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CZECH REPUBLIC
DEVELOPMENT COOPERATION



Baseline study report of the Switch Off Air Pollution project



БАРИЛГЫН ЭРЧИМ ХҮЧ ХЭМНЭЛТИЙН ТӨВ
BUILDING ENERGY EFFICIENCY CENTER



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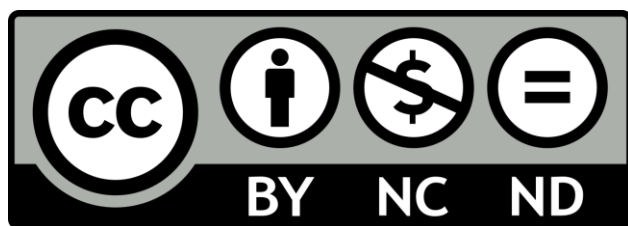


TABLE OF CONTENTS

LIST OF TABLES	4
LIST OF FIGURES	4
ACKNOWLEDGEMENTS	7
LIST OF ACRONYMS	8
FOREWORD	9
Background	9
Purpose and scope	10
Report structure	11
1. 12	
Research of documents and materials	12
1.1. Data Collection	13
1.2.1 13	
1.2.2 16	
1.2. Analysis	17
2. 18	
2.1. Interviewee information	18
2.2. Household information	18
2.3. Social status of household members	19
3. 23	
3.1. Knowledge and attitude towards air pollution	23
3.2. Knowledge and attitude towards heat loss	27
4. 32	
4.1. Household income and expense	32
4.1.1 32	
4.1.2 38	
4.2. Household savings and loans	46
4.2.1 46	
4.2.2 47	
4.3. Future plans on households assets and investments	51
4.3.1 51	
4.3.2 52	
5. 53	

5.1.	Ageing, structure/arrangement and materials of houses	54
5.1.1		54
5.1.2		54
5.1.3		56
5.1.4		57
5.2.	House insulation and heat loss	58
5.2.1		58
5.2.2		61
5.3.	Heating, clean and waste water management	64
5.3.1		64
5.3.2		66
6.		68
6.1.	Future plans on housing	68
6.2.	Measures to reduce heat loss	69
6.3.	Financial capabilities and interests of respondents	73
	CONCLUSIONS	77
	APPENDIX	83
	Questionnaire	83
	REFERENCES	95

LIST OF TABLES

<i>Table 1. The population and sample size, by location</i>	14
<i>Table 2. Demographic characteristics of the interviewees (n=416)</i>	18
<i>Table 3. Demographic characteristics of household members (n=1002)</i>	19
<i>Table 4. The warmth of a house and average coal consumption, average number of stoking the furnace</i>	31
<i>Table 5. The classification of average household income</i>	32
<i>Table 6. Grouping of average household income and the number of employed members of a household</i>	34
<i>Table 7. Average consumption of firewood and coal of a household</i>	41
<i>Table 8. Electricity expenses and the size of a house</i>	45
<i>Table 9. Expense and family types</i>	45
<i>Table 10. Average ageing of houses, house wall types and household income, by years</i>	54
<i>Table 11. Characteristics of one-room houses (n=226) and top view drawing</i>	55
<i>Table 12. Characteristics of houses with more than one room (n=190) and top view drawing</i>	56
<i>Table 13. Technical solutions and priorities ranked by respondents</i>	72
<i>Table 14. Previously identified technical solutions and ranking of solution by selection of respondents</i>	75

LIST OF FIGURES

<i>Figure 1. The project's goal, activity, and results</i>	10
<i>Figure 2. The scope of the baseline survey</i>	11
<i>Figure 3. The baseline survey phases and their activities, results</i>	12
<i>Figure 4. The (GPS) location of the households that participated in the sample research, by district, khoroo</i>	15
<i>Figure 5. The quality control of the information</i>	16
<i>Figure 6. Methods used in focus group interviews</i>	16
<i>Figure 7. The focus group interview organized among households of target khoroo in Sukhbaatar district: 2019-02-16, Total participants: 13 people</i>	16
<i>Figure 8. The focus group interview organized among households of target khoroo in SonginoKhairkhan district: 2019-02-17, Total participants: 18 people</i>	16
<i>Figure 9. Segmentation by the number of family members (n=416)</i>	18
<i>Figure 10. Types of the household (n=416)</i>	19
<i>Figure 11. The decision maker of the household (n=651)</i>	19
<i>Figure 12. Education level of total adult members (n=1002)</i>	20
<i>Figure 13. Education level of the household head (n=389)</i>	20
<i>Figure 14. Education level of the head of household and household income type (n=389)</i>	21
<i>Figure 15. Last 12 months employment status of total adult members (n=1002)</i>	21
<i>Figure 16. Last 12 months employment status of the head of household (n=389)</i>	21
<i>Figure 17. Employment industries of total adult members (n=662)</i>	22
<i>Figure 18. Employment industries of the head of household (n=389)</i>	22
<i>Figure 19. The social insurance payment of total adult members, by employment status</i>	22
<i>Figure 20. The scope of measuring air pollution knowledge</i>	23
<i>Figure 21. The understanding of AQI and its pink tag (n=416)</i>	23
<i>Figure 22. Knowledge of main source of air pollution (n=416)</i>	24
<i>Figure 23. The knowledge about harmful effects of air pollution to the human body (n=416)</i>	25
<i>Figure 24. Actions towards protecting their health, total number of answers (n=660)</i>	25
<i>Figure 25. The damages caused by air pollution faced by households (n=416)</i>	26
<i>Figure 26. Ger district households' suitable methods to decrease air pollution (n=416)</i>	26

<i>Figure 27 Ger district households' suitable methods to decrease air pollution and income type (n=416)</i>	27
<i>Figure 28. The most important actions to be taken towards air pollution reduction by ger district households (n=460 proposals)</i>	27
<i>Figure 29. The scope of measuring the knowledge about heat loss</i>	28
<i>Figure 30. Actions towards keeping a house warm (n=549)</i>	28
<i>Figure 31. Actions towards keeping a house warm and income types, by actions (n=549)</i>	29
<i>Figure 32. Actions towards keeping a house warm and suitable methods to reduce air pollution</i>	29
<i>Figure 33. Actions towards keeping a house warm by households that didn't insulate their house (n=189)</i>	29
<i>Figure 34. The income types of households that didn't insulate their house (n=189)</i>	29
<i>Figure 35. House insulation (n=300)</i>	30
<i>Figure 36. The comfort and warmth of a house (n=416)</i>	30
<i>Figure 37. Insulation of a house (n=300)</i>	31
<i>Figure 38. Grouping of average household income, total sample, by district</i>	33
<i>Figure 39. The relationship between average household income and the number of employed members of a household</i>	34
<i>Figure 40. Income type of a household and type of family</i>	35
<i>Figure 41. Sufficiency of household income (n=416)</i>	35
<i>Figure 42. Income types of a adult members of a household (n=999)</i>	36
<i>Figure 43. Type of household income (n=416)</i>	36
<i>Figure 44. Type of household income, by income type</i>	37
<i>Figure 45. Income sources of household members, by income type</i>	38
<i>Figure 46. Grouping of education and tuition expenses, by year (n=174)</i>	38
<i>Figure 47. Whether education and tuition expenses are paid, by income type (n=416)</i>	39
<i>Figure 48. Grouping of education and tuition expenses, by income type (n=174)</i>	39
<i>Figure 49. Monthly health expenses of a household, tugrik (n=392)</i>	40
<i>Figure 50. Grouping of medical expenses, by income class (n=392)</i>	40
<i>Figure 51. Grouping of respiratory diseases' expenses (n=384) and statistical measures</i>	41
<i>Figure 52. Grouping of cardiovascular diseases' expenses (n=101) and statistical measures</i>	41
<i>Figure 53. Monthly firewood expenses of a household (n=235) and statistical measures</i>	42
<i>Figure 54. Annual firewood expenses of a household (n=159) and statistical measures</i>	42
<i>Figure 55. Monthly coal expenses of a household (n=163) and statistical measures</i>	43
<i>Figure 56. Annual coal expenses of a household (n=237) and statistical measures</i>	43
<i>Figure 57. Grouping of electricity expenses, by heating and non-heating season (n=416)</i>	44
<i>Figure 58. Grouping of electricity expenses in heating season, by income type (n=392)</i>	44
<i>Figure 59. Household savings (n=461)</i>	46
<i>Figure 60. Other infomation on household savings (n=84)</i>	46
<i>Figure 61. Types of household loans (n=461)</i>	48
<i>Figure 62. The amount of household loans (n=135)</i>	48
<i>Figure 63. The amount of household loans, by income type (n=135)</i>	49
<i>Figure 64. Loan term (n=135)</i>	49
<i>Figure 65. Loan repayment of households (n=135)</i>	49
<i>Figure 66. Loan purpose of households (n=170)</i>	50
<i>Figure 67. Grouping of households with vehicles, by number of vehicals (n=226)</i>	51
<i>Figure 68. Types of vehicles (n=252)</i>	51
<i>Figure 69. Land area (n=416)</i>	51
<i>Figure 70. Households' ownership of a house and existence of real estate certificate (n=416)</i>	52
<i>Figure 71. Households' ownership of a house and usage as collateral (n=416)</i>	52
<i>Figure 72. Households' near future investment plans (n=416)</i>	53

<i>Figure 73. Planned timeframe for investments in buildings and houses (n=101)</i>	53
<i>Figure 74. Ageing of houses (n=416)</i>	54
<i>Figure 75. Area/sizes of houses (n=416)</i>	55
<i>Figure 76. Wall materials and types of roofs (n=416)</i>	57
<i>Figure 77. Wall materials and floor materials (n=416)</i>	57
<i>Figure 78. Contractors/builders of the houses and income groups (n=298*)</i>	58
<i>Figure 79. Contractors/builders of the houses and wall types (n=299*)</i>	58
<i>Figure 80. Whether households insulated their houses, by wall types (n=416)</i>	59
<i>Figure 81. Factors influencing in selecting insulation materials (n=172*)</i>	59
<i>Figure 82. Evaluation of households in the quality of their house insulation (n=130)</i>	59
<i>Figure 83. Difficulties that households encounter in making insulation in their homes (n=674)</i>	60
<i>Figure 84. Level of interest in hiring professional contractors (n=416)</i>	60
<i>Figure 85. Parts of houses that lose heat outside (n=427)</i>	61
<i>Figure 86. Parts of houses escaping heat through and wall types (n=427)</i>	62
<i>Figure 87. Insulated parts of the houses (n=298)</i>	63
<i>Figure 88. Insulated parts of the houses vs. materials used (n=298)</i>	63
<i>Figure 89. Sources that respondents purchased insulation materials (n=298)</i>	63
<i>Figure 90. Types of household's stoves (n=416)</i>	64
<i>Figure 91. Number of firing/burning fuel, per day (n=416)</i>	64
<i>Figure 92. Number of burning fuel and status of insulation of houses (n=416)</i>	65
<i>Figure 93. Stove types and heating devices (n=416)</i>	66
<i>Figure 94. Drinking water sources (n=416)</i>	66
<i>Figure 95. Amount of daily water use for drinking and households use (n=416)</i>	66
<i>Figure 96. Venues of bathing (n=416)</i>	67
<i>Figure 97. Waste water removal (n=416)</i>	67
<i>Figure 98. What are you planning to do with the current house you live in? (n=416)</i>	68
<i>Figure 99. Years planned to move to apartments, %</i>	68
<i>Figure 100 Measures to reduce heat loss #1</i>	69
<i>Figure 101 Measures to reduce heat loss #2</i>	69
<i>Figure 102 Factors considering in house repair and modification</i>	71
<i>Figure 103 Ways of resolving financing (n=416)</i>	74
<i>Figure 104 Households' readiness to spend money for insulation (n=416)</i>	74
<i>Figure 105 Amount possible to spend for insulation</i>	74

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This research has been conducted by main and support teams of MIRIM Consultant LLC. The main team consists of D. Byambasuren (quantitative research advisor), L. Tselmegsaikhan (qualitative research advisor) and Ts. Badamsuren (research coordinator).

LIST OF ACRONYMS

LI	Low income
MCUD	Ministry of Construction and Urban Development
BEEC	Building energy efficiency center
KII	Key informant interview
GCMC	Ger community mapping center
AAI	Above average income
AI	Average income
MNCA	Mongolian National Construction Association
SIP	Social insurance payment
NPHC	National public health center
HSES	Household Socio-Economic Survey
PIN	People in need
NSO	National statistics office
FGD	Focus group discussion
MUST	Mongolian University of Science and Technology

FOREWORD

Background

As of the end of 2017, 55.5% of 386'218 households in Ulaanbaatar are living in ger districts.¹ Although the re-planning and reconstruction of ger district land has been initiated and implemented by CCGO (Capital City Governor's Office) since 2013, the number of ger district households has not decreased. The main reason behind the increase in the number of ger district household is that the number of people migrating to the capital is 2-3 times higher² than the number of people emigrating out of the capital, and the majority of the newcomers settle down in ger districts.

Due to undeveloped infrastructure in ger districts, households are prone to using unprocessed coal for heat during winter. According to HSES (Household Socio-Economic Survey)³ 2017, an average household in Ulaanbaatar used 66 bags of firewood and 3.3 tone of coal every year. Furthermore, factors such as inefficient heating system, insufficient income and heat loss of a house have been main reasons for increased fuel usage. This situation is causing air pollution, soil contamination and environmental pollution, severely harming the health of every resident in the capital.

About 90 percent of houses in ger districts have no engineering calculations nor design plans, and have been built by non-standard household means, thus they are susceptible to fire and prone to heat loss (MCUD, 2017). Moreover, usually citizens build houses themselves with little to no knowledge or education on how to improve according to standards.

Funded by European Union and Abbé Pierre foundation, GERES International NGO, PIN International NGO, GCMC, MNCA, BEEC are collaborating to implement a four-year project⁴ on providing consultancy and financial intermediary services on building sustainable energy-efficient housing in unplanned areas of Ulaanbaatar, which started back in January of 2018. This project's goal is to improve the health condition of the Mongolian population by habituating house residents to rational use of energy.

In doing so, the project aims to deliver direct and non-direct benefits to the entire Ulaanbaatar population by providing support to local governments and other organizations, ger district households and construction industry SMEs. The project's target group is ger district households that wish to decrease heating expenses and improve overall comfort of the house, and further focus will lie in households below living standards and female headed households.

Within the project's main goal, the following activities and results are expected:

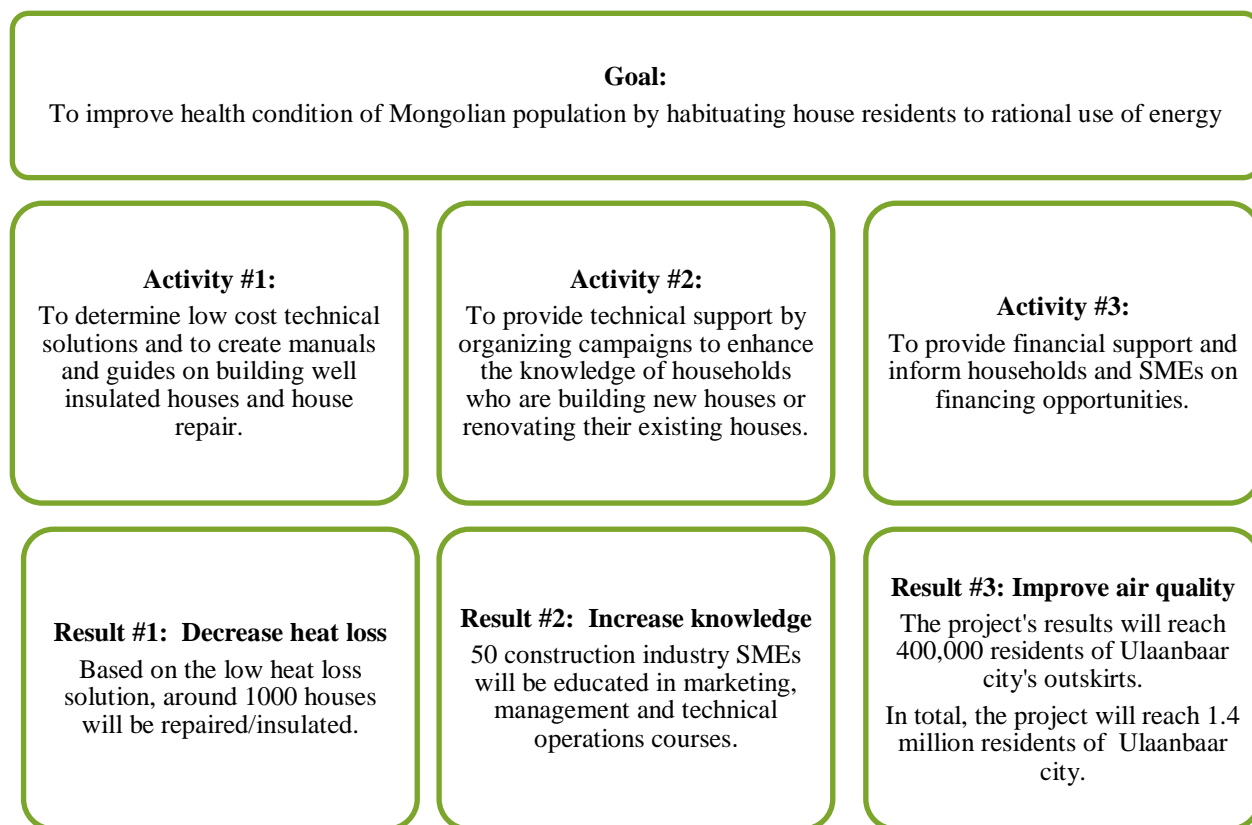
¹ National Statistical Office of Mongolia

² In 2017 the number of people migrating out of Ulaanbaatar was higher than the number of people migrating to Ulaanbaatar for the first time. The difference was 1069 people.

³ HSES is a national survey aimed at identifying the living standards and poverty status, including estimating household income and expenses, updating the information used in Consumer Price Index, and providing with necessary information for calculating GDP by consumption. In 2017, 3562 households in Ulaanbaatar participated in the HSES.

⁴ The project name will be abbreviated as SOAP going forward.

Figure 1. The project's goal, activity, and results



Source: SOAP project document

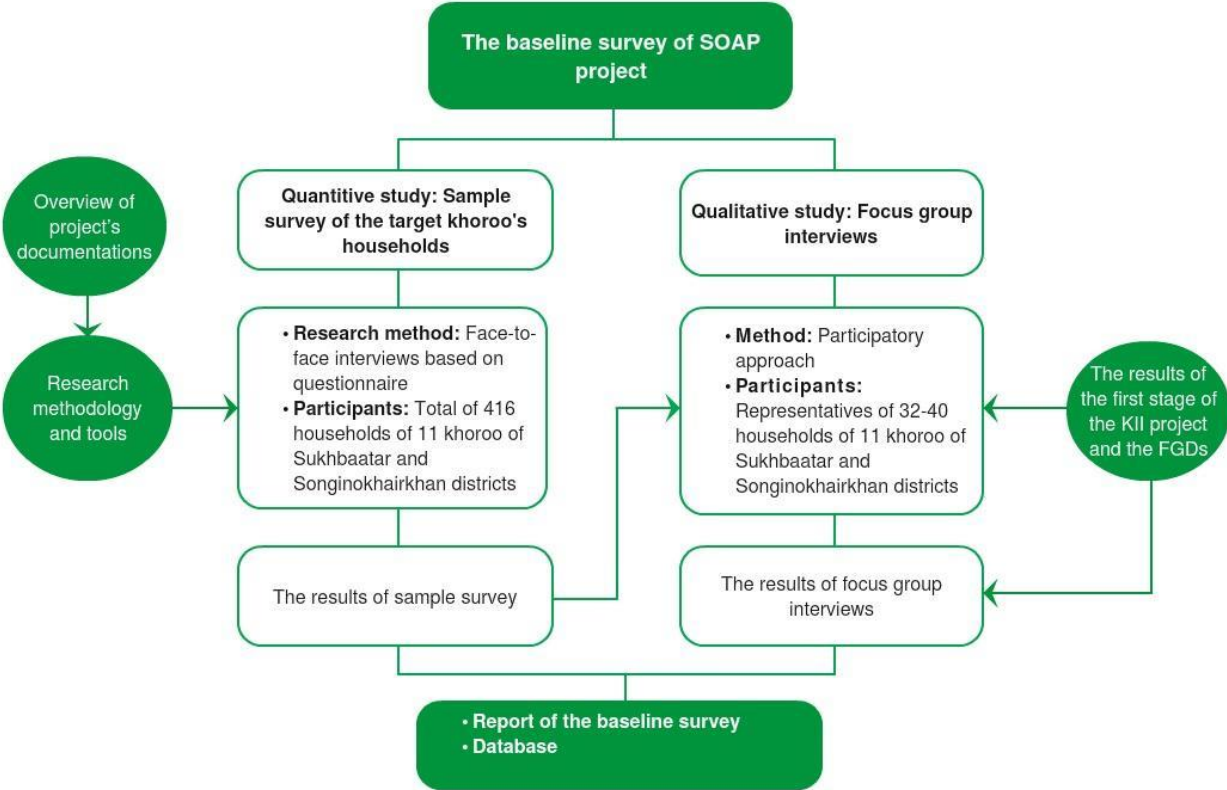
Purpose and scope

The main purpose of the baseline survey is to ascertain SOAP project's basic information, as well as to determine the financial situation, capability and the further need for housing of the target group. Within this purpose the following goals were outlined:

- To determine the levels of knowledge and attitude towards air pollution and heat loss of a house from households within target khoroo,
- To determine social and economic conditions of households within target khoroo,
- To determine the current housing situation and further needs from target khoroo.

The survey has been developed based on documentations, qualitative and quantitative data. Within this scope, sample survey and focus group interviews conducted on households within target khoros have been summarized altogether. The scope of the research is shown in the figure below.

Figure 2. The scope of the baseline survey



Report structure

The research report consists of six chapters. *The first chapter* explains the methodology used in the baseline research. The first part of the chapter summarizes results of research design and the research of documentations, while the second part discusses the methodology of sample survey. Specifically, topics such as tools, sampling, data collection and considerations during analysis are covered. In the last part of the chapter, the methodology and the organization of focus group interviews has been outlined.

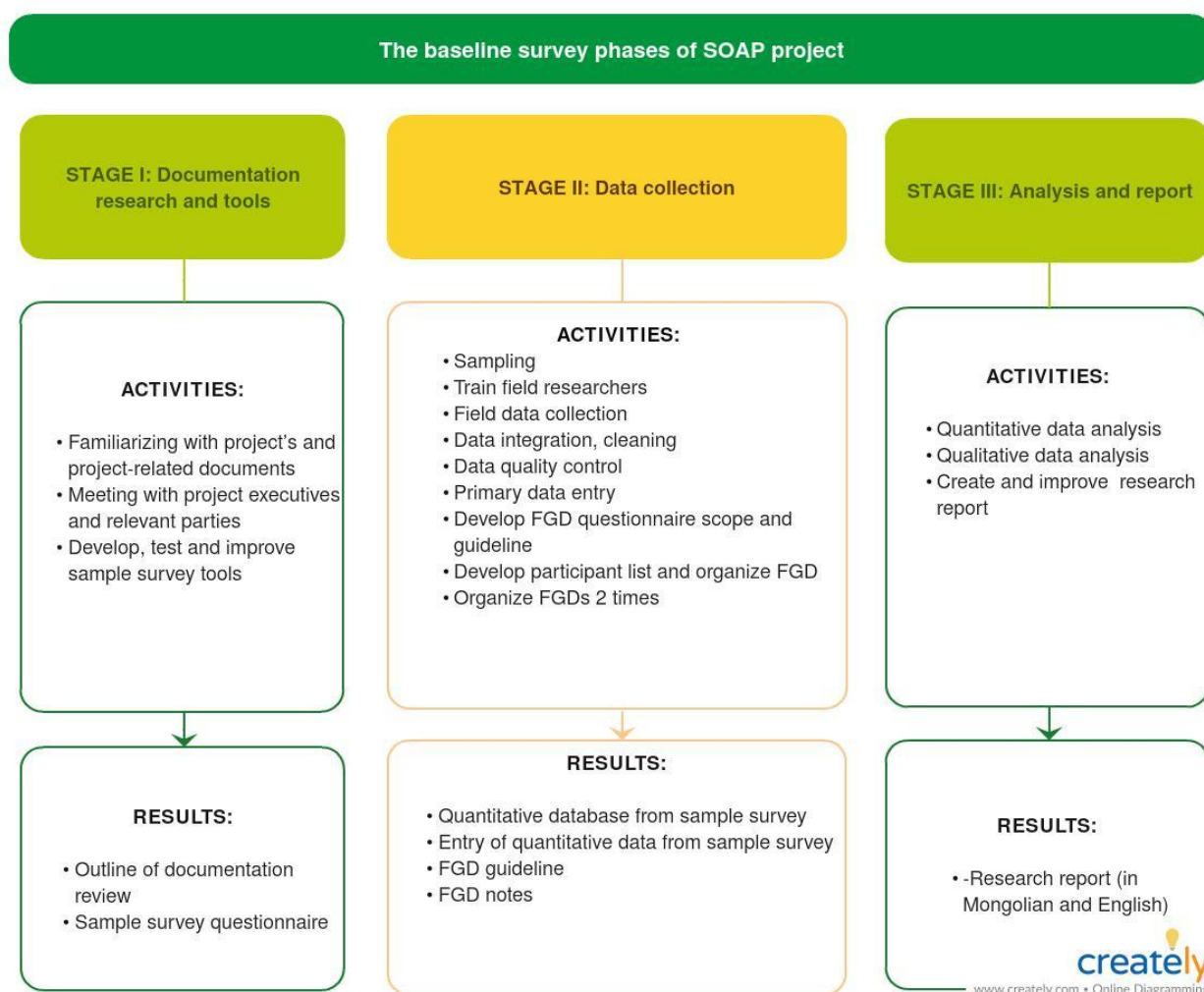
In the second chapter, the demographic information of sample survey’s participants along with their social and economic characteristics is introduced. *The third chapter* describes survey’s participants’ level of knowledge and attitude towards air pollution and heat loss of a house. *In the fourth chapter*, households’ financial capability is discussed. The financial capability of households has been calculated based on household income, expense, savings and loans, assets, and households’ future investments plans were taken into account.

The fifth chapter describes current situation of households’ housing. Aspects that are being discussed include ageing, structure and organization, insulation, heat loss and heating of a house, clean and waste water. *In the sixth chapter*, households’ further interest and plan is closely discussed. Finally, the main results of the research have been summarized.

1. THE METHODOLOGY AND ORGANIZATION OF THE RESEARCH

The baseline survey consists of three phases. These include: (i) the development of research means based on the result of project’s documentation overview; (ii) the qualitative and quantitative data collection from target khoroo’ households; (iii) research data analysis and report writing process. In the Figure below, the research phases and their activities has been summarized.

Figure 3. The baseline survey phases and their activities, results



Research of documents and materials

In the first stage of the research, MIRIM’s research team examined project relevant documentation in order to produce sample survey and FGD research tools. Including:

- Notes and reports from KII and FGD organized by the project team in 2018,
- Outline of relevant studies, projects and programs produced by the project team. Including: Social research of ger district, ger district reconstruction, income-based housing, building energy conservation, and city surveys.
- Statistical information of households in target khoroo.
- Documentation on principles of gender equality from the “SWITCH Asia II” project

Additionally, a total of seven consultation meetings were held with project implementers PIN, GERES, and BEEC. Survey questionnaire was developed based on the results from documentation review and consultation meetings.

Sample survey questionnaire for households in target khoroo⁵: The questionnaire is structured, with 76 questions in four sections. The first part of the questionnaire includes questions about general household information, while the next parts inquire about their knowledge and attitude regarding air pollution and house heat loss. The third part, aims to determine the household financial capabilities by asking questions about household income, expenses, savings, loan, property and future investment plans. In the last part of the questionnaire, questions were aimed to determine household structure, organization, insulation and heat loss, as well as future housing needs. Furthermore, the photographs of the outside of the house, window and wall junctions were taken from the households involved in the survey.

Within the development of the questionnaire, MIRIM's team took the following steps:

- The questionnaire development meeting with the client.
- First questionnaire draft was developed and delivered to the client.
- Organized meetings with the client regarding changes to the questionnaire, and improved the questionnaire.
- Pilot survey was conducted on 12 households to test the questionnaire.
- Questionnaire was improved based on the pilot results
- After completing the questionnaire development, a tablet version was created

1.1.Data Collection

1.2.1 Data collection of quantitative research

Sampling

Sample scope: Households with houses from Sukhbaatar district's 15th, 16th, 17th, 18th khoroo, Songinokhairkhan district's 7th, 8th, 9th, 10th, 11th, 28th, 31st khoroo were included.

The size and the representativeness of a sample: As of fourth quarter of 2018, there are 15'674 households with houses in these 11 khoroo, of which 384 households were randomly chosen by random sampling method. The number of households to participate in the research was calculated by the formula below:

$$n = \frac{Z^2 p(1 - p)}{C^2}$$

where n is sample size, Z – confidence level (at confidence level of 95% Z=1.96), p – probability of the variable being detected, C - error level (confidence interval). Sample error level was chosen to be ±4.9%, and confidence level – at 95%. However, in the research process additional 32 household's information has collected and the total of 416 households participated in the research.

After determining the total number of households to participate, the number of households from each khoroo has to be estimated, and in that we used double sampling method⁶. Due to certain

⁵ Please see the attachment.

⁶ Double random sampling method calculates certain khoroo sample size by multiplying total sample size with that khoroo's percentage of population.

reasons⁷, the number of participating households in Songinokhairkhan district's 9th khoroo has been less than planned, whereas in 10th and 28th khoroo of this district this number has been more than expected. 71% of the samples come from Songinokhairkhan district, and the rest are from Sukhbaatar district.

Table 1. The population and sample size, by location

№	Location	Population		Planned sample		Additional sample	Total size of sample
		Households with houses (a)	Percentage of population	Sample size	Percentage of sample size		
Sukhbaatar district							
1	15 th khoroo	768	5%	19	5%	-	19
2	16 th khoroo	1602	10%	39	10%	1	40
3	17 th khoroo	1121	7%	27	7%	-	27
4	18 th khoroo	1436	9%	35	9%	-	35
Songinokhairkhan district							
5	7 th khoroo	2722	17%	67	17%	1	68
6	8 th khoroo	1269	8%	31	8%	-	31
7	9 th khoroo	1200	8%	29	8%	-8	21
8	10 th khoroo	1647	11%	42	11%	27	69
9	11 st khoroo	1350	9%	33	9%	-	33
10	28 th khoroo	996	6%	24	6%	11	35
11	31 st khoroo	1563	10%	38	10%		38
	Total	15674	100%	384	100%	32	416

Note: (a)- National statistics office

Selection of target households: A random sampling method was used to select a single household from every khoroo. The segmented random sampling was carried out as follows:

- Determine the number houses to skip in a certain khoroo as $k=N/n$.
- The number of steps or number of households to skip before choosing a target household was calculated with $k=N/n$, where k – number of steps, N – total number of households with housing from the khoroo, n – sample size of the khoroo.
- The sampling began after a random integer was selected between one to k . Afterwards, every k^{th} household was selected for sampling. For example, let's assume k equals 10. Then a random number is selected between 1 and 10, which is 3. Then every 10th household from 3rd household is selected. Thereby the sample includes households 3, 13, 23, 33 (until n) and so on.

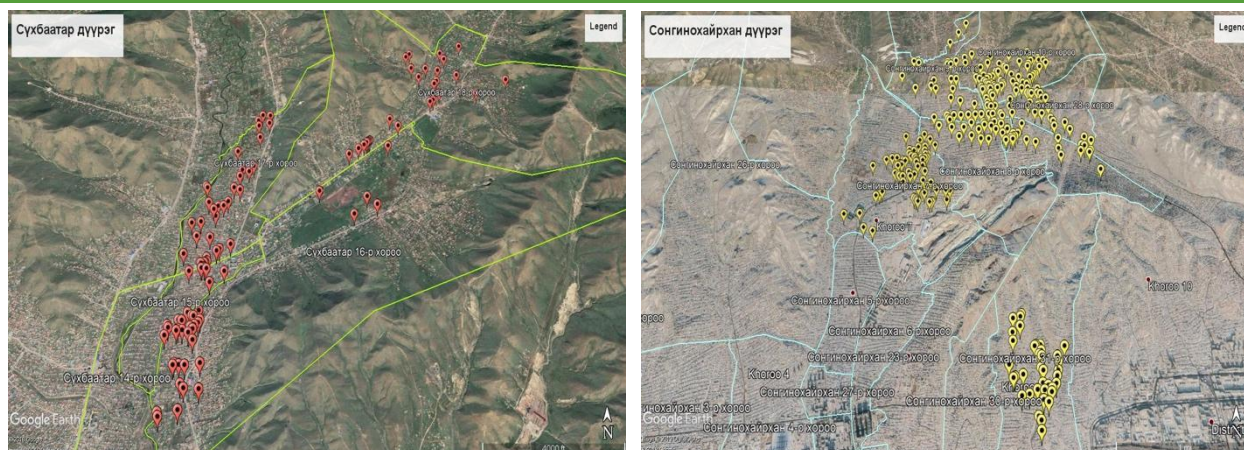
⁷ See Obstacles faced during data collection from Data collection section

As for this sampling, number of steps or number of households was selected by the aforementioned method and selected using the following rules:

1. Acquire information by randomly selecting 2-3 households from a single street.
2. The minimum number between selected households shall be 10.
3. If the household is rented or empty, the following household is selected.

The following Figure summarizes the location of the interviewed households for each khoroo⁸.

Figure 4. The (GPS) location of the households that participated in the sample research, by district, khoroo



Selecting an interviewer: Interviews involved the household head, household head's wife, or an adult member who participates in the decision-making process. Furthermore, if the interviewer did not know the answer to a question, another member of the household answered the question. 58% of all interviewees were household heads, 28% were wives, 11% were adult children and the remaining 3% were other members of the household.

Data collection process

The data collection process from target households was organized between January 5th and 15th of 2019. Before conducting the main survey, researchers were trained and tested with fieldwork. Fifteen field researchers, representatives from PIN International NGO, GERES International NGO, members from MIRIM's main research team participated and made preparations for the survey and pilot.

Data collection activities from households in target khoroo began once the fieldwork team, questionnaire, fill out form and other tools were ready. Research route, work plan and team organization were prepared according to the plan in advance. However, the following difficulties were encountered during data collection:

- *Loss of time:* time lost due to absence of family members or lack of households meeting criteria requirements.
- *Refusal of disclosing information:* Some households refused to invite the researchers, withheld information on monthly income, savings, loans and other financial information, and prohibited photographs of their house to be taken.

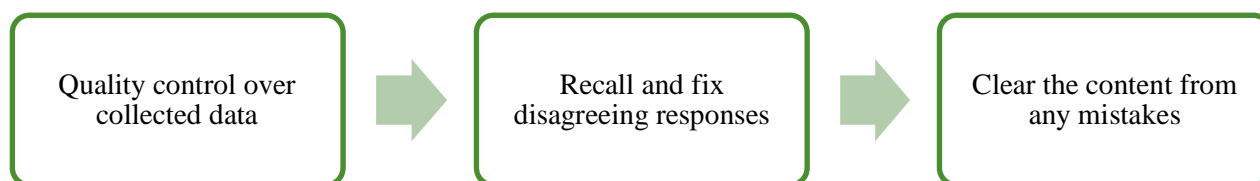
⁸ Displayed on a GPS for each household.

- *Environmental and atmosphere obstacles:* Weather and other difficulties encountered during work in the remote ger districts.

Information control and database

Sample survey database was reviewed and verified using the following model.

