Household survey on use of individual heating systems in 2015

TECHNICAL REPORT

DRAFT 1

Prepared for

World Bank

February 2016

During the 2015 heating season, SocEconic Center for social and economic research conducted a survey on different individual heating systems, and related problems caused by the use of ineffective and air polluting heating systems. The survey was initiated jointly by the World Bank, and the Ministry of Economy of the Kyrgyz Republic.

The survey will help identifying the types of heating systems used by the public, fuel types as well as the needs of the public in resources for heating their residential buildings.

Obligations of SocEconic included:

1. Arrangement of the survey;
2. Preparation of the survey tools;
3. Training of personnel involved in the survey;
4. Conducting the survey;
5. Establishing a database;
6. Preparing a report on the survey.

SELECTION AND SURVEYING METHODOLOGY

SELECTION RANGE

Total amount of selection is representative at the national level, and the following three strata: 1) Bishkek; 2) urban areas (excluding Bishkek), and 3) rural areas. To analyze the assessment of the share (percentage) of population in each strata, the selection error was at least 4.4% with accuracy for 95% of the confidence interval.

We used the following equation to determine selection range with preset parameters:

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

where:
Z = Z-factor (1.96 for 95% of the confidence interval)
p = percentage of target respondents or answers in decimal form (0.5 by default)
c = specified error, in decimal form ($0.05 = \pm5\%$)

Hence, the equation showed the result of 1,500 observations (households) needed for achieving required accuracy. The given amount of selection is sufficient for ensuring reliable data, and extrapolating the survey findings to the national level, and the three strata.

We used the following equation to calculate the limiting irreversible random selection error for shares:

$$\sigma = \sqrt{\frac{p(1-p)}{n}} \left(1 - \frac{n}{N}\right)$$

where:

6 = selection error
p = percentage of target respondents or answers in decimal form (0.5 by default)
n = amount of selection population
N = amount of parent population

Table 1. Selection errors per strata

	Number of households		Selection error for 95% of the confidence interval
	Census	Selection	
Urban areas	134,338	496	4.40
Rural areas	614,376	500	4.38
Bishkek city	78,255	504	4.37
Total	**826,969**	**1,500**	**2.53**

To reduce the design effect, and based on time required for one survey and the load on one interviewer, we decided to set the value of primary selection units (PSU) at 12 households.

SELECTION PLAN

Selection for surveying households in the Kyrgyz Republic on the use of individual heating systems was planned to obtain representative estimates of indices at the national level for urban and rural areas as well as Bishkek. Urban and rural areas and Bishkek were used as strata with selection of the households in two steps.

Framework for the first step was developed on the basis of the list of 12,418 registration districts, made in the course of the 2009 census of households that specified under "Types of Amenities": heating from individual boilers, stove heating, and other types of heating. Some registration districts comprising of less than fifteen households were merged with neighboring districts resulting in 11,753 PSUs. Selection was distributed by regions, proportional to the population in urban and rural strata. Table 2 below shows the results of 2009 census, and distribution of selection by regions:

Table 2. Distribution of selection by regions

	Census 2009			Selection for survey	
	Number PSUs	Population	HHs	PSUs	HHs
Issyk-Kul region	978	385,768	82,634	9	108
Jalal-Abad region	2,424	937,901	154,405	18	216
Naryn region	657	242,779	45,807	5	60
Batken region	1,011	421,942	67,666	9	108
Osh region	2,816	1,140,478	175,690	18	216
Talas region	539	220,261	39,873	4	48
Chui region	1,876	662,240	156,525	12	144
Osh (city)	420	155,048	26,114	8	96
Bishkek	1,032	428,936	78,255	42	504
Total	11,753	4,595,353	826,969	125	1500

At the second stage, in each of the selected 125 PSUs, we selected 12 households using the updated list of households as selection framework, and the method of systematic equiprobable selection. To update the lists for each region, we prepared lists of PSUs based on 2009 census of population. The goal of the interviewers was to update the lists before the survey, i.e. check the availability of residential buildings, enter correct addresses, and assign consecutive numbers for preparing the selection.

