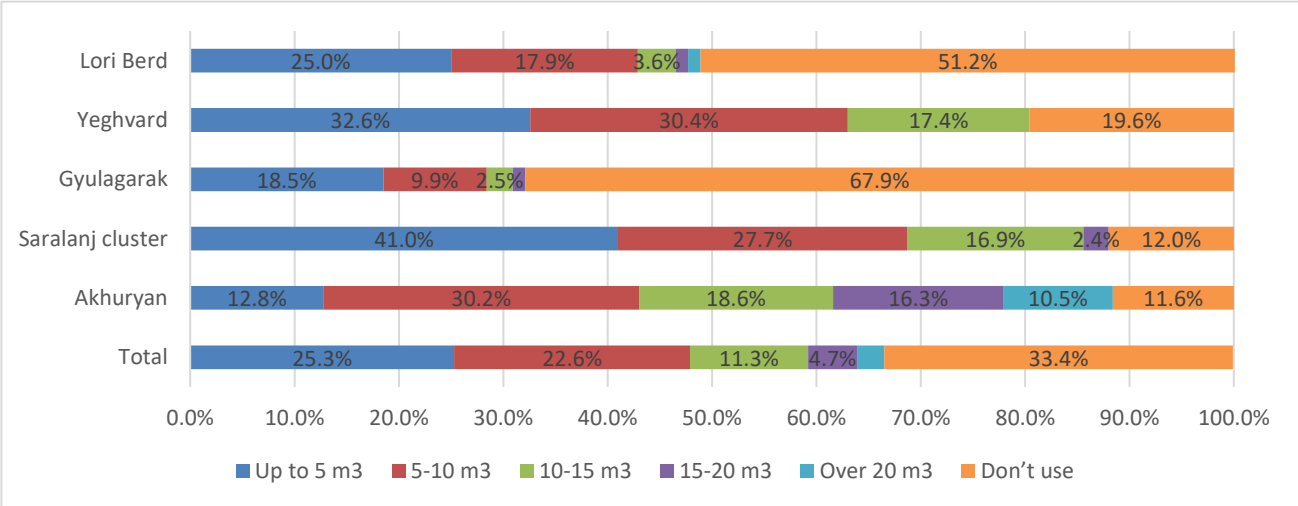
About 27% of respondents use up to 5m^3 fuelwood and 46% - 5-10m^3, 17% - 10-15 m^3 and 4.2% do not use fuelwood.

Chart 11. Quantities of used fuelwood



In case of dung about 25% of respondents use up to 5 m^3 dung, 22% - 10-15 m^3, 11% - 10-15 m^3 and 33.4% do not use it.

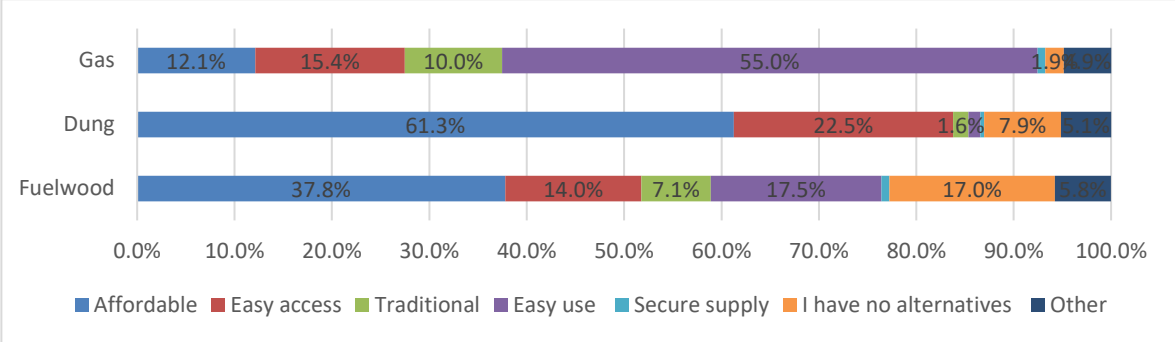
Chart 12. Quantities of used dung



The use of dung is less common in Lori communities. During the focus group discussions the respondents stated that the higher air humidity is an obstacle to dry dung.

The chart below shows the factors for choosing different types of fuel as the first heating fuel.

Chart 13. The factors for choosing fuel types



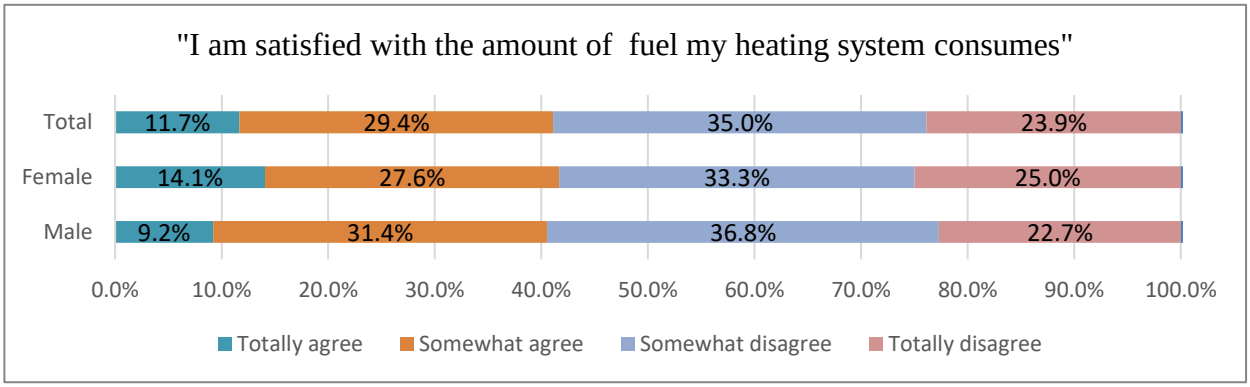
The **fuelwood** users indicated affordability (37.8%), easy use (17.5%), lack of alternatives (16.9%) and easy access (13.9%).

Among the **dung** users the main factors of choice are affordability (61.3%), accessibility (22.3 %) and lack of alternative (7.9%).

The **gas** users indicated easy use (55%), accessibility (15.4%) and affordability (12.1%).

Meanwhile, only about 40% of respondents are satisfied with the amount of fuel their heating system consumes and about 25% are strongly dissatisfied.

Chart 14. Satisfaction with the amount of consumed fuel

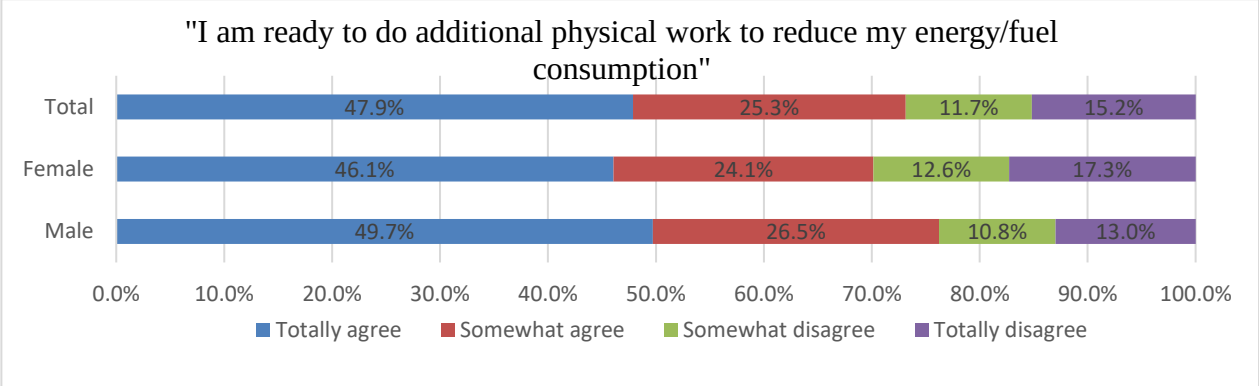


In the structure of fuelwood users about 91% of the respondents pay for fuelwood in cash when buying it and the rest make deferred payment. In Gyulagarak community 30% of the respondents pay for fuelwood by deferred payment. In Gyulagarak and Lori Berd communities 16% and 13% of respondents obtain fuelwood without payment. In Yeghvard community 16% of the respondents use their own wood from orchards.

Among the dung users 7% pay in cash when buying it and 12% make deferred payment, about 42% use dung produced by own livestock (do not pay for dung) and about 39% obtain dung without payment. In Gyulagarak and Lori Berd communities high share of dung users (77% and 90%) obtain dung without payment conditioned by the fact that the weather conditions are not favorable for drying dung and the respondents with surplus of dung may give it for free to their neighbors and relatives.

Meanwhile, about 75% of respondents are mainly ready to do additional work to reduce their fuel consumption.