Figure 5. The quality control of the information



The following measures were taken to ensure quality:

- ✓ Ensure that all questionnaires have been completed and the contents are valid and logical.
- ✓ Verify the answers by contacting 30% of the total sample.
- ✓ Analytic review on research database.

After data quality control all data was combined and refined into a research database.

1.2.2 Data collection of qualitative research

Focus group interviews were conducted among the target group population to provide additional clarifications to the collected data, including in-depth attitude analysis of household that planned to renovate and repair their homes.

The following topics were discussed during focus group interviews:

- Determine the citizen’s prioritization of the selected technical solutions.
- Determine the effects of factors such as outer appearance of the technical solutions, comfort, energy efficiency, proposed prices on the decision-making process.
- Clarify the main reason for low usage of electric heater and obstacles faced by households.
- Clarify the main reason for decreasing usage of smokeless stoves (project stoves)

Figure 6. Methods used in focus group interviews



Scope: Focus group interviews included 30 representatives from households from the two target districts. The representatives were balanced by gender by inviting both wives and husbands, who were key decision makers in the household. In order to have greater engagement, group interviews were held during the weekends and around the center of the target khoroo.

Figure 7. The focus group interview organized among households of target khoroo in Sukhbaatar district: 2019-02-16, Total participants: 13 people

Figure 8. The focus group interview organized among households of target khoroo in SonginoKhairkhan district: 2019-02-17, Total participants: 18 people



Organization: SOAP project's participants were involved in the focus group interviews as follows:

1. PIN: Gave a brief introduction about the SOAP project at the beginning of the interview, responded to some clarifications and asked some additional in-depth questions.
2. BEEC: Introduced the defined technical solutions with a presentation and an example model. Clarified questions regarding building material and insulation methods.
3. MIRIM Consultant: Organized and gave general direction during the focus group interviews.

After the initial focus group interview among target citizens from Sukhbaatar district, the member organizations met to further examine the progress and improve the following day's interview.

In addition to the two focus group interviews, additional notes and reports from FGDs, conducted by the concretum of project implementers between October and November of 2018, were analyzed and included in relevant sections of this report.

Under framework of KII conducted by the concretum of project implementers: KII conducted for the purpose of learning from key khoroo residents/members more about the socio-economic conditions, past and current experience with building solutions and projects. KIIs were organized in 11-17 October 2018 at the Songinokhairkhan (khoroo 9, 10, 16 and 28) and Sukhbaatar District (khoroo 12, 16 17, and 18), and 15 participants from khoroo governors, social workers, kheseg leader and representatives from the local community were involved.

Under framework of FGD conducted by the concretum of project implementers: FGD organized among targeted khoros for the purpose of identifying barriers, knowledge, attitude, and practices related to all aspects of the technical solutions of warming up house. FGDs conducted among 67 female and 60 male participants in different 16 groups at the selected khoros, Songinokhairhan and Sukhbaatar Districts.

1.2. Analysis

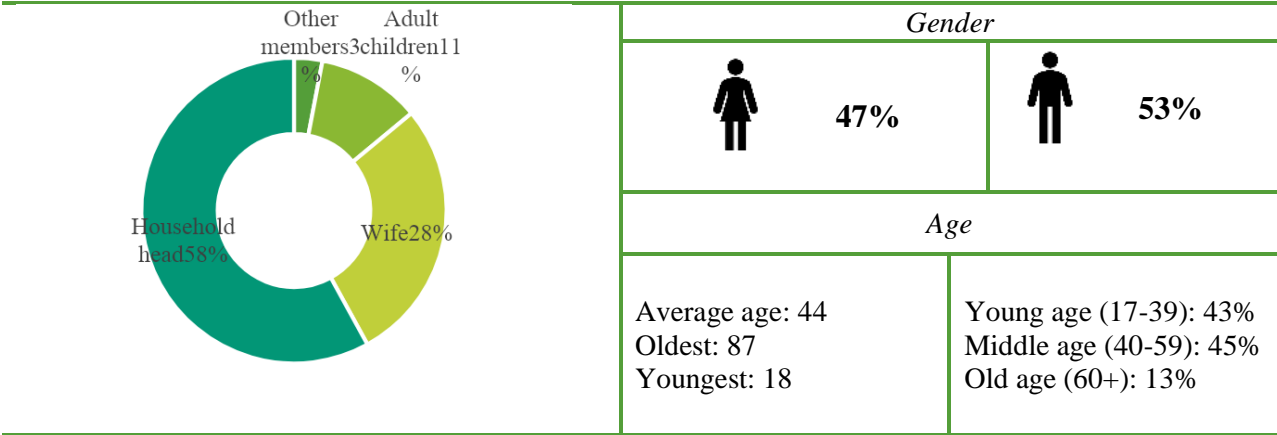
Qualitative data was processed using descriptive and correlation analysis methods. In doing so, we aimed to identify the differences among groups by analyzing households based on income and housing type, and interviewee based on their gender. For focus group interviews we grouped people based on their common characteristics and compared whether two districts had differing answers.

2. THE INFORMATION OF HOUSEHOLDS PARTICIPATING IN THE SURVEY

2.1. Interviewee information

Out of 416 total survey interviewees, 58% were household heads, 28% were wives, and 11% were adult children and the rest were other members of a household. Interviewees were 53% male and 47% female, while average age was 44, with the youngest being 18 and the oldest being 87 years old. By age group, 43% of interviewees were between the ages 17 and 39, 45% were between 40 and 59, and 13% were over 60 years old.

Table 2. Demographic characteristics of the interviewees (n=416)



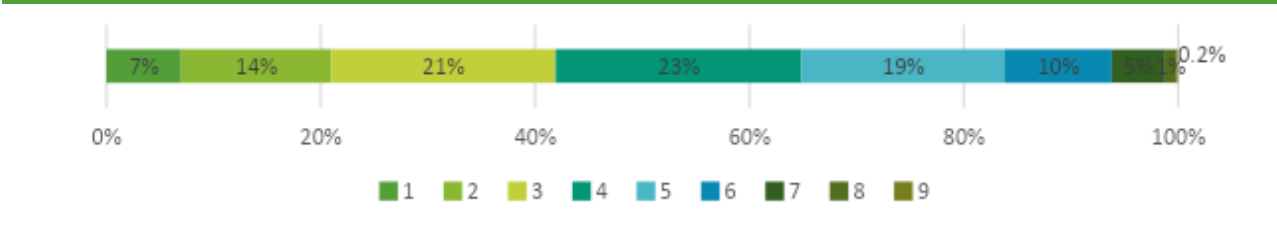
Source: Survey results

2.2. Household information

A total of 1618 members from 416 households participated in the survey, with an average household size being 4. 42% of households have 3 members, 23% have 4, 19% have 5 and the remaining 15% have between 6 and 9 members

From all households 604 were children, 159 were elderly and 26 were disabled people. Meaning, a household had an average of 1.5 children, 39% of households had an elderly person and 7% had a disabled family member. On the other hand, a single household had an average of 2 people⁹ able to work.

Figure 9. Segmentation by the number of family members (n=416)

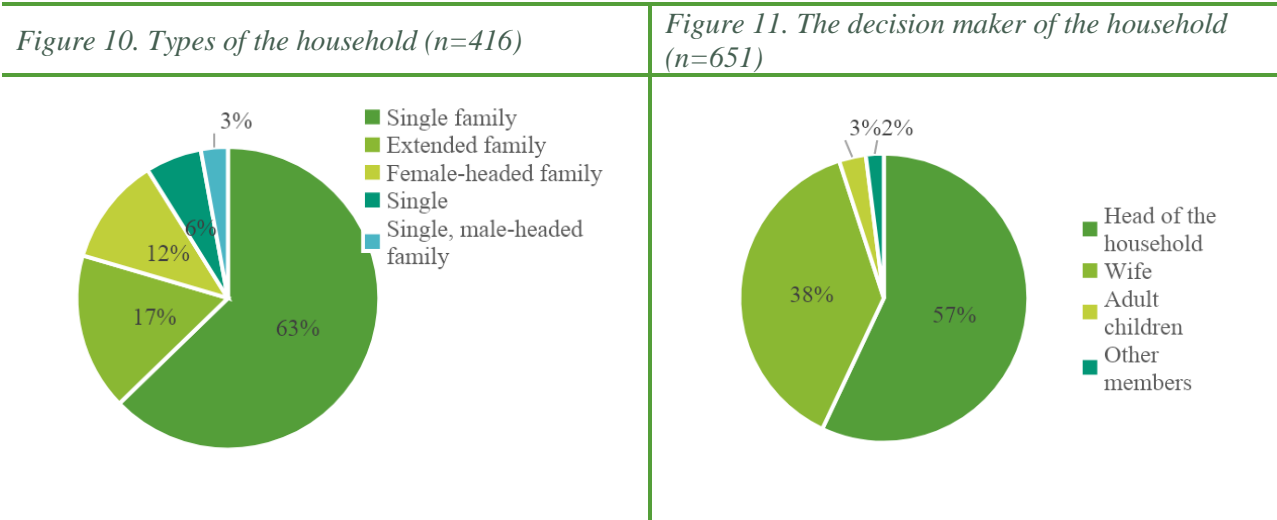


Source: Survey results

⁹ A total of 829 working age people.

According to the family type, 63% of all households were single families¹⁰, 17% were extended families¹¹, 6% were single, 11% were female headed households and 3% were single male-headed households. Meaning, 14% of all households were single men and women heading households, a group that has significant distinction from all other family types.

Out of all interviewed households, 651 people make decisions on important household purchases and investments. Of them, 57% are heads of household, 38% are wives, 3% are adult children, and the remaining 2% are other members. During the survey, it was observed that most household spouses discuss and make important family decisions with one another.





Source: Survey results

2.3.Social status of household members

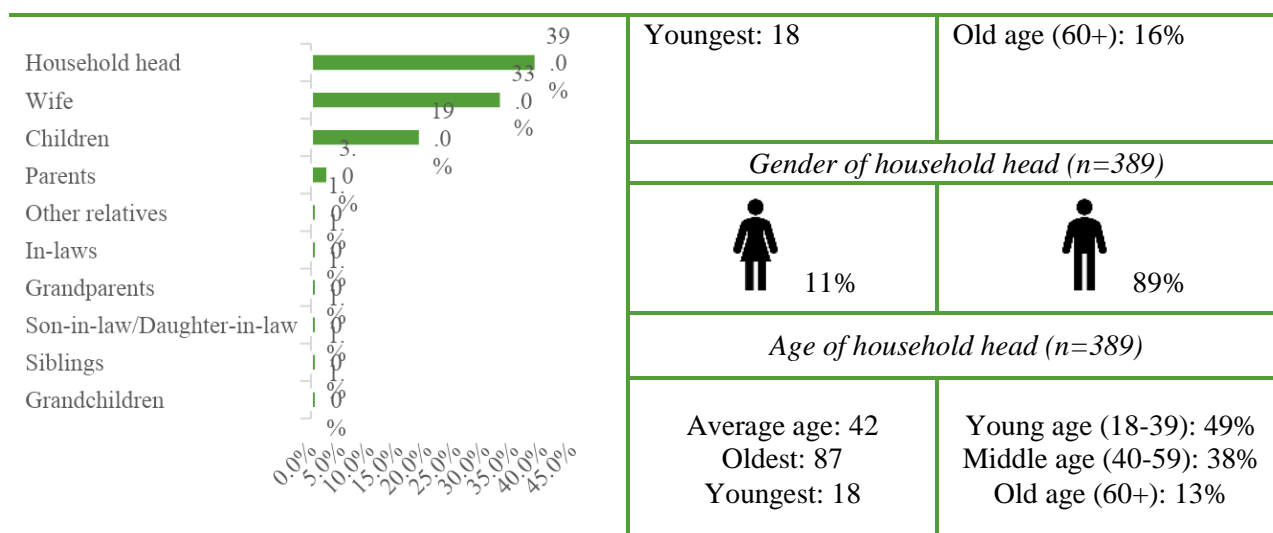
The survey collected social and income information of 1002 adult members from 416 households. Of these, 39% were household heads, 33% were wives, 19% were children, and the rest were other members. 53% were female and 47% were male. The average age of adults was 42 years old, with the youngest being 18 and the oldest being 87 years old. Out of all adults, 49% were between the ages 18 and 39, 38% were between the ages 40 and 59, and 13% were older than 60 years old.



Household heads were 89% male and 11% female. The average age of a household head was 46, with the oldest being 85 and the youngest being 18. Out of household heads, 34% were between the ages 18-39, 50% were between the ages 40 and 59, and 16% were older than 60 years old.

	<i>Gender of adults (n=1002)</i>	
	 53%	 47%
	<i>Age of adults (n=1002)</i>	
	Average age: 46 Oldest: 85	Young age (18-39): 34% Middle age (40-59): 50%

¹⁰ Family consisting of a wife, husband and children.

¹¹ Family consisting of a wife, husband, children, grandma, grandpa and other relatives



Youngest: 18		Old age (60+): 16%	
<i>Gender of household head (n=389)</i>			
 11%		 89%	
<i>Age of household head (n=389)</i>			
Average age: 42 Oldest: 87 Youngest: 18		Young age (18-39): 49% Middle age (40-59): 38% Old age (60+): 13%	

Source: Survey results

Out of all adults, 30% had higher education, 5% had technical and vocational education, 48% had secondary education, 6% had vocational secondary education, 9% had primary education, and 3% had no education.

Out of household heads, 20% had higher education, 7% had technical and vocational education, and 66% had secondary and lower education. However, 7% had no education and had an average age of 50. Household heads have a lower education level¹² than all adults in Ulaanbaatar, with majority of household heads having a secondary education. Comparing the education level of household heads to the income class shows direct relation to the level of living standards. Meaning, the lower the education level of the household head the lower the household's income, while household heads with higher education had higher income (*Figure 14*).

Figure 12. Education level of total adult members (n=1002)

Figure 13. Education level of the household head (n=389)

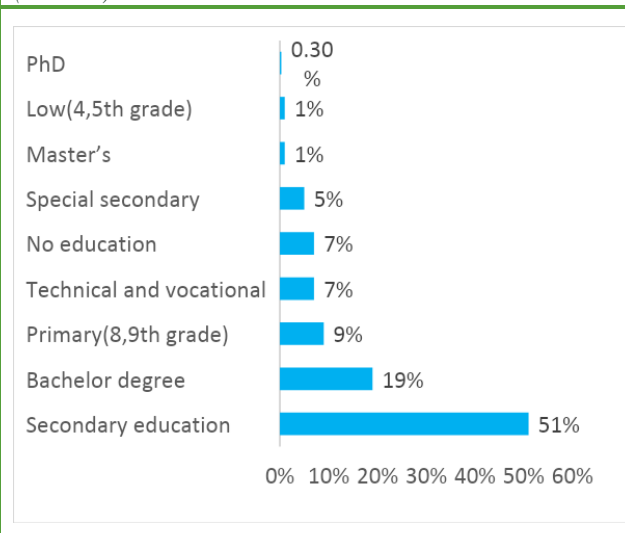
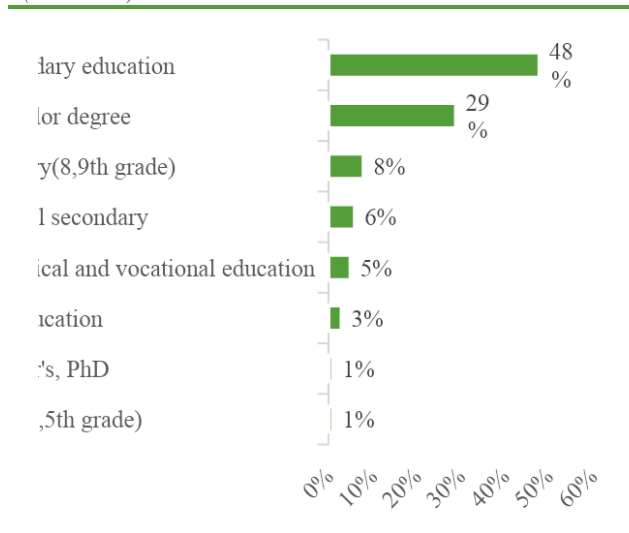


Figure 14. Education level of the head of household and household income type (n=389)

¹² 29.6% of total population of Ulaanbaatar have secondary education, 25.7% have higher education (Labor welfare service, 2013)



Source: Survey results

51% of all adult members work in the private sector, 15% work in a government organization, and 34% are currently not working. Of these, 16% are retired, 7% are students, and 6% are unemployed. While 33% of household heads are self-employed, 24% work in the private sector, 15% work in a government organization, 22% have pensions, part of group and 4% are unemployed.

Figure 15. Last 12 months employment status of total adult members (n=1002)

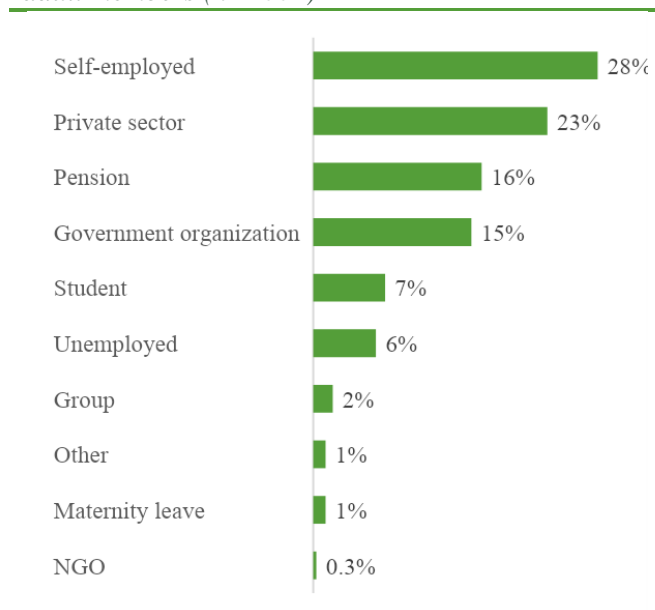
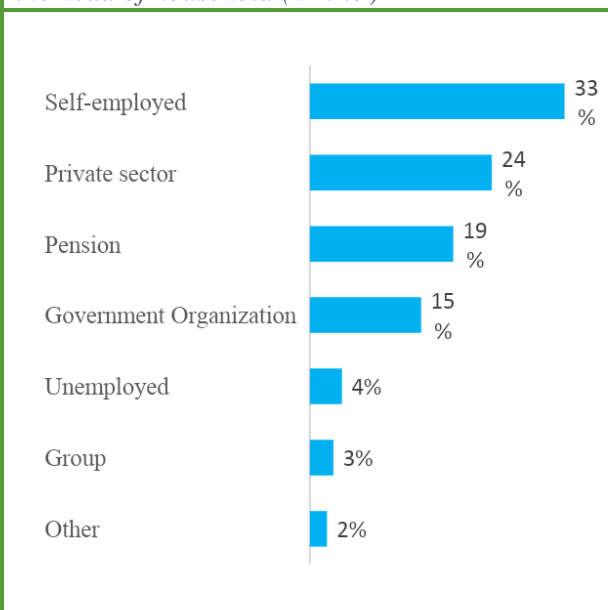


Figure 16. Last 12 months employment status of the head of household (n=389)



Source: Survey results

31% of all 662 employed adults work in the trade and service sector, 24% in construction, mining, production and energy sector, 13% in the education and medical sector, 9% in agriculture, defense, banking, communications sector, and the remaining 23% work in other sectors. Meanwhile, household heads work primarily in service, construction, mining, trade sector.

Figure 17. Employment industries of total adult members (n=662)

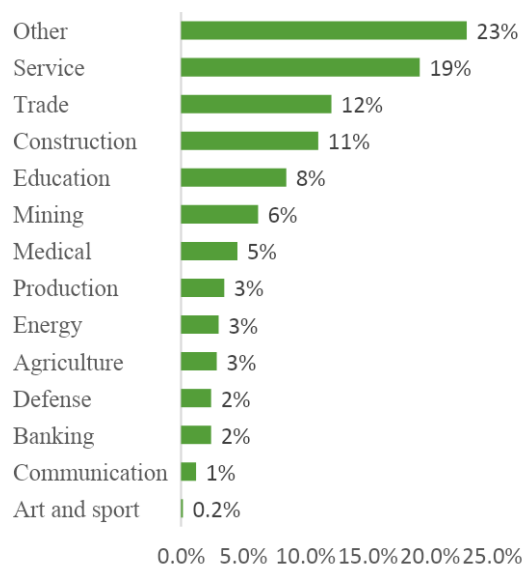
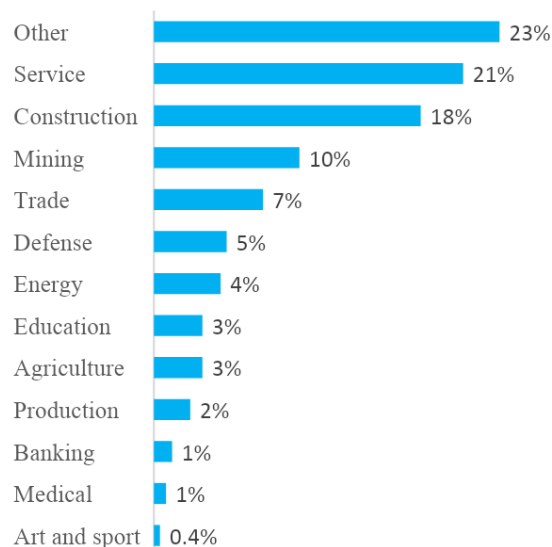


Figure 18. Employment industries of the head of household (n=389)

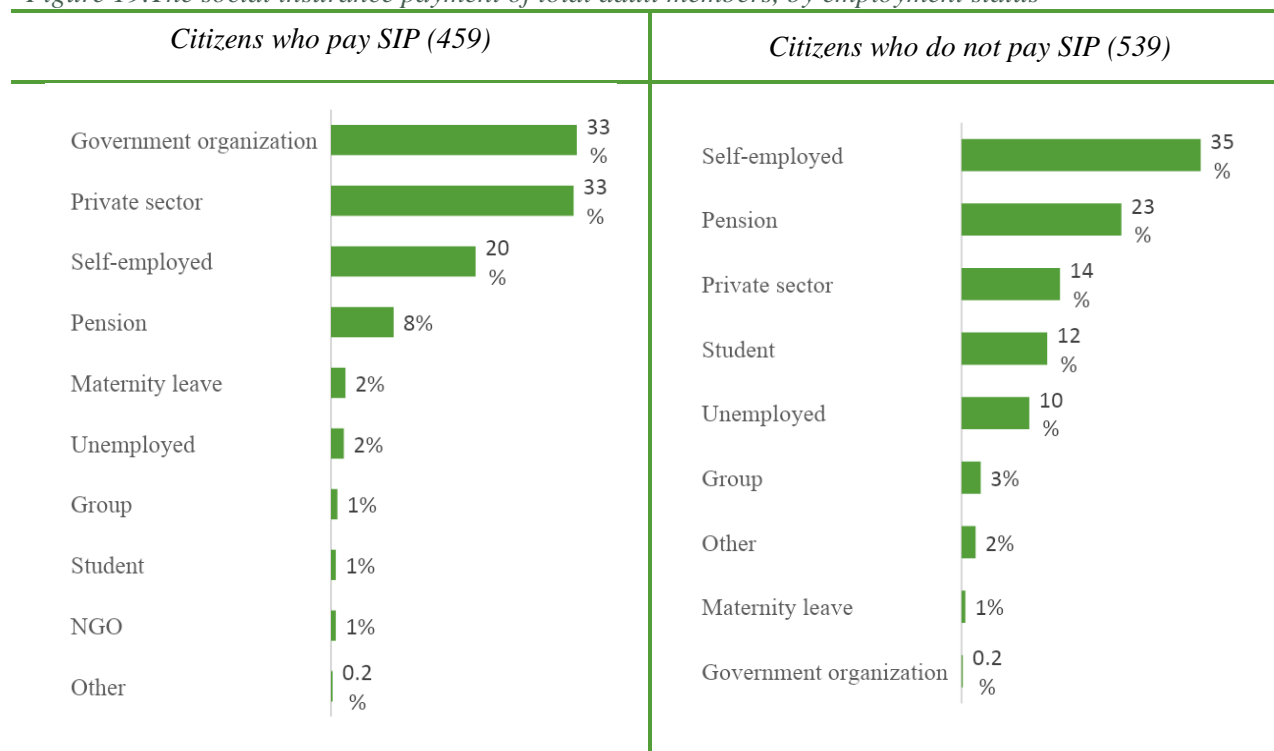


Source: Survey results

46% of all adults pay Social Insurance, while 54% do not. 66% of citizens that pay SIP work in a private or government organization, 20% are self-employed, and the remaining 14% currently do not work. While the 35% of citizens that do not pay SIP are self-employed, 14% work in a private organization, and 49% are currently unemployed.

On the other hand, members living in a government organization all pay SIP, 67% of members working a private organization pay SIP, and 40% of self-employed members pay SIP.

Figure 19. The social insurance payment of total adult members, by employment status



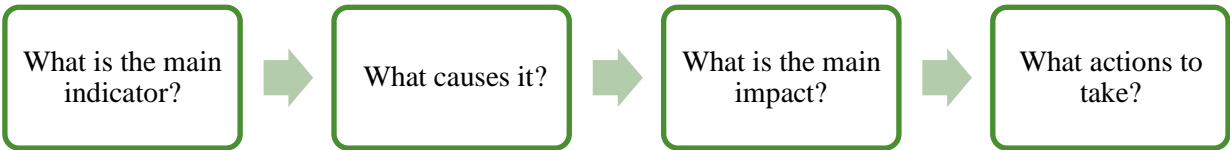
3. KNOWLEDGE AND ATTITUDE TOWARDS AIR POLLUTION AND HOUSE HEAT LOSS

In this chapter summarizes sample survey results and outcomes from focus group interviews organized by the SOAP project team on the knowledge and attitude towards air pollution and house heat loss.

3.1. Knowledge and attitude towards air pollution

The knowledge and attitude of households participated in our research towards air pollution has been measured within this scope.

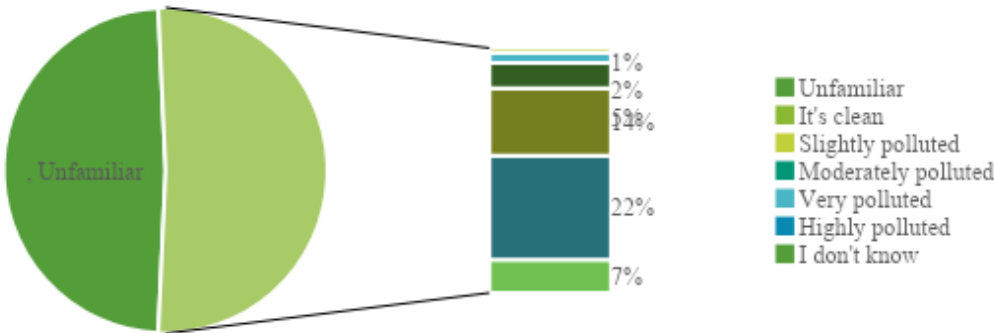
Figure 20. The scope of measuring air pollution knowledge



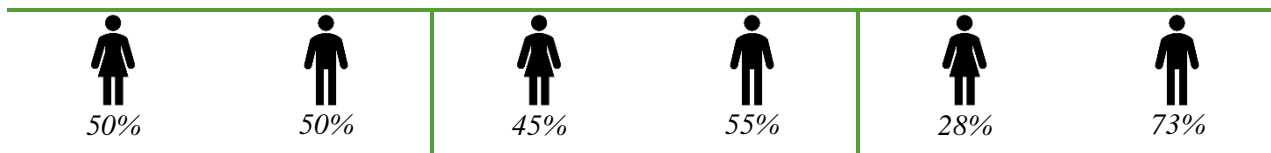
The basic knowledge about air quality indicators is poor. The main indicator of air quality in Ulaanbaatar city is air quality index (AQI). The purpose of AQI is to make air quality measures at a certain location understandable to the public, and there is a need for this indicator to penetrate everyday life of citizens same as the weather news. Specifically, all citizens have to habituate checking the air quality before going out for a walk or working for long hours outdoors.

Around 49% of the participants have never heard of AQI. Grouped by age and gender, these citizens have no understanding of AQI regardless of their age and gender. Whereas 51% of the participants have heard of the term AQI, however the majority of them have no basic knowledge on how to understand it. For example, when participants were asked to explain a color tag, only 5% of the participants answered correctly, most of which were men.

Figure 21. The understanding of AQI and its pink tag (n=416)



<i>Participants that are not familiar with AQI (n=202)</i>	<i>Participants that are familiar with AQI (n=214)</i>	<i>Participants that correctly defined the color tag (n=22)</i>
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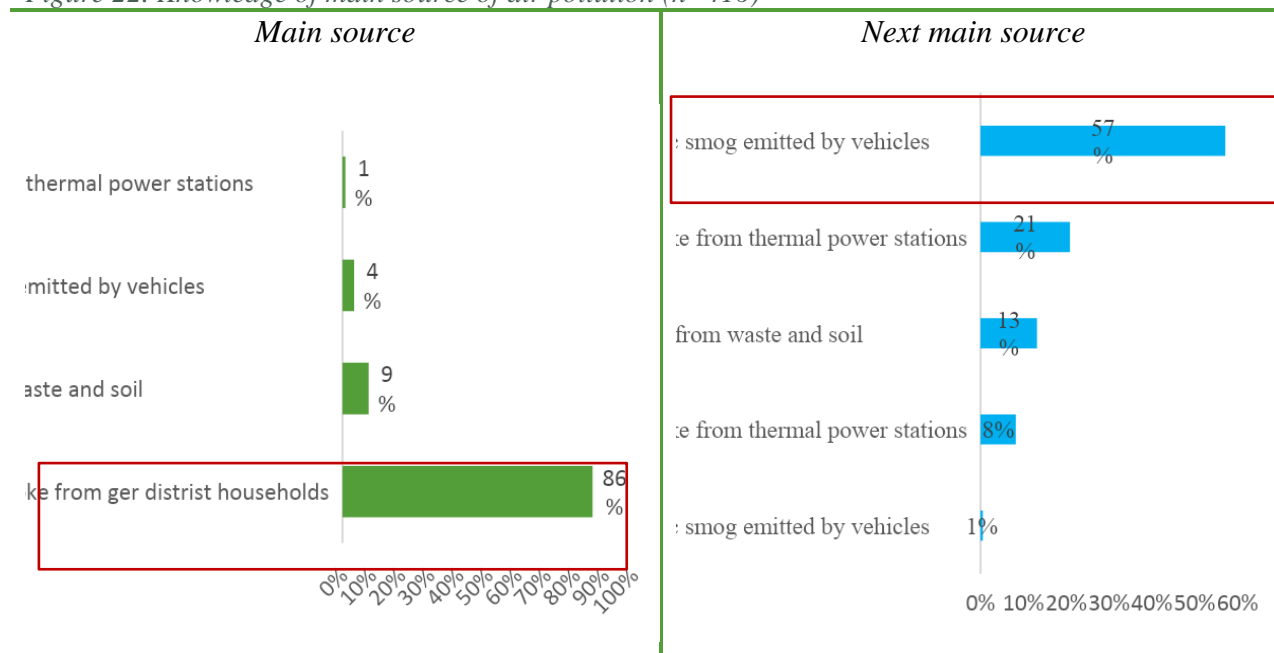


Source: Survey results

Knowledge about main sources of air pollution is sufficient. 80% of Ulaanbaatar city’s air pollution is caused by furnace smoke from ger district households, and 10% comes from vehicles smog, whereas 6% and 4% of it is produced by three thermal power stations’ annual coal consumption and soil pollution accordingly. (Zorig Foundation, Konrad Adenauer Stiftung, 2018).

86% of the participants named furnace smoke of ger district households to be the main source of air pollution in Ulaanbaatar, and more than half of the participants identified toxic smog emitted by vehicles as the next reason. These results were confirmed by focus group interviews. (Oct-Nov 2018 FGD).

Figure 22. Knowledge of main source of air pollution (n=416)



Source: Survey results

The basic knowledge about the impact of air pollution on health is sufficient. More than half of the participants wear masks to protect their health from air pollution. Air pollution has enormous effect on the internal organs of the human body such as respiratory system, nervous system, cardiovascular system and reproductive system. (NPHC, 2017). The most common diseases are respiratory system diseases, such as acute and chronic respiratory diseases.

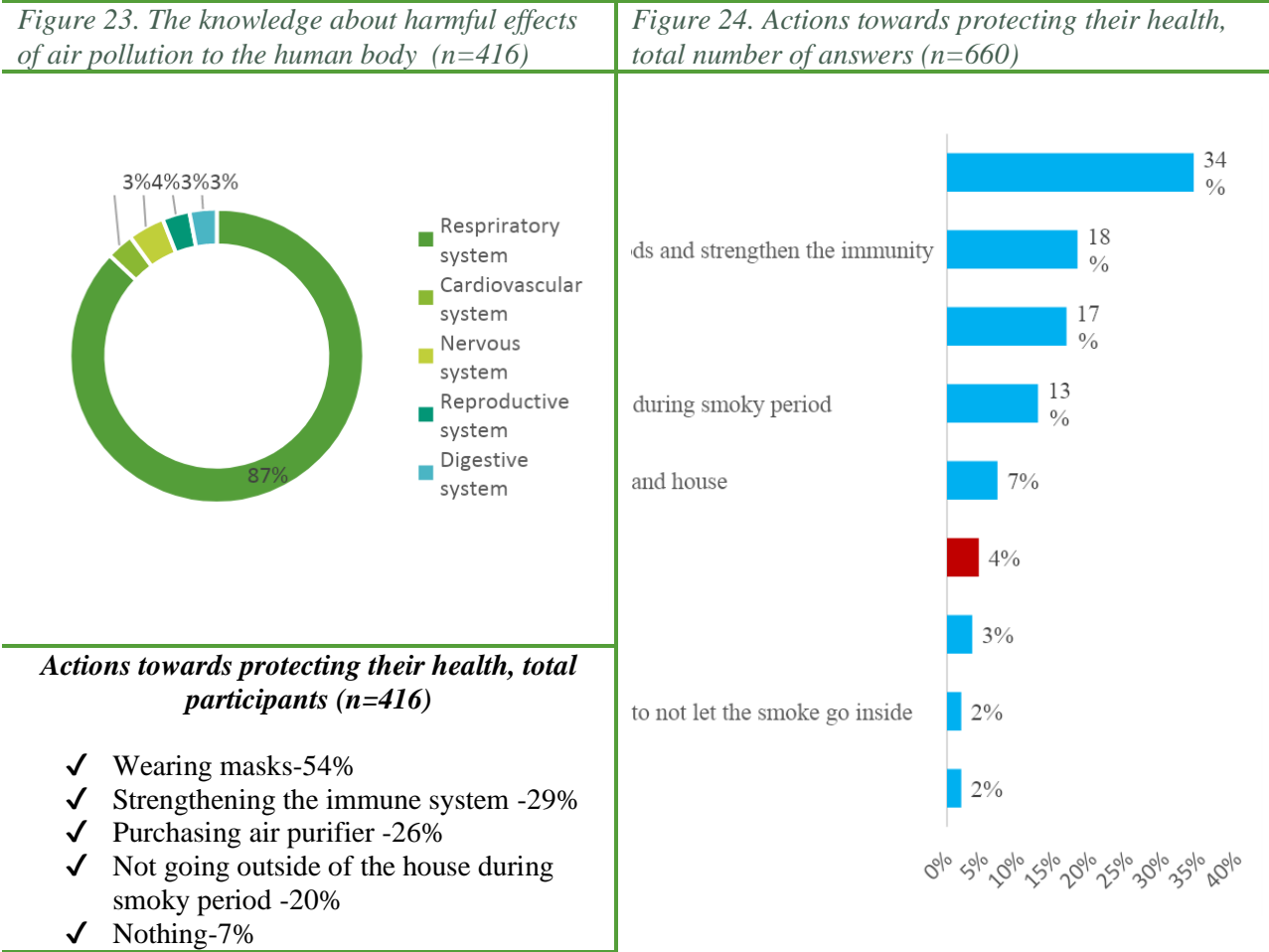
87% of the participants answered correctly by choosing respiratory system diseases as the most common negative impact of air pollution on health, whereas 10% of the participants named nervous, cardiovascular and reproductive system diseases. Although these are correct answers, they are lower in commonality. However, 3% of the participants incorrectly chose digestive system diseases.