After updating the lists, interviewers informed the office on the number of residential buildings for each PSU. Then, using the Template, the office staff prepared selection that comprised of the number of residential building, and made the main and supplementary lists.

Figure 1. Household selection (main and supplementary lists)

СИСТЕМАТИЧЕСКАЯ ВЫБОРКА ДОМАШНИХ ХОЗЯЙСТВ

1500

ВЫБЕРИТЕ ДОМАШНЕЕ ХОЗЯЙСТВО СО СЛЕДУЮЩИМИ ПОКАЗАТЕЛЯМИ

Регион	Номер кластера	К-во дх	Размер кластера	1	1Д	2	2Д	3	3Д	4	4Д	5	5Д	6	6Д	7	7Д	8	8Д	9	9Д	10	10Д	11	11Д	12	12Д
2	01	163	24	3	10	17	24	30	37	44	51	58	64	71	78	85	92	98	105	112	119	126	132	139	146	153	159
2	02	206	24	2	11	19	28	37	45	54	62	71	80	88	97	105	114	122	131	140	148	157	165	174	183	191	200
2	03	304	24	12	25	38	50	63	76	88	101	114	126	139	152	164	177	190	203	215	228	241	253	266	279	291	304
2	04	291	24	7	19	32	44	56	68	80	92	104	116	129	141	153	165	177	189	201	213	226	238	250	262	274	286
2	05	200	24	4	12	20	29	37	45	54	62	70	79	87	95	104	112	120	129	137	145	154	162	170	179	187	195
2	06	228	24	5	14	24	33	43	52	62	71	81	90	100	109	119	128	138	147	157	166	176	185	195	204	214	223
2	07	210	24	8	17	25	34	43	52	60	69	78	87	95	104	113	122	130	139	148	157	165	174	183	192	200	209
2	08	256	24	3	14	24	35	46	56	67	78	88	99	110	120	131	142	152	163	174	184	195	206	216	227	238	248
2	09	162	24	1	8	15	21	28	35	42	48	55	62	69	75	82	89	96	102	109	116	123	129	136	143	150	156
3	01	306	24	7	19	32	45	58	70	83	96	109	121	134	147	160	172	185	198	211	223	236	249	262	274	287	300
3	02	191	24	6	14	21	29	37	45	53	61	69	77	85	93	101	109	117	125	133	141	149	157	165	173	181	189
3	03	139	24	5	11	16	22	28	34	39	45	51	57	63	68	74	80	86	92	97	103	109	115	121	126	132	138
3	04	69	24	2	5	8	11	14	16	19	22	25	28	31	34	37	39	42	45	48	51	54	57	60	63	65	68
3	05	167	24	5	12	19	26	32	39	46	53	60	67	74	81	88	95	102	109	116	123	130	137	144	151	158	165
3	06	323	24	6	19	33	46	59	73	86	100	113	127	140	154	167	181	194	207	221	234	248	261	275	288	302	315
3	07	310	24	4	17	29	42	55	68	81	94	107	120	133	146	159	172	185	197	210	223	236	249	262	275	288	301
3	08	251	24	9	19	29	40	50	61	71	82	92	103	113	124	134	144	155	165	176	186	197	207	218	228	239	249
3	09	280	24	10	21	33	45	56	68	80	91	103	115	126	138	150	161	173	185	196	208	220	231	243	255	266	278
3	10	197	24	4	12	20	29	37	45	53	61	70	78	86	94	102	111	119	127	135	143	152	160	168	176	185	193
3	11	245	24	9	19	29	39	49	60	70	80	90	101	111	121	131	141	152	162	172	182	192	203	213	223	233	243
3	12	173	24	4	12	19	26	33	40	48	55	62	69	77	84	91	98	105	113	120	127	134	141	149	156	163	170
3	13	131	24	5	11	16	21	27	32	38	43	49	54	60	65	71	76	81	87	92	98	103	109	114	120	125	131
3	14	125	24	3	9	14	19	24	29	35	40	45	50	56	61	66	71	76	82	87	92	97	102	108	113	118	123
3	15	279	24	6	18	29	41	53	64	76	88	99	111	122	134	146	157	169	181	192	204	216	227	239	250	262	274
3	16	259	24	1	12	23	34	44	55	66	77	88	98	109	120	131	141	152	163	174	185	195	206	217	228	239	249
3	17	194	24	8	16	24	32	40	48	56	65	73	81	89	97	105	113	121	129	137	145	153	161	170	178	186	194
3	18	199	24	2	11	19	27	35	44	52	60	69	77	85	94	102	110	118	127	135	143	152	160	168	176	185	193
4	01	182	24	7	14	22	30	37	45	52	60	67	75	83	90	98	105	113	120	128	136	143	151	158	166	174	181
4	02	125	24	2	8	13	18	23	29	34	39	44	49	55	60	65	70	75	81	86	91	96	101	107	112	117	122
4	03	211	24	3	11	20	29	38	46	55	64	73	82	90	99	108	117	126	134	143	152	161	170	178	187	196	205