Chart 15. Readiness to do additional work to reduce fuel consumption



Heating homes with **natural gas and central heating system** was the most preferred choice for many respondents during focus group discussions in all settlements. The need for the initial investment for the installation of the system and the high gas price (in some cases the lack of gas supply in the community) are the main limiting factors.

For **women respondents**, the heating convenience is especially important – expansion of the heated area of the house and simplification the heating-related household chores. **Men respondents** prefer access to affordable fuel types, they mention the import of fuelwood and coal and selling it at more affordable prices. They wish there was a straw briquetting production in their community (in the communities where there is no production).

Alternative fuel

The respondents in the Shirak region mentioned that the main advantage of **dung** they use is the affordability and accessibility, they often use the dung of their own livestock for free. However, as a fuel, the dung has its serious disadvantages: it requires a lot of hard work and is time-consuming, it is inconvenient for use, as the house becomes dirty. It is desirable that alternative fuel is affordable (can be more expensive than dung, but cheaper than fuelwood) and requires less physical work (as compared with dung).

For the respondents in the Lori region it is important that **alternative fuel** is cheaper than fuelwood and at the same time have a better heating capacity. The respondents are willing to do additional physical work, but in that case, the fuel should be cheaper, almost free of charge. Women highlight that the alternative fuel should be clean and safe and should not cause unpleasant smell in the house.

The respondents in Yeghvard community settlements are willing to use new **alternative** fuel, as dung is very work- and time-consuming. In case of alternative they will save time and use more dung for fertilizing the soil.

Coal has been mentioned in some settlements as a desirable alternative if it is more affordable than it is now.

The respondents in almost all focus groups mentioned they try to **save fuel**. However, it is not always possible to do so, especially if there are children at home or the heating device is inefficient. The respondents mentioned the following energy efficiency methods (*in a descending order of prevalence*): partial heating of the house, reducing heating hours, ensuring continuous fire in the house through the use of dung, use of the pressed dung mixed with straw (common especially in Akhuryan community settlements), heating domestic water on the stoves, house insulation (installation of metal-plastic windows, covering windows with polyethylene film, roof insulation with aggregate or gypsum plasterboards, thickening of walls), the use of electric heating sheets, etc.

In many settlements, respondents expressed the opinion that **fuelwood should be semi-dry** because

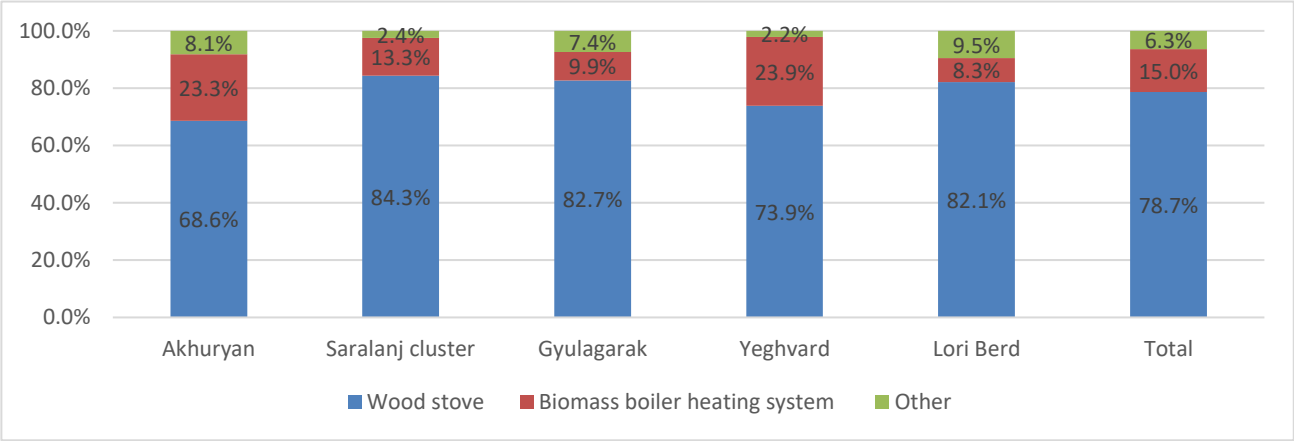
it burns longer and saves fuel. For this purpose, firewood is left in the rain or snow for several days before storing, it is sprayed with water just before use and both dry and semi-dry fuelwood are used together to put in the stove.

The conclusion from the above statistics and the focus group discussions is that the respondents would accept an alternative to fuelwood if it is at least of the same price or cheaper given the same level of comfort for its use. Meanwhile the majority of the dung users do not pay for it. Therefore, it is difficult to imagine they would accept an alternative for which they have to pay, unless there are clear also financial benefits of dung use for another purpose, rather than for heating.

Home heating devices

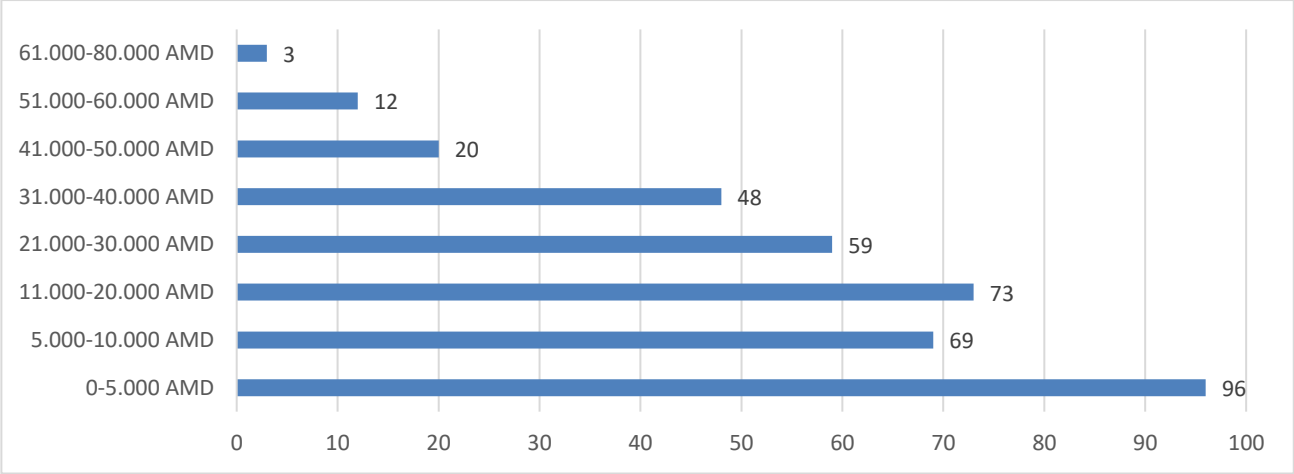
Locally manufactured solid biomass stoves and boilers (with centralized heating system) are the main devices used by respondents. About 80% of respondents use wood stoves and 15% - biomass boilers. The other types of heating devices (gas and electric heater, gas boiler, etc.) makes smaller proportion among respondents.

Chart 16. Devices used for heating homes (as first choice)



The chart below shows the willingness of respondents to pay for an energy-efficient stove with a market price of 80.000 AMD.

Chart 17. The willingness to pay for an energy-efficient stove

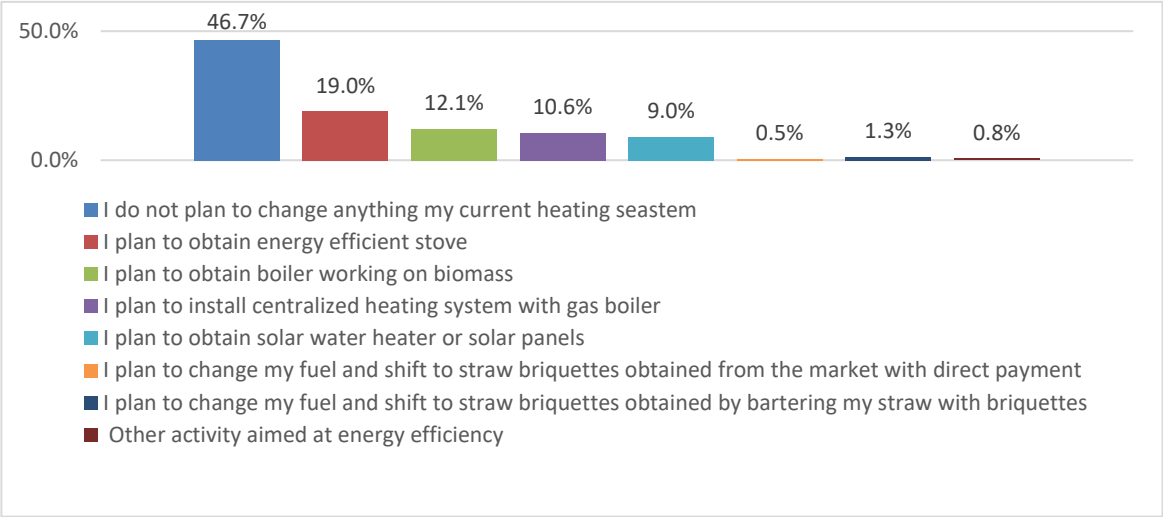


The majority of respondents - 91% are ready to pay only up to 40.000 AMD (half of the offered price) and 62.6% are ready to pay only up to 20.000 AMD and only 9% are ready to pay more than the half of the price.