Common methods of protecting themselves and their family from air pollution include wearing masks outside, strengthening their immune system, and purchasing air purifier for the house.

(Figure 24). 54% of the participants wore masks, 29% strengthened their immune system, 26% have purchased air purifier and 20% try not to go outside of the house during smoky period.

Excerpt. ... The smoke has increased noticeably due to the increasing number of households. Smoke settles to the bottom. There are places where the smoke settles at the bottom on the way to the kindergarten. Every evening I go home with food and medicine from pharmacy. It has toxic impact on children. And it's bad for fetuses; we pray to have healthy children. We drink juices extracted from natural berries. The actions we take to protect ourselves from smoke is not to open window during smoky period. It's especially dangerous when the chimney of downstairs household is close to the window of upstairs household. If the electricity prices were low, we wouldn't stoke the furnace and cause air pollution. (Citizen of 28th khoroo in Songinokhairhan district, 2018-10-31)

7% of the participants took no action towards protecting their health.

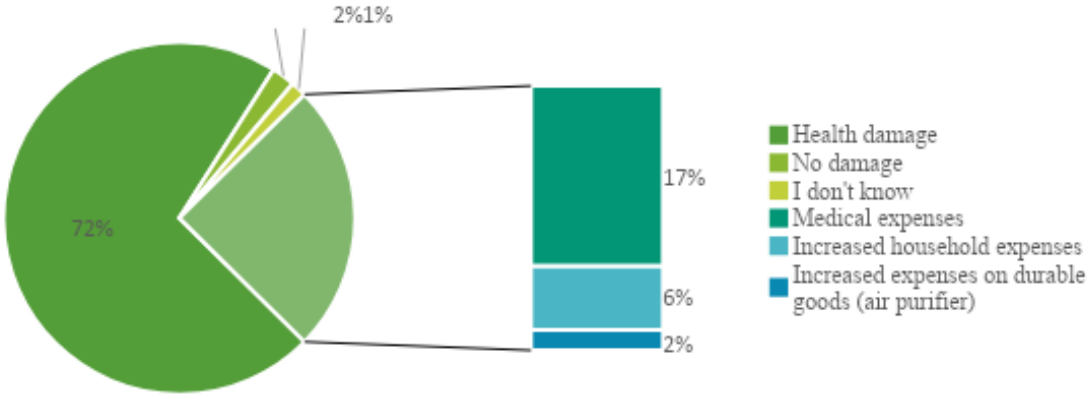


Source: Survey results

The main damage caused by air pollution to households is health issues. 72% of the participants identified health issues as the main negative impact, whereas 25% claim to suffer from financial disadvantages. Specifically, 17% out of them believe that health expenses have increased, while

8% say that expenses on price of durable goods to prevent from air pollution has increased. 2% of the participants answered that no harm was caused by air pollution, and 1% didn't have anything to say.

Figure 25. The damages caused by air pollution faced by households (n=416)



Source: Survey results

Ger district households' most suitable method for reducing air pollution is to use electric heater, insulate the house and decrease coal consumption. 37% of the participants believe that using electric heater is the optimal way of contributing to the decrease of air pollution, 36% think it is house insulation, whereas 14% named using processed fuel as a suitable contribution. (Figure 26). Although high percentage of the participants chose electric heater as an appropriate method, it was noted during focus group interviews that electric heaters burn the air, and have negative impact on lungs, and are not suitable for families with infants. (Oct – Nov 2018, FGD).

45% of the households that chose electric heaters had low income, and 55% had average to high income, whereas 54% of the households that chose the insulation and use of processed fuel had low income, and 46% had average to high income. Grouped by income levels, low-income households believe that insulation of the house, use of processed fuel or an electric heater are suitable for them, while average to high income households claim to contribute to the decrease of air pollution by using processed fuel and electric heater, planting trees in the yard and moving into apartments.

Figure 26 Ger district households' suitable methods to decrease air pollution (n=416)

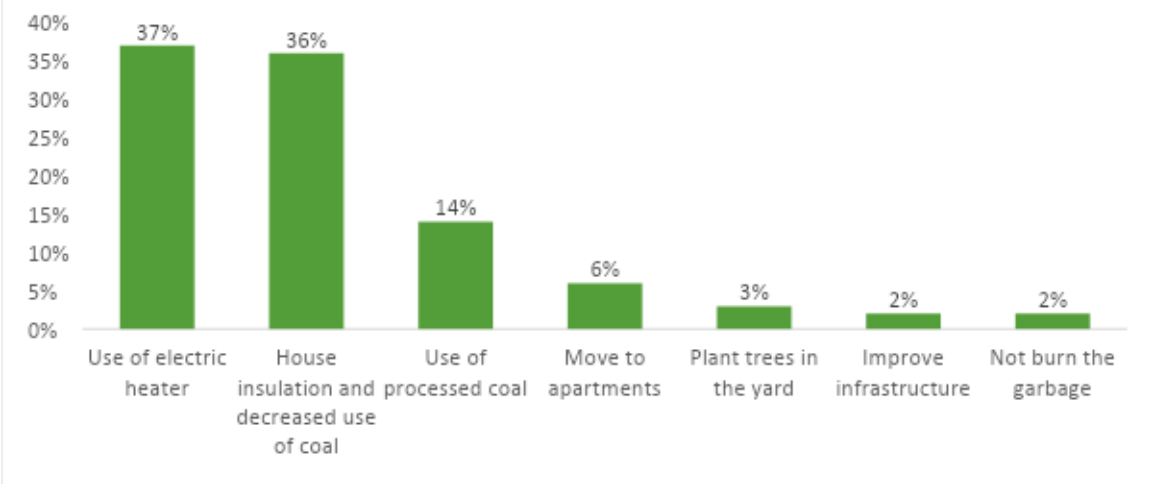
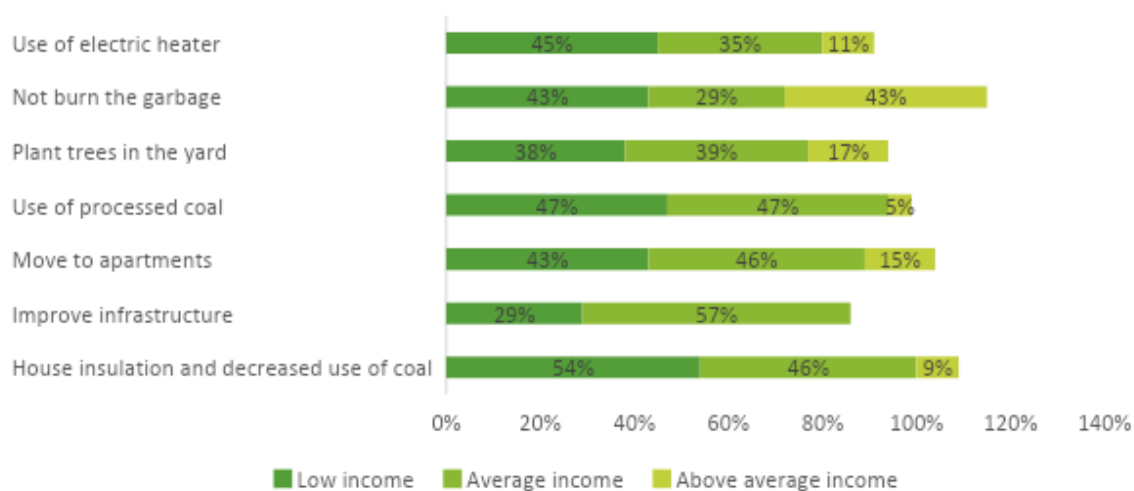


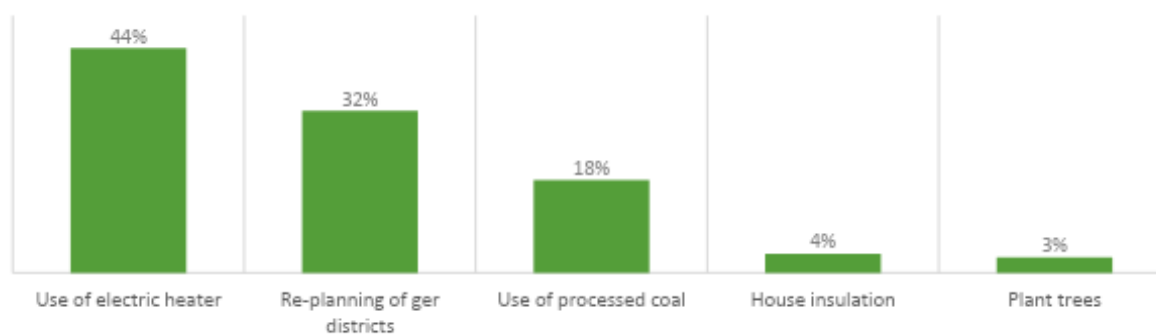
Figure 27 Ger district households' suitable methods to decrease air pollution and income type¹³ (n=416)



Source: Survey results

When asked about possible high priority actions the government, business entities and citizens could take in order to reduce air pollution the majority of the households answered that the use of electric heater and processed fuel is required from citizens, and the government has to support this consumption and re-planning Ger districts. The most suitable and affordable method for ger district households is to utilize electric heaters.

Figure 28. The most important actions to be taken towards air pollution reduction by ger district households (n=460 proposals)



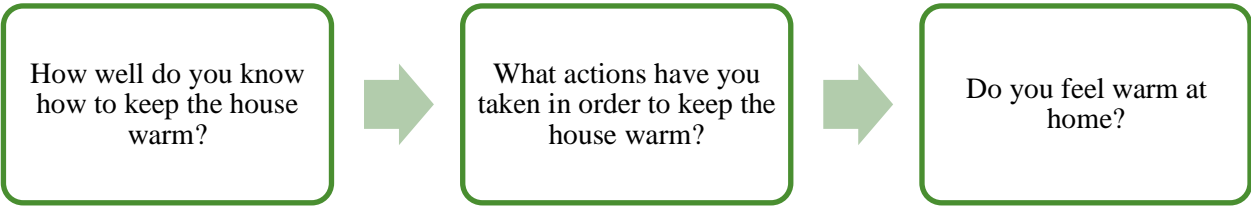
Source: Survey results

3.2. Knowledge and attitude towards heat loss

The knowledge and attitude of households participated in our research towards heat loss has been measured within this scope.

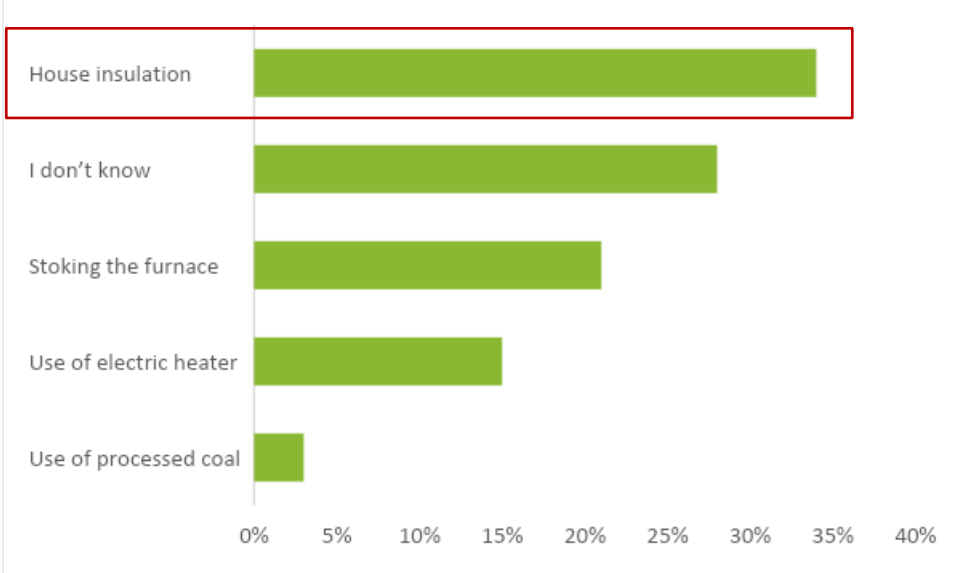
¹³ Household income classification is available on "Table 5. The classification of average household income".

Figure 29. The scope of measuring the knowledge about heat loss



The knowledge about keeping the house warm and reducing the heat loss is poor. We asked participants to answer with 2 possible actions to take in order to keep the house warm and overall 549 answers were given. 34% of these were the insulation of the house, 15% were the use of an electric heater, 3% were the use of processed fuel, whereas 28% of the answers were clueless and 21% preferred stoking the furnace. In other words, about half of the answers show ignorance about insulation of a house and fuel efficiency.

Figure 30. Actions towards keeping a house warm (n=549)



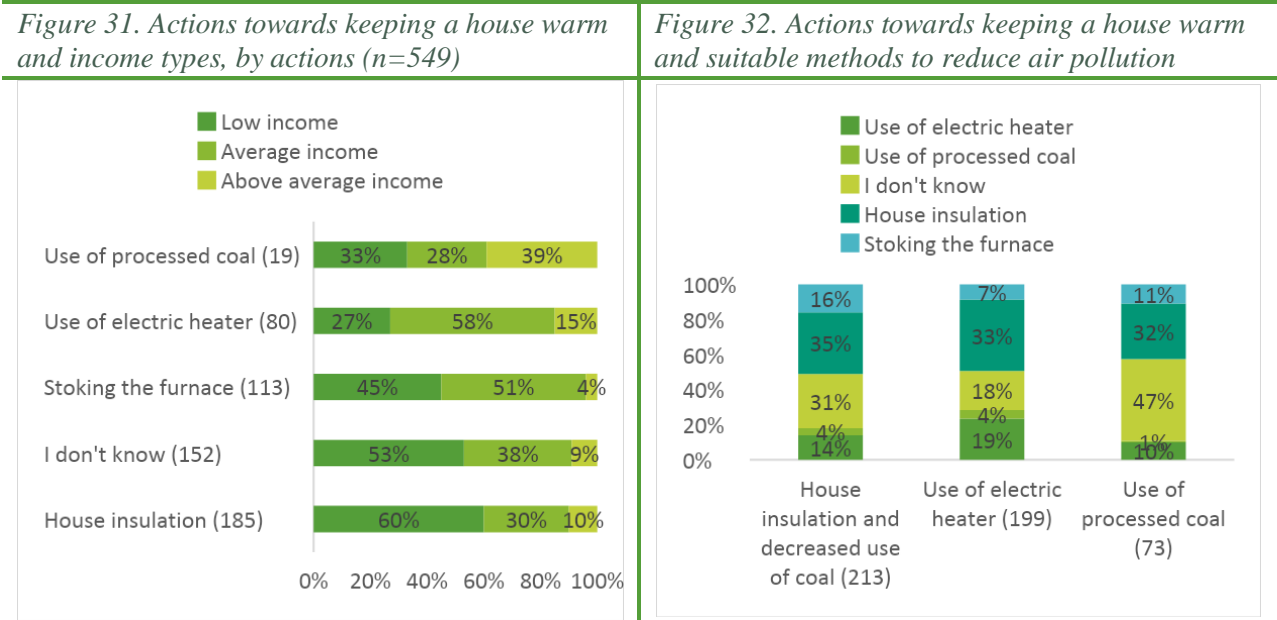
Source: Survey results

There is a slight difference in knowledge about house insulation and heat loss decrease between households depending on their income levels. 91% of the households that answered “I don’t know” in the question above, 96% of the households that answered “I’ll stoke the furnace” and 90% of the households that answered “I’ll insulate” were medium and low income households.¹⁴ 76% of the households that answered “I’ll use electric heater” in the question above and 67% of the households that answered “I’ll use processed fuel” were medium to high income households. (Figure 31).

The suitable actions to reduce air pollution, such as use of electric heater, insulation of the house and use of processed fuel were compared to the suitable actions for keeping the house warm. 47% of the participants who chose “insulation as an optimal way of reducing air pollution” gave different answers on keeping the house warm such as “I’ll stoke the furnace” (16%), “I don’t know” (31%), while only 35% chose insulation. And 45% of the participants who chose “use of

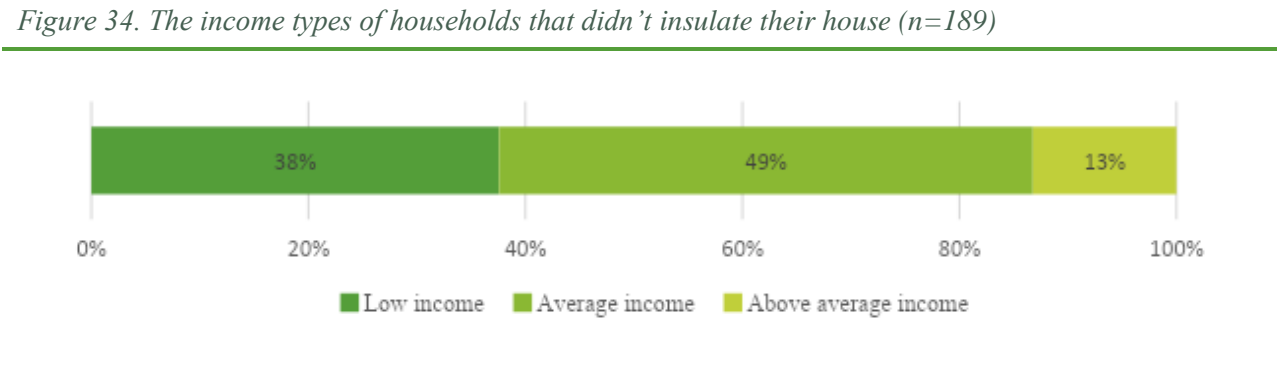
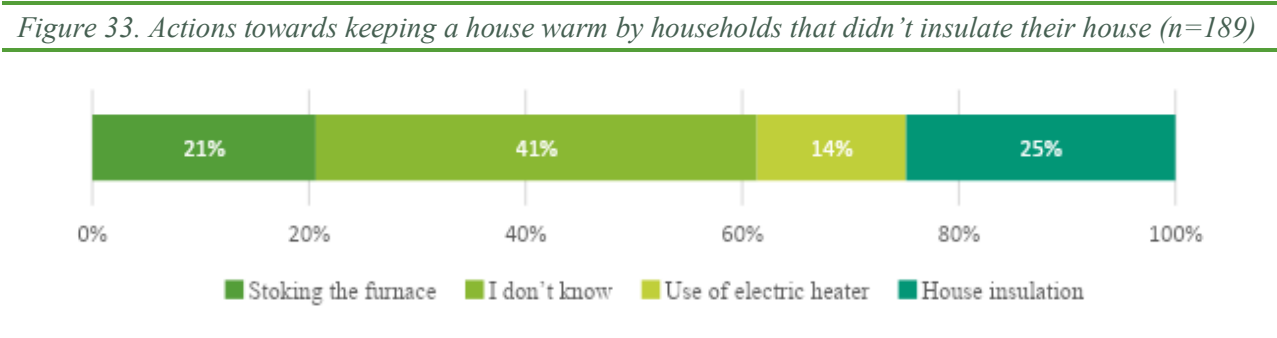
¹⁴ Household income classification is available on “Table 5. The classification of average household income”.

electric heater as a suitable method for reducing air pollution” answered that they will stoke the furnace (27%), they don’t know (18%), whereas 19% chose the electric heater and 33% - insulation. From this we can conclude that almost half of the participants didn’t support their initial answers.¹⁵ Therefore, almost half of the participants have no clear understanding about effect and relationship between house insulation, heat loss decrease and air pollution. (Figure 32).



Source: Survey results

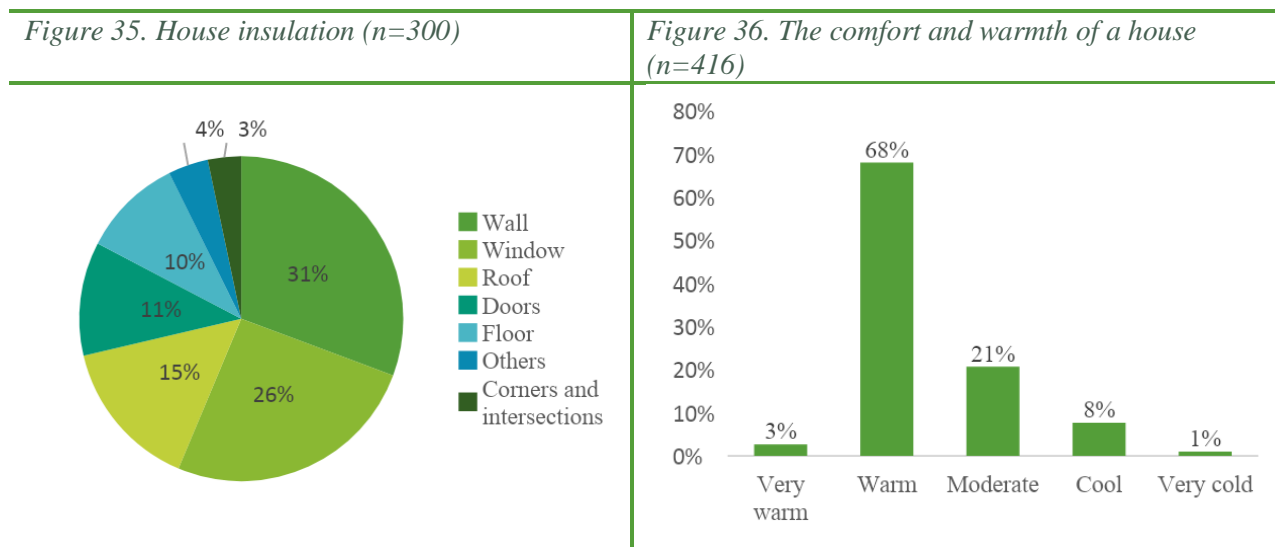
The tendency to keep the house warm and reduce the heat loss is not sufficient. The main factors affecting this are the lack of knowledge and insufficiency of income. Specifically, almost half of the participants (46%) have never insulated their houses before, of which 62% have no idea about insulation and 87% are medium to high income households.



¹⁵ The purpose of the question was the same but the formulation of the question was different.

The households that have insulated their houses mostly insulated the walls, window and the rooftop. 54% of the participants had insulated their houses before, and in total of 300 insulations have been recorded. (Figure 35).

The majority of the households are comfortable and warm at home in winter season. 71% of the participants claim to be warm at home, 21% - moderate and 9% are feeling cold at home.



Source: Survey results

Average coal consumption and average number of stoking has been calculated for every answer about the warmth of the house. Households¹⁶, which disclosed their coal consumption in months, answered “warm” on the question above and had high coal consumption, whereas households¹⁷, which disclosed their coal consumption in years, answered “very warm” and had even higher coal consumption, which leads us to believe that coal consumption is important for comfort and warmth at home. However, the average coal consumption of households that feel cold at home is still high.

On the other hand, when comparing the comfort and warmth of a house with number of stoking, it’s clear that when heat of the house decreases, the number of stoking increases. This means that households that are cold at home stoke the furnace multiple times a day, burning high amount of coal.

Table 4. The warmth of a house and average coal consumption, average number of stoking the furnace

The comfort and warmth of a house	Average coal consumption		Average number of stoking in winter season
	Monthly (bags)	Annual (tonn)	
Very warm	22	4.7	2.6
Warm	26	3.7	3.2
Moderate	22	3.8	3.7
Cold	22	4	4.2

¹⁶ 163 households

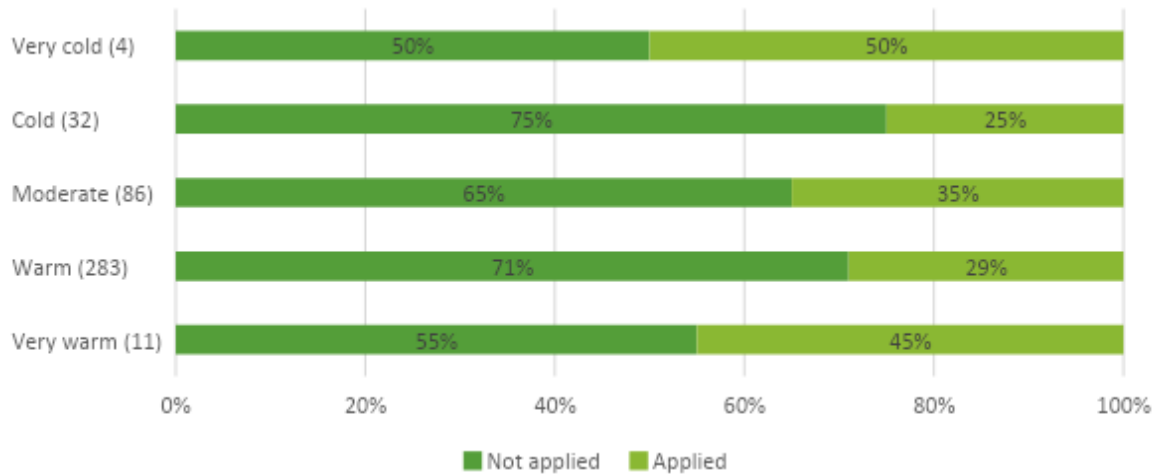
¹⁷ 237 households

Very cold	36	3.3	4.3
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Source: Survey results

When comparing the comfort and warmth of a house with house insulation, the majority of the participants haven't insulated their house. To be specific, 55% of households that answered "very warm", 71% of households that answered "warm", 65% of households that answered "moderate" haven't insulated the house. Therefore, it supports our previous conclusion that the comfort and warmth of a house depends on coal consumption.

Figure 37. Insulation of a house (n=300)



Source: Survey results

4. FINANCIAL CAPACITY OF A HOUSEHOLD

In this chapter income and expenses, savings and loans, assets and investment plans of the households that participated in our research has been overviewed.

4.1. Household income and expense

4.1.1 Household income

Average household income

Almost half of the participating households have monthly incomes lower than 700 thousand MNT and the average monthly income of target khoroo' households are lower than the average monthly income of total households in the capital. Participating households from Sukhbaatar districts have slightly higher income than those from Songinokhairkhan district.

Grouped by average monthly income, 26% of the households have incomes lower 500 thousand MNT, 22% have between 500-700 thousand MNT and 17% of them have incomes between 700-900 thousand MNT. 35% of the households receive 900 thousand MNT or higher as monthly income. The average monthly income of a household has been calculated as 840'000 MNT. (Figure 38).

When compared by districts, the income of participating households from Sukhbaatar district is slightly higher than those from Songinokhairkhan district. To be specific, the percentage of low-income households in Sukhbaatar district is lower, the percentage of average income households in Sukhbaatar district is higher and the percentage of high income households is similar. (Figure 38).

The research results have been compared to monetary income per household¹⁸ in the IV quarter of 2018, and we found that the percentage of households with incomes lower than 500 thousand MNT is higher by 14%, whereas the percentage of households with incomes around 500-700 thousand MNT is higher by 11%, and the percentage of households with incomes around 700-900 thousand MNT is higher by 3%, and, on the contrary, the percentage of households with incomes higher than 900 thousand MNT is lower by 31%. Moreover, average monthly monetary income per household in the capital is 1.3 million MNT, which is 460 thousand MNT higher than the average income of the households participating in the research. (Figure 38).

Further in the research households will be divided into following income classes and characteristics of those classes will be examined.

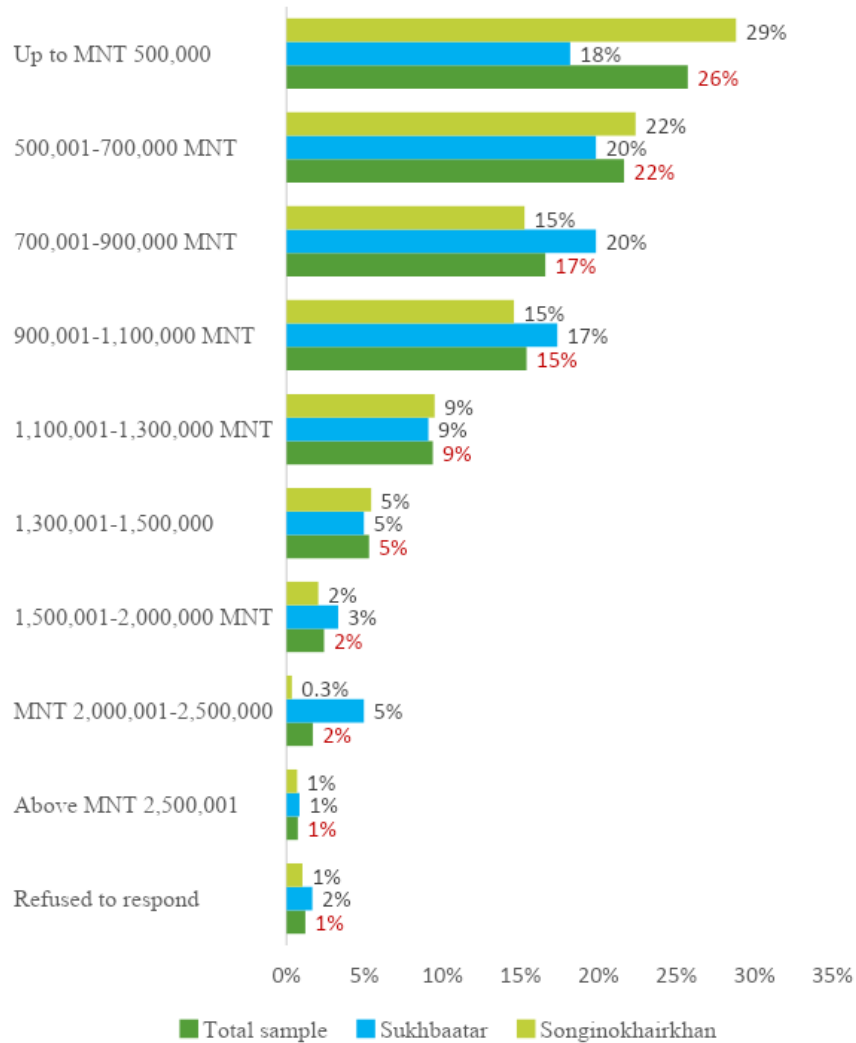
Table 5. The classification of average household income

Class name	Monthly income	Percentage of household¹⁹
Low income	Lower than 700,000 MNT	48%
Average income	700,001-1,300,000 MNT	42%
Above average income	Higher than 1,300,001 MNT	11%

¹⁸ NSO, www.1212.mn

¹⁹ Omitted 5 households that refused to disclose their average monthly income.

Figure 38. Grouping of average household income, total sample, by district



Grouping of average household income in the capital -2018.IV (NSO)
Lower than 500 thousand MNT
12%
500-700 thousand MNT
11%
700-900 thousand MNT
12%
Higher than 900 thousand MNT
65%
Average monthly monetary income per household in the capital
1.3 million MNT
Average monthly income of households participating in the sample research
840,000 MNT

Source: Survey results, NSO (www.1212.mn)

There were 14 households that are paid from foreign countries via money transfer, and 11 of them refused to disclose the amount. The remaining 3 households receive 1.2 million, 6 million and 500 thousand MNT per year.

The average household income has been compared to the number of employed members of the household, and the results are shown in the table below. On average, there are 1.7 employed people per household. There is positive relationship between average household income and the average number of employed members. Specifically, as the number of employed members rise, the household income increases as well.

Figure 39. The relationship between average household income and the number of employed members of a household

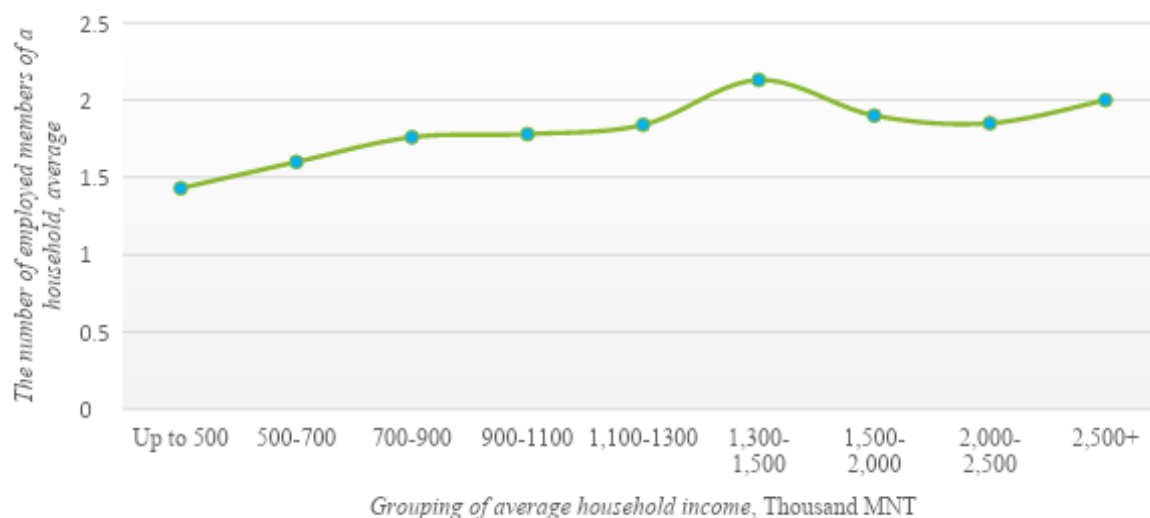


Table 6. Grouping of average household income and the number of employed members of a household

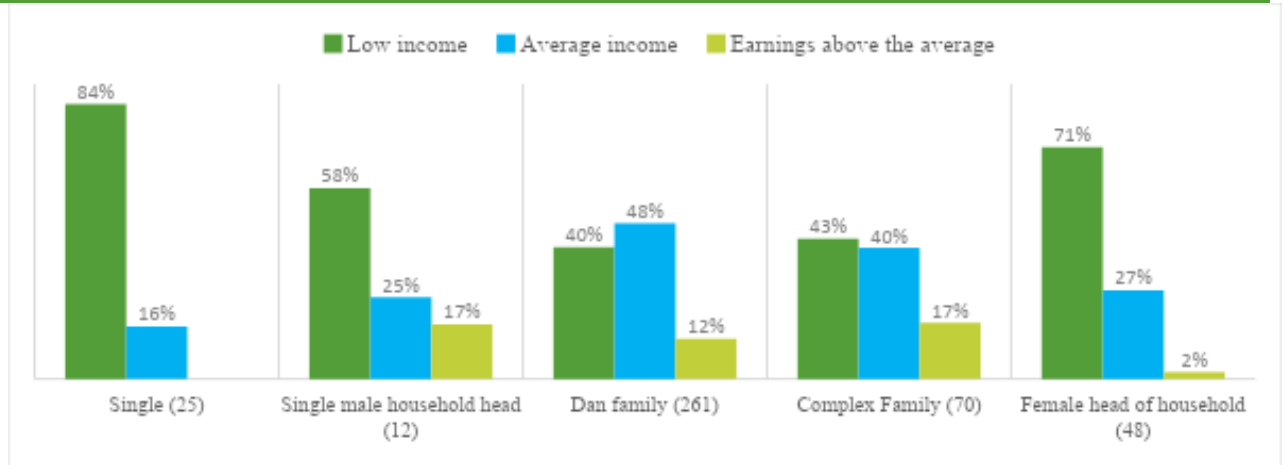
Grouping of average household income	The number of employed members of a household						Total	The average number of employed members
	0	1	2	3	4	5		
Lower than 500,000	17	38	43	7	1	1	107	1.43
500,001-700,000	9	32	36	12	1	-	90	1.6
700,001-900,000	8	13	38	8	1	1	69	1.7
900,001-1,100,000	9	14	28	8	5	-	64	1.78
1,100,001-1,300,000	4	7	21	6	0	1	39	1.84
1,300,001-1,500,000	2	3	10	4	3	-	22	2.13
1,500,001-2,000,000	2	1	4	2	1	-	10	1.9
2,000,001-2,500,000	-	3	2	2	-	-	7	1.85
Higher than 2,500,001	-	1	1	1	-	-	3	2
Refused to answer	-	1	2	1	1	-	5	2.4
Total	51	113	185	51	13	3	416	1.68

Source: Survey results

The majorities of single, female-headed households as well as single, male-headed households have low income. 84% of single people, 71% of female-headed households, 58% of single, male-headed households have low income. Whereas, most of single and extended families have average and above average income. (Figure 40).