Numbers in the supplementary list highlighted in green.

Probability of phij selection of hij household in hi PSU or h strata is determined as:

$$p_{hij} = \frac{k_h n_{hi}}{N_h} \frac{m_{hi}}{n'_{hi}}$$

where

k_h is the number of PSUs selected in strata h;

n_{hi} is the number of households according to the 2009 census in hi PSU;

N_h is the total number of households in strata h;

m_{hi} is the number of households selected in hi PSU (12 as standard);

n'_{hi} is the number of households in the updated list of hi PSU.

The two fractions on the right part of the equation represent the probability of PSU selection at the first stage, and probability of selection of household at the second stage, respectively.

As the selection was not self-weighting, and to obtain unbiased estimate on the basis of selection, the data collected from all households had to be multiplied by weight factor whij, which is equal to the value that is reciprocal to its probability of selection (whij=1/phij). After calculation of probability scales, we made corrections to the number of population as of the beginning of 2015.

SURVEY TOOLS

The survey was conducted using CAPI, the technology, and hardcopies of questionnaires. Questionnaires in Kyrgyz and Russian were uploaded on a tablet Pc for further use.

- ✓ The questionnaire included 12 modules:
  1. Module A: INFORMATION ABOUT HOUSEHOLD, AND THE LIST OF HOUSEHOLD MEMBERS
  2. Module B: RESIDENTIAL BUILDING SPECIFICATIONS, AND OWNERSHIP
  3. Module E: USE OF HEATING EQUIPMENT DURING THE HEATING SEASON
  4. Module F: TYPES OF EQUIPMENT USED FOR FOOD PREPARATION
  5. Module G: TYPES OF FUEL USED BY HOUSEHOLD
  6. Module H: USE OF COAL BY HOUSEHOLD
  7. Module I: USE OF FIREWOOD BY HOUSEHOLD
  8. Module C : CONSUMPTION EXPENDITURES

To ensure the quality of interviews, we prepared instructions:

- Instructions for interviewers on filling the questionnaire that includes explanations to almost all questions as well as description of work on the tablet, and photos of heating equipment;

- Instructions for supervisors that set the functions of supervisors as they pertain to supervision of interviews.

The interviewers were provided with tablets and hardcopies of questionnaires in case of impossibility to hold interviews using tablets, ID cards, letter of request, and selection. The entire set of tools supplemented by pens, pencils, erasers, notepapers, and clear pockets was packed in a briefcase, and provided to each interviewer.