Intentions to change the heating system

The chart below presents the intentions of respondents to change their heating system.

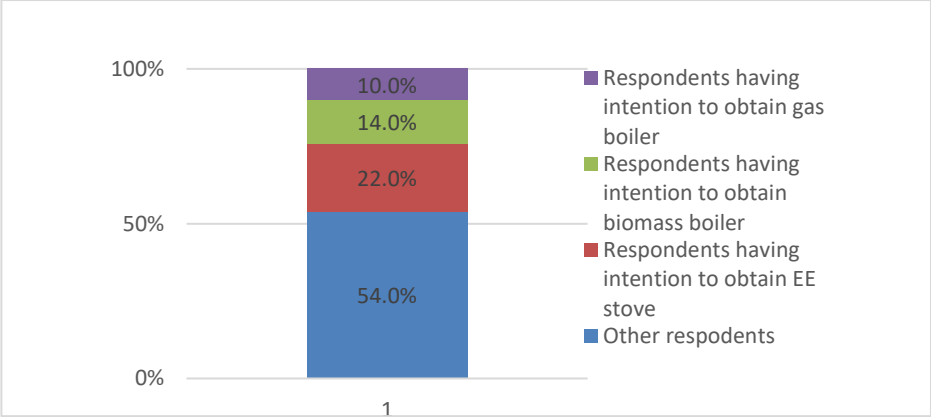
Chart 18. Intentions to change the heating system



The analysis showed that 19% of respondents wanted to obtain energy efficient stove, 12.1% - to install biomass boiler, 10.6% - to install gas boiler, 9% - to install solar heater or solar panel and 46.7% did not intend to change anything.

The chart below presents the intentions of 299 stove using respondents.

Chart 19. Intention of stove users to change the stove heating



Out of 299 respondents who use stoves for heating, 22% plan to purchase an energy-efficient stove, 14% - to shift to a fuelwood/briquette boiler and 10% - to shift to a gas heating system.

Almost in all settlements during the focus group discussions many respondents mentioned that they are interested in purchasing **energy-efficient devices** to save energy. Many of them want to have self-made fuelwood/dung heating boiler. In all settlements, **women and men** respondents mentioned the following main reasons for not purchasing energy-efficient devices: difficulty in making an initial financial investment, lack of information about the device and use experience in their settlements, as well as uncertainty about their efficiency. In the surveyed settlements, energy-efficient LED bulbs are quite widespread.

The conclusion from the above analysis is that the main limitation for the biomass stove users to change their heating device or the heating system is the need for initial investment as well as the lack of reliable information. The EE stoves (and other devices) with the proven quality and the lowest possible price will have a higher chance to be purchased. The awareness raising on existing possibilities can be considered as an important step to promote the EE devices in the communities.

Time consumption for the fuel use related activities

The chart below shows how much time (hour per day) the respondents spend on cooking, heating the house and hot water preparation tasks.

Chart 20. Time consumption, male respondents

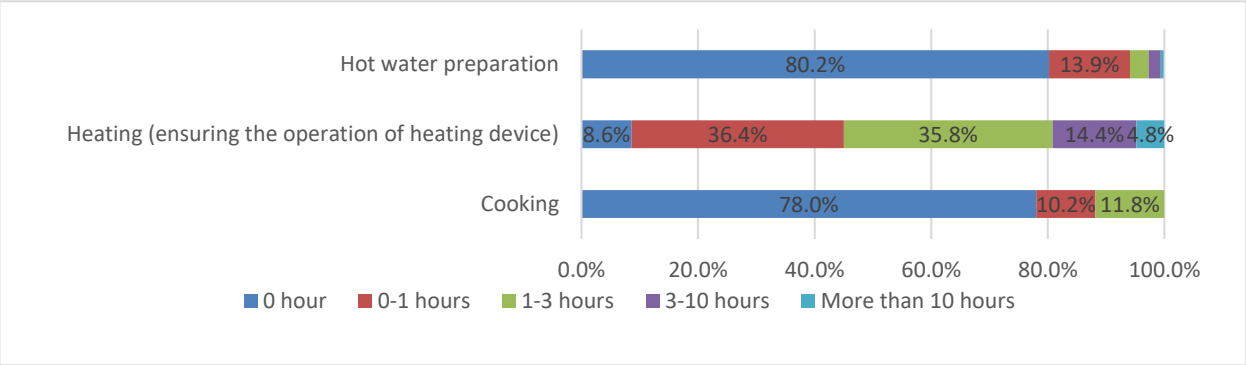
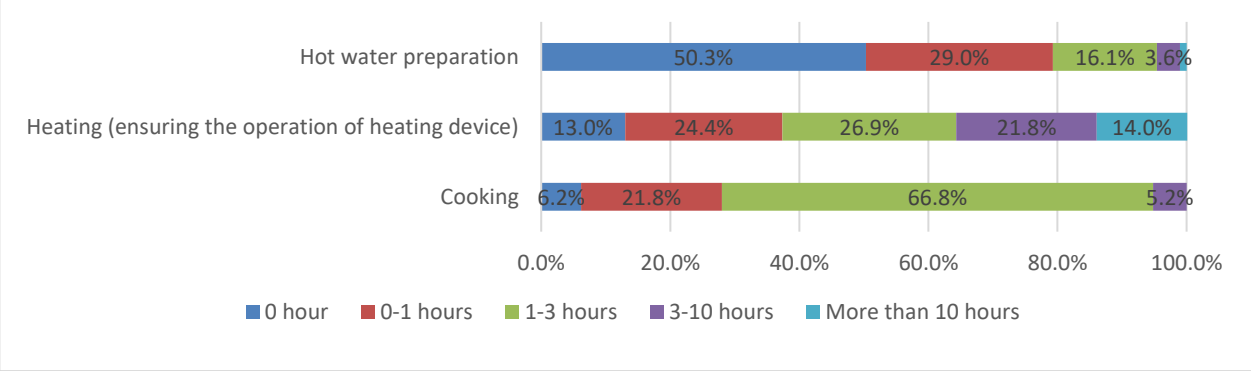


Chart 21. Time consumption, female respondents



Females spend more time on **cooking** than male: 88.6% of female spend up to 3 hours per day and only 6.2% do not spend time for that, 22% of male spend up to 3 hours and 78% do not deal with cooking.

More males deal with the **heating maintenance** than females: 72.6% of male spend up to 3 hours per day and 8.6% do not spend time for that, 51.3% of female spend up to 3 hours and 13% do not spend time for that. However, during the day the females spend more time than males on heating maintenance.

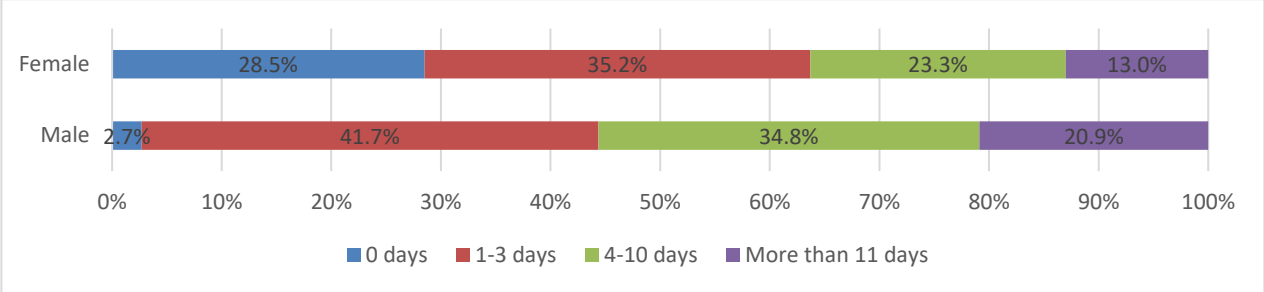
For **hot water preparation** 80.2% of male and 50.3% of female do not spend time (probably conditioned by use gas, electricity and solar energy for heating water), 45.1% of female and 17.1% of male spend up to 3 hours per day.

The focus group discussions showed that people who spend their all day at home often deal with the heating. They consider this as their main business at home and it is difficult for them to estimate the time they spend to maintain heating. This relates to the respondents who mentioned "3-10 hour and more" intervals.

Time spent on storing fuelwood and dung

The chart below shows how much time (days) the respondents spend on preparing and storing fuelwood for winter. In general, some respondents chop the wood and store it on their own, while the others hire people to get it done.