For more than half of the households, the income is insufficient. 53% of the participants have evaluated their income as insufficient, 40% as moderate sufficiency and only 6% answer that they have sufficient income. (Figure 41).

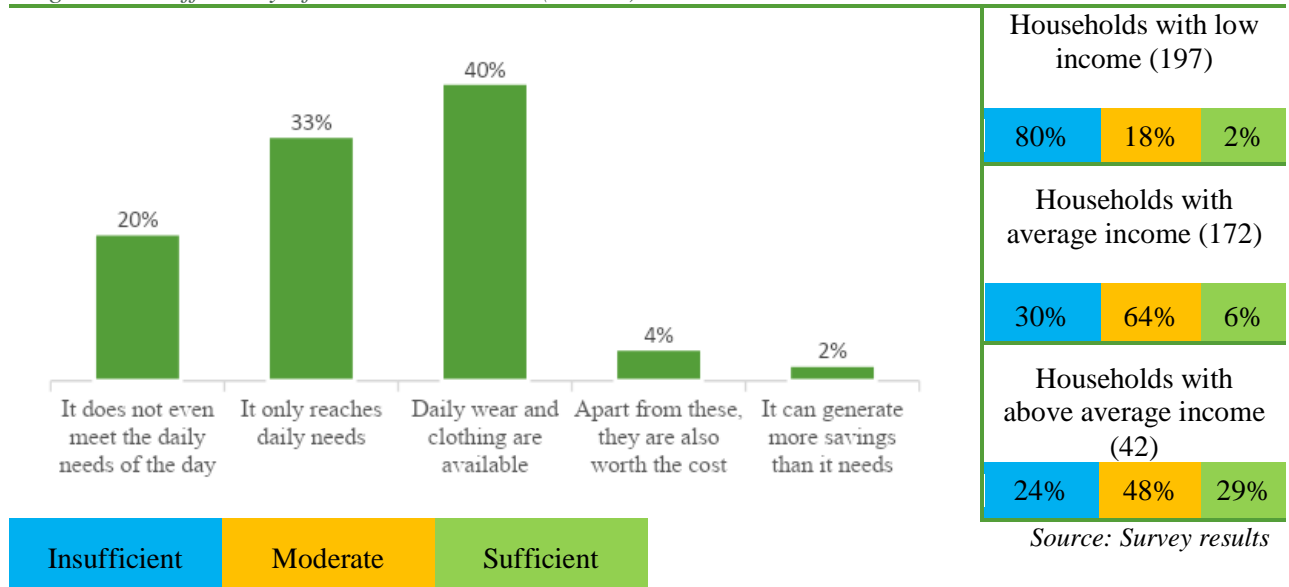
Figure 40. Income type of a household and type of family



Source: Survey results

We examined the income sufficiency by income class, and found that 80% of the households with low income, 30% of the households with average income and 24% of the households with above average income are not satisfied with their income. And 18% of the households with low income, 64% of the households with average income and 48% of the households with above average income claim that their income is enough to purchase everyday items and clothes. Whereas 2% of the households with low income, 6% of the households with average income and 29% of the households with above average income believe that their income is sufficient.

Figure 41. Sufficiency of household income (n=416)



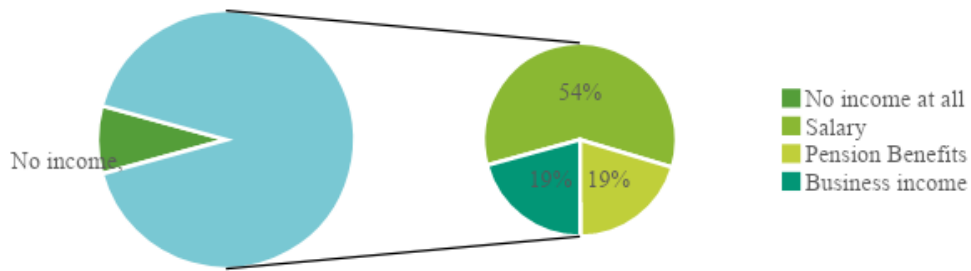
Source: Survey results

The income of adult members of a household

More than half of the adult members of a household have steady income, and one third of the households participated in the research have all of the members employed. Moreover, households with salary and pension income as well as households with salary and business incomes are the next big portions of the participants.

9% of adult members of a household have no income, whereas the rest 91% of them have at least one source of income. Of them 54% have salary income, 19% have pension income, and 19% have business income.

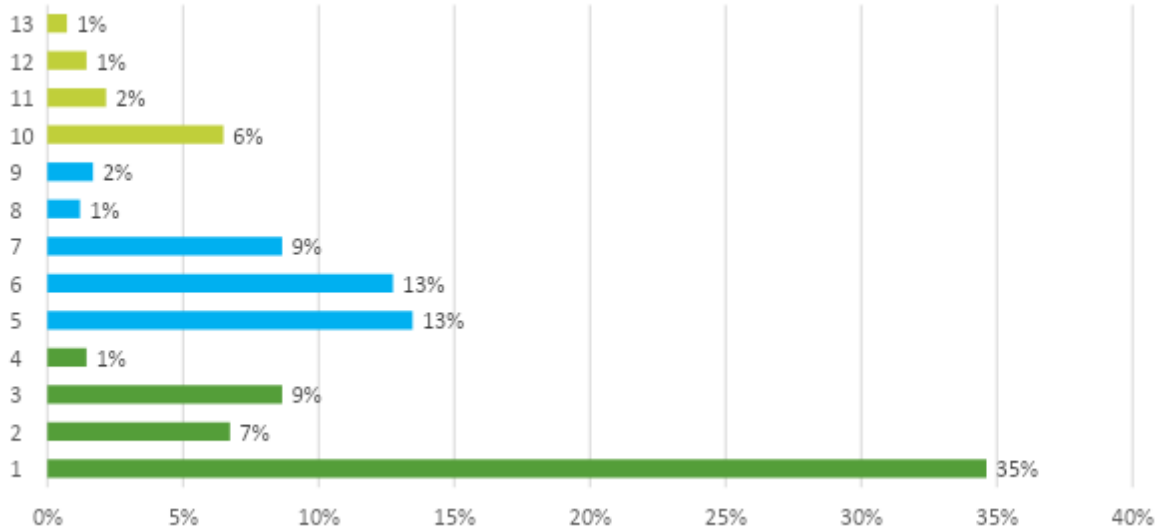
Figure 42. Income types of a adult members of a household (n=999)



Source: Survey results

Income types of households show that 51% of the households have one type of income, 38% have two types, and 11% have more than two types of income. All members have only salary income (35%), salary + pensions (13%), salary + with business income (13%), all members with business income (9%), salary + no income (9%) are common.

Figure 43. Type of household income (n=416)



Source: Survey results

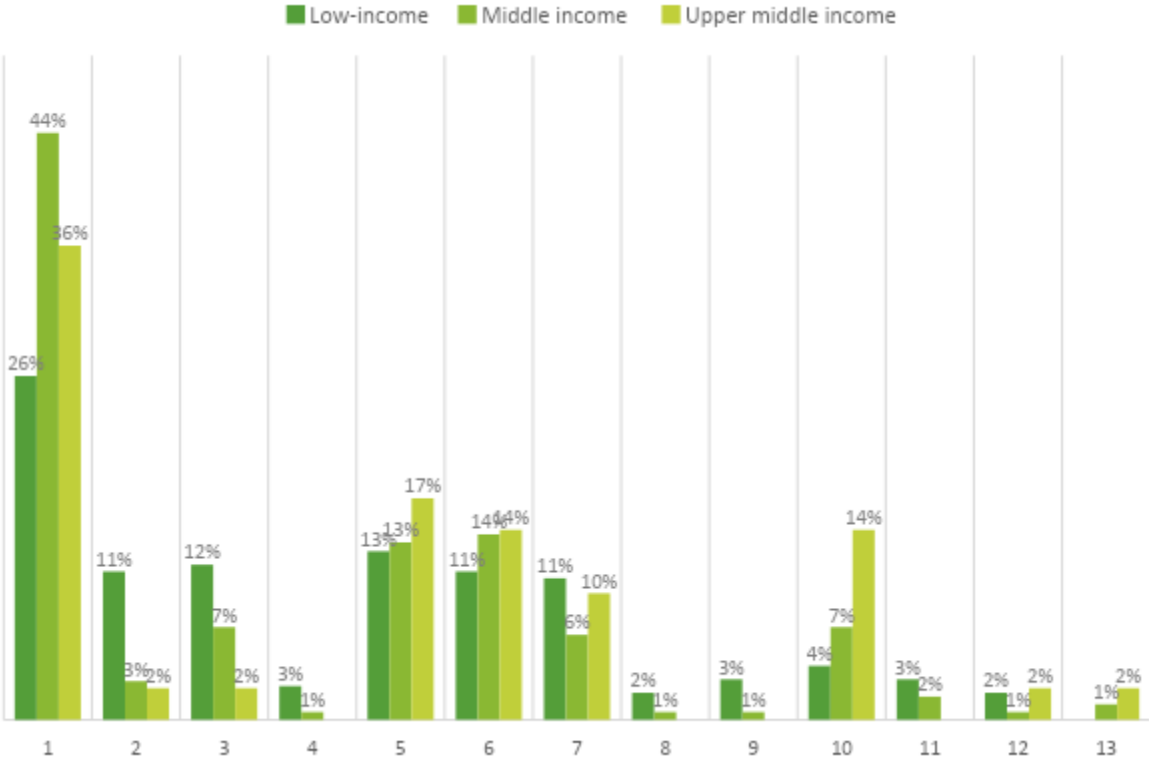
By income class, 51% of the low-income households have one source of income, and of them 26% have only salary income. 40% of the low-income households have two types of income, and in this category, households with salary and pension income, households with salary and business income, households with members having salary or no income are dominating. 9% of the low-income households have two and more sources of income.

55% of the average income households have one type of income and of them 44% have only salary income. 35% of the average income households have two sources of income, and households with salary and pension income, households with salary and business income are dominating. 10% of the average income households have two and more sources of income.

40% of the average income households have one type of income and of them 36% have only salary income. 40% of the average income households have two sources of income, and households with salary and pension income, households with salary and business income are dominating. 10% of

the average income households have two and more sources of income and the majority of them are households with salary, pension and business income.

Figure 44. Type of household income, by income type



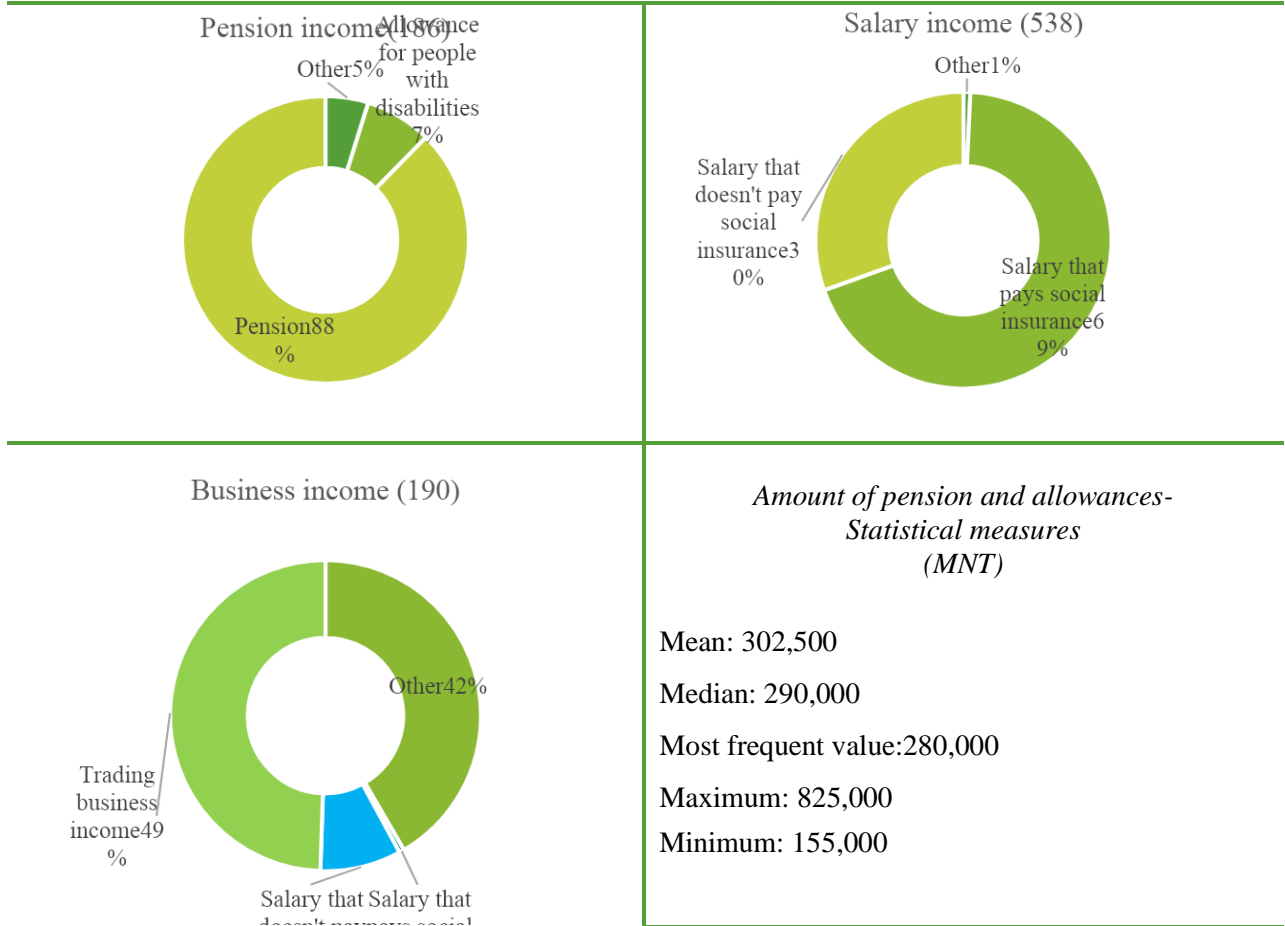
Source: Survey results

Most of the households with salary income have source of income that pays social insurance, and majority of the households with business income are operating in trading and other businesses. The households with pension income receive 302’500 MNT on average per month.

Grouped by the source of income, 69% of the salary income pays social insurance, 30% doesn’t pay social insurance, and 1% is other salary income. The main source of business income is trading business (49%) and other businesses (42%).

88% of the pension income is pension, 7% is allowance for people with disabilities, and 5% is other allowances. There were 186 people with pension income, of which 83% disclosed the amount of pension received while 17% refused to disclose the information. On average, monthly pension amount equals 302’500 MNT, at most 825’000 MNT and at least 155’000 MNT.

Figure 45. Income sources of household members, by income type



Source: Survey results

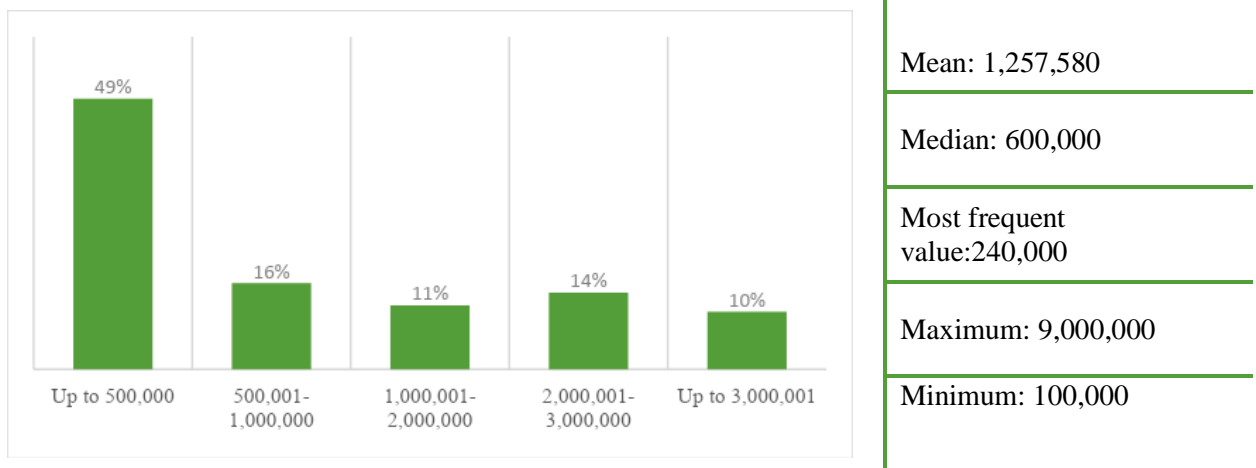
4.1.2 Household expenses

Household expenses are divided into education, tuition expenses, health expenses, and electricity expenses.

Education and tuition expenses

42% of the participants pay education and tuition expenses, and on average these households spend 1.2 million MNT a year on education. The households have spent at most 9 million MNT and at least 100 thousand MNT. And 49% of the households that pay for education spend 500 thousand MNT a year, 16% spend 500-1000 thousand MNT, 11% - 1-2 million MNT, and 24% spend more than 2 million a year on education.

Figure 46. Grouping of education and tuition expenses, by year (n=174)



Source: Survey results

When compared to household income classes, the results show that more than half of the households that don't spend on education are low income households, whereas more than half of the households that spend on education are average income households. If the households that spend on education were separated by income classes, around 60% of the households with low income, 70% of average income households and 55% of households with above average income spend less than 1 million MNT on education.

Figure 47. Whether education and tuition expenses are paid, by income type (n=416)

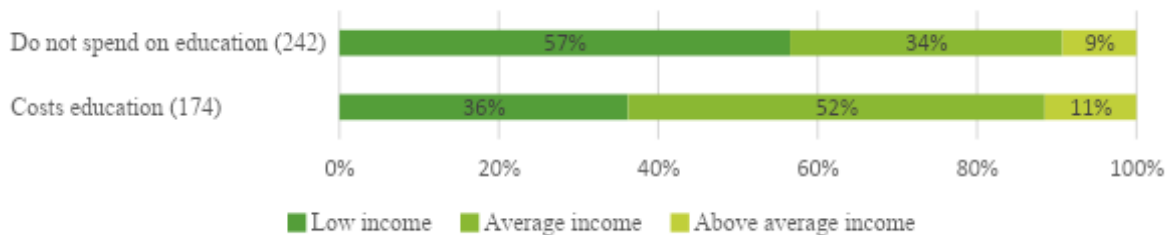
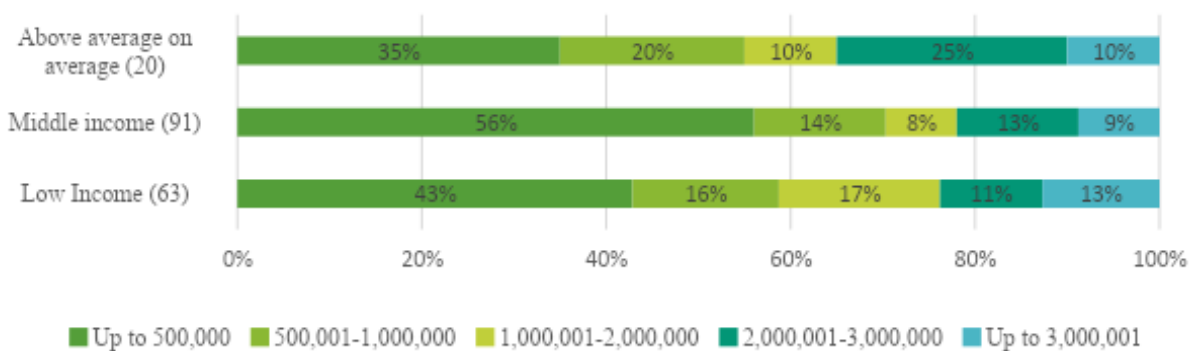


Figure 48. Grouping of education and tuition expenses, by income type (n=174)



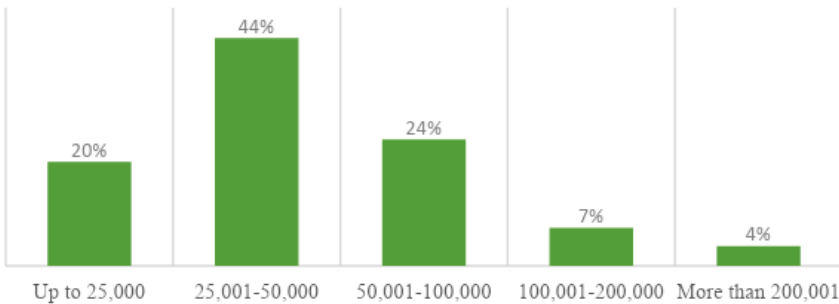
Source: Survey results

Medical expenses

94% of the households participated in the research have medical expenses, and on average these households spend around 63'400 MNT every month. At most they spend 350'000 MNT and at least 6'000 MNT has been spent on health a month. And 20% of the households that have medical expenses have spent less than 25 thousand MNT, 44% spend around 25-50 thousand MNT, 24% -

around 50-100 thousand MNT, 7% - around 100-200 thousand MNT and 4% spend more than 200 thousand MNT.

Figure 49. Monthly health expenses of a household, tugrik (n=392)

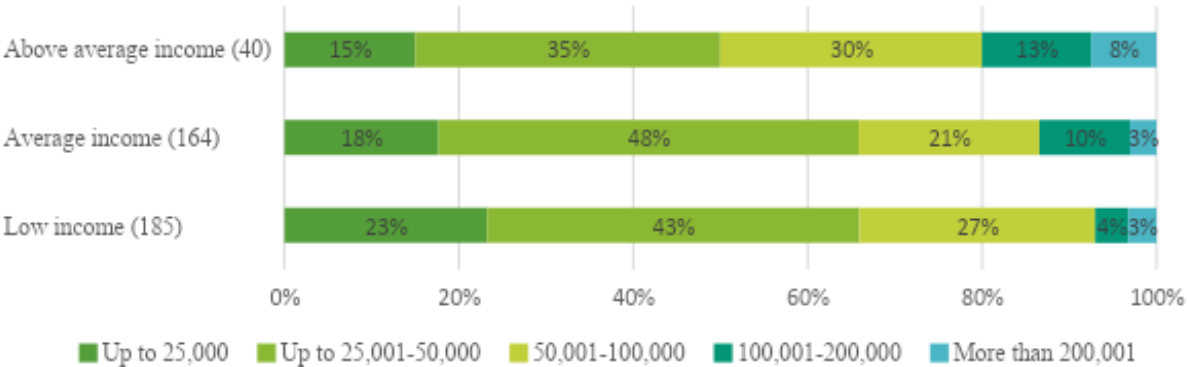


Mean: 63,406
Median: 41,600
Most frequent value: 30,000
Maximum: 350,000
Minimum: 6,000

Source: Survey results

When compared with income classes, the results show that low income households spend 53'370 a month on average, average income households spend 61'580 a month on health, and above average income households spend 76'200 a month. Two thirds of the households with low to average incomes, and the half of the above average income households spend less than 50'000 MNT on health a month. While 34% of the households with low to average incomes, and 51% of the above average income households monthly spend more than 50'000 MNT on health. From this we can conclude that there's almost no difference in medical expenses of low and average income households, whereas above average households spend on average 15'000-20'000 MNT higher than the previous two groups

Figure 50. Grouping of medical expenses, by income class (n=392)



Medical expenses (monthly)	Low income	Average income	Above average income
Mean (MNT)	54,370	61,580	76,220
Median (MNT)	40,000	40,000	50,000

Source: Survey results

92% of the participants are paying for respiratory disease expenses, and 24% - cardiovascular diseases. Medical services for respiratory diseases on average cost 37'125 MNT monthly per household, while cardiovascular diseases cost 27'660 a month. And 51% of the households that spend on respiratory diseases pay less than 20'000 MNT monthly, 35% pay around 20-50 thousand MNT, 10% - 50-100 thousand MNT and 5% spend more than 100 thousand MNT a month. About

58% of the households that spend on cardiovascular diseases pay less than 20'000 MNT monthly, 32% pay around 20-50 thousand MNT and 10% spend more than 50 thousand MNT a month.

Figure 51. Grouping of respiratory diseases' expenses (n=384) and statistical measures

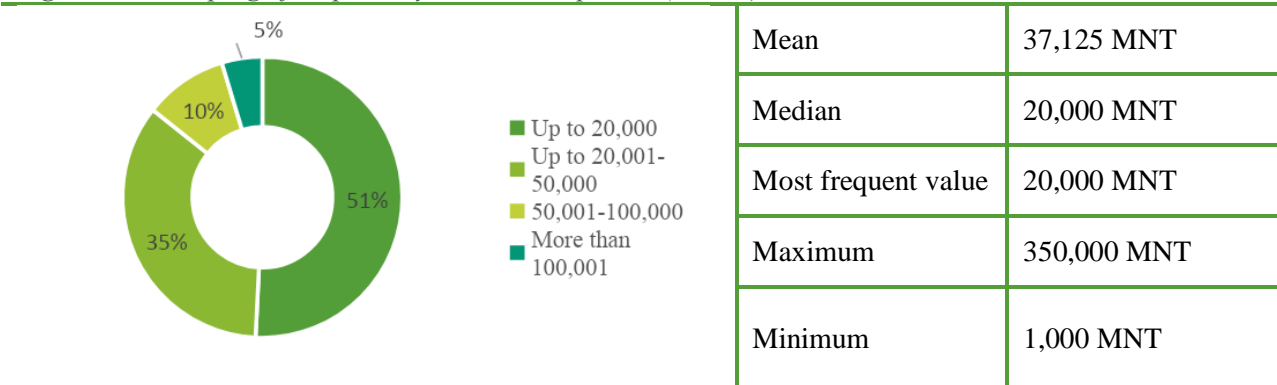
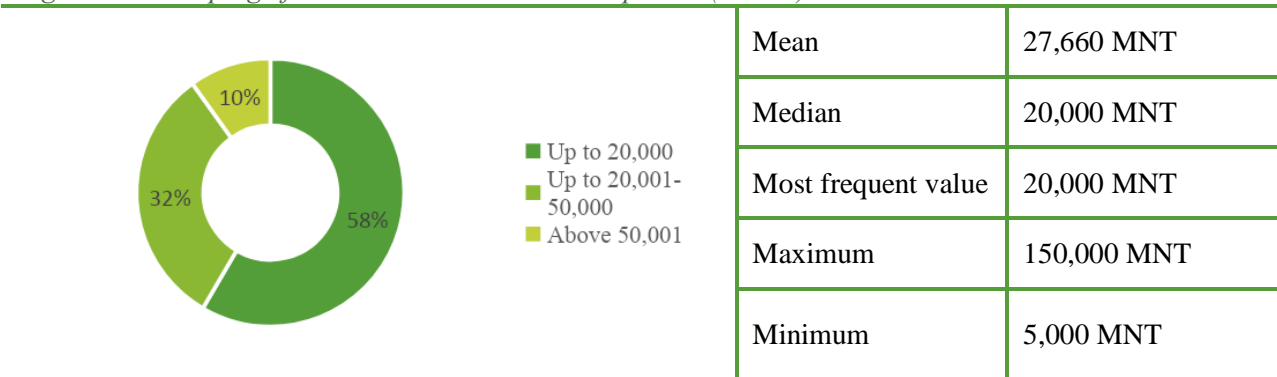


Figure 52. Grouping of cardiovascular diseases' expenses (n=101) and statistical measures



Source: Survey results

Firewood and coal expenses

The households participated in the research on average consume 69 bags of firewood and 4 tons of coal annually. In winter season they use up around 16 bags of firewood and 1 ton of coal monthly. These results are almost identical to results from HSES.

Table 7. Average consumption of firewood and coal of a household

	Monthly consumption				Annual consumption				Average price
	Me a n	Me dian	Maxi mum	Mini mum	Me an	Me dian	Maxi mum	Mini mum	
Firewood, cubic meter	1.5	1	3	1	3.1	4	6	1	36,000-45,000
Firewood, bag	16	12	60	4	69	72	120	15	3,000-4,500
Coal, ton	1	1	1.5	0.3	4	4	8	2	150,000
Coal, sack	20	24	36	8	72	60	120	24	3,000-4,000

Source: Survey results

36% of the households use coal from Baganuur, and 36% - from Nalaikh, and 24% don't know where the coal they use comes from, 1% - from Tavantolgoi, Alagtolgoi and the remaining 3% don't stoke the furnace with coal.

The monthly expense of the household on firewood and coal equals 57'340 MNT, whereas the annual amount of this expense is 214'996 MNT. As for the monthly consumption, 55% of the 235 households that have provided us with monthly consumption data spends less than 50 thousand MNT a month, and 45% of them spends around 50-200 thousand MNT monthly.

Figure 53. Monthly firewood expenses of a household (n=235²⁰) and statistical measures

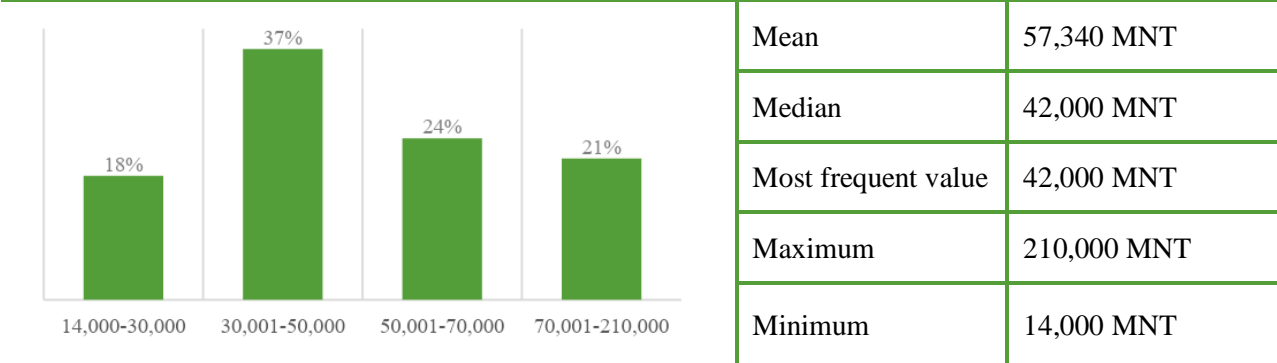
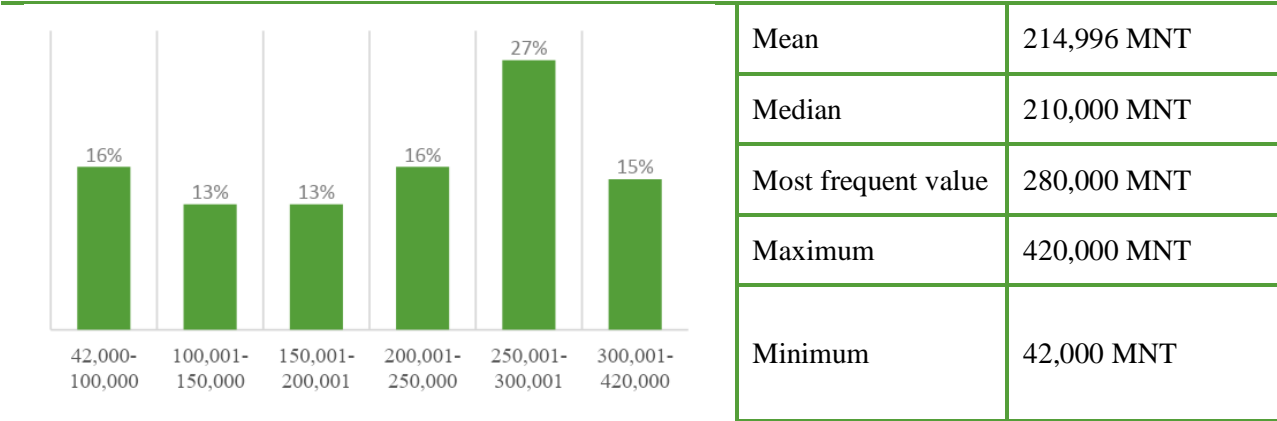


Figure 54. Annual firewood expenses of a household (n=159²¹) and statistical measures



Source: Survey results

As a result of monthly and annual coal expenses calculation, we found that a household on average spends around 88'950 MNT on coal²² monthly and 607,468 MNT annually. And 26% of 163 households that provided their monthly coal consumption data spend less than 75 thousand MNT, 24% spend 75-100 thousand MNT, and 50% of them pay 100-157 thousand MNT a month on coal.

The relationship²³ between monthly coal expenses and income classes is slightly positive, however has no significance statistically. Specifically, around 50% of every income class spends more than average coal expense. When coal consumption of the households that insulated their houses was compared to those who didn't insulated, monthly expense on coal was lower by 3 bags of coal.

²⁰ Data of the households that provided weekly and monthly data has been used.

²¹ Data of the households that provided annual data has been used.

²² In the coal price calculation, one bag of coal costs 3500 tugriks, one ton of coal cost 150'000.