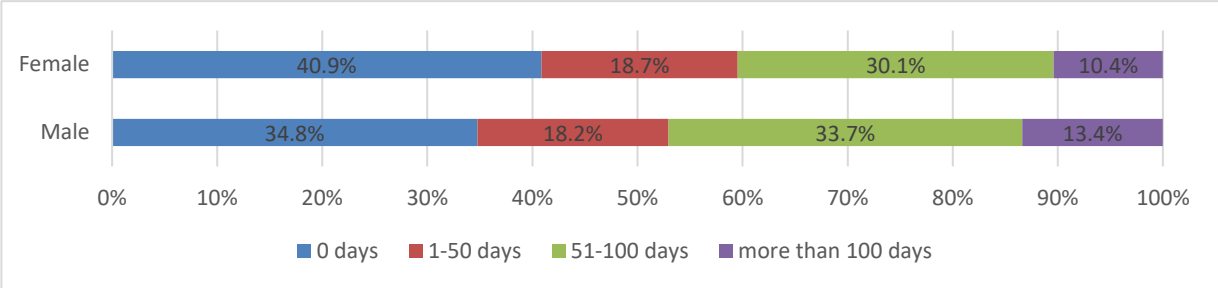
Chart 22. Time spent on storing the fuelwood required for the heating season



Male respondents: 3% don't spend any time for storing fuelwood, 42% spend 1-3 days, 35 % of the male respondents spend 4-10 days, 21%- more than 10 days. Female respondents: 29% don't spend any time for storing fuelwood, 35% spend 1-3 days, 23 % spend 4-10 days, 13% - more than 10 days. The conclusion is that more men deal with fuelwood preparation than women and men spend slightly more time for that than women.

The chart below shows how much time (days) the respondents spend on preparing and storing dung for winter. It should be mentioned that when answering this question, the respondents often meant the period, in which they dedicated certain time for preparing it. Some of the respondents carry out the dung preparation activities on their own as a daily routine, which is quite time-consuming, while some others purchase dung and spend time only to dry and store it for winter.

Chart 23. Time spent on storing the dung required for the heating season



In case of dung 34.8% of male respondents and 40.9% of female respondents don't spend any time on preparation and storing of dung. Out of those respondents who spend some time, most of the male (33.7%) and female (30.1%) respondents spend 51-100 days, 18.2% of males and 18.7% of females spend 1-50 days and13.4% of males and 10.4% of females spend more than 100 days. So, 51.9% of men and 48.8% of women spend up to 100 days. It can be concluded that women are almost equally engaged in dung preparation and storage as men.

3.4 Impact of heating and fuel types on human health and the environment

The respondents assessed the impact of their used fuel for heating and cooking on health. As the charts below show about 75% of respondents think that the fuel they use for heating mainly does not affect their health and about 85% of respondents think that the fuel they use of cooking mainly does not affect their health.

Chart 24. Impact of the heating fuels on health

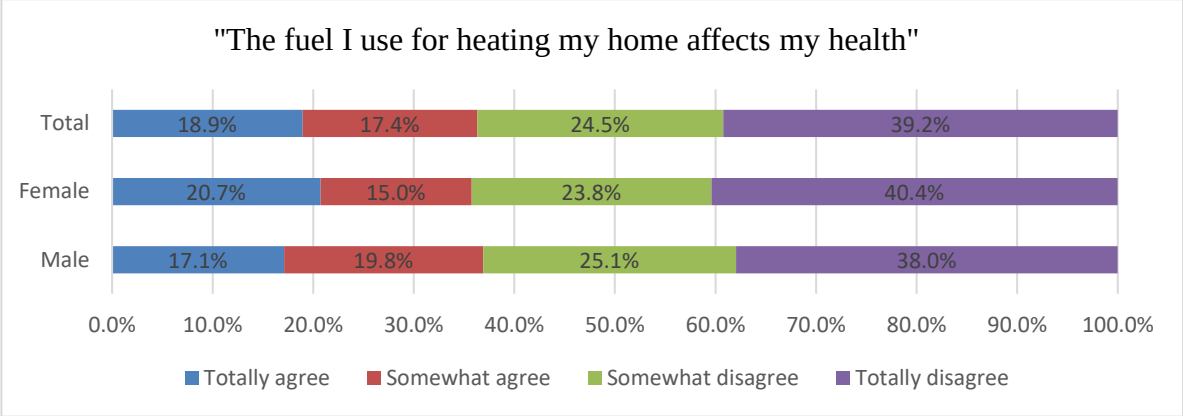
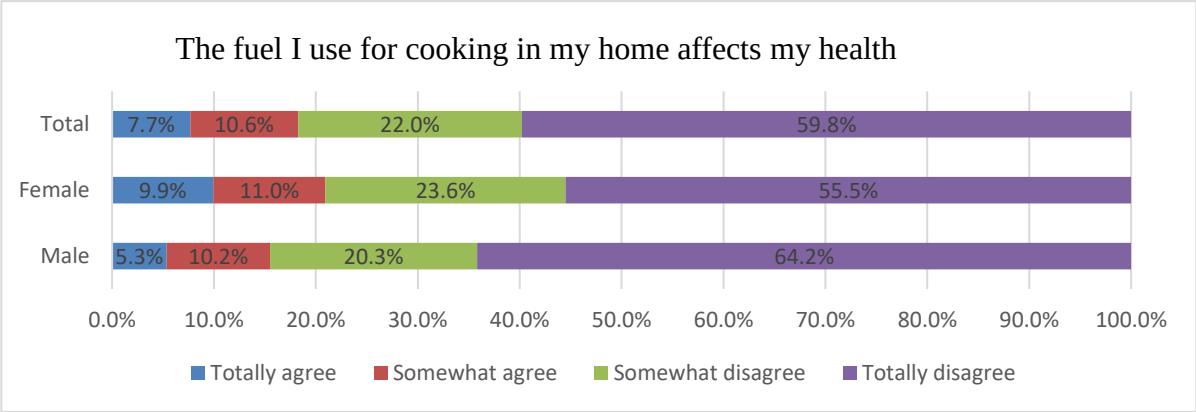


Chart 25. Impact of the cooking fuel on health



Meanwhile, the respondents assessed the possible negative impact of fuels on health on the scale 1-5 scale where 1 means “Don’t have any impact”, 5 - “Has a very big impact” and 0 – “I do not know”.

Chart 26. Possible negative impact of fuel types on human health, male respondents