²³ The correlation between monthly coal expenses and income classes is 0.049

Figure 55. Monthly coal expenses of a household (n=163²⁴) and statistical measures

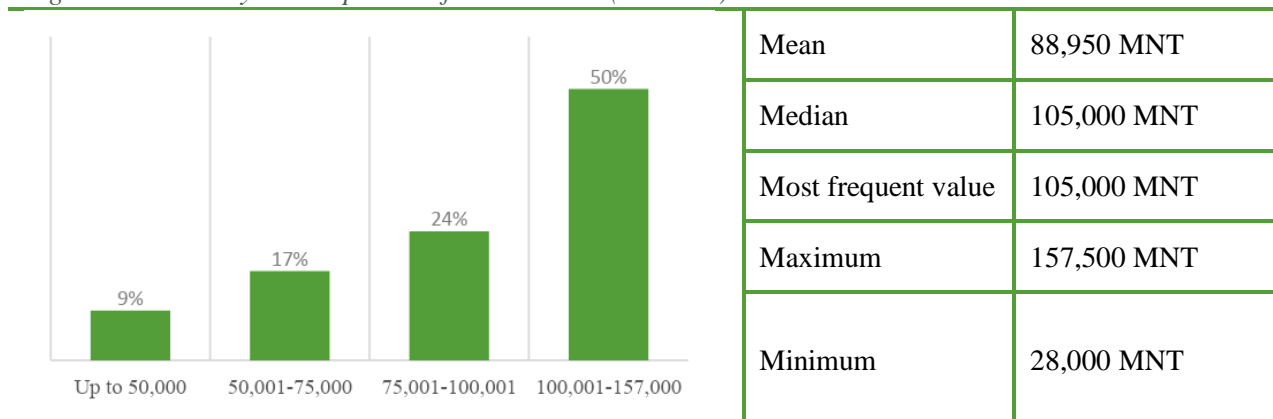
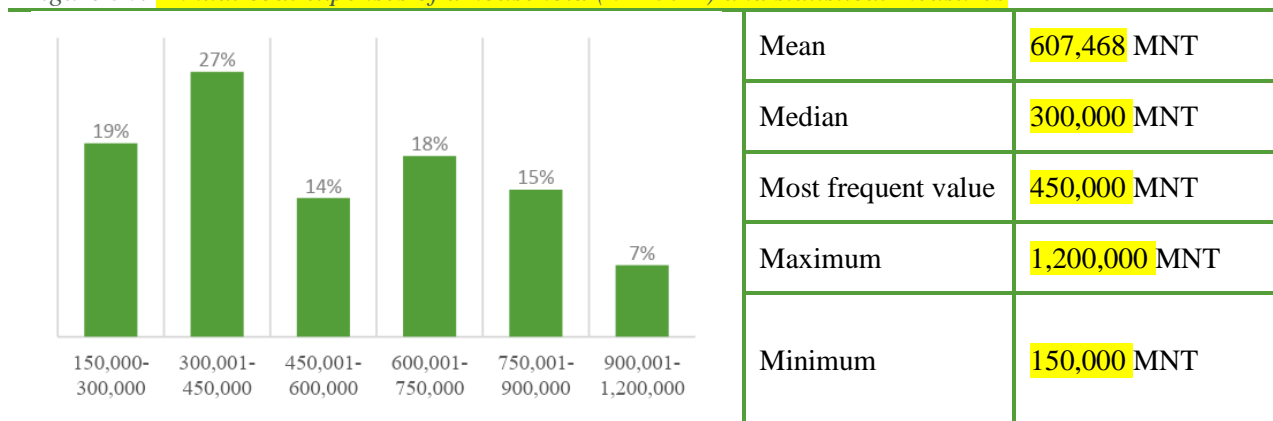


Figure 56. Annual coal expenses of a household (n=237²⁵) and statistical measures



Source: Survey results

Electricity expenses

During heating season, households spend around 52'900 MNT per month on electricity, whereas in non-heating season electricity costs 37'280 MNT a month. Regardless of season, most of the households pay 30'000 MNT. The fact that in heating season the households' electricity expenses rise by 10'000-15'000 MNT shows that the households from target khoroo utilizes electricity in heating their houses at some level. The majority of the households that use electricity in keeping their homes warm are average and above average income households.

The average monthly electricity expense of the households participating in the research in heating season²⁶ is 52'900 MNT, at most 350'000 MNT, at least 10'000 MNT. Whereas, in a non-heating season household spend 37'280 MNT a month on average, at most 120'000 MNT, at least 8'000 MNT.

The number of households that pay less than 25 thousand MNT on electricity in non-heating season is higher than the number of households that pay the same amount in heating season by 15%. The number of households that pay around 25-50 thousand MNT and 50-75 thousand MNT in heating season is higher than the households with the same amount of expense by 3% and 6% respectively.

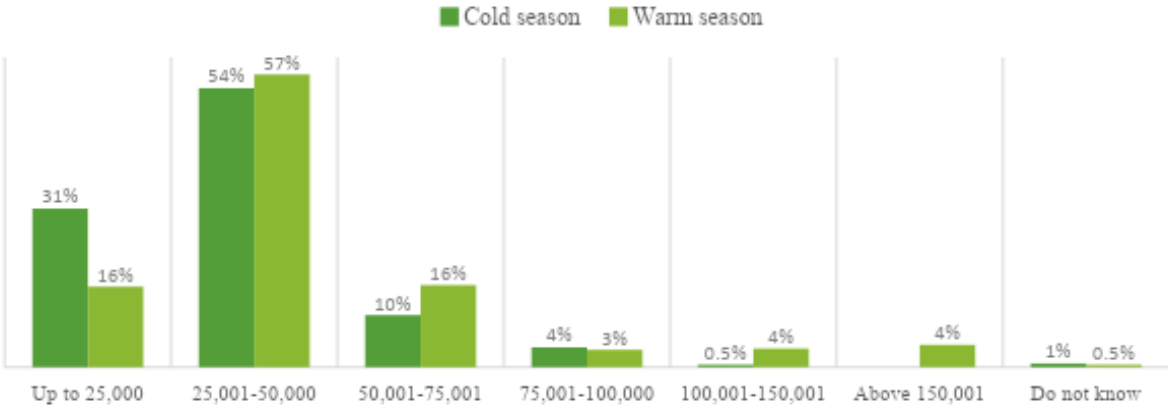
²⁴ Data of the households that provided weekly and monthly data has been used.

²⁵ Data of the households that provided annual data has been used.

²⁶ This applies to a period of time between mid-September and start of May.

Moreover, the result that 8% of the households spend more than 100'000 MNT shows that the households from target khoroo utilize electricity in heating their houses.

Figure 57. Grouping of electricity expenses, by heating and non-heating season (n=416)

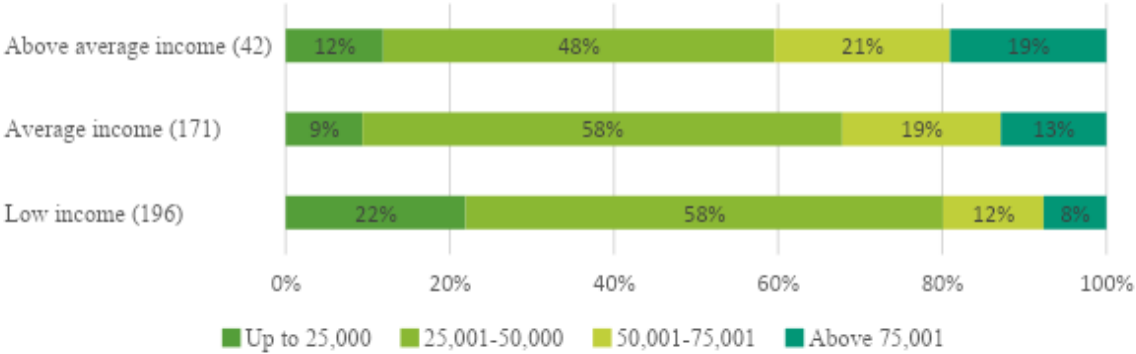


Monthly electricity expense	Heating season (MNT)	Non-heating season (MNT)
Mean	52,900	37,280
Median	40,000	30,000
Most frequent value	30,000	30,000
Maximum	450,000	120,000
Minimum	10,000	8,000

Source: Survey results

The results of comparing electricity expenses during heating season and income classes show that low income households spend 44'020 MNT a month on average, average income households spend 57'730 MNT and above average income households spend as much as 70'930 MNT monthly on electricity. Furthermore, 80% of low-income households, 67% of average income households and 60% of above average income households spend less than 50'000 MNT a month on electricity. Whereas 20% of low-income households, 33% of average income households and 40% of above average income households spend more than 50'000 MNT on electricity each month. From this we can conclude that the majority of the households that use electricity to keep their homes warm are the households with average and above average incomes.

Figure 58. Grouping of electricity expenses in heating season, by income type (n=392)



Monthly electricity expense	Low income	Average income	Above average income
Mean (MNT)	44,020	57,730	70,930
Median (MNT)	35,000	40,000	45,000

Source: Survey results

There is a negative relationship between electricity expense and coal consumption²⁷. To be specific, there is a slight decrease in electricity expense when coal consumption rises. The average electricity expense of a household that consumes less than 15 bags of coal a month is 59'470, the average electricity expense of a household that consumes around 16-30 bags of coal a month is 44'210, the average electricity expense of a household that consumes around 31-45 bags of coal a month is 45'600 MNT.

Moreover, the relationship between electricity expense and the size of a house is slightly positive²⁸, meaning that as the size of a house increases electricity expense raises insignificantly.

Table 8. Electricity expenses and the size of a house

Size of a house		16-30m ²	31-45m ²	46-60m ²	61-75m ²	76-90m ²	91m ² +
Electricity expense (MNT)	Mean	43,760	45,200	62,681	69,920	53,450	77,600
	Median	36,000	35,000	40,000	48,000	49,000	45,000

Source: Survey results

If we analyse these 4 household expenses by family type, the results show that there is no pattern of single, male- or female-headed families having any less expense than other family types. On the contrary, average education expense of single, female-headed family and average electricity expense of single, male-headed family is the highest among other types of family. However, average electricity and coal expense of single, female-headed family and average medical expense of single, male-headed family is the lowest among other types of family.

Table 9. Expense and family types

Expense types		Education expenses (annual)	Medical expenses (monthly)	Coal expenses (annual)	Electricity expense in heating season (monthly)
Single, female-headed family	Mean	1,819,545	69,665	382,800	36,562
	Median	1,400,000	50,000	330,000	30,000
Single, male-headed family	Mean	1,555,300	40,454	440,000	63,083
	Median	1,450,000	30,000	440,000	38,000
Single family ²⁹	Mean	1,075,658	59,200	448,540	55,540
	Median	500,000	40,000	440,000	40,000
Extended family ³⁰	Mean	1,444,800	88,300	506,000	52,703
	Median	1,020,000	60,000	495,000	40,000

²⁷ The correlation coefficient between electricity expense and monthly coal consumption expense is -0.1

²⁸ The correlation coefficient between electricity expense and size of a house is +0.12

²⁹ Family consisting from husband, wife and children

³⁰ Family consisting from husband, wife and children and grandparents, relatives.

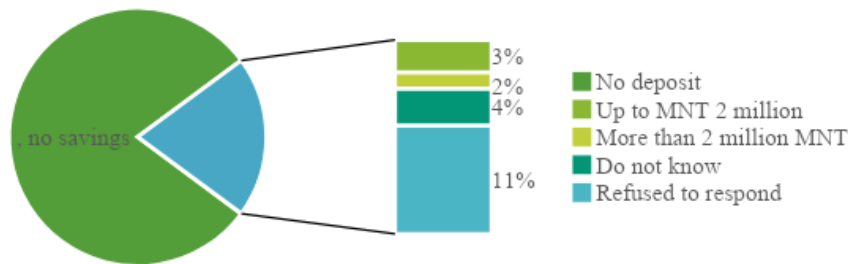
4.2. Household savings and loans

4.2.1 Household savings

Only 20% of the households have savings, and the average amount of the savings is 2 million MNT. 30% of the households with savings are low income households, 54% are average income households and only 16% are above average households. Although the number and the amount of savings is insignificant, the households have developed money saving habits. The majority of the savings are dedicated for future investments and risks, while only 6% is dedicated for house renovation and repair.

80% of the participants have no savings, and the remaining 20% have some savings. Of them 15% either refused to disclose the amount or didn't know the exact amount. Therefore, the savings information about only 5% of the households is available. And the average amount of savings among the households is 2 million MNT. 30% of the households with savings are low income households, 54% are average income households and only 16% are above average households.

Figure 59. Household savings (n=461)



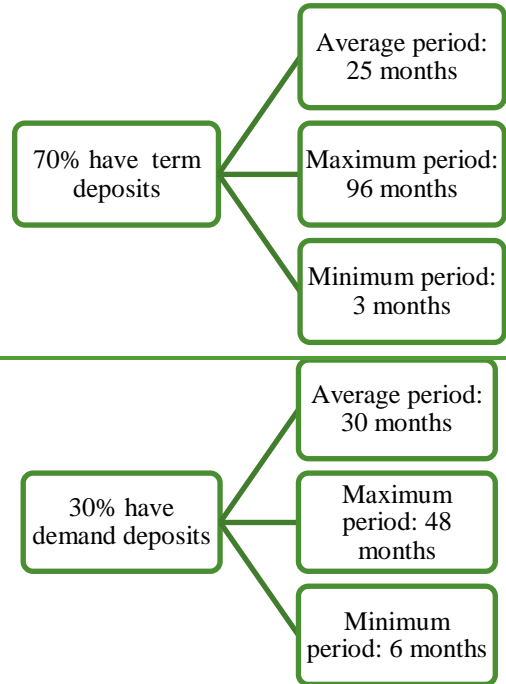
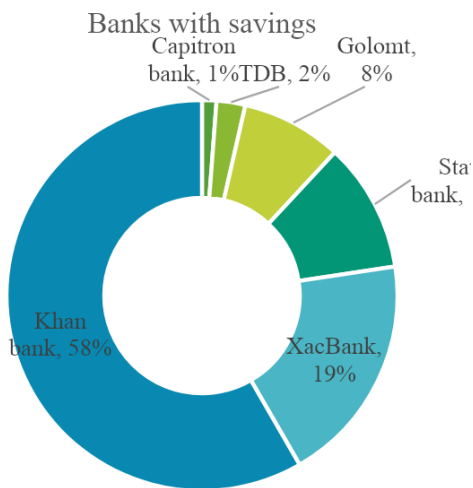
Mean: 2 million
Median: 1 million
Most frequent value: 500,000
Maximum: 6 million
Minimum: 20,000

Source: Survey results

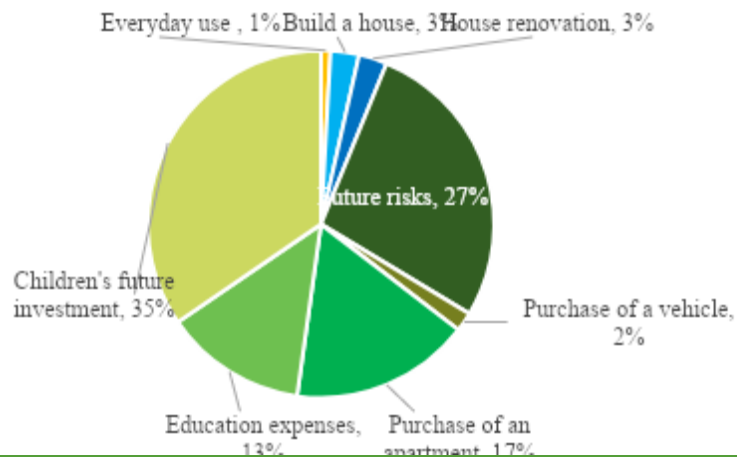
58% of the households that have savings chose Khan bank, 19% - Xacbank, 11% - State bank, 8% - Golomt bank, and the remaining 3% have savings in TDB and Capitron bank. 70% of the savings are term deposit accounts, and 30% are demand deposits. Although the number of households that have savings is low, it's safe to assume that the households have habituated money saving tendency into their lifestyles. Because the households on average have had savings for 2 years, at most 8 years, and at least 3 months.

35% of all the savings are dedicated for children's future investments, 27% are for future risks, 17% are for apartments, 13% are for education and only 6% are for house renovation and repair.

Figure 60. Other information on household savings (n=84)



The purpose of household savings (n=84)



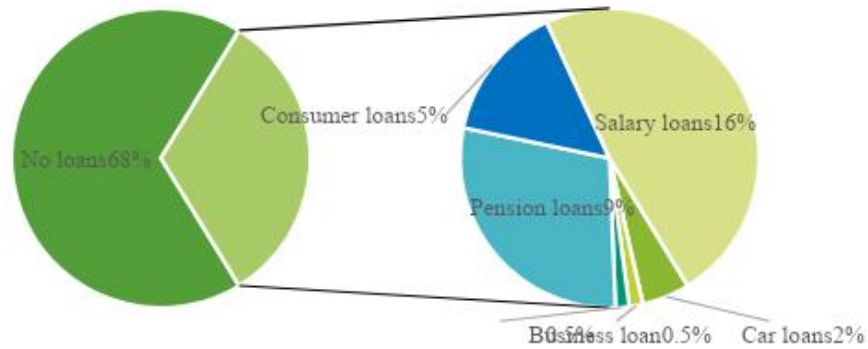
Source: Survey results

4.2.2 Household loans

One third of the households have loans, and the majority of them are salary, pension, and consumer loans. The average loan amount of total households with loans is 5.8 million MNT, the average loan amount of the households with salary loans is 6.2 million MNT, and the average loan amount of the households with pension loans is 4.2 million MNT. The average term of the loan is 2 years, and the households pay around 374.8 thousand MNT a month on average in loan repayment. About 21% of the participants spent the borrowed money on renovation, repair, construction and purchase of a house.

68% of the participants have no loans, and the rest of them have some amount of loans. Of them 16% have salary loans, 9% - pension loans, 5% - consumer loans, and remaining 3% have car, business loans and mortgage.

Figure 61. Types of household loans (n=461)



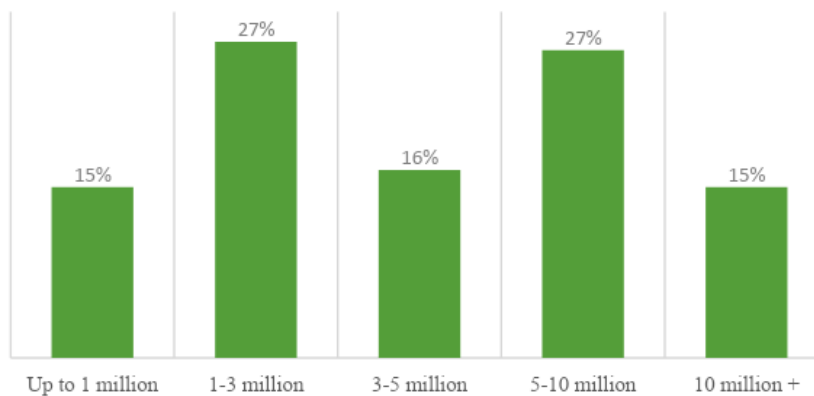
Source: Survey results

12% of the households with loans have two loans, the majority of which is salary and pension loans.

The average loan amount of the households with loans is 5.8 million MNT, at most 30 million MNT, and at least 150 thousand MNT. 15% of the households with loans have less than 1 million MNT loan, 27% have around 1-3 million MNT loan, 16% have around 3-5 million MNT loan, 27% have around 5-10 million MNT loan, and 15% have loans with amount more than 10 million MNT.

When the loan amount is analyzed by the main types of loans, the results show that the average loan amount of the households with salary loans is 6.2 million MNT, while the average loan amount of the households with pension loans is 4.2 million MNT.

Figure 62. The amount of household loans (n=135)



Mean: 5,846,300

Median: 4,500,000

Most frequent value:
3,000,000

Maximum:
30,000,000

Minimum:
150,000

Main types of loans and the average amount of loans

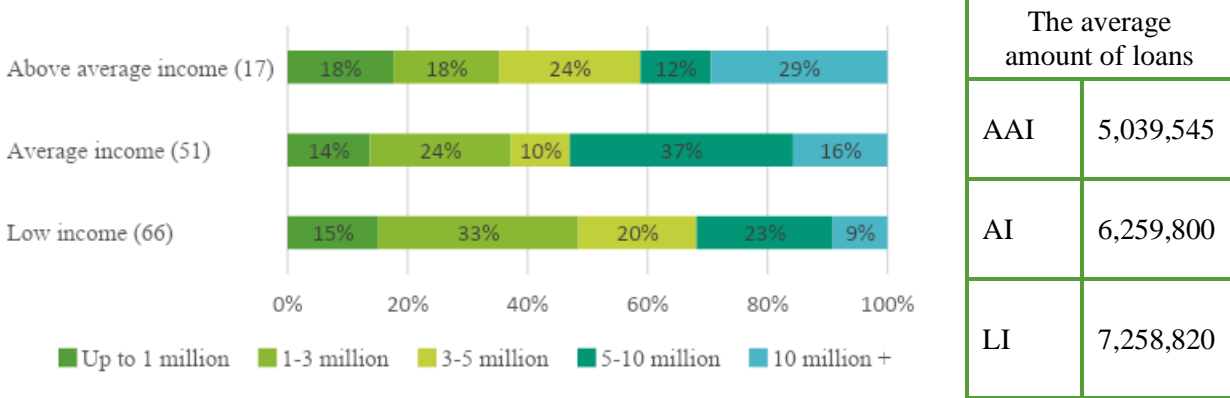
	Salary loan	Pension loan	Consumer loan	Car loan
Mean	6,248,930	4,213,590	6,105,000	7,021,430
Median	5,000,000	3,000,000	4,000,000	5,000,000

Source: Survey results

The results of analysis by income classes illustrate that 50% of the households with loans are low income households, 38% are average income households, and 13% are above average income households. The average loan amount of low-income households is 5 million MNT, the average loan amount of average income households is 6.2 million MNT, and the average loan amount of

above average income households is 7.2 million MNT, which shows that as the income class rises, loan amount raises with it. Moreover, almost half of the low income households that have loans, 38% of average income households and 36% of above average income households have less than 3 million MNT loans.

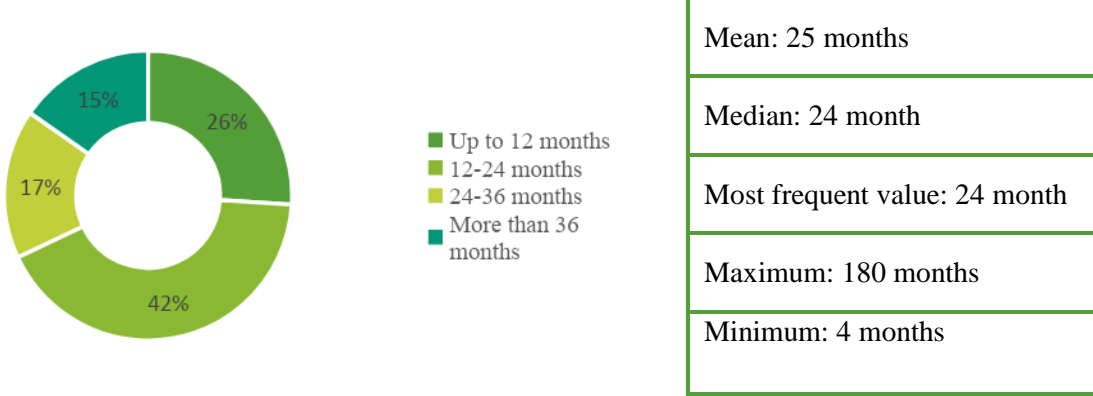
Figure 63. The amount of household loans, by income type (n=135)



Source: Survey results

The average loan term is 2 years, at most 15 years, and at least 4 months. 26% of total households with loans have 1-year loan term, 42% have 1-2 years, 17% - 2-3 years, and 15% have more than 3 years loan term.

Figure 64. Loan term (n=135)



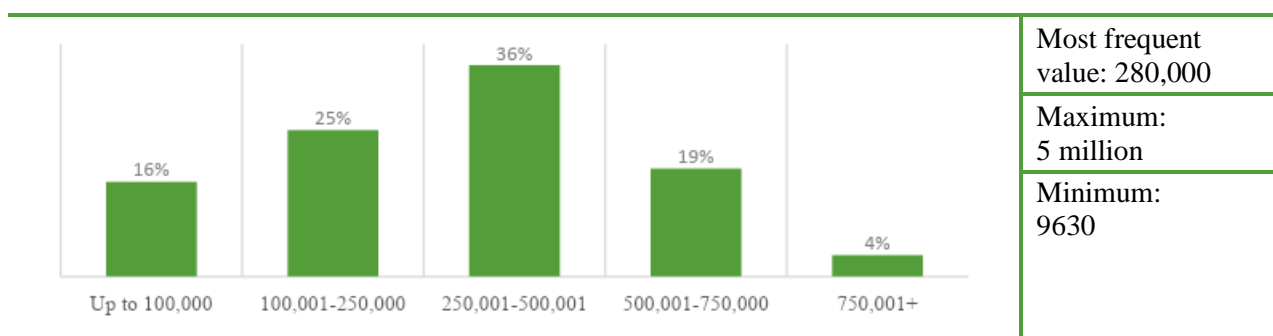
Source: Survey results

The households with loans pay around 374.8 thousand MNT monthly in loan repayment, at most 5 million, and at least 9630 MNT. 15% of the households with loans pay less than 100 thousand, 25% - around 100-250 thousand, 36% - around 250-500 thousand, 19% - 500-750 thousand, and 3% pays more than 750 thousand MNT every month in loan repayment.

The results of comparing loan repayments by main loan types show that the households spend 376.8 thousand MNT in salary loan repayment, 272.8 thousand MNT in pension loan repayment monthly.

Figure 65. Loan repayment of households (n=135)

Mean: 374,795
Median: 290,000



Main types of loans and the average amount of monthly loan repayment

	Salary loan	Pension loan	Consumer loan	Car loan
Mean	376,860	272,280	332,780	416,700
Median	350,000	280,000	250,000	415,000

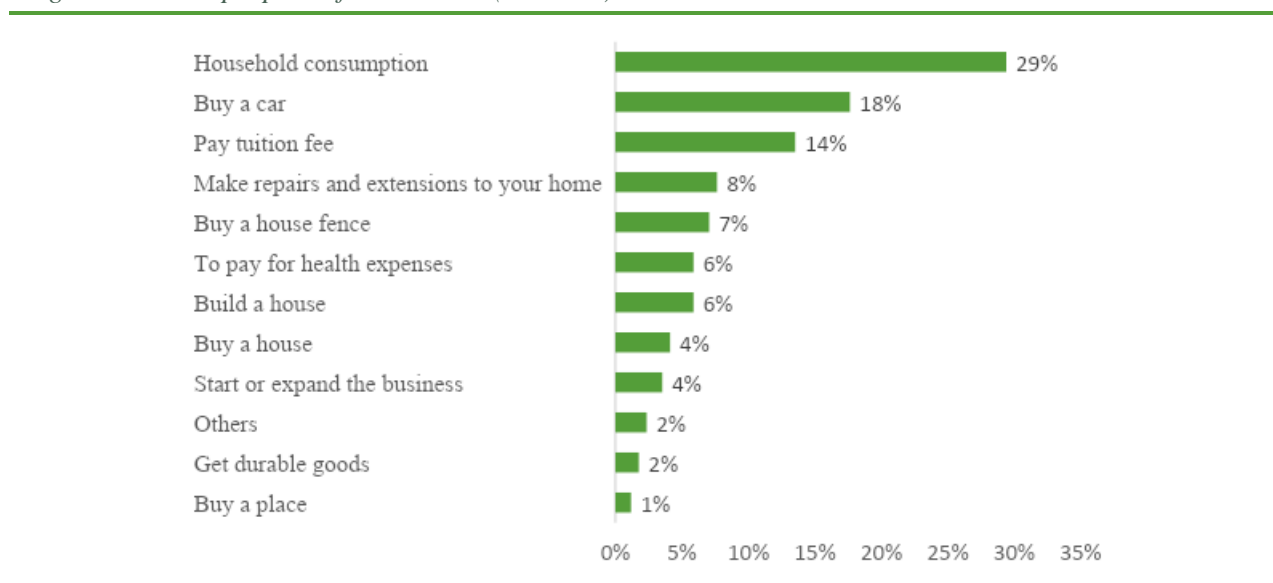
Source: Survey results

The results of analyzing loan repayment by income sufficiency show that as income sufficiency of a household improves, monthly loan repayment amount increases with it. To be specific, the households that evaluated their income as insufficient pay around 245 thousand MNT a month, households that evaluated their income sufficiency as low to medium pay around 275 thousand MNT a month, and households that evaluated their income sufficiency as medium pay around 320 thousand MNT a month, while households that evaluated their income sufficiency as medium monthly pay around 385 thousand MNT.

The majority of the households got their loans from banks and financial organizations. Specifically, 87% of them took a loan from a bank, 9% - from non-bank financial institutions, 1% - from SACCO and the remaining 3% took loan from legal entities and individuals.

29% of the households with loans spent their borrowed money on household expenses, 18% - on car purchase, 14% - on education, and 21% spent it on renovation, repair, construction and purchase of a household.

Figure 66. Loan purpose of households (n=170³¹)



Source: Survey results

³¹ In total there are 170 responses from 135 households.

4.3.Future plans on households' assets and investments

4.3.1 Household assets

Movable assets: 54% of the participants have vehicles, and in total there are 252 vehicles. On average one household owns 1.2 vehicles, and at most this number reaches 6 vehicles. 85% of the households that possess vehicles own only one vehicle, 11% - two vehicles, 2% - three vehicles, 2% - 4 vehicles, and 0.4% or 1 household owns 6 vehicles. By type of vehicle, the results are following: 89% possesses passenger cars, 10% - trucks, 1% - buses. 7% of total vehicles are being used as collateral

Figure 67. Grouping of households with vehicles, by number of vehicles (n=226)

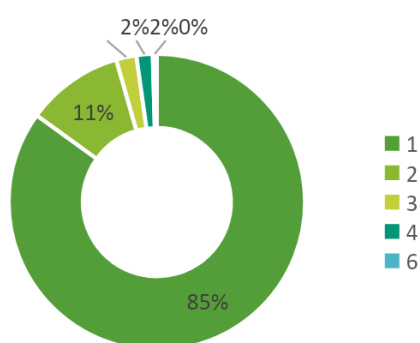
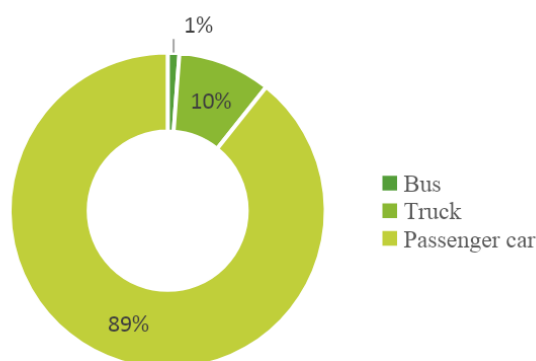


Figure 68. Types of vehicles (n=252)



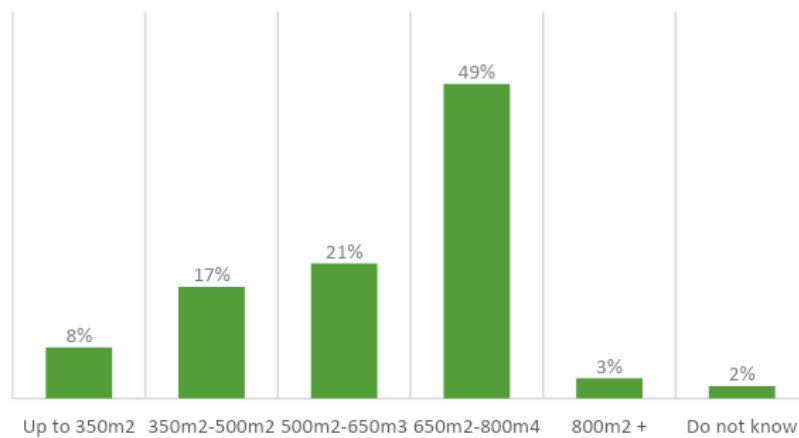
Source: Survey results

Moreover, 30% of the households that own vehicles are low income, 54% - average income, 15% - above average income households. 90% of low income households that possess vehicles, 85% of average income households, and 79% of above average income households own only one vehicle, whereas the majority of the households that have more than 2 vehicles are average and above average households.

Real estate: 77% of households participating in the research own the land, 17% - hold the land, 5% - do not own the land, 1% - have no legal documents on the land. An average household owns 606 m² of land; at most this number reaches 1000 m² of land, and at least – 134 m² of land. 46% of total households have less than 650 m² of land, 49% - 650-800m² of land; the remaining 5% possesses more than 800 m² of land.

Figure 69. Land area (n=416)

Mean: 619m ²
Median: 700m ²
Most frequent value: 700m ²
Maximum: 134m ²



Minimum: 1000m2

Land area	Low income	Average income	Above average income
Mean (m2)	603	615	578
Median (m2)	697	700	600

Source: Survey results

96% of the households own the houses they live in, and of them 77% have official documents, while 19% doesn't have any legal papers. Moreover, 9% of the households that own their houses use them as collateral. The households that do not own the house are low and average income households, except for one household.

Figure 70. Households' ownership of a house and existence of real estate certificate (n=416)

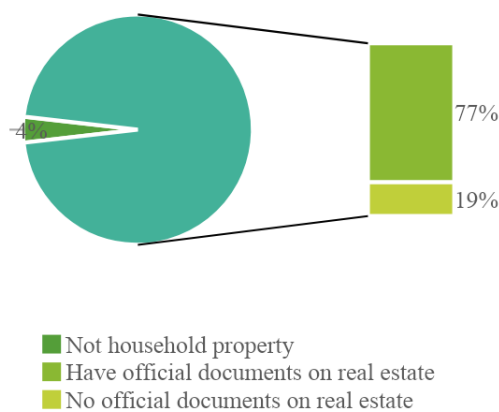
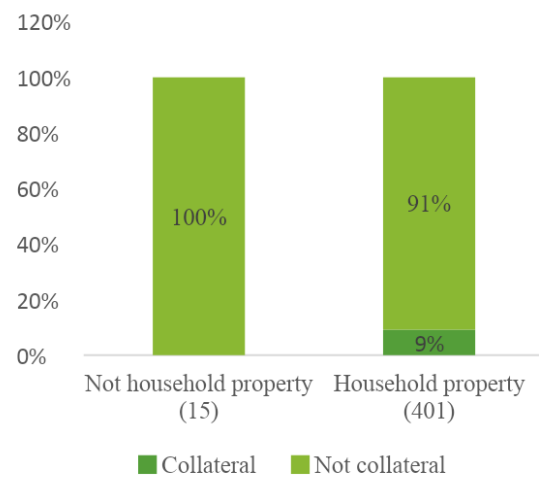


Figure 71. Households' ownership of a house and usage as collateral (n=416)



Source: Survey results

4.3.2 Future plans on household investments

67% of the participants have no investment plans in near future, while 24% are planning to invest in housing, 3% - in education, 3% - in vehicle, and the remaining 2% of the households will invest in going abroad, medical expenses and big celebratory events.

54% of the households that have no future investments plans are low income, 42% are average income, and 5% are above average income households. 40% of the households that are planning to invest in housing are low income, 40% are average income, and 20% are above average income households. Of them 71% are planning to invest in 2019-2020, while 29% are planning to invest in 2021-2023.

Figure 72. Households' near future investment plans (n=416)

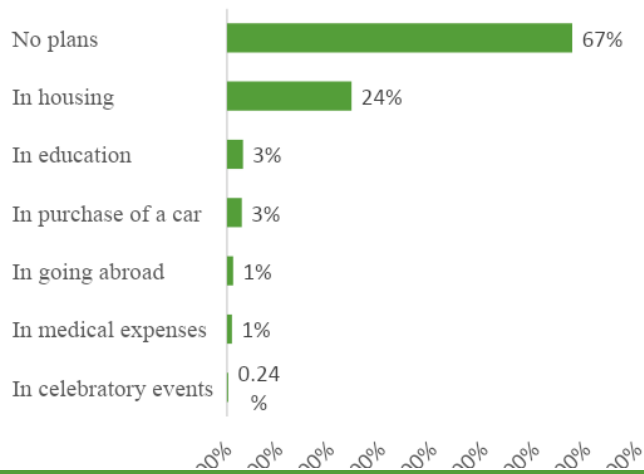
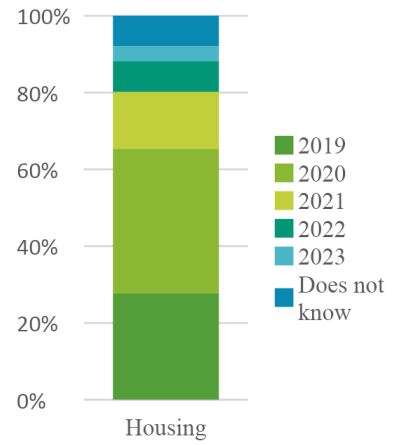


Figure 73. Planned timeframe for investments in buildings and houses (n=101)



Source: Survey results

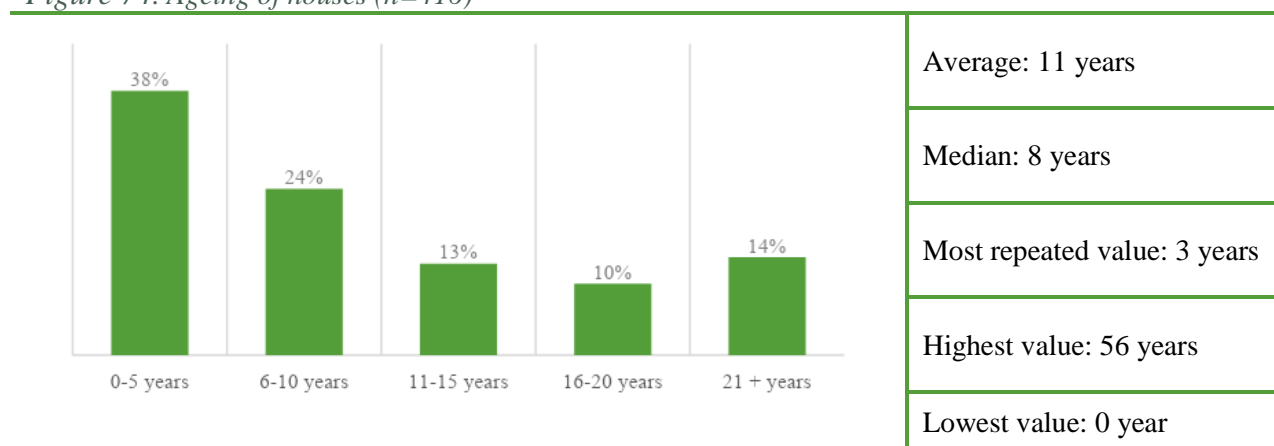
5. HOUSEHOLD HOUSING CONDITIONS

5.1. Ageing, structure, arrangement and materials of houses

5.1.1 Ageing of houses

47% of respondents to the survey does not know when their houses were built. Therefore, researchers used the years that respondent households have lived in this accommodation in order to determine ageing of house they live. Resulting from such proxy means, average ageing was found 11 years, with maximum 56 years and minimum as less as 1 year or below. Of all respondent households, 38% live in houses aged for 0-5 years, 24% in 6- 10 years old houses, 13% live houses aged for 11-15 years, 10% live in houses aged for 16- 20 years and 14% live in houses over 21 years old.