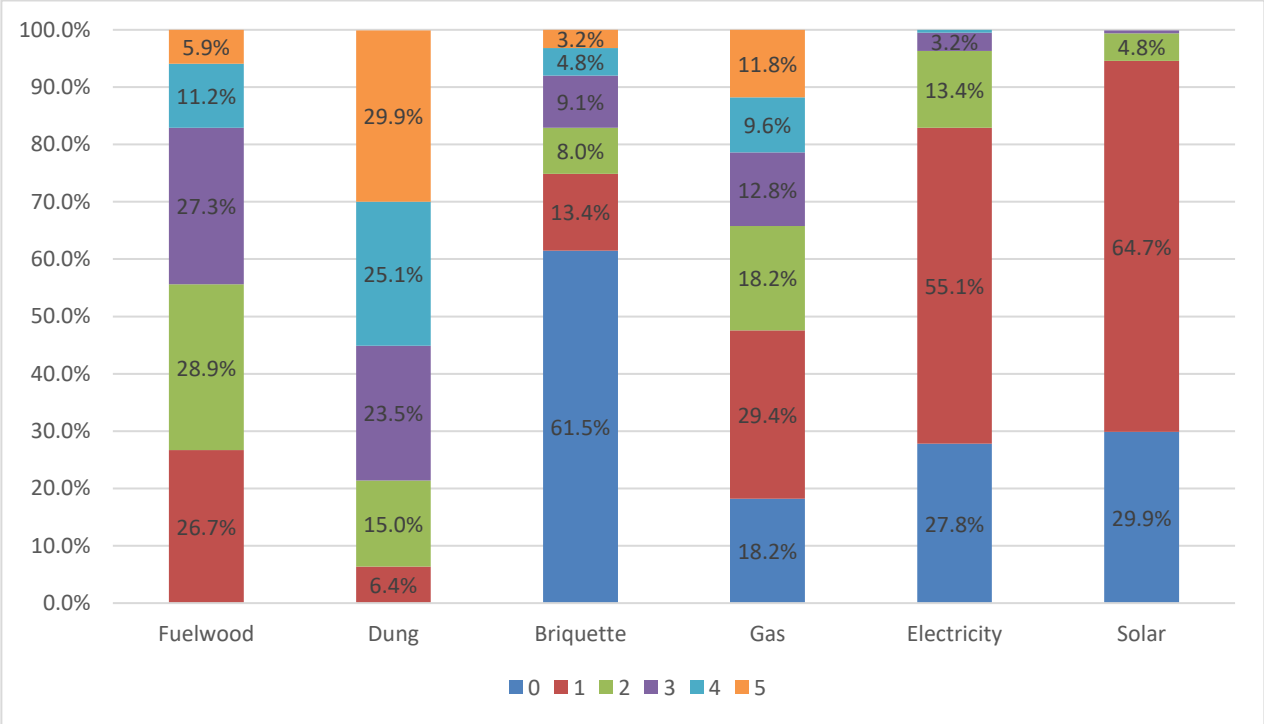
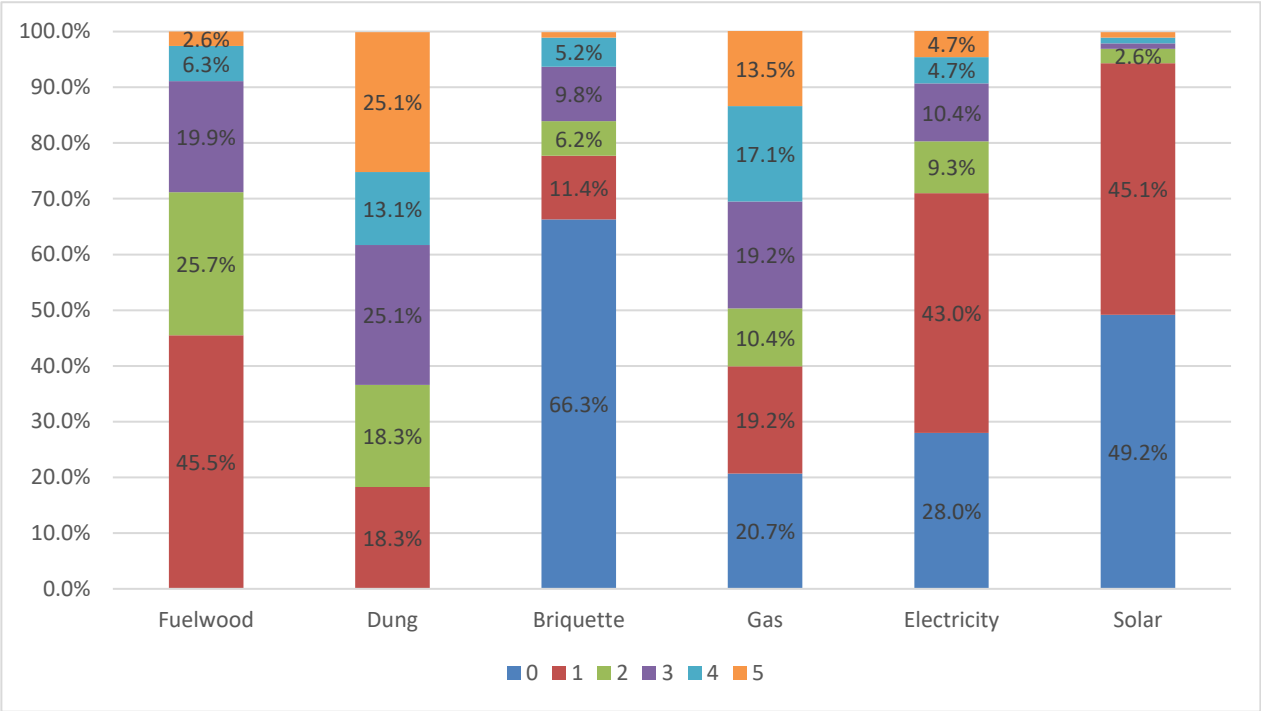


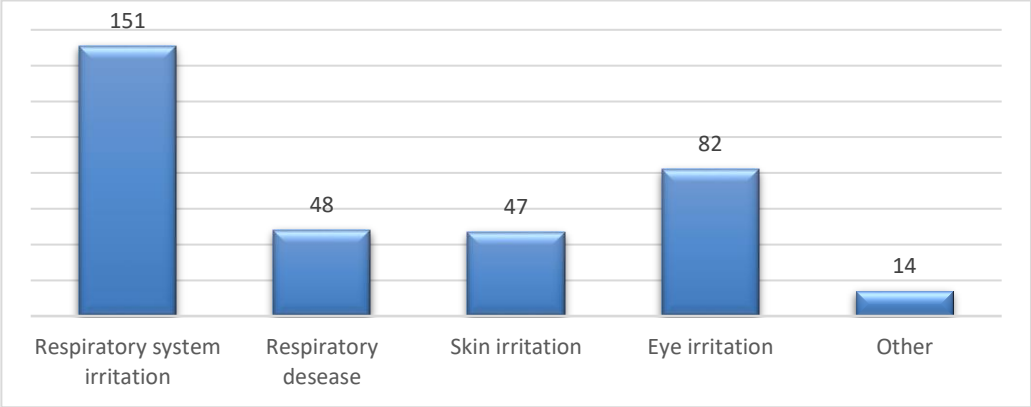
Chart 27. Possible negative impact of fuel types on human health, female respondents



In general the respondents think that use of fuelwood for heating has less negative impact on health than use of dung. 55% of male and 38.2% of female respondents mentioned about big impact of dung (scores 4-5). Overall the males think that fuelwood and dung has more negative impact and the females assess the impact is less. More than 60% of both males and females do not know about the impact of briquettes, probably because they have not used it and have no much information.

The chart below shows the impact of used fuel on different health aspects in the families (the respondents could give several answers). The problems with respiratory system irritation (about 40% of respondents) and eye irritation (22% of respondents) were the most common answers followed by respiratory diseases and skin irritation.

Chart 28. Health problems related to the used fuel



During focus group discussions in almost all settlements the respondents mentioned that especially indoor stoves cause smoke, dust and unpleasant smell when operated with dung and fuelwood and have negative impact on human **health** (respiratory diseases, allergy, eye irritation, etc.).

According to women, heating with fuelwood stoves dries the air in the house. Cleaning the remaining ash from use of dung is especially harmful to the health. The indoor temperature fluctuations resulting from fuelwood savings or not having a constant fire in the house can cause cold and illness in the family. Importance was attached to the **safe** heating and cooking and the availability of a well-functioning ventilation system.

In many settlements the respondents mentioned that **rubber and plastic items, tires and similar items or materials, sometimes also household waste** are burned mainly in locally manufactured **boilers** installed outside of the houses. The prevalence of this phenomenon varies in different settlements.

In some cases, people burn household waste to get rid of it, especially if there is a waste collection issue in the community, but sometimes they do it by habit.

Financially unsecure families burn similar items and materials in their indoor stoves, they also do this when they run out of purchased fuelwood and other fuels. **Especially women** respondents realize the negative consequences on human health and the environment, still sometimes they have to go for that if there is no other alternative.

The respondents also assessed the possible negative impact of fuels on environment on the scale 1-5 scale where 1 means "Don't have any impact", 5 - "Has a very big impact" and 0 – "I do not know".