Figure 74. Ageing of houses (n=416)



Source: Findings of random sampling survey

In the event that average ageing of houses are classified by house types and household income groups, average ageing of brick and timber houses were found bit higher than the other types of houses. In terms of household income, houses owned by middle income households were relatively lower aged as opposed to houses owned by low and higher-middle income households.

Table 10. Average ageing of houses, house wall types and household income, by years

	House wall types					Household income groups		
	Plank	Brick	Timber	Light concrete block	Hollow concrete blocks	Low	Middle	Higher middle
Average age	12	10	19	11	8	12	9.5	11
Median age	9	8	18	7	6	9	6	9.5

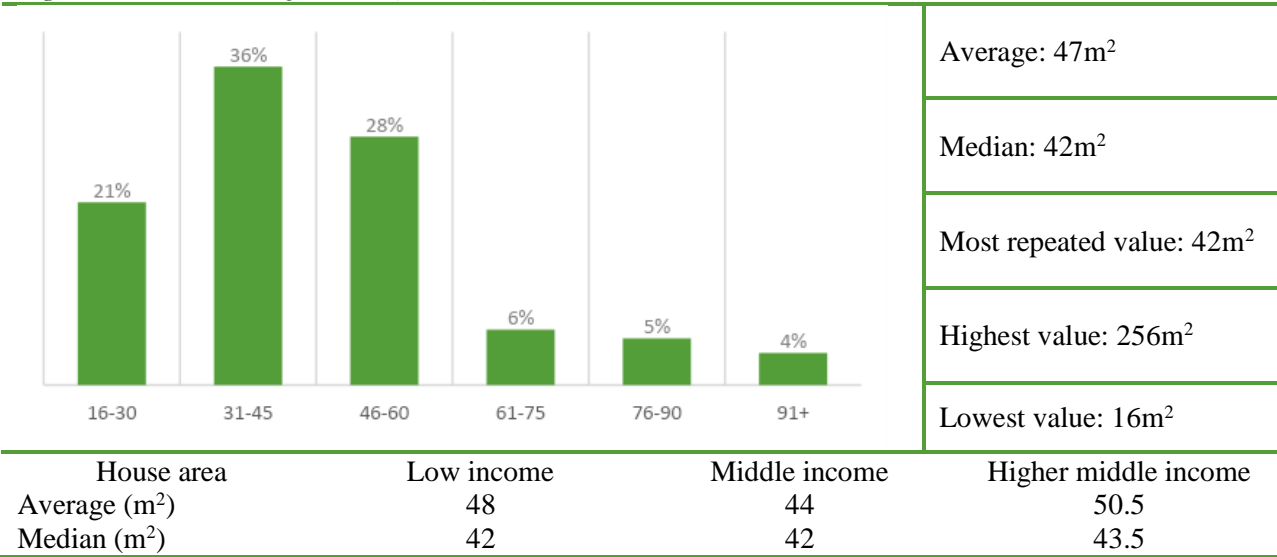
Source: Findings of random sampling survey

5.1.2 House area sizes and room arrangements

Average area of respondents' houses were 47 m², with the largest being 256 m² and smallest 16 m². Of all respondent households, 21% live in houses with up to 30 m² area, 64% in houses with 31-60 m² of area, 11% live in houses with 61-90 m² areas while remaining 4% lives in spacious houses with larger than 91 m² area. When the house size/area is correlated to household incomes,

no significant difference was found among income groups in terms of house area sizes. In addition, 4% of households have two-floor houses.

Figure 75. Area/sizes of houses (n=416)



Source: Findings of random sampling survey

55% of all respondents live in one-room house, which consist of a one single room where living room, kitchen and bedrooms are not separated while 45% of respondents live in houses with more than one room. Now, let’s classify house arrangements segregated by one room and more than one room.

Characteristics of one-room houses: Houses of this type generally have 41 m² areas, in average, have a door and two windows, both facing to south.

Table 11. Characteristics of one-room houses (n=226) and top view drawing

Average area	41m2							
Mansard style roof	8%							
Vestibule	31%							
Door orientation	South	62%						
	North	4%						
	West	13%						
	East	21%						
Window orientation	Number of windows							
		0	1	2	3	4	7	9
	South	4%	11%	54%	27%	4%	0.4%	-
	North	86%	12%	2%	-	0.4%	-	-
	West	74%	18%	7%	1%	-	-	-
East	73%	17%	8%	1%	0.4%	-	0.4%	

Source: Findings of random sampling survey

Characteristics of houses with more than one room: Houses belonging to this type usually have 55 m² of space in average, 2- 3 rooms, a door and 2 windows facing south, and one window either facing to east or west. Houses with three rooms include a living room, a bedroom and kitchen while two-room houses consist of a living room and a kitchen, respectively.

92% of these houses have a living room, 66% have a bedroom, 79% have a bedroom and 17% have a washroom. Also, 17 households live in two-bedroom houses and 1 household in three-bedroom houses, respectively.

Table 12. Characteristics of houses with more than one room (n=190) and top view drawing

Average area size	55m ²									
Mansard style roof	8%									
Vestibule	48%									
Door orientation	South	73%								
	North	2%								
	West	11%								
	East	14%								
Room arrangement	Number of households (190)						Living room	Bedroom	Kitchen	Washing room
	10%						+	+	+	+
	35%						+	+	+	
	4%		+	+		+				
	1%		+		+	+				
	1%			+	+	+				
	9%		+	+						
	35%		+		+					
8%			+	+						
Window orientation	Number of windows									
		0	1	2	3	4	5			
	South	3%	15%	46%	30%	4%	2%			
	North	80%	14%	5%	1%	-	-			
	West	55%	33%	9.5%	1%	0.5%	1%			
East	52%	38.5%	8%	0.5%	1%	-				

Source: Findings of random sampling survey

5.1.3 Structure of houses

Overall, respondent households live in houses with following two structural designs.

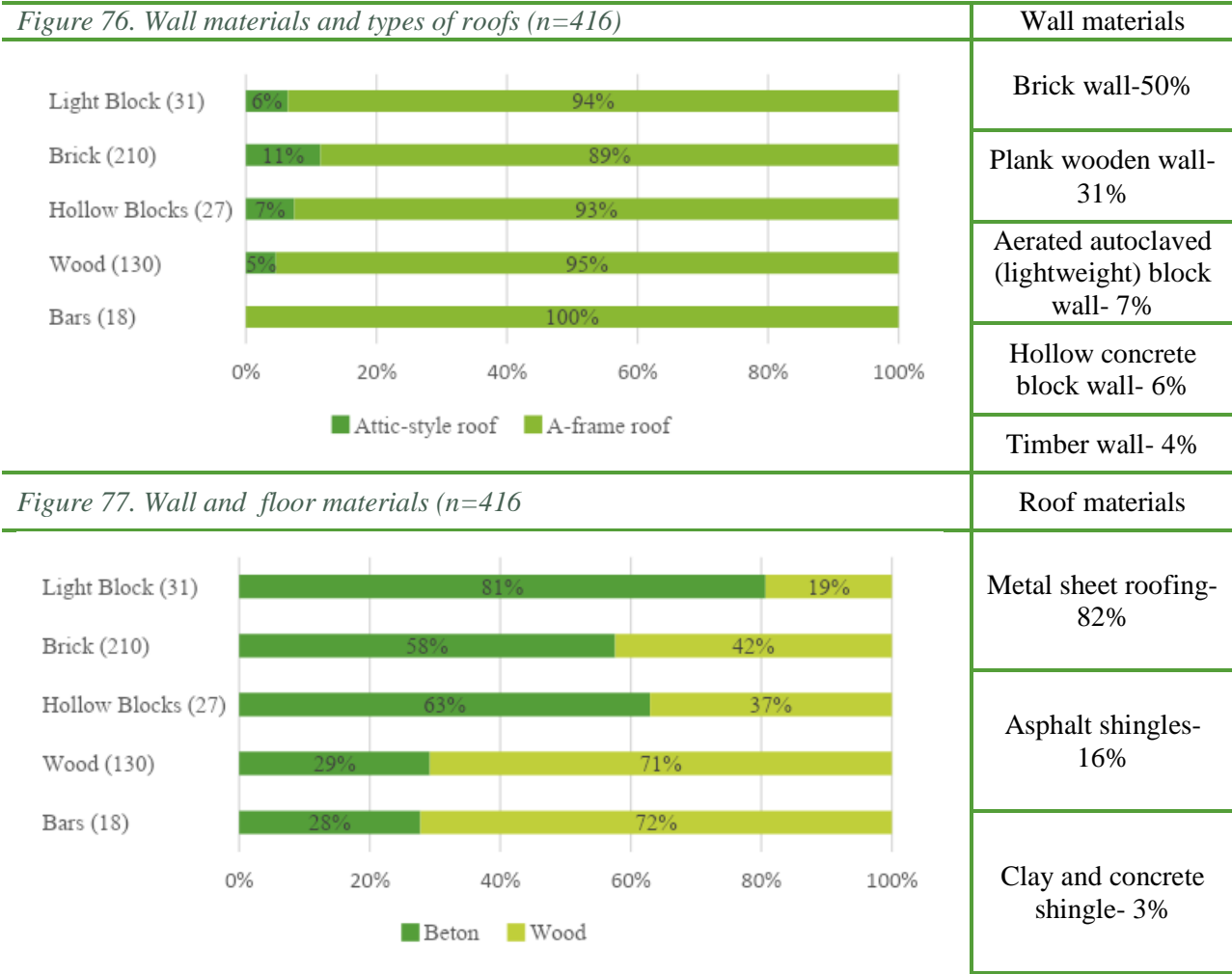
- Brick wall, gable roof and concrete floor
- Wooden wall, gable roof and wooden floor

50% of respondent households live in houses with brick walls, 31% in houses with wooden walls and remaining 19% live in houses with timber or hollow block or aerated lightweight block walls,

respectively. In addition, 91% of houses have gable roof and remaining 9% have houses with mansard roofs.

11% of houses with brick walls, 7% of houses with hollow blocks, 6% of houses with aerated lightweight blocks and 5% of wooden houses, respectively, has mansard roof while remaining houses all have gable roof. In terms of materials, majority of houses have metal sheet roofs.

Most houses with brick, hollow and aerated lightweight block walls have concrete floors while wooden and timber houses have wooden floors.



Source: Findings of random sampling survey

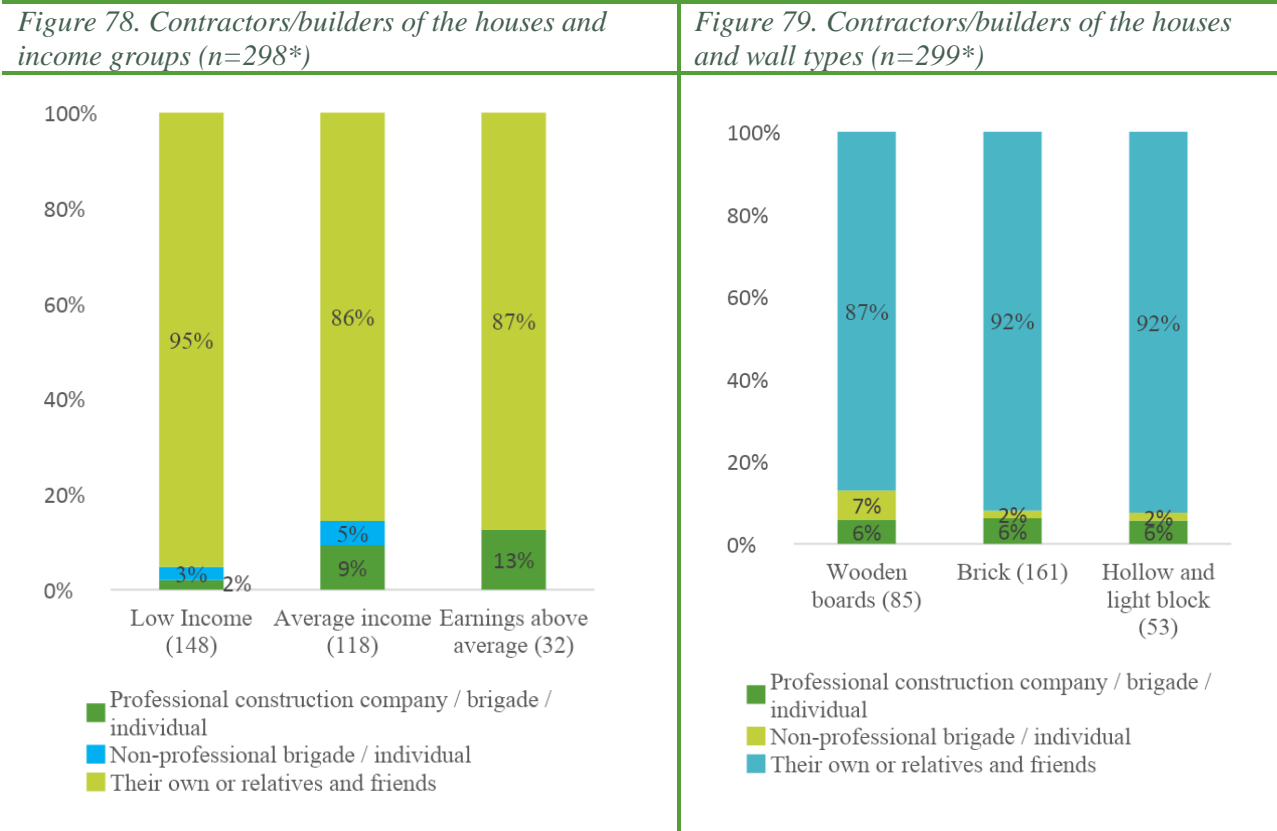
5.1.4 Building contractors/builders of houses

Majority of respondent households said they built their houses themselves showing there is no attitude of contracting with professional companies for house construction. 28% of respondent households don't know who built the houses they live in. Whilst, 65% built their houses either themselves or in cooperation with relatives and friends, 2.5% hired individuals or so-called "brigades" (a group of people formed into informal group) and only 4.5% hired a professional construction company or group of professional individuals.

Analyses on connection between households knowing the person/company that built their houses and their house types discover that 9- 13% of middle and higher-middle income groups hired professional contractors for construction of their houses. Among low-income groups, almost no

household addressed to professional contractors. In terms of house types, 6% of houses belonging to each type were built by professional contractors.

Moreover, 6% of households said they have someone who has experiences in house construction in their family while 66% said they have no person in family who have experience in house construction.



Source: Findings of random sampling survey

Note: *-Number of households that don't know who built their houses were excluded.

As such, majority of households built their houses themselves based on their knowledge and experiences of people nearby; subsequently they suffer from non-standard houses, in particular condensation on windows, no ventilation/air circulation, poor heat retention and uneven floor surface, as mentioned by participants of focus group discussions. (FGD, October- November, 2018).

5.2. House insulation and heat loss

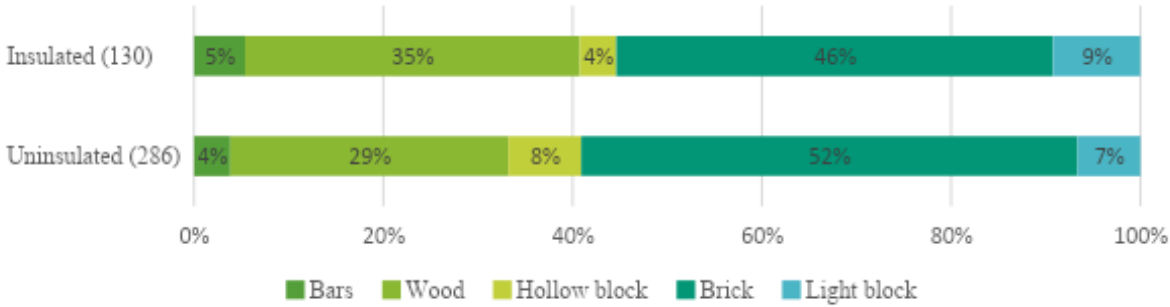
5.2.1 House insulation against heat loss

Only one third of all households made additional insulations in their houses in order to reduce heat loss and to retain heat. Citizens have poor knowledge and understanding on importance of insulating their houses so that they can have warm winter. During some FGD, respondent said they understand “preparation for winter” as just stocking firewood and coal (FGD, October- November, 2018). In terms of households that insulated their houses, key factors for selection of insulation materials included affordability (cheap price) and availability on the market. Almost 100% of households insulated their homes themselves and more than half think that quality of insulation was good. Asked to name three main challenges in insulation of houses, respondents

say lack of financing, lack of human resources and shortage of time to spend for insulation work. Low and middle income households account for 92% of all households suffering from financial difficulties.

32% of respondent households insulated their houses while remaining 68% live in noninsulated houses. Of insulated houses, 46% have brick walls, 35% have wooden walls and 19% have other types of walls.

Figure 80. Whether households insulated their houses, by wall types (n=416)



41% of households that insulated their houses selected insulation materials for it was cheap and 37% selected materials as it was available on the market. Remaining 18% purchased materials through seeking grounded on the experiences and advice from others and 4% purchased materials taking into account of easiness for use and quality of materials. (Figure 81).

98% of households that insulated their houses, carried insulation work themselves as opposed to remaining 2% that hired either professional or unprofessional individuals. 12% of respondents say quality of their insulation as “very good”, 43% “good”, 38% “fair” and 8% “poor” (Figure 82).

Figure 81. Factors influencing in selecting insulation materials (n=172*)

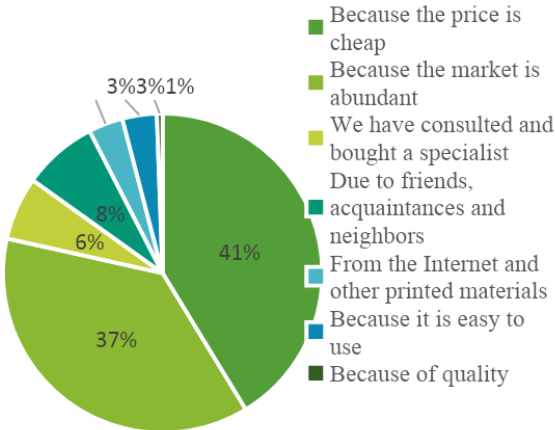
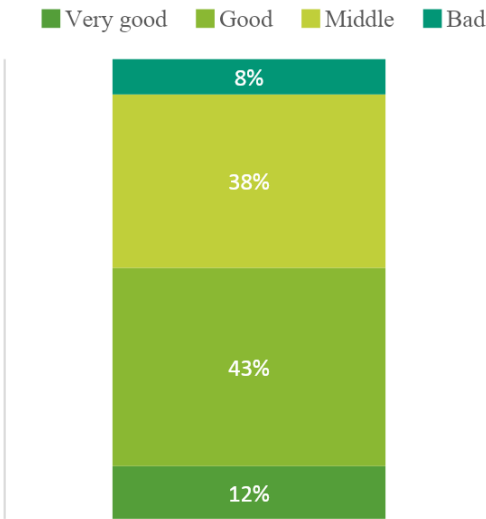


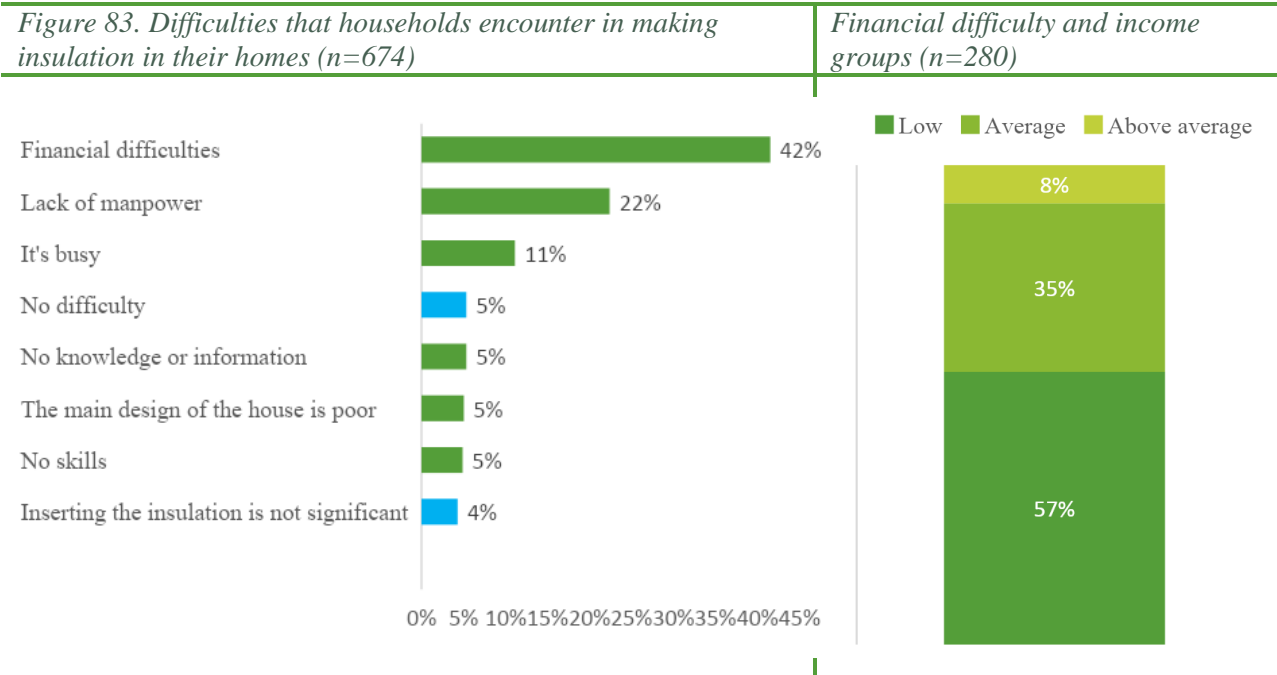
Figure 82. Evaluation of households in the quality of their house insulation (n=130)



Source: Findings of random sampling survey

Note: *-Number of all responses from 130 households.

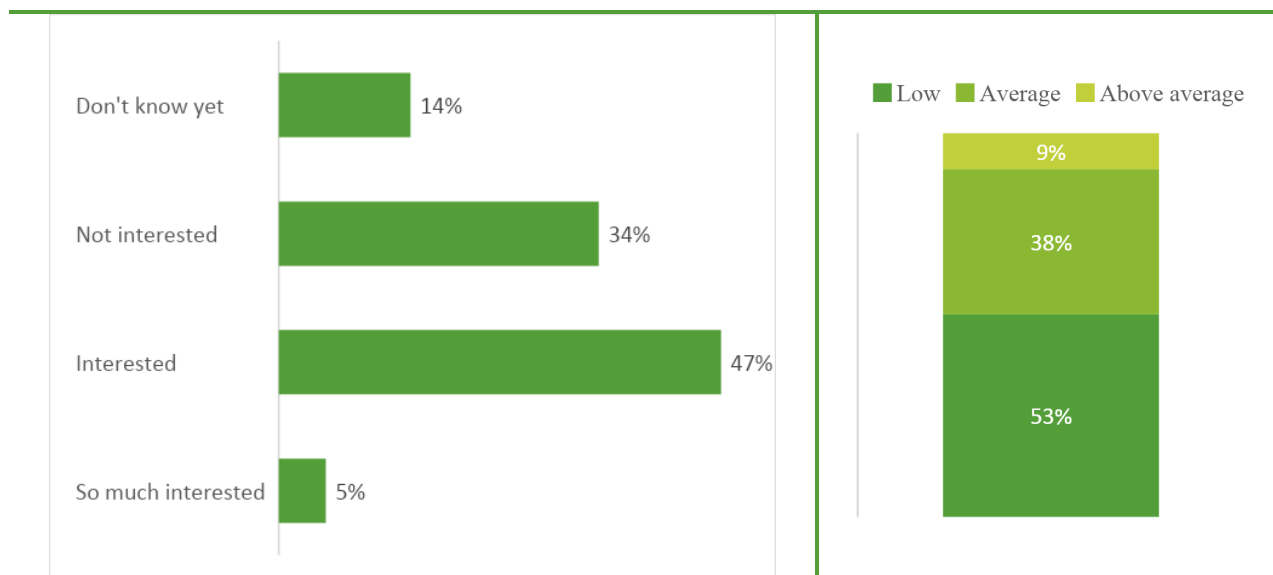
Asked to tell two main difficulties/challenges that households encounter in insulating their houses, respondents provided 674 answers altogether. Of these answers, lack of financing, shortage of human resources and shortage of time were three top answers among all. 5% of all households said they face no difficulties or obstacles in insulating their houses while 4% say they don't think it is important to insulate. According to classification exercise of households with financial difficulties by income groups, 57% belong to low-income, 35% to middle-income and 8% to higher middle-income groups.



Source: Findings of random sampling survey

52% of respondent households are interested in hiring professional group of contractors for house insulation as opposed to 34%, which are not interested in these professionals at all and 14%, which cannot say anything on this subject matter. When the first group that are interested in hiring professional contractors, is divided into income groups, 53% belong to low-income, 38% to middle-income and 9% to higher middle-income groups.





Source: Findings of random sampling survey

5.2.2 Heat loss

Two thirds of all households say their houses lose heat through a certain part of their houses saying windows and doors were the points that have higher heat escape. More than half say they took measures to limit or reduce heat loss by adding more insulation on their doors, windows and roofs. For insulation, they mainly used foam board and asbestos board. For wall and roofs, families put 14 cm thick insulation board, in average, and for the floor, they used 12 cm board; mainly acquired from local markets and retailers.

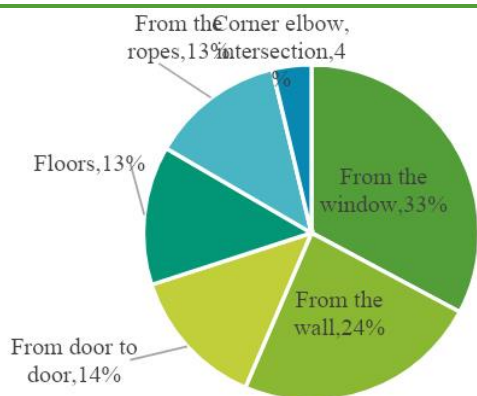
24% of respondent say their houses are well sealed and no heat loss, while 11% don't know whether there is any heat loss or not. As opposed to these groups, 65% said their houses are depleting heat through a certain part of their houses by giving 427 responses (272 households), of which one third said window, 24% said wall, and 13% said door, floor and roof, respectively.

During FGD, interviewees said heat loss through the window is recognized easily that ice buildup, cold air leak and condensation on glazing are the main signs. Heat loss through window does not differ by types of window frames: either wood or vacuum PVC. Citizens are mostly disappointed with the quality of modern vacuum sealed PVC windows saying they often encounter problems such as locks/handles falling apart and rubber seals gets loose. As for wooden windows, it requires more work for insulation, highly aged resulting in cracks and air leak (FGD, February, 2019).

In addition, 47% of respondents say their houses lose heat through one point/part, 45% through two parts, 6% through three parts and 3% through 4 parts of the house. Asked which parts their houses lose heat through, households with two parts say "wall and window", "window and door", "all and floor" and "wall and floor". As for households cited one part of their building as leaking cold air say window, door and floor, respectively.

Figure 85. Parts of houses that lose heat outside (n=427)

Households with houses losing heat through four parts of the building	3%
Households with houses losing heat through three parts of the building	6%



Households with houses losing heat through two parts of the building
45%

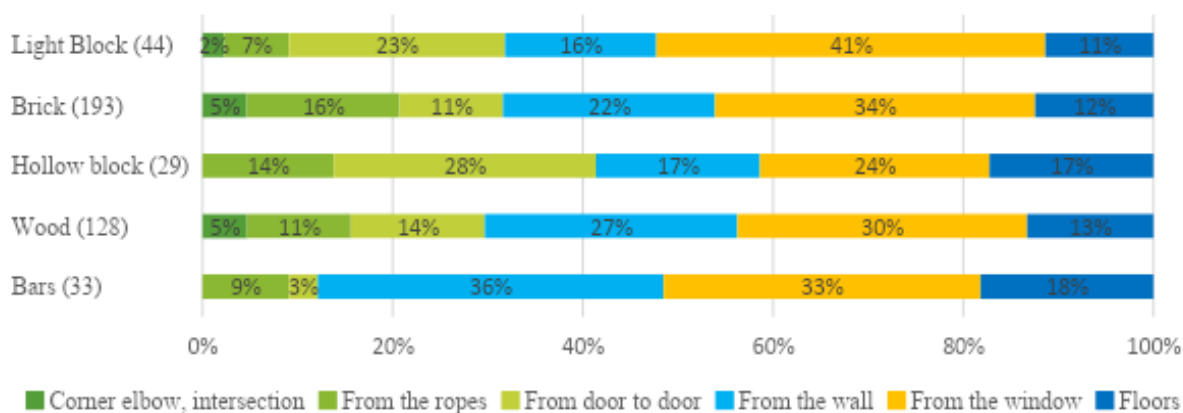
Households with houses losing heat through one part of the building
47%

Source: Findings of random sampling survey

If the parts that heat escape from house are compared against wall types, households living in houses with brick, wood and timber walls lose heat through windows and walls while households living in houses with hollow block walls lose heat through windows and doors.

Looking at experiences of FGD participants, it was found that heat loss commonly occurs through wall in the north side, and it was caused by incorrect installation of insulation and using thin boards for insulation. The key problems they suffer include wind blow through corner/joints and floor wall joints, and peeling off wallpaper due to accumulation of condensation and humidity (FGD, February, 2019).

Figure 86. Parts of houses escaping heat through and wall types (n=427)



Source: Findings of random sampling survey

45% of responding households have taken no measures to reduce heat loss, of which more than half of them responded either their houses don't have heat escape or don't know.

Specifically, most wide-spread experience among all households was that they have no understanding on heat loss through the roof, don't make an insulation on the roof and are unaware of the importance of roof insulation. In addition, they increasingly ignore the importance of floor insulation (FGD, February, 2019).

Contrary to it, 55% tried some measures to reduce heat loss, particularly 298 cases were found that households made insulation on their houses, of which 31% insulated their wall, 26% windows, and 15% roof while remaining 27% insulated doors, floors and wall corners. Most common materials used for insulation were foam insulation and mineral wool. Of all 298 insulation cases, 33% used

foam board, 28% asbestos wool and 7% mineral wool or rock wool. The rest (30%) used other types of materials including saw dust, cloths and silicone seals.

In-depth study on insulation materials vs. insulation points/parts demonstrates that families mostly used foam board for insulating walls, windows and corners/joints, other types of materials for floor and door insulation, and asbestos wool for roof. In relation to insulation materials, they cited several hardships such as foam board hosting mice and rodents, excessive white foam particles spreading inside building and outer clay layer swept away by rain and snow. Another problem related to insulation that citizens concern were lack of air circulation solutions. FGD participants said they ignored ventilation/air circulation in their houses due to the fact that they have limited knowledge on potential solutions, have no access to information on available solutions and lack of financial resources (FGD, February, 2019).

Figure 87. Insulated parts of the houses (n=298)

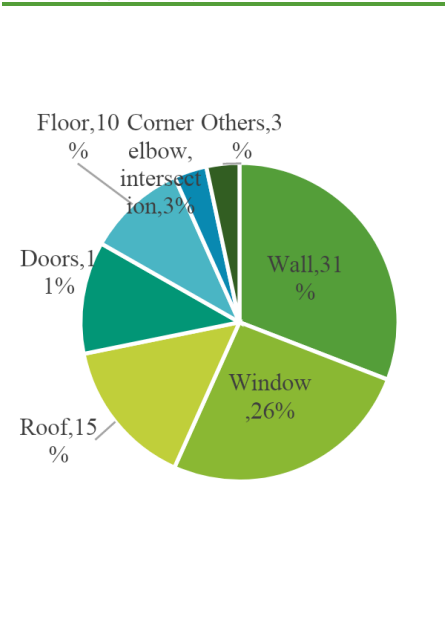
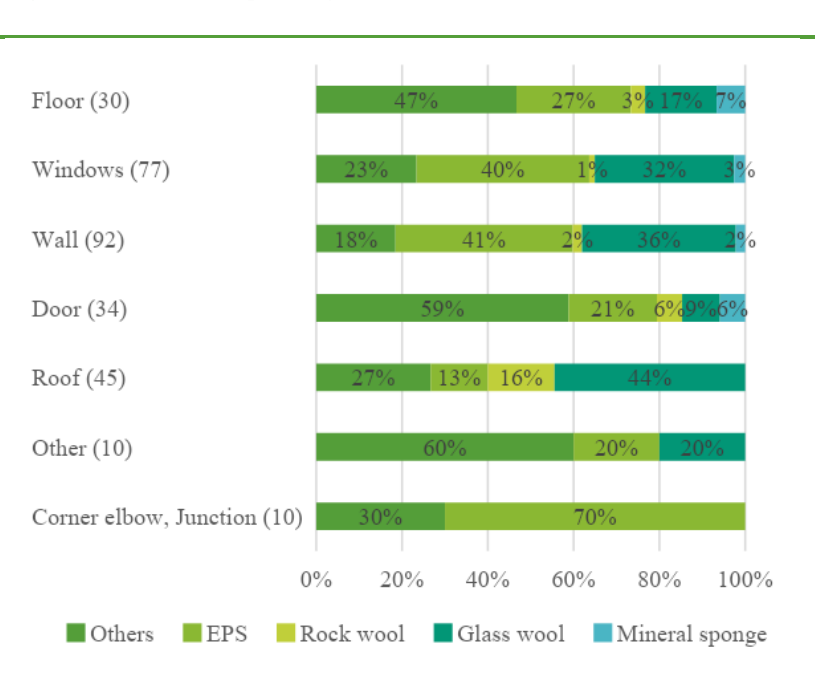


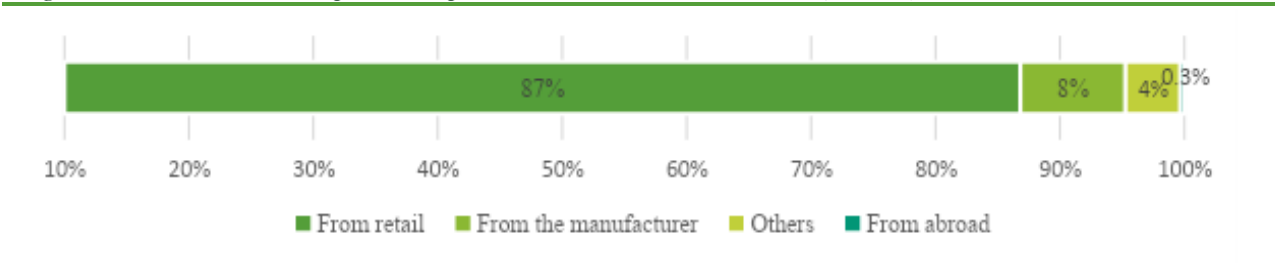
Figure 88. Insulated parts of the houses vs. materials used (n=298)



Source: Findings of random sampling survey

In terms of insulation materials, households buy materials from retailers. In particular, 87% of households that insulated their houses to reduce heat loss, purchases insulation materials from retailers, including construction materials stores, markets and trade centers, 9% directly from manufacturers. Only 4% of respondents said they purchased materials from other sources, including their relatives or friends/acquaintances.

Figure 89. Sources that respondents purchased insulation materials (n=298)



Source: Findings of random sampling survey

Excerpt ... Initially, I purchased a house with 36 cm thick brick wall and then insulated the house with 5 cm thick foam board from inside. Know that it has adverse impact of the foam board if installed inside, but I had no choice as the winter was close. It has cement board on top, and it is very cold from the floor. I have a conventional masonry type stove. I purchased insulation materials from construction materials market at Zoon Ail Khousi...

General Figure reveals that households agree that insulating houses to reduce heat loss would make contribution to reducing coal consumption and air pollution. They are interested in having access to information and knowledge on affordable and easy-to-use technologies and practices.

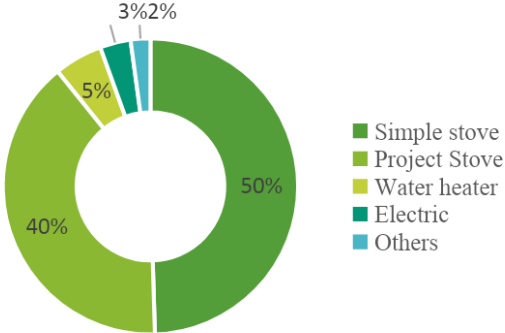
5.3. Heating, clean and waste water management

5.3.1 Heating

According to the survey, households fire their stoves 3- 4 times a day during winter months. When the average number of firing is compared against the number of households, both insulated and noninsulated their houses, almost no difference was revealed evidencing the insulation that households made themselves don't result in reducing number of firing.

50% of respondent households have traditional stove, 40% have improved stove (smokeless, distributed by project on clean air) and remaining 10% have water heating stove (heating radiators) and electric stoves. Total of 12 households own two types of stoves, the most common one was a combination of traditional and water heating stove.

Figure 90. Types of household's stoves (n=416)



Combination of stoves	Number of households with 2 stoves
Improved stove + water heater stove	1
Improved stove + electric heater	1
Electric heater + Others	1
Traditional stove + Water heater stove	6
Traditional stove + electric heater	1

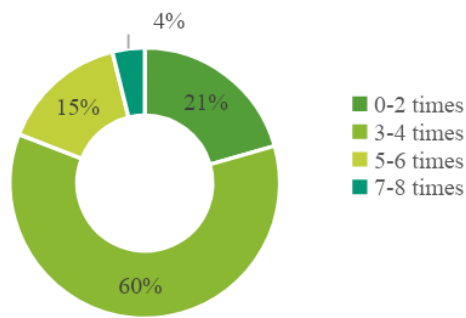
Source: Findings of random sampling survey

During winter period, households fire (heat their stove by burning fuel- hereinafter referred to as burning, sometimes) their stoves about 3.4 times a day while some households repeat this process as much as 8 times a day. 21% of all households fire their stoves 0-2³² times a day, 60% fire 3-4 times, 15% fire 5-6 times and 4% fire 7-8 times a day. When the house wall types are correlated to average number of firing, households living in houses with aerated lightweight block walls fire their stoves the most frequently, 4 time a day, households living in wooden/timber wall houses fire their stoves 3.5- 3.6 times a day while households with brick and hollow block houses fire their stoves 3.1- 3.2 times a day, the lowest among other groups.

Figure 91. Number of firing/burning fuel, per day (n=416)

Average: 3.4

³² Some households that use electric heaters don't burn anything for heating and the number of such households was 2.



Median: 3
Most repeated value: 3
Maximum value: 8
Minimum value: 0

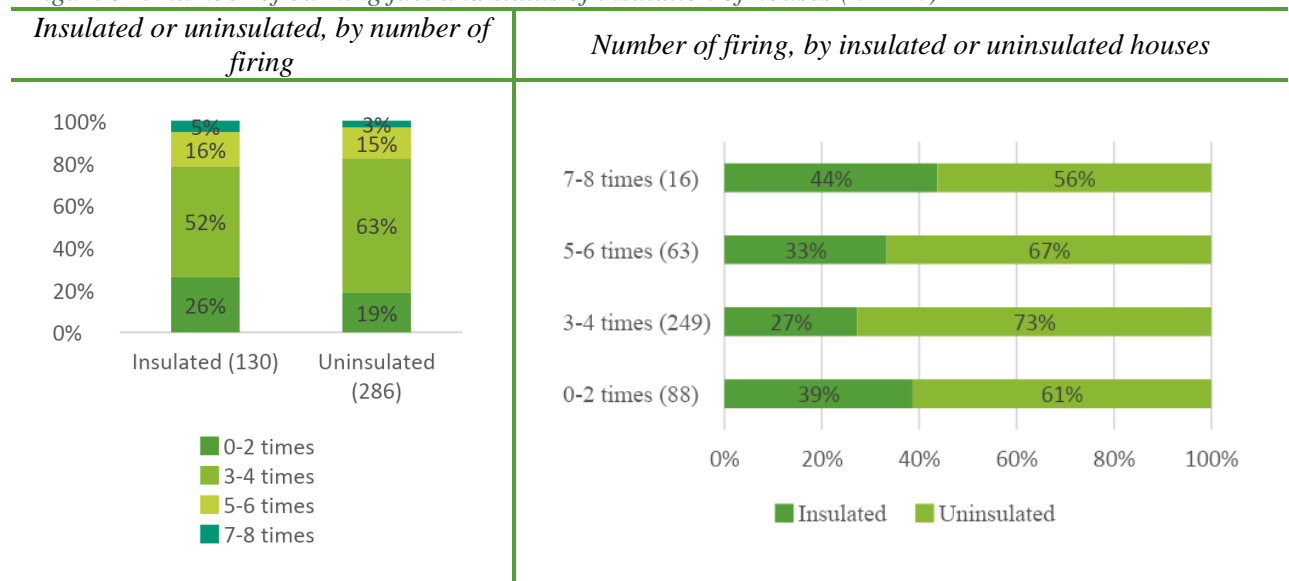
House wall type	Plank	Timber	Brick	Hollow block	Aerated lightweight block
Average number of refueling per day	3.6	3.5	3.2	3.1	4

Source: Findings of random sampling survey

No significant difference was observed from an analyse comparing the number of firing against the households; both insulated and noninsulated their houses. Whether the house is insulated or not, households fire their stoves 3.4 times a day, in average, during winter period. When the number of firing is compared against households (both insulated and uninsulated their houses), it was revealed that percentage of households (insulated) firing 0-2 times a day was 7% higher than uninsulated households, percentage of households firing 3- 4 times a day was 11% lower while the number of households firing 5 ore more times a day was 3% higher than others. To state differently, number of families with insulated houses that fire less a day was lower than uninsulated counterparts, but percentage of households firing multiple times was also higher. From this finding, it can be concluded that the insulation, which households made themselves doesn't influence on reducing the number of firing per day.

Moreover, average number of firing by families that live in insulated houses was slightly lower that the number of firing of families living in uninsulated houses.

Figure 92. Number of burning fuel and status of insulation of houses (n=416)



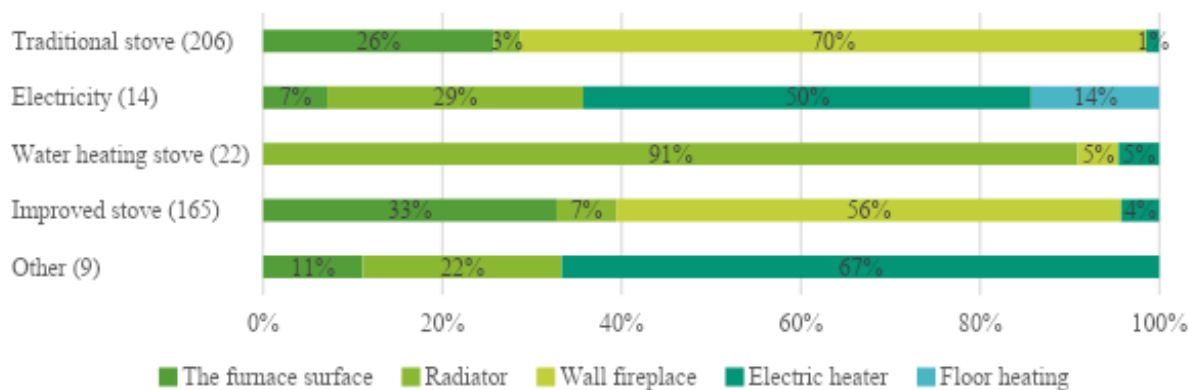
Part of houses with insulation	Wall	Roof	Floor	No insulation at all
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Frequency of refueling a day	3.2	3.3	3	3.6
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Source: Findings of random sampling survey

As for heating devices, 57% use wall style stove, 26% have ordinary stove with heating surface/top, 10% has radiators powered by stove heat, 6% has electric heaters and 0.5% has floor heating system. If heating stove types are compared against heating devices, 70% of households with ordinary heating stoves use masonry style stove, 56% of households with “project stove” has connected the stove to masonry system and 56% use their stove as-is or simply use stove surface as heating device.

Figure 93. Stove types and heating devices (n=416)



Source: Findings of random sampling survey

5.3.2 Drinking and waste water

Clean water sources and consumption

61% of respondents get their drinking water from nearby water kiosks, 35% from mobile water tankers (at certain times a day/week), 3% from protected deep wells or open sources such a stream/river, and only 1% get water from centralized water supply pipelines.

In average, households use about 35 liters of water per day with maximum being 125 liters and minimum 2.5 liters. Of all respondent households, 39% consume up to 20 liters of water a day, 19% use 21-30 liters, 16% use 31-40 liters of water while remaining quarter (255) use more than 41 liters of water per day.

Figure 94. Drinking water sources (n=416)

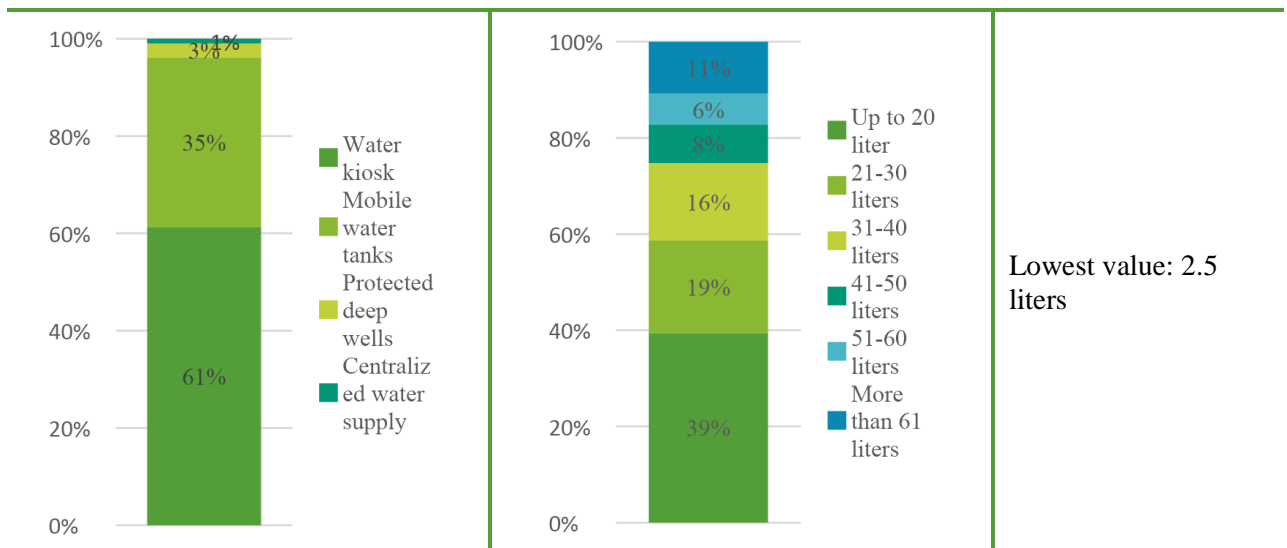
Figure 95. Amount of daily water use for drinking and households use (n=416)

Average: 35.1 liters

Median: 26 liters

Most repeated value: 20 liters

Highest value: 125 liters



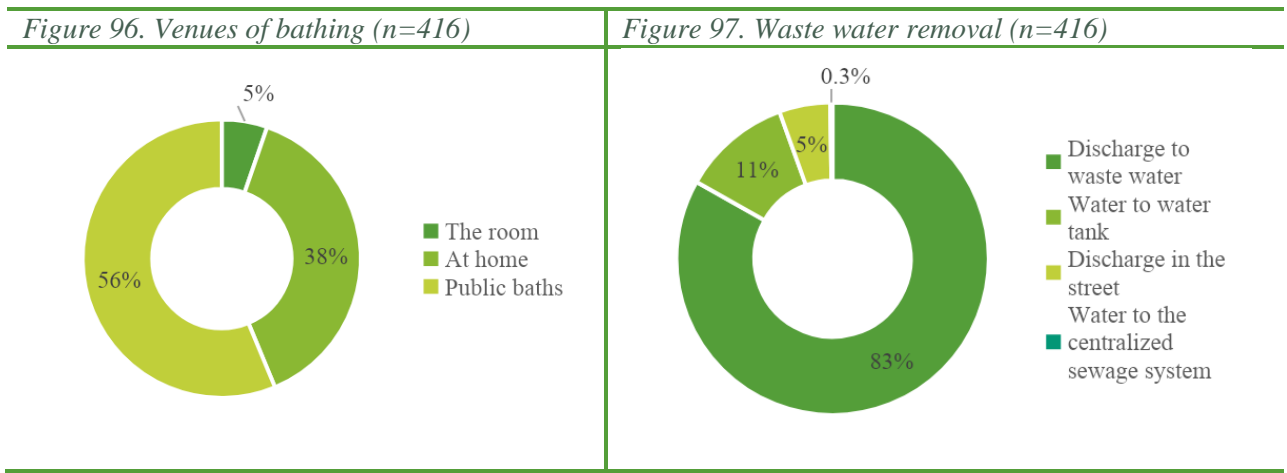
Lowest value: 2.5 liters

Source: Findings of random sampling survey

Waste water removal and places of bathing

56% of respondent households say that they use public bathhouses/showers, 39% they bath at home and 5% visit their relatives living in apartment buildings to have bath/showers.

Asked what they do with waste water removal, 83% said they discharge it to waste water pit/soak pit or pit latrine, 12% to water water tank, which is emptied by vacuum tanker, 5% just discharge in street and remaining 1 household (0.3%) removes waste water to the centralized sewage system.



Source: Findings of random sampling survey

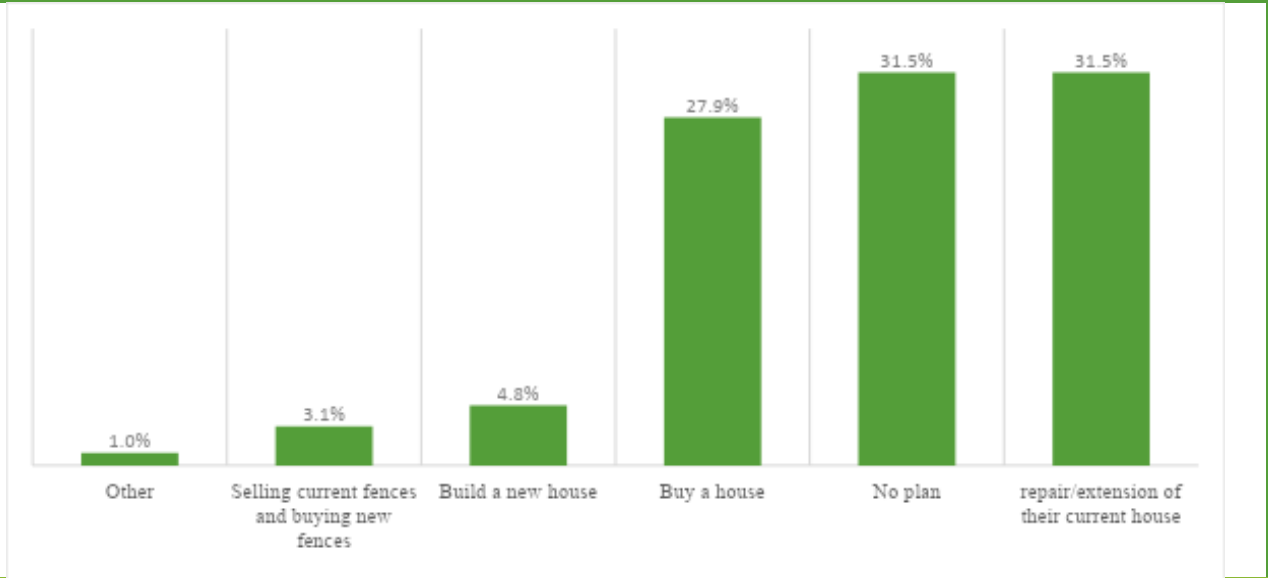
6. FUTURE INTERESTS OF RESPONDENTS ON THEIR HOUSES

This section describes the interests, willingness and plans of respondent households on making changes and modifications on their current houses.

6.1. Future plans on housing

In general, respondent households are willing to remain living in their current houses. In particular, 28% of respondents are willing to move to apartment buildings while remaining 72% are interested in repair/extension of their current house (31.5%), building new houses (4.8%) or have no plan at all (31.5%).

Figure 98. What are you planning to do with the current house you live in? (n=416)

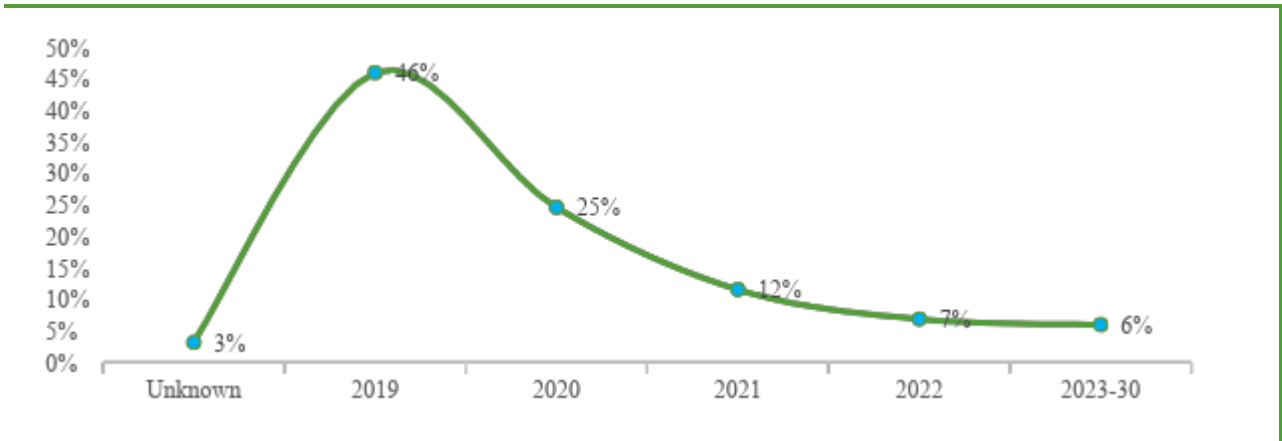


Source: Findings of random sampling survey

In case that the 28% of respondents, which answered they are interested in moving to apartment buildings, are broken down by their income level, half of them (14% of total) belong to low income group, bit more than one third (10%) belong to middle income group and only one seventh (4%) belong to high income group. If broken down down by number of household members, households with 1- 5 members account for the majority, among which families with four take the majority again. Look at links between the households planning to transfer to apartment buildings and their income level demonstrates that real number of households moving to apartment buildings would not be such high in reality.

Majority of households (72%) plan changes in their housing situation in the near term, or 2019-2020.

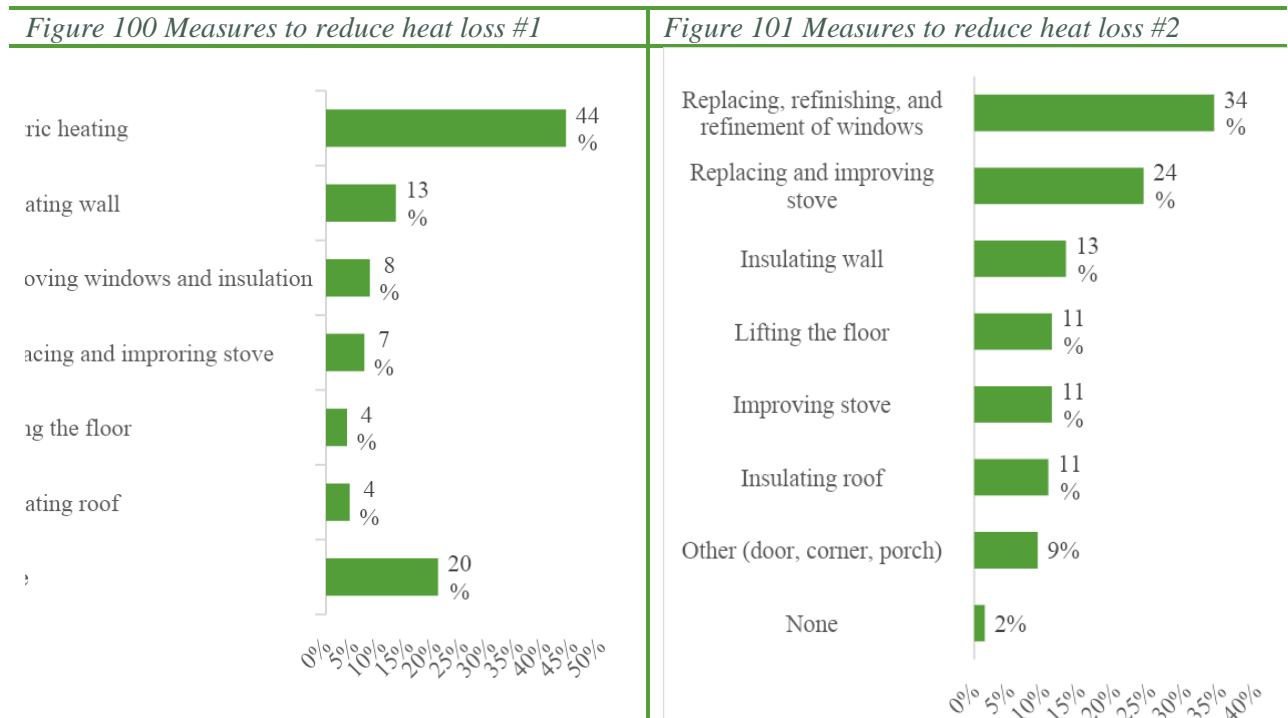
Figure 99. Years planned to move to apartments, %



Source: Findings of random sampling survey

6.2. Measures to reduce heat loss

Results of quantitative survey asking what measures the households prefer for reducing heat loss, citizens selected electric heater as the priority choice, followed by insulation, particularly the parts of windows, walls and floors for energy efficiency.



Source: Findings of random sampling survey

Respondents (44%) selected **electric heaters** as their priority choice for reducing heat loss for almost a single reason that monthly electricity payment for electric heater almost equals to price of a mini truck of coal. According to respondents, they pay about MNT 150- 200 000 for electricity bill, per month (FGD, October- November, 2018). However, a number of factors limit the use of electric heaters, such as [1] low power in mains supply in the areas that respondents live and fire risk due to outdated electrical circuit, and [2] high tariff for electricity and higher costs incurred for purchase and installation of electric heaters due to low financial capability of respondents.

During the focus group discussion, respondents cited following reasons as prohibitive factors for using electric heaters (FGD, February, 2019):

FGD in Sukhbaatar District:

- Low electricity voltage in the area
- Low voltage electrical wiring cannot withstand the high voltage needs of electrical heaters
- Limited number of households that can buy electric heaters
- Price for each kilowatt of electricity is high
- Government nullified night tariffs, but its coverage and length is short
- Night tariff is high
- Electric heaters burn air and poses fire risks
- No need for electric heater as I have a masonry style stove
- Schedule for zero tariff application is incorrect.

FGD in Songinokhairkhan District:

- Fire risk as the electrical wiring is old
- High price for electricity
- Failure to monitor the electricity meter
- Households with electric heaters must keep their eyes on the electricity meters
- Don't know how much is saved from electricity costs
- Have no good knowledge on the night tariff
- Accustomed to burning firewood/coal as I have a small house
- Heaters would not make it good unless we find good solutions for insulation.

For reducing heat escape and improving thermal energy efficiency, the second priority choice made by respondents was **replacing or improving their stoves**. Among the households, heat-only-boiler, masonry style stove and smokeless stove, which is commonly referred to as project stove (distributed by air pollution reduction project) were used mostly. Depending on experience and habits of using stoves, respondents cited numerous advantages and downsides for different types of stoves they use.

As part of this study, researchers tried to clarify reasons that the use of project stoves (smokeless) kept declining among households in Ulaanbaatar. In response to this question, respondents say the project stove require higher fuel/coal, low ability for retention of heat, uneasy firing and inconsistency with Mongolian conditions as the main reasons. Among all responses, most common reason was that the project stove is well suited to traditional ger dwelling to they sell these stoves to people living in the countryside. During the FGD, following reasons were mentioned as the key reasons for not using the project stove:

FGD in Sukhbaatar District:

- It needs more firewood to fire
- The part that holds ashes was broken, so it is unable to use it anymore
- Its outlet faucet cracked and the overall surface cracks when cold and iced coal is burnt

FGD in Songinokhairkhan District:

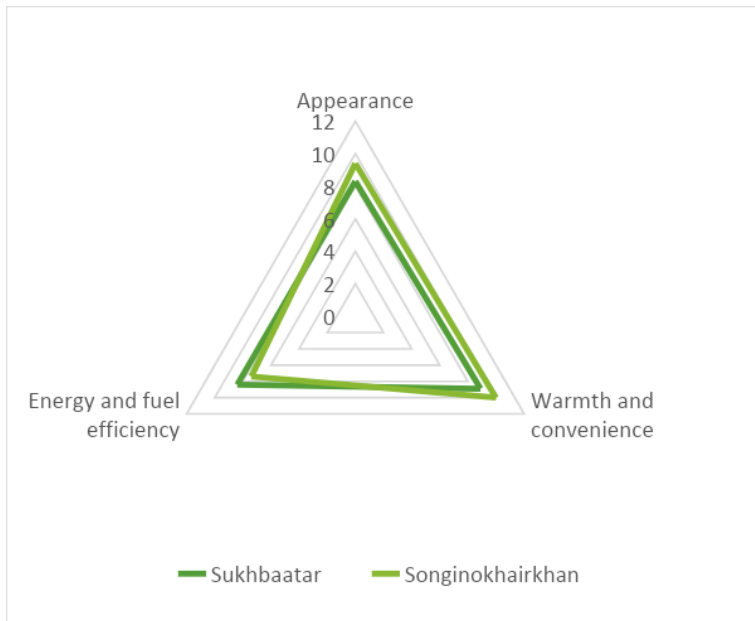
- It is hard to use; not all members in the household can properly use it
- No good heat generation, gets hot quickly, but loses the heat quickly
- When it is connected to the masonry style stove, it requires more fuel
- It blew up once. Dangerous

- Not suitable for households use
- It is impossible to put the cooking pan on the heating top
- It is not designed for Mongolia, likely it fits best for Turkey.
- It does not reduce smoke.
- Smoke emission is the same, so people stopped using it
- My masonry stove connected to the project stove blew up; it is not an appropriate stove
- Project stoves have different burning characteristics for different quality coals
- All project stoves went to rural areas
- It requires frequent firing as opposed to normal stoves
- Not useful for large area
- Cast iron part that lowers ash level often cracks/falls apart
- When raw coal is burnt, it does not retain heat for longer period, but good when improved fuel is burnt. Good thing is it does not leave any ash. Price is higher
- It is sold to people in the countryside.

Next priority measure that respondents selected was insulation of houses for better heat retention and heat loss reduction. Most common practice of insulation was found to be wall insulation; however, FGD discovered that respondents had limited understanding, knowledge and information on how to insulate roofs and floors.

Citizens tend to get interested in more complete and well-designed solutions in the event that the price is affordable, regardless the type of houses. In order to clarify this preference, researchers asked respondents to score three components for their houses (*1. Appearance, 2. Heat production and convenience, 3. Energy efficiency*) according to their importance by 1- 10 scores (using participatory tool) and the average scores given by two groups were almost the same. Respondents emphasized the importance of warmth and convenience when they think of repair and modernizations on their houses, but also, they highlight on appearance and design. Despite that they prefer fuel and energy efficiency, but they scored 1- 1.5 points lower as opposed to previous two characteristics.

Figure 102 Factors considering in house repair and modification





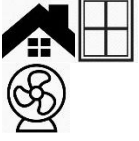
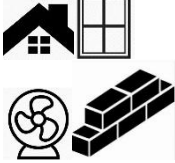
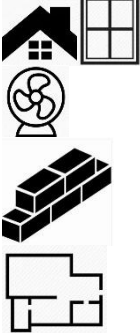
Characteristics	SB district	SKh district	Average
Appearance	9.4	8.3	8.8
Warmth and convenience	10	8.9	9.4
Energy and fuel efficiency	7.4	8.4	7.9

Preference on insulation solutions: Researchers asked which part of their houses citizens want to insulate for reducing heat loss if they agree to use one of the proposed solutions by Center for Building Energy Efficiency. Participants of the FGD selected their preferred choices among 5 different solutions, and they tend to increasingly select Solution #3, 4 and 5.

- As opposed to Solutions #1 and 2, last three solutions (4, 5 and 6) are more attractive as they contain solutions on ventilation and air circulation in the package.
- Citizens that are interested in Solution #4, think this solution as the best because this offers window insulation in addition to previous solutions. However, they cannot afford Solution #5 for they might incur higher costs for acquiring the floor and house foundation insulation and this solution require more work.
- Households interested in Solution #5 say the foundations of houses differ, but think they must get complete set as long they become project beneficiaries and spend resources; that was the main reason for their choice.

Table 13. Technical solutions and priorities ranked by respondents

Solutions	Solution #1	Solution #2	Solution #3	Solution #4	Solution #5
	<ul style="list-style-type: none"> • Roof insulation 	<ul style="list-style-type: none"> • Roof insulation • Window insulation 	<ul style="list-style-type: none"> • Roof insulation • Wall insulation • Ventilation/ air circulation settings 	<ul style="list-style-type: none"> • Roof insulation • Wall insulation • Window insulation • Ventilation/ air circulation settings 	<ul style="list-style-type: none"> • Roof insulation • Wall insulation • Window insulation • Ventilation/ air circulation settings • Floor and foundation insulation

					
Sukhbaatar district	1	1	1	5	5
Songinokhairkhan district	1	2	5	3	7
Total	2	3	6	8	12

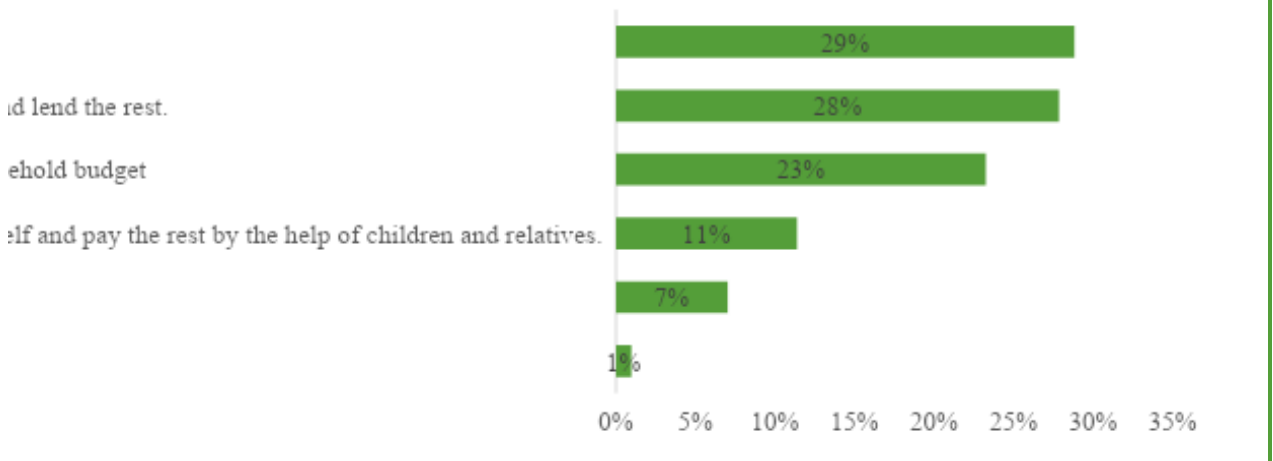
In addition, series of FGD, held in autumn 2018, and observation during the interviews indicate that the households receive information and ads on solutions available on the market and other goods, but they have no specific information and knowledge to facilitate their choice, such as which to purchase and how to use. This is verified by that many respondents asked more question and requested in-depth information on the solutions presented at the meeting. This necessitates the need to disseminate more information on the solutions proposed by the project, including detailed instructions, price and place for purchase, to the target groups in a way accessible to them (FGD, 2018, 2019).

Respondents highlighted the importance of building a model house in the target khoroo territory so that more detailed information can be supplied to target group. In addition, respondents proposed information leaflets could be placed in crowded areas, use social network to reach youth, work closely with khesege (sub-division) leaders (note that some respondent warned that khesege leaders provide information to some socially active families and reach to limited scope) or organize public events on weekends (in local school gym and etc) so that information can be disseminated to wider audiences (FGD, October- November, 2018).

6.3. Financial capabilities and interests of respondents

The survey asked what degree of interests that respondents have in terms of making financial decisions regarding changes and modifications to their houses. In response to this question, one third of respondents have no idea or position on how to make decision or what decision to take, about half said they would make upfront payment (in any ways) for purchasing solutions and about a quarter said they would address to any credit/lending sources for financing.

Figure 103 Ways of resolving financing (n=416)



Source: Findings of random sampling survey

Specifically, to a question “If it is possible to reduce your fuel cost by about 20%, will you be able to spend money for insulation”, 27% said “No”, 19% said “Yes, and will pay all costs”, 37% said “Yes and will pay part of costs by loan” and 18% said, “Don’t know”. Key limiting factor that make households refrain from injecting investment for house insulation was the limitations of financial resources. In particular, households without permanent incomes are more concerned about the collateral for loan.

Moreover, some households in Sukhbaatar District are waiting for ger area re-development project (some families have been waiting for 8 years for this project to commence), so they were found reluctant and precautious to make large sum financial decisions, according to findings of FGD in the autumn of 2018.

54% of households say that they are able to spend up to MNT 2 million for insulation of their houses for better energy efficiency/ heat loss reduction.