Chart 29. The impact of heating and fuels on environment, male respondents

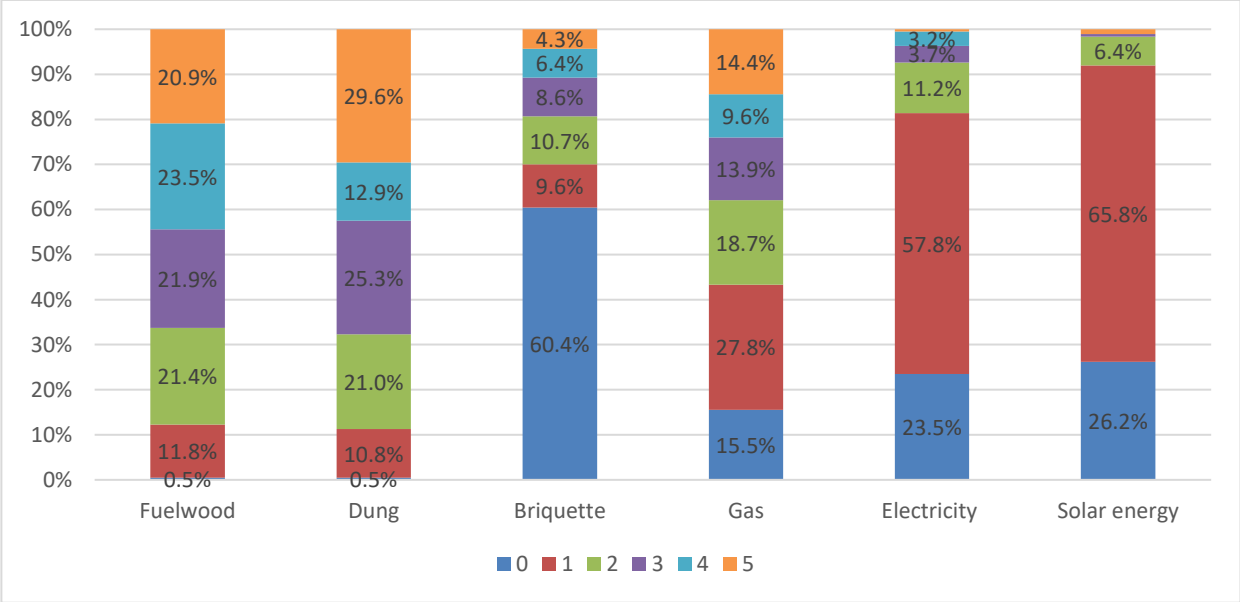
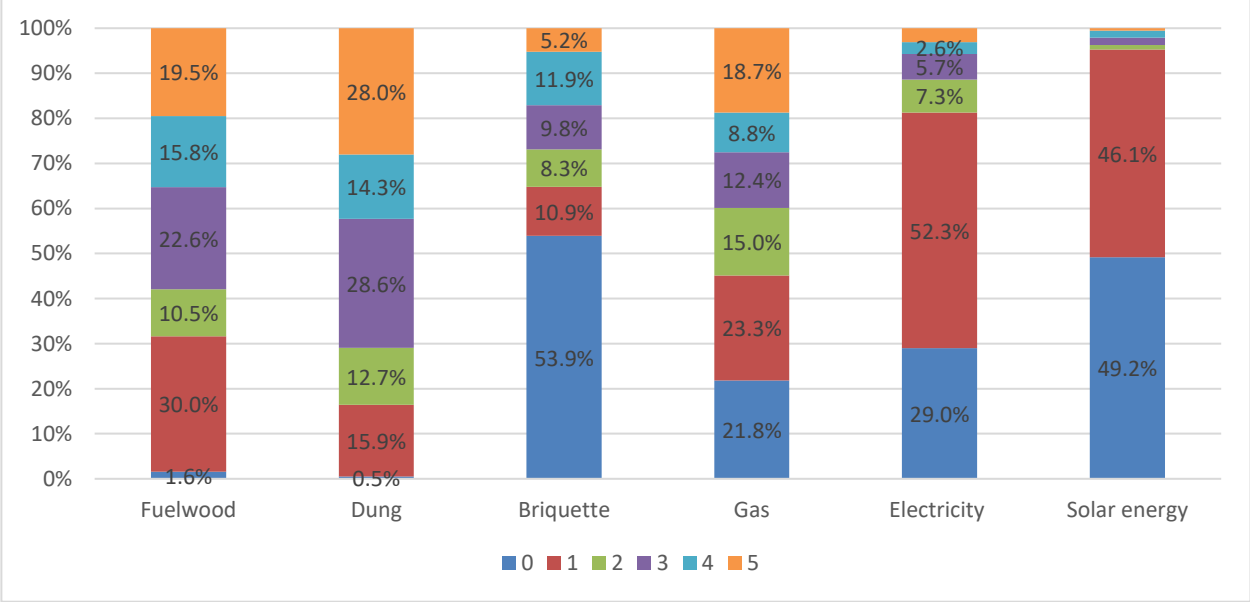


Chart 30. The impact of heating and fuels on environment, female respondents



Less than the half of all respondents, namely 44.4% of male and 35.3% of female respondents think that the use of fuelwood has big impact on environment (scores 4-5). The same is with dung: 42.5%

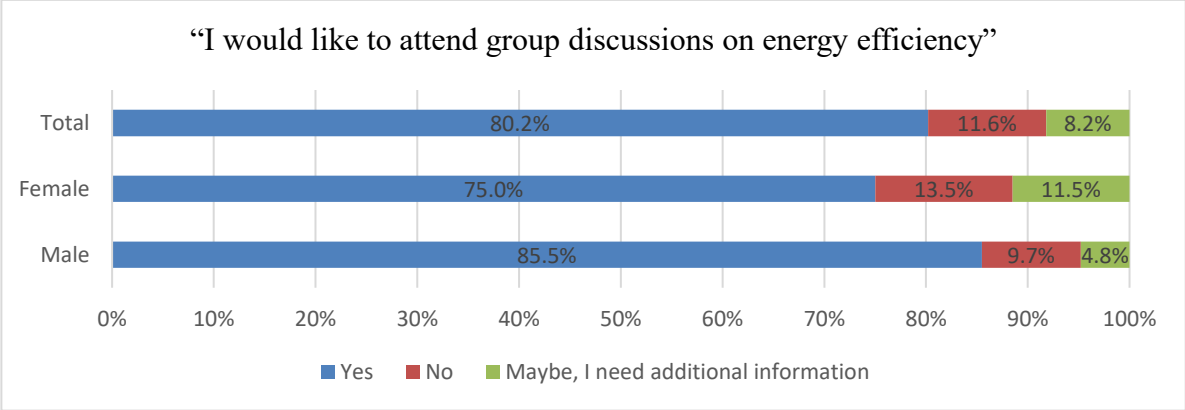
of males and 42.3 of female consider the impact of dung as big. About 50-60% of both male and female respondents do not know about the impact of briquettes on environment, which confirms that they have not used it and have no much information about it.

During all the focus group discussions, respondents expressed concern about deforestation and deteriorating forest conditions, they are concerned that fuelwood may become inaccessible or more expensive in the future.

3.5 Information, decision-making, new technologies

The majority of respondents would like to participate in group discussions on energy efficiency in their home or community. The chart below shows that 85.5% of males and 75% of females were interested in participating in group discussion. Slightly more women (11.5%) than men (4.8%) needed more information to decide if they want to participate.

Chart 31. The willingness to attend group discussions on energy efficiency



Almost in all settlements the focus group discussion respondents think that the **information** on energy efficiency is mainly available. The innovations tested by the villagers are considered to be more trustworthy. The respondents mentioned the following information sources for energy efficiency and energy saving (*in descending order of prevalence*): information from relatives and friends, representatives of companies offering solar energy devices, internet, TV and information obtained during the work abroad.

The charts below show to what extend the respondents share their opinion on energy issues. In particular, 82% of male and 63% of female respondents mainly share their opinion with the neighbors. About 50% of respondents share their opinion on energy during the community gatherings.

Chart 32. Sharing the opinion on energy with neighbors

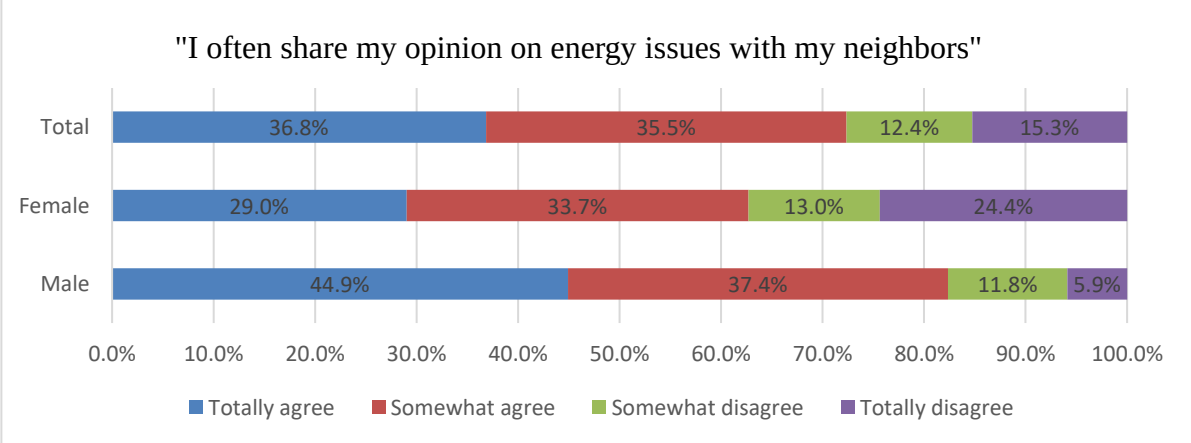
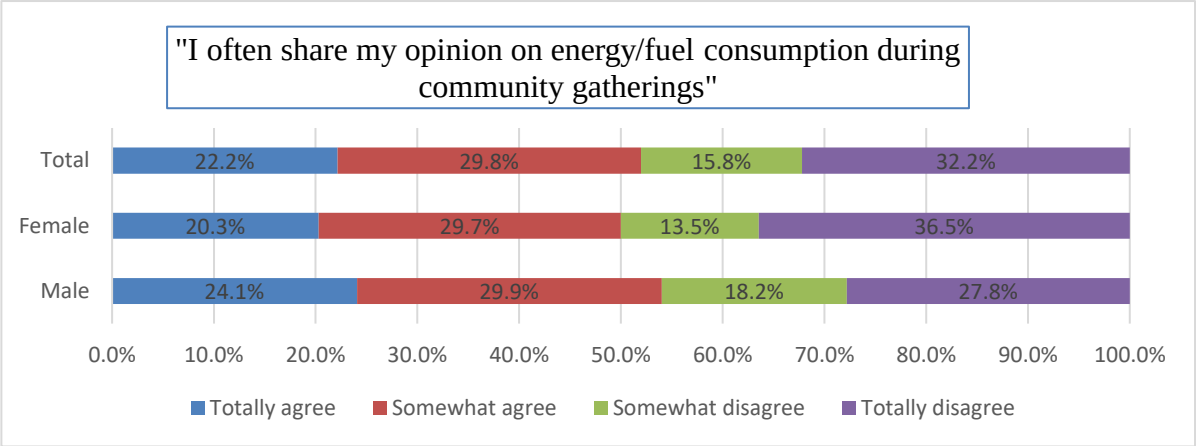


Chart 33. Sharing the opinion on energy during community gatherings



As the charts below show totally 66% of respondents are interested in new technologies in the field of energy, men are slightly more interested than women. However, more than 70% of respondents are not among the first who apply the new technologies.