Figure 104 Households’ readiness to spend money for insulation (n=416)

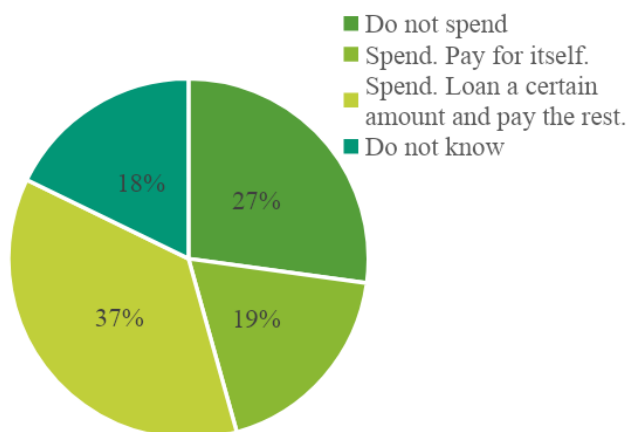
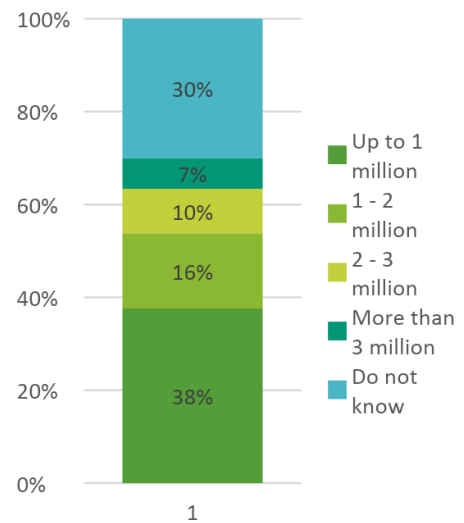


Figure 105 Amount possible to spend for insulation



Source: Findings of random sampling survey

Excerpt... MNT 6 million for an average building would be an enough investment. For some houses, MNT 2 million is OK. When we save up some money, we would first think of improving our accommodation so that we live in convenient house and children grow up in healthy environment. If we get materials, we can get instructions from experts and can do the insulation ourselves with firm commitments. No need to be concerned for additional costs for materials and services. If it is possible for many households to get this done if the standard materials prices are not excessive and work cost is not added affluently as not everyone can do it him/herself (A citizen of khoroo# 28, Songinokhairkhan District, 31 October, 2018).

Technical solutions and financing: Citizens were more interested in proposed price and payment conditions when they are asked to make their choices from the previously identified technical solutions. As for interviewees in the FGD, it was found common that many citizens were interested in injecting investment for insulation of their houses in case they are offered with financing with accessible and acceptable terms and conditions. During the discussion, participants discussed about the most acceptable financing terms and conditions if they need to select a technical solution for 50 m² houses. Following Table summarizes the findings of the discussion (FGD, February, 2019).

Table 14. Previously identified technical solutions and ranking of solution by selection of respondents

Indicators	Value	Proposal
Area size	50 m ²	Conditional
Total amount	5-7 million	Citizens think that proposed solution #5, which include complete set of all solutions, under a condition that it would cost MNT 5 million if citizens would install all insulations themselves or MNT 7 million if households hire professional contractors, as the most feasible solution. They are interested in injecting these amounts as investment if their heat loss problems are resolved and convenient living environment is created. However, participants to the previous FGD in the autumn of 2018 mentioned that they can spend about MNT 1- 2 million. At this time, solutions were presented and its expected impacts and importance were described, so such detailed information could have driven the respondents think MNT 5- 7 million as feasible/affordable. As opposed to this idea, some citizens said the amount could be increased slightly to MNT 10 million and they could build a new house, so the proposed amount is cost-prohibitive. Therefore, it is necessary to get more detailed information on their understanding of prevailing market prices for construction materials.
Interest rate	1%	On the proposed 1% interest rate, respondents have no comments and all agreed on the rate.

Term	30-36 months	FGD in two districts reveals that respondents were more interested in long- term loan services saying 36-month loan would be the most suitable. Therefore, it is important to select loan product that offers longer terms as opposed to 30-month consumption loan, and even offering much longer terms like mortgage loan. The reason that respondents are more interested in longer term loan was that longer-term loan would require monthly payment amount lower.
Monthly payment	MNT 220,000 – 305,000	It setting the monthly payment amount, it is important to set the amount tied with the household income level (employment rate). Senior citizens and pensioners think MNT 170 000- 200 000 installment per month would be appropriate while middle aged, employed respondents say they are able to pay as much as MNT 300 000 per month.

During the discussions, citizens expressed their willingness and interests, as well as the realistic need for, in the project which offers access to financial leasing services in accordance with terms and conditions set forth by the group discussion, insulation of their houses with affordable and premium quality insulation materials available on the market, in accordance with the specific insulation instructions, and hiring services of professional contractors for some parts of insulation, which require higher skills and workmanship. This finding coincides with and proved by the findings of FGD, held in October and November, 2018, respectively.

However, respondents mentioned about the need to establish a binding responsibility system that the households receiving soft loan for insulation materials must adhere to. They also highlighted the importance of repayment of project loan financing, which offers suitable terms and monthly payment schedules for house insulation; in this case project would be implemented successfully and open up opportunities for more households (FGD, October- November, 2018).

CONCLUSIONS

Respondent households

Survey covered 416 households living in 11 target khoroo of Sukhbaatar and Songinokhairkhan districts. An average respondent household has 4 in the family and 1.5 child. 39% of them has a pensioner and 7% has a disabled member. Also, there are 2 persons that are incapable for employment, in each household.

Of all households, 14% belong to households that are considered as vulnerable. To state differently, 11% of all households are headed by women and 3% has single fathers as head of the family.

Majority of households included young and middle-aged families. However, education level of heads of households were found lower as exemplified by 66% of all household heads have gained secondary or lower education and 7% obtained no formal education at all. The lower the education level of heads of household is, the lower the household income gets.

Half of adult members of households work in private sector, 15% are employed in public sector while remaining 34% are currently not employed. People who are employed mainly work in sectors such as trade, service, construction, mining, processing, energy, education and health sector.

Of all adult members of respondent households, 46% pay social insurance premiums, including all people working in public sector, 67% of private sector employees and 40% of self-employed respondent pay social insurance premium resulting in having full coverage.

When households need to make larger procurements, either the head of household or a wife makes investment decisions, in many cases they make their minds up jointly through negotiation.

Knowledge and attitude on air pollution

In determining knowledge and attitude of households regarding air pollution, researchers considered several factors, such as whether they are aware of air quality indicators, knowledge on the sources of air pollution, major adverse impacts and potential ways for reducing the pollution.

Air quality measures: Primary level knowledge on the air quality measures were found poor as 51% of respondent households said they heard about air quality index, but majority of them had no firsthand knowledge on how to convert and understand air quality index.

Sources of air pollution: respondents have good knowledge on major sources of air pollution. Majority of respondent households traditional stove used by get-district residents and vehicle emission as main sources of air pollution of Ulaanbaatar city.

Adverse impact from air pollution: Respondent have good level of primary knowledge on the adverse impact from air pollution on human health. Moreover, 72% said their health condition suffers from air pollution and 25% said they incur excessive economic costs due to air pollution. Over half of respondent wear face masks to protect their health from devastating impact from air pollution; this demonstrates that the self-protection attitude has been created among the population.

Contribution to reducing air pollution: Respondents think electric heater and insulation of house to reduce coal use are the most appropriate ways for the households living in houses in the ger

districts. If classified by income groups, low income households select house insulation, use of improved fuel and electric heaters are suitable solutions while middle and higher middle-income groups select use of improved fuel, electric heater, tree planting in the yards and moving to apartment buildings as their contribution to reducing air pollution.

Knowledge and attitude on heat loss

Several factors, including what must be done, have been done and is being done to keep the house warm, were used to determine respondents' knowledge and attitude on house heat loss.

Knowledge on keeping house warm: Citizens have poor knowledge in how to insulate their houses and how to reduce heat escape. Asked what they do in order to keep their homes warm, half of the respondents said "burn/fire stove" and "don't know" showing that they have no knowledge on house insulation and fuel efficiency. In addition, level of knowledge on insulation and heat loss reduction differ slightly according to income levels.

Insulation of houses: Trends among citizens to keep their homes warm and to reduce heat loss were inadequate. Key factors affecting this slow trend include shortage of knowledge and inadequacy of incomes. In particular, almost half of the respondents (46%) did not do any insulation in their homes, of which 62% said they have no knowledge at all on how to keep the homes warm while 87% were household belonging to middle and higher-income groups.

Warmth at home during winter: Majority of households stay warm and convenient in their homes, but one third said they feel cold, of which more than half has not made any insulation in their houses.

Household income

Monthly average income: Over half of respondent households earn MNT 700 000 or less per month. To sum up, average monthly income of community in the target khoroo was discovered to be lower than the average income of all households in capital Ulaanbaatar. Average monthly income of respondent households representing Sukhbaatar district was slightly higher than similar households representing Songinokhairkhan district.

If calculated in approximate values, average monthly income of households was MNT 840 000, which is lower by MNT 460 000 as opposed to average monthly income of all households in capital Ulaanbaatar. Moreover, 26% of all households generate up to MNT 500 000 monthly income and its 17% (71 HHs) has 3 or more family members. It, therefore, can be concluded that 17% of total households has a monthly income under the lowest livelihood level³³. In addition, most households with single mothers and father had low income level.

In case that households with single mother or fathers as head of the family are classified as vulnerable group in terms of family type, and households having monthly income up to MNT 500 000 with 3 or more family members are classified as vulnerable group in terms of income, total of 131 households or 31% of households would fall into this group.

³³ According to National Statistics Office, lowest livelihoods level (poverty line) for the population in 2019 was MNT 217 900 per month.

Income of more than half of respondent households is not adequate for sustaining their livelihoods. 80% of low-income households, 30% of middle-income households and 24% of higher middle-income households say their income is not adequate for livelihoods.

Number of adult members of the households: More than half of adult members in the households receive salaries and all members of one third of respondent families have salary income. Also, households with salary + pension and salary + business income form the second largest group. Most family members that earn salaries from employment pay social insurance premiums and majority of households with business income have sources of revenues from their businesses. Household members with pension and welfare income get about MNT 302 500 per month, in average.

Household costs/expenses

Household expenses were classified according to four categories; costs for education, health, fuel/firewood and electricity.

Education costs: 42% of respondent households say they incur costs for education saying the average annual expense for this purpose equals to MNT 1.2 million. Majority of households incurring education costs belong to middle and higher middle-income groups while more than half of those incurring no education costs belong to low-income groups.

Health costs: 94% of respondents say they have health related expenses and pay about MNT 63 400 per month for their health. Low income families spend monthly MNT 54 370, middle income families spend MNT 61 580 and higher middle-income families spend MNT 76 200 for this purpose. 92% of households incur expenses for curing respiratory diseases and 24% for cardiovascular diseases. These households incur MNT 37 125 for treatment of respiratory diseases and MNT 27 660 for curing cardio-vascular diseases, per month and in average, respectively.

Firewood and coal costs: Households use 69 bags of firewood and 4 tons of coal every year as average. During the cold months, average family use 16 bags of firewood and 1 ton of coal a month. For firewood, average household spends MNT 57 340 per month totaling MNT 214 996 a year while they spend MNT 88 950 per month for coal totaling MNT 607 468 annually.

Electricity costs: Respondent households pay average MNT 52 900 for electricity bill a month during cold season and MNT 37 280 a month in other seasons. Regardless cold or warm season, vast majority of households pay MNT 30 000 for electricity a month. During the heating season (cold season), electricity bills raise by as much as MNT 10 000- 15 000 showing that the target groups use electricity to some extent for heating purposes. Majority of household using electricity for heating belongs to middle and higher-middle income groups.

Household saving and loan

Savings: Only 20% of respondent households have savings with average amount being MNT 2 million. Of those households with accumulated savings, 30% belongs to low-income group, 54% to middle-income group and 16% to higher middle-income group. Although both the number of families and the amount of savings are low, majority of households have habits of saving. Most savings are made up for future investment and risk while only 6% of households save for building houses and extension of their existing houses.

Households loan: 32% of the participants have some amount of loans. Of them 16% have salary loans, 9% - pension loans, 5% - consumer loans, and remaining 3% have car, business loans and mortgage. Average amount of total outstanding loans of all households equal to MNT 5.8 million while average amount for salary loan of all households equals to MNT 6.2 million and amount for pension loan equals to MNT 4.2 million. Average loan period was found to be 2 years and respondent say they pay about MNT 374.8 thousand as monthly repayment, per month, in average. Repayment amount for salary loan was as much as MNT 100 00 higher than repayment amount of pension loans. 21% of households with outstanding loans used the loan for building houses, purchasing land and repair and extension of houses.

Household assets-properties and future investment plans

Household assets/property: More than 50% of respondent households own a car, of which 85% has one car and remaining households own 2- 6 cars. 7% of all cars have been collateralized for loan.

77% of households own their land (private) and 17% possess (public) their land. Average area of the land was 606 m², in average. In addition, 96% of households formally own the houses they and most of them have certificate for immovable property title. 9% of those own their houses have used them as collateral for loan.

Future investment plans: Only one third of all households have their future plans for investment, and majority of these households plan to inject investment into housing. Of these households, low-income groups account for 40% and middle and higher-income groups account for 60%.

Condition of houses

Ageing, arrangement and structure of houses: Households live in 11-year-old houses with 47 m² of area, in average. More than half of respondent households live in one-room house. Average one-room house has 41 m² area, a door and two windows facing to south as common characteristics. As opposes houses with more than one room has about 55 m² of area, 2- 3 rooms, a door and two windows facing south, and a window facing east and west, each. As for three-room houses, it has a living room, a bedroom and a kitchen while two-room houses consist of a living room and a kitchen.

In terms of materials, households live in either of the following two types of houses: (i) house with brick wall, A-frame roof with metal sheet cover and concrete floor and, (ii) house with wooden walls, A-frame roof made with metal sheet cover and wooden floor.

Majority of households built their houses themselves and it is uncommon to hire professional contractors for house construction.

House insulation and heat loss: Only one third of households have insulated their houses for better thermal energy efficiency. Respondent comply with criteria, such as affordable price and availability of materials in the market, in selecting insulation materials. Almost 100% of households made insulation themselves and think that the quality of their insulation is good. According to respondents, three main challenges they encounter in insulating their houses include lack of financing, shortage of human resources and unavailability of time to spend for insulation work. Low-income families account for 92% of respondent that said financing as one of key challenges. In addition, more than half of households expressed their interests to hire professional

contractors for insulation, and 53% and 47% of them belong to low and higher middle-income groups, respectively.

Two thirds of respondents said that their houses lose heat through at least on part, with window and door being the most probable places for heat escape. More than half have taken measures to reduce heat loss by insulating their windows, doors and roofs. For insulation, they used foam board and asbestos wool as the primary materials and purchased the materials mainly from retail traders.

Heating: 50% of households use conventional stove, 40% use project stove and remaining 10% use electric stoves and water stoves that heats radiators. In average, they fire their stoves 3- 4 times a day in winter. When the average number of firing was compared with households that insulated and uninsulated their houses, no difference was found between insulated and uninsulated; this evidences that self-made insulations does not result in decreasing the number of firing a day. Majority of households use masonry style stove addition and heating top as the main heat generators.

Future plans regarding the current houses

Short-term interests: Majority of citizens plan to continue living in the places they are in now. Although one third of the respondent said they are planning to move to apartment buildings, it is still unclear if their real financing standing (permanent income size, savings and outstanding loans) would meet the requirements for housing mortgage loan. Remaining two thirds have vested interest in repairing and insulating their houses, and majority of them (72%) plan this to be achieved in the short term, namely in 2019- 2020.

Steps for reducing heat loss: Respondents say electric heating, renovation of heating stoves and insulating houses are the most effective ways for improving heat supply and convenience of their existing houses. Discounted electricity tariff encourages use of electric heating, but the misapprehension about fire hazards and initial cost for electric heating set limitations. Though respondents think improving stoves and reducing fuel consumption, they disagree that the smokeless stove (one that is called project stove- distributed by Clean Air project) is an optimal solution. In the short term, insulating houses was the most appropriate solution and citizens are currently at the stage that their understanding and knowledge are being formed.

Most interested solutions. Citizens are increasingly willing to select the comprehensive solution for house insulation reducing heat escape. They prefer not only insulation, but also solutions simultaneously improving their house appearance and saving on fuel and firewood. This was found to be a trend notwithstanding the household income level, but a common trend among all groups. However, the number of populations that has clear understanding and knowledge on insulation materials selection and instructions on how to make insulation was limited, which means there is steady demand for information on these subject matters. For dissemination of information, direct methods and channels are preferred, including building a model house showing the solutions in the khoroo territory, organizing face-to-face meetings with the community, placing print information in the public places and using social network.

Financial capability: It is expected that financial leasing or loan offering various terms and conditions that are based on the financial capability of households would open up opportunities

for wide variety of households to acquire the technical solutions necessary for their needs. Majority of respondents think that can spend about MNT 1- 2 million for the house insulation, but they could become interested in injecting MNT 5- 7 million in the event that they have clear understanding on the long-term impact from this investment. In order to achieve this result, it is important to offer low repayment (~200,000 MNT), longer term (~36 months) and lower interest rate (<1%) so that citizens would be more interested in accessing to the service. In case that the project intends to involve low-income, vulnerable families to the project, the requirements imposed by the banks must be flexible depending on the status of recipient households. For instance, it might be necessary to take into account of each groups such as households without assets for loan collateral, households whose current houses don't qualify for collateral, groups that have no permanent income, groups that don't pay social insurance premiums, and groups employed in informal sectors or for seasonal jobs.

APPENDIX

Questionnaire

BASELINE SURVEY REPORT FOR PROJECT “ENERGY EFFICIENCY ADVISORY AND FINANCIAL INTERMEDIATION FOR SUSTAINABLE HOUSING IN UNPLANNED AREAS OF ULAANBAATAR

MIRIM Consultant LLC is currently survey households living in ger areas for the baseline survey of the TOP project. The purpose of this survey is to define the knowledge, attitudes, needs, financial capacity, and current conditions of the dwelling for the target households. Based on the findings of this survey, you will be encouraged to participate in the research and to provide accurate information as the future work of the project will be planned. We will keep the confidentiality of the information you provide and will only be used for research purposes.

(This survey is based solely on a household head or a spouse's household or permanent resident household members who are involved in household decision-making)

Criteria question: Does your house rent this house?

Yes (Stop survey)

No (Continue survey)

Nº	Data collection team information	
1	Researcher's name	
2	The survey was completed date	0 1 1 9
3	Start time (time, minute)	:
4	Expired time (time, minute)	:

Nº	Respondent's information	
5	Respondent's name	
6	Respondent's age	
7	Respondent's sex	1. Male 2. Female
8	Location	District: Khoroo:
	Read GPS	Street: Door Nº:
9	How does the respondent relate to the household head?	
10	Respondent's phone number	

I. GENERAL INFORMATION RELATED TO HOUSEHOLD

№	Question	Answer
1.1	The number of members living permanently in your household	1.person 1.1. Number of a minor child..... 1.2. Number of the elderly.....
1.2	Family type	1. Single 2. Female head of household (mother and child of a family) 3. Single male head of household (father and child of a family) 4. Normal family (mother, father and child of a family) 5. Compound family (husband, wife, children, grandparents and relatives of a family) 6. Other (please specify)
1.3	Does your household have a disability?	1. No 2. Yes. Number of disability:.....
1.4	Who usually make decisions about major (For example: 300000 MNT or more) purchases and investments in your household? (Choose up to 2 main people, ask for the name and type behind the selection)	1. Household head..... 2. Wife..... 3. Adult child..... 4. Parents of household head..... 5. Siblings of household head..... 6. Son in law/daughter in law of household head..... 7. Grandparents of household head..... 8. Parents in law of household head..... 9. Brother in law/sister in law of household head..... 10. Other (please specify)

Here's a list of adult members living in that household

№	1.5 Relevance to household head Please use the code below 1=Household head 2=Wife/Husband 3=Child 4=Grandson/Granddaughter 5=Father/Mother 6=Brother/sister 7=Son in law/Daughter in law 8=Grandfather/grandmother 9=Father in law/mother in law 10=Other relatives 11=Not relatives 12=Other.....	1.6 Sex Please use the code below 1=Male 2=Female	1.7 Age	1.8 Educational status Please use the code below 1=No education 2=Low(4,5 th grade) 3=Primary (8,9 th grade) 4=Secondary education 5=Technical and professional 6=Special secondary 7=Bachelor 8= Master 9=Doctor	1.9 Employment status in the last 12 months Please use the code below 1=Government organization 2=Private sector 3=Self-employed 4=NGO 5=NUO 6=Pension 7=Maternity leave 8=Herder 9=Unemployed 10=Group 11=Student 12=Other
1					
2					
3					
4					
5					
6					
7					
8					
9					

Here's the information about adult members living in that household (continued)

№	1.12 Income type 1=Salary 2=Pension 3= Household production and services (business) income	1.13 Income source 1=Salary that pays social insurance 2= Salary that doesn't pays social insurance 3=Pension 4=Allowance for people with disabilities 5=Trading business income 6=Other (please specify).....
1		
2		
3		
4		

5		
6		
7		
8		
9		

II. KNOWLEDGE AND ATTITUDE TOWARDS AIR POLLUTION AND HOUSE HEAT LOSS

№	Question	Answer
AIR POLLUTION		
2.1	Did you hear it air quality indicators?	<ol style="list-style-type: none"> 1. Unfamiliar (please skip question 2.2) 2. Familiar
2.2	If air quality is marked in pink, how do you understand it?	<ol style="list-style-type: none"> 1. It's clean 2. At normal level 3. Slightly polluted 4. Moderately polluted 5. Very polluted 6. Highly polluted 88. I don't know
2.3	Circle the two main sources of air pollution in UB.	<ol style="list-style-type: none"> 1. Furnace smoke from ger district household 2. Dust from waste and soil 3. Toxic smog emitted by vehicles 4. Smoke emitting power plants 5. Smoke from waste incineration 6. Smoke from construction work
2.4	Which air pollution does the most damageing to the human body?	<ol style="list-style-type: none"> 1. Digestive system 2. Respiratory system 3. Neurological system 4. Reproductive system 5. Cardiovascular system 6. I don't know
2.5	What have you done to protect your family's health from air pollution? Multiple choice	<ol style="list-style-type: none"> 1. Wear comfortable masks when traveling 2. Set up air freshener in your home 3. Do not leave out as much as possible during high smoke 4. Monitor home-oven drip 5. Use high-quality food and promote immune system 6. Shut off doors and windows so as not to smoke outdoors 7. Do not smoke at home or in your car 8. Other (please specify)..... 9. Nothing
2.6	What is the damage to your family due to air pollution?	<ol style="list-style-type: none"> 1. Health is injured 2. Health-related costs are rising 3. Cost of household consumption (mask and prevention) 4. cost of various measures). 5. Require to buy expensive items such as air purifiers 6. is out. 7. Other 8. There is no harm 88. I don't know
2.7	What is the best way to contribute to reducing air pollution in your family?	<ol style="list-style-type: none"> 1. Build a house and reduce coal consumption 2. Use improved fuel 3. Use electric heaters 4. Planting trees in green areas and establishing green areas 5. Do not burn the garbage 6. Moving to apartment 7. Other(please specify).....
2.8	What do you think is the priority for reducing air pollution in ger areas?	<ol style="list-style-type: none"> 1. 2. 3. 88. Don't know

ENERGY SAVING		
2.9	What should be done to keep the house warm?	1. 2. 88. I don't know
2.1 0	Do you have a warm, comfortable wintering home?	1. Very warm (always warm) 2. Warm 3. Moderately 4. Cool 5. Very cold (always cool)

III. FINANCIAL CAPACITY OF HOUSEHOLD

INCOME OF HOUSEHOLD		
3.1	Average monthly household income (To supply all revenue other than cash receipts from abroad)	1. 500,000 up to MNT 2. 500,001-700,000 MNT 3. 700,001-900,000 MNT 4. 900,001-1,100,000 MNT 5. 1,100,001-1,300,000 MNT 6. 1,300,001-1,500,000 MNT 7. 1,500,001-2,000,000 MNT 8. 2,000,001-2,500,000 MNT 9. 2,500,001 over MNT 99. Refused 88. Don't know
3.2	If you receive cash transfers from abroad, how much do you receive on average per annum?	1..... 2. Do not take 99. Refused
3.3	How much is your household income?	1. Even in the short-term needs of the day (such as fuel, food, bus and bus) 2. It only reaches daily needs 3. It only touches everyday needs and clothing 4. They also have access to valuable items (electrical appliances, furniture, jewelery etc.) 5. It can generate more savings

HOUSEHOLD EXPENSES [fill in the expense for the appropriate amount of time]

(If no expense is incurred, write 0)

№	Cost type	Week	Month	Year
3.4	How much does your household spend on education and tuition fees?			
3.5	How much does your household spend on health (medicines, medical treatment, hospitalization)?			
3.5. 1	How much do you spend on the respiratory tract (colds, pneumonia)?			
3.5. 2	How much do you spend on cardiovascular diseases on average?			
3.6	How much fuel do your household use?			
3.6. 1	Firewood (cubic meter / bag)			

3.6. 2	Coal (tons / bag)					
3.6. 3	How much is the average coal price for sack?MNT				
3.7	How much is coal used to use?	1 2..... 88. I don't know				
3.8	Monthly charges for electricity					
3.8. 1	Heating season (9-5 months) MNT				
3.8. 2	Non-heating season (6-8 months) MNT				
3.9	Tell your household electricity code.	1..... 88.I don't know 99. Refused				
HOUSEHOLD SAVINGS AND LOANS						
3.10	Do you and your household have savings?	1. No (skip it question 3.14) 2. Yes				
3.11	How much is your household's total savings?	1..... MNT 99. Refused 88. Don't know	Name of Bank, NBFI, SCC:1..... 2..... 3..... 4.....			
3.12	Please tell us the type and time of deposit. (Consistent with multiple types of savings, the average time is calculated)	#	Types of savings 1= Demand savings 2= Time limit savings	Time (month)		
		1				
		2				
		3				
		4				
3.13	What are you currently saving for? Multiple choice	1. Buy a house 2. Buy a fence house 3. Build a house 4. Repair and extend your house 5. Purchase the land 6. Buy a car 7. Start or expand business 8. Pay tuition fee 9. For household use (electronic goods, furniture etc.) 10. Invest in your child's future 11. Prevent future risks 12. Others				
3.14	Does your household have a loan?	1. Yes 2. No (skip it 3.17)				
3.15	Please specify the amount, time, and amount of the loan for each type of loan (If there are multiple types of loans, the aggregate amount will be calculated, the average of the time, and the borrowed place)					
	#	Type of loan 1 = Salary loan 2 = Pension loan 3 = Housing loan	Amount (MNT)	Timing (months)	Monthly repayment amount (MNT)	Place of loan 1 = Bank 2 = NBFI 3 = SCC

		4 = Consumer loan 5 = Business loan 6 = Car loan 7= Other (specify)				4 = Official organization 5 = Individuals 6 = pawnshop 7 = Other (specify)
	1					
	2					
	3					
	4					
	5					

3.16	Multiple choice	What is the purpose of your loan?	<ol style="list-style-type: none"> 1. Buy a house 2. Buy a fence house 3. Build a house 4. Repair and extend your house 5. Purchase the land 6. Buy a car 7. Start or expand the business 8. Pay tuition fee 9. Household consumption 10. Take durable goods (goods, furniture etc.) 11. Conduct your household member abroad 12. To pay for medical expenses 13. Others (specify)
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PROPERTY

3.17	Does your household own a car? Multiple choice	#	Automatic type	Number	Whether pledge 1=Yes, 2=No
		1	Car seat		
		2	It has a truck		
		3	Car (micro, large)		

3.18	Please tell us about ownership and size of the plot.	Owned or owned		Size of land (m2)
		<ol style="list-style-type: none"> 1. Owns 2. Owns 3. No documentation 4. Not my family property 	

3.19	Tell us about the ownership of this house you live in?	Whether the household is a property	Whether with a NAT certificate	Whether pledge
		<ol style="list-style-type: none"> 1. Yes 2. No 	<ol style="list-style-type: none"> 1. Yes 2. No 	<ol style="list-style-type: none"> 1. Yes 2. No

FUTURE PLANS ON HOUSEHOLDS ASSETS AND INVESTMENTS

3.20	Do you plan to invest in your household in the next two years?	#	Things to invest	The year you are planning	
		1	Housing		
		2	Buy a car		
		3	Education (tuition fees etc)		
		4	For treatment		
		5	Travel abroad (travel and travel)		
		6	For a major celebration event (wedding)		
		7	No plans		

IV. HOUSEHOLD HOUSING CONDITIONS

№	Question	Answer	
STRUCTURE AND ORGANIZATION			
4.1	What was your house built in?	1.year 2. 88. Don't know	
4.2	How many years have you lived in this household?year	
4.3	Your house size	1. House size: x (ratio) 2. Floor Number: 3. (if only the winter and summer stay are included in the floor of the heater)	
4.4	Do you have the following rooms in your house?	1. All together one room (guest, bedroom, kitchen) 2. Living Room: 3. Bedroom: 4. Kitchen: 5. Bathroom: 6. In manpower: 7. Gong 8. Other	
4.5	Circle the corresponding rooms and write the number of rooms.	Type -	1 = Front, 2 = North, 3 = West, 4 = East
		Door	
		Windows	Next North West Left
4.6	Directions pointed to doors and windows What was your house built in? How many years have you lived in this household?	#	Exterior wall
		1	Brick
		2	Hollow block (fence block)
		3	Wood (pallets, boards, pliers)
		4	Bananas
5	Light block		
4.7	Your house size	1. A-frame roof 2. Attic style 3. Others (specify)	
4.8	Do you have the following rooms in your house?	1. Iron 2. Black paper 3. Wavy plate (chip) 4. Others (specify)	
4.9		1. Wood 2. Concrete 3. Others (specify)	
4.10	Circle the corresponding rooms and write the number of rooms.	1. They built their own friends or relatives 2. Construction professional construction company 3. Professional brigade construction / individuals built 4. Non-specialized Brigade / Individuals 88. Do not know	
4.11		1. Have 2. Don't have	
INSULATION			

4.12	Have you made any insulation in your house?	<ol style="list-style-type: none"> 1. Made 2. Failed (skip it 4.18) 				
4.13	Why bought the thermostat? Multiple choices	<ol style="list-style-type: none"> 1. 1. Because the price is cheaper 2. 2. Because the market is abundant 3. 3. Because of friends, acquaintances and neighbors 4. 4. Because it is easy to use 5. 5. Receive advice from professional and make purchases accordingly 6. 6. Internet and other printed materials have been purchased 7. 7. Others (specify) 				
4.14	How did you do your insulation?	<ol style="list-style-type: none"> 1. 1. They or their relatives or friends 2. 2. Professional company / brigade team hired 3. 3. Have a non-professional person 4. 4. Others (specify) 				
4.15	How is your insulation made of quality?	<ol style="list-style-type: none"> 1. Very good 2. Good 3. Intermediate 4. Bad 5. Very bad 				
4.16	Tell us the 2 most important challenges you face in building your house	<ol style="list-style-type: none"> 1. Financial difficulties 2. Lack of manpower 3. No knowledge (do not know how to do it) 4. Skilled 5. It's busy 6. Inserting insulating is not significant 7. The main design of the house is poor 8. Other 				
4.17	Is there any interest in hiring a professional brigade when it comes to insulation?	<ol style="list-style-type: none"> 1. Very interesting 2. Interesting 3. There is no interest 4. I do not know yet 				
HEAT LOSS						
4.18	Where is your house warming? Multiple choices	<ol style="list-style-type: none"> 1. There is no lost area 2. From the wall 3. From the roof 4. Floor 5. From the window 6. Doors 7. From the elbows and intersections 8. Others (specify) 88. Do not know 				
4.19	What measures have been taken to reduce heat loss?	#	Place of Insulation	Reference Materials 1 = Glass cotton 2 = Stone cotton 3 = Mineral cotton 4 = Bubbles 5 = Other	Size of thickness (cm)	Where did the thermal insulation materials be obtained? 1 = Producer (internal and external) 2 = Retail from 3 = Imported from abroad 4 = Other (specify)
		1	Wall			
		2	Roof			
		3	Floor			

		4	Window			
		5	Doors			
		6	Corners and intersections			
		7	Other (specify)			
		8	Not insulated			
HEATING						
4.20	What kind of stove do you have? Multiple choice		1. Traditional stoves 2. Improved furnace 3. Water heating stove 4. Electricity 5. Others (specify)			
4.21	How many times do you spend in the winter a few times a day?		1.times			
4.22	What kind of heating equipment?		1. 1. The surface of the boiler 2. 2. Electric heaters (eyelets, boilers) 3. 3. Radiator (cable) 4. 4. Wall fireplace 5. 5. Other			
CLEAN WATER SOURCE AND CONSUMPTION						
4.23	What is your source of drinking water for your household?		1. Connected to central water supply system 2. Water distribution site 3. Portable water service 4. Protected deep wells and springs 5. Bottled water 6. Others (please specify)			
4.24	How much water does your household use per day?	 liter tank..... days			
4.25	Where do you go to water?		1. Home 2. Room 3. Public baths			
4.26	How do you get rid of your household sewage?		1. Centralized lines 2. To the sewer bore to drain 3. To the wastewater or toilet borehole (absorbed) 4. It burns openly 5. Other			
FURTHER INTEREST						
4.27	What plans are there for a living? What plans are there for a living?	№	Types of plans		The year you are planning	
		1				
		2	Buy a house			
		3	This fence will sell your house and buy a fence in another place			
		4	Build a new house in this yard			
5	This house will be repaired and extended					

		9 9	There are currently no plans
4.28	What plans are there for a living?		<ol style="list-style-type: none"> 1. 1. All expenses shall be borne by the household budget 2. 2. Pay part of the expenses and pay the rest with the help of the children and relatives. Part of the cost will be paid and the rest will be levied. 3. All costs are lent 4. Others (specify)..... 88. Don't know
4.29	If your household's fuel cost is reduced by at least 20 percent, do you spend money on heating?		<ol style="list-style-type: none"> 1. Spend. Pay for itself. 2. Spend. Loan a certain amount and pay the rest. 3. Do not dismiss (skip it 4.30) 4. 88. Don't know
4.30	If you want to spend money, tell me about your potential cash payments		<ol style="list-style-type: none"> 1. 1,000,000 up to 2. 1,000,001-2,000,000 3. 2,000,000-3,000,000 4. 3,000,0001 over 88. Don't know
4.31	What is your first priority in reducing heat loss for your household? (up to two choices)		<ol style="list-style-type: none"> 1. Electric heaters 2. Replace your stove and cooker 3. Improve your stove and stove 4. Insulating wall 5. Insulated roof 6. Insulation 7. Improvement of windows and insulation 8. Replace the window 9. Hold the door 10. Others (specify) 11. Don't know
4.32	Are you interested in building this solar-powered extension into your house? (Show and describe the Figure of Veranda)		<ol style="list-style-type: none"> 1. Interested 2. Not interesting 88. I do not know yet

Thank you for participating in the survey

Field researcher description

#	Things to do	Whether made
1	Take Figures of the exterior of the house from the front and the whole house	1. Taken 2. Not taken 88. Refused
2	Take Figures of windows and wall panels close together	1. Taken 2. Not taken 88. Refused
3	Take a Figure of the stove and heating	1. Taken 2. Not taken 88. Refused
111	Was this family interested in insulation?	<ol style="list-style-type: none"> 1. It's very interesting 2. Interesting 3. Not interested

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