Chart 34. The interest in new technologies in the energy field

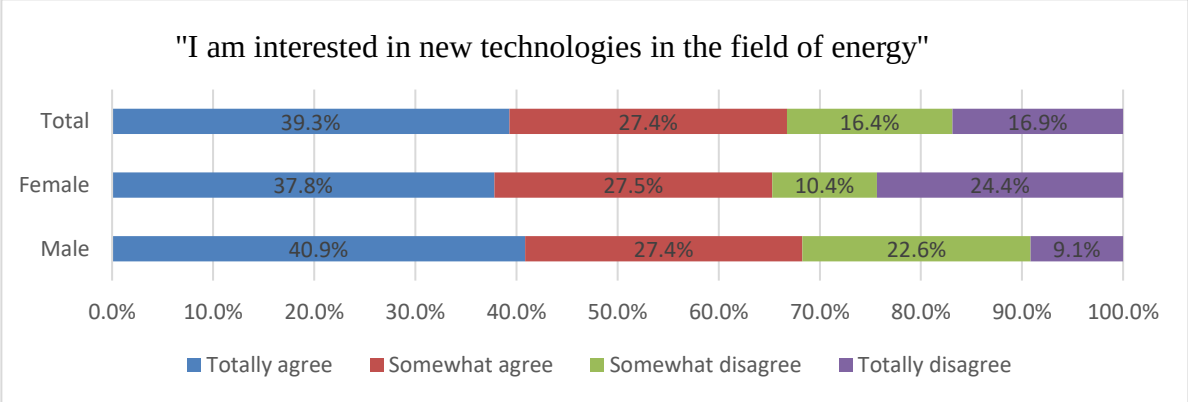
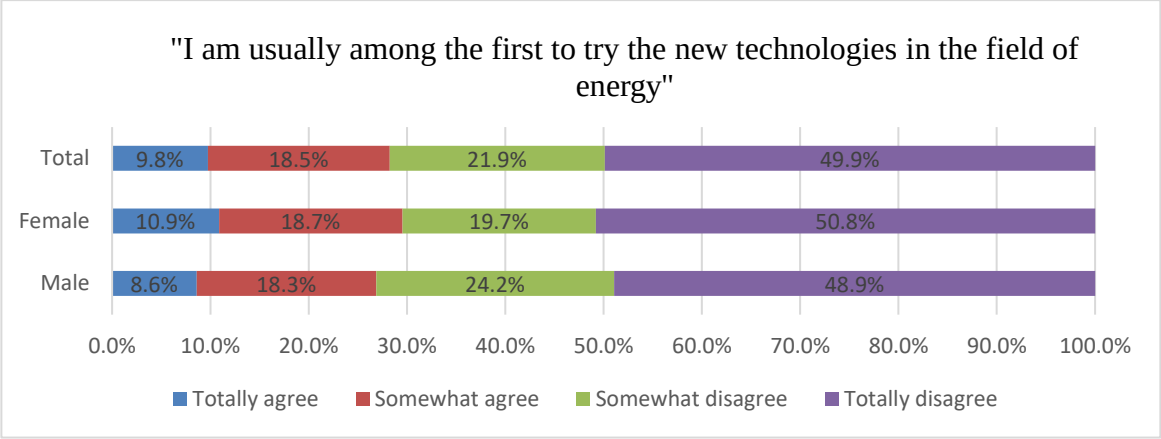
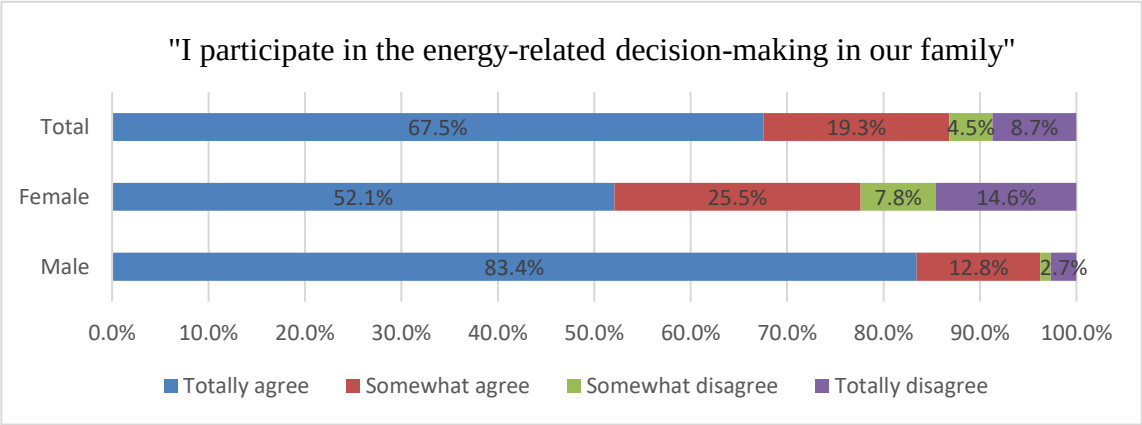


Chart 35. The use of new technologies in the energy field



The overwhelming majority of respondents (87%) mainly participate in the energy-related decision-making in their families. Meanwhile there is difference between males and females with 96% and 78% of participation respectively.

Chart 36. Participation in decision-making regarding the energy issues



4. Main conclusions and recommendations

4.1 Conclusions

Heated space, insulation and satisfaction with heating

During winter the respondents heat 62-81% of their houses. The level of thermal insulation is not high. About 22% of respondents have no **thermal insulation** of any type, over 36% have insulation of only one component, about 26% - 2 components, about 11% - 3 components and only 3.9% - 4 components. The most common insulated sections of the houses are windows, followed by the ceiling. Only the half of respondents is mainly satisfied with the indoor temperature at home and about 15% is strongly dissatisfied.

Use of fuelwood and dung for heating

Almost 96% of respondents use fuelwood and 66% of respondents use dung as heating fuel (many respondents use both fuelwood and dung). **Fuelwood** is used by 72.6% of respondents as the first heating fuel option and by 23% as the second and third options. **Dung** is used by 20.5% of respondents as the first heating fuel option and by 45.5% as the second and third options.

Among the solid biomass fuel users, the **fuelwood** was the first-choice fuel in all surveyed communities except Akhuryan. The fuelwood use rate for Akhuryan was 47% and in all the other communities – more than 70% with the highest rate of 91,4% in Gyulagarak (forest adjacent community). About 27% of respondents use up to 5m^3 fuelwood and 46% use 5-10m^3.

Dung showed to be frequently used especially in Akhuryan (46%), Saralanj cluster (19.3%) and Yeghvard (19.6%) conditioned by the widely spread livestock breeding. In the forest adjacent areas, the use of dung is less preferred: Gyulagarak (4.9%) and Lori Berd (10,7%). About 25% of the respondents use up to 5 m^3 dung, 22% - 10-15 m^3, 11% - 10-15 m^3 and 33.4% do not use it.

Only about 40% of respondents are satisfied with the amount of fuel their heating system consumes and about 25% are strongly dissatisfied.

The most preferred heating option is the centralized gas boiler system, the main limiting factors are the need for initial investment and high price of gas.

In general fuelwood and dung are widely used as the heating fuel. According to the respondents (focus group discussions) in the surveyed communities 60-95% of population use fuelwood, 10-30% use dung and 5-20% use gas for heating. The proportions vary in different communities depending on the distance from forest, livestock breeding and availability of gas.

Cooking and hot water preparation

For **cooking** the respondents most frequently use gas both during the heating season (72.9%) and non-heating season (80.5%). In the forest adjacent communities, the respondents use more fuelwood for cooking in non-heating season: Glyuagarak (33.3%) and Lori Berd (25%).

The main fuel for **hot water** preparation is also gas in the range of 35.2% in Akhuryan to 78.6% in Yeghvard. For hot water preparation the respondents use also electricity (almost 12%) and solar energy (9%). Solar energy is used more in Akhuryan community (22.55%) and Saralanj cluster (15.6%). The use of fuelwood for hot water preparation is rather high in forest adjacent communities Lori Berd (18.7%) and Gyulagarak (22.1%), meanwhile the use of solar energy is very low.

Choice of heating fuel and fuel saving

According to the respondents the main factors for choosing **fuelwood** as the heating fuel are

affordability (37.8%), easy use (17.5%), lack of alternatives (16.9%) and easy access (13.9%). For the **dung** users the main factors of choice are affordability (61.3%), accessibility (22.3 %) and lack of alternative (7.9%). For the **gas** users the factors of choice include easy use (55%), accessibility (15.4%) and affordability (12.1%). The use of **straw briquettes** is very limited. According to the respondents the main obstacle is the lack of information and experience, as well as the availability of briquettes and its high price. In case an affordable alternative exists, they would not use dung for heating, rather use it as fertilizer.

The overwhelming majority of fuelwood users buy fuelwood (pay for it). Meanwhile, only 20% of the dung users pay for it, the rest obtain it without payment. About 75% of respondents are mainly ready to do additional work to reduce their fuel consumption.

This implies that the respondents would accept an alternative to fuelwood if it is at least of the same price or cheaper than fuelwood and given the same level of comfort for its use. Meanwhile it is difficult to imagine that the dung users would accept an alternative for which they have to pay, unless there are clear also financial benefits of dung use for another purpose, rather than for heating.

The respondents save fuel as much as possible by different methods. Sometimes there is wrong perception by the respondents that semi-dry fuelwood is more efficient than the properly dried wood as it burns longer.

Heating devices

About 80% of respondents use locally manufactured wood stoves and 15% - biomass boilers. To obtain an EE stove the majority of respondents (91%) are ready to pay only the half of the offered price of 80.000 AMD and 62.6% are ready to pay only 25% of the price.

Among the stove users 22% intend to purchase an energy-efficient stove, 14% - to shift to a fuelwood/briquette boiler and 10% - to shift to a gas heating system. The main reasons for not obtaining EE devices include the need for initial investment, lack of information and experience with the devices and lack of trust regarding their efficiency.

The EE stoves (and other devices) with the proven quality and the lowest possible price will have a higher chance to be purchased. The awareness raising on existing possibilities can be considered as an important step to promote the EE devices in the communities.

Time consumption for heating maintenance and fuel preparation.

The heating with fuelwood and dung cause certain inconveniences to rural households including fuel preparation/storage and heating maintenance.

More males deal with the **heating maintenance** than females: 72.6% of male spend up to 3 hours per day and 8.6% do not spend time for that, 51.3% of female spend up to 3 hours and 13% do not spend time for that. However, the females spend more time than males on heating maintenance.

More men deal with **fuelwood** preparation and storage than women and men spend slightly more time for that than women: 3% of males and 29% of females are not engaged in fuelwood preparation, 42% of males and 35% of females spend 1-3 days and 35% of the males and 23% of females spend 4-10 days.

In case of **dung** preparation and storage 51.9% of men and 48.8% of women spend up to 100 days per year (the number of days when they dedicate certain time for that task). So women are almost equally engaged in dung preparation and storage as men. According to the respondents the preparation of dung is very work- and time-consuming.

Impact on health and environment

About 75% of respondents think that their heating fuel mainly does not affect their **health**. In general, the respondents think that use of fuelwood for heating has less negative impact on health than use of dung: 55% of male and 38.2% of female respondents mentioned about big impact of dung. Overall the males think that fuelwood and dung has more negative impact and the females assess the impact is less. However, women highlight more the importance of fuel to be clean and safe for health. The most common health problems are respiratory system irritation and eye irritation followed by respiratory diseases and skin irritation.

In some settlements there is use of **plastic, rubber, domestic waste** and other such items as fuel in biomass boilers installed outside of the house. The use of such items as fuel is the indoor stoves is conditioned by the lack of other heating alternatives, mainly in socially vulnerable families. Especially women realize the risk for health when using such items as fuel.

Less than the half of all respondents (44.4% of males and 35.3% of females) think that the use of fuelwood has big impact on **environment**. More than 40% of respondents consider that the use of dung as fuel has big impact on environment. The respondents are greatly concerned about the forest degradation and deforestation and see the risk that in future the fuelwood may become not available and more expensive.

Information and decision-making

The majority of respondents would like to participate in group discussions on energy efficiency in their home or community. Man (82%) share their opinion on energy related issues with neighbors more than women (63%). About 50% of respondents share their opinion on energy during the community gatherings.

Totally 66% of respondents are interested in new technologies in the field of energy, men are slightly more interested than women. Meanwhile, more than 70% of respondents are not among the first who apply the new technologies.

The majority of respondents (87%) mainly participate in the energy-related decision-making in their families. There is difference between male (96%) and females (78%).

4.2 Recommendations

1. The main reason for not changing towards more sustainable heating approaches is the lack of financial resources to make initial investment for changing the heating system or shifting to alternative fuel. There is a need for accessible and affordable alternative fuel and efficient heating devices to reduce the use of fuelwood and dung. In order to be widely accepted and used the alternatives financially should be in a range of the current market prices of the other used fuels or devices unless they have additional advantages (comfort, time saving) to be acceptable for some users, who will be willing to pay for those.
2. There is a need for affordable financing and financial mechanisms to encourage rural population to go for the EE/AE changes in their households. This include the EE/AE solutions, which require higher financial investments, but can ensure also the higher fuelwood and monetary savings in the longer terms, such as thermal insulation of houses. There should be a differentiated approach for the low-income segment of rural population with special programs to ensure they use less inappropriate fuels, which cause the risks for their health and environment.
3. Awareness raising and capacity building on EE/AE should be an important component of the rural energy activities. Those should be based on the proven and reliable information as well as successful examples within the communities to be followed and replicated. Informing and educating women on the energy related issues can have impact on household level.
4. The actions towards increasing EE and AE and reducing the use of fuelwood/dung imply the benefits for the families and in particular women. Therefore, all possibilities should be explored and used to reduce the household burden and the risks related to the current heating practices with the solid biofuels.

Annex 1. Use of different fuels for heating by communities according to the respondents

The shares of different fuel types used by the population for heating, according to the participants of focus group discussions:

Note. **communities without gas supply; Pokr Mantash has partial gas supply*

Akhuryan community settlements (Shirak marz)	
Aygabats	Fuelwood and dung - 60-80%, gas - 20-30%, electricity - 10%
Arevik	Gas - 40-50%, fuelwood and dung - 50%
Basen*	Fuelwood and dung - 60-80%, dung - 20-40%
Kamo	Manure - 60%, fuelwood and dung -30%, gas - 10-30%
Karnut	Fuelwood and dung - 20%, dung - 80%
Hovit	Fuelwood and dung - 60%, dung - 40%, coal - 3%
Jrarat*	Fuelwood and dung - 90%, dung -10%

Non-enlarged communities in the Shirak marz	
Harich	Dung - 80-90%, fuelwood and cones - 10-20%
Mets Mantash	Fuelwood and dung - 80%, gas - 15-20%
Nahapetavan	Fuelwood and dung - 70-80%, dung - 30%, gas - 10%
Saralanj	Fuelwood and dung - 80-90%, gas - 10-20%
Pokr Mantash*	Fuelwood and dung - 70-80%, dung - 10%, gas - 5-10%, coal -5-10%

Gyulagarak community settlements (Lori marz)	
Amrakits	Fuelwood - 60%, fuelwood and dung - 30%, gas - 10%
Gargar	Fuelwood - 80-90%, gas - 10-15%, dung – very little
Gyulagarak	Fuelwood - 75-85%, dung - 5%, gas - 20%
Kurtan	Fuelwood - 80-90%, dung - 20%
Hobardzi	Fuelwood - 90%, dung - 10%, gas - 10-20%
Pushkino	Fuelwood - 90-100%, dung – very little
Vardablur	Fuelwood and dung - 80-90%, gas - 10%

Lori Berd community settlements (Lori marz)	
Agarak	Fuelwood and dung - 85-90%, gas - 10-15%
Bovadzor	Fuelwood and dung - 90%, gas - 10%
Lejan	Fuelwood - 50%, fuelwood and dung - 30%, gas - 15-20%
Lori Berd	Fuelwood - 80%, gas - 10-15%, dung – very little
Koghes	Fuelwood - 85-95%, fuelwood and dung - 5%, gas - 5-10%
Yaghdan	Fuelwood - 80-90%, gas - 10%
Urut	Fuelwood and dung - 90-95%, gas - 5-10%
Sverdlov	Fuelwood and dung - 60-80%, dung - 30%, gas or electricity -10-20%

Yeghvard community settlements (Kotayk marz)	
Aragyugh	Fuelwood and dung - 70-80%, gas - 20%, briquette - 5%
Buzhakan*	Fuelwood and dung - 80-90%, dung - 10-20%
Zoravan	Fuelwood and dung - 70%, gas - 30%
Saralanj*	Fuelwood and dung - 90%, briquette – very little

ENVIRONMENT, CLIMATE, OPPORTUNITIES

for people and nature

Management of natural resources and safeguarding of ecosystem services for sustainable rural development in the South Caucasus (ECOserve)

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