TRAINING OF PERSONNEL

Personnel with experience in interviewing households was engaged for fieldwork. Most of them participated in large-scale surveys, e.g. 2012 Health and Demographic Survey, and 2014 Multiindicator Survey. The personnel underwent a five-day training. Training was held in two rounds: from December 25 to 30, 2015 for interviewers in Chui region, and Bishkek, Batken, Jalal-Abad, Osh regions, and the city of Osh, and from January 1 to 4, 2016 for interviewers in Issyk-Kul, Naryn, and Talas regions.

The training comprised of three stages: the first focused on theory of interviewing, the second – on working with tablet PC, and software, and the last stage – practical exercises.

First stage

Explanation of the overall survey technique, and discussion of arrangement issues.

Explanation of general standards, and face-to-face interview methodology.

Explaining the process and rules for selection of suitable respondent (heads of households or members aware of heating issues).

Second stage

Training on the use of tablet PC.

Training on the use of software (switching over, checking completeness, comments, turning in questionnaire form supervisor, making changes, synchronization for sending data to server).

Third stage:
Practical exercises included different levels:

- Face to face;
- Under supervision of a group;
- Under supervision of class.

Objective of the first level was to understand all questions in the questionnaire, and drill the interview technique. The second level focused on filling questionnaire under supervision of other members of the group. The objective was to observe the interview technique, and note possible mistakes in the course of interview. Further discussion of mistakes allowed the group to focus on omissions made during the interview. Working in groups continued until all the mistakes were corrected.

On the third level, practical exercises on interviewing was carried out under supervision of the entire class. Turn by turn, members of different groups acted as interviewers and respondents, holding a complete interview. The goal of the practical exercises under the third level was to see if all the groups had been trained to the required extent. In the course of discussion of mistakes, the trainees returned to studying the issue and subsequent interview.

The training was delivered in two languages: Kyrgyz, and Russian.

FIELDWORK AND QUALITY CONTROL

22 interviewers collected data; their work was supervised by three regional supervisors and two supervisors in the company head office.

Fieldwork started on January 1, 2016, and completed on January 28, 2016.

One of the common challenges in all regions was the fact that all interviews were held outdoors. Due to cold weather, a few respondents, regardless of their welfare or proposed compensation, refused to

participate when they learned that the interview would take 50 minutes. Interviewers had to persuade them.

Because of the cold weather in Naryn region, tablet PCs did not function properly, and interviewers had to hold interviews using hardcopies of questionnaires. For security reasons in Jany Makhalla village, where the majority of population is gypsies, interviews were also held using hardcopies. The second major issue was the irritation of respondents with questions related to expenses, family members, including infants. Respondents believed that those questions were not relevant to heating, and responded reluctantly. In such cases, interviewers had to explain the purpose of the questions, and it took them a great deal of time. In Ivanovka village, Chui region, respondents refused to answer questions related to environment stating that they are not important and take too much time.

Most of the respondents did not understand why the survey requires so much detail, and they were not sure if it will have a positive impact on their lives or have any outcomes at all. In general, people were cautious, they kept asking where the data would go, and they expressed distrust as it pertains to confidentiality.

Interviewers in Chui region, and Bishkek faced many refusals. Despite explanations and arguments, a few respondents refused to participate in the survey, and insisted that everything is fine as they heard the survey topic. According to interviewers, such an attitude was observed among people with secondary education; the higher the level of education, the easier it was to persuade a respondent to participate in the survey. In addition, most of the respondents were not happy with a large number of questions, for instance, residents of VIP-town in Orto Say village, Bishkek.

Selection for Kadamjay district, Batken region, included poor households that did not have means to pay for electricity, and the debt was more than KGS 30,000.

In all regions where interviewers had problems with tablet PCs, the hardcopies of the questionnaires were entered in the tablet PC, and sent to the server by interviewers.

In the course of the survey, we verified the progress both in the field and from office against the server protocol.

Quality control was carried out in three stages:

First stage
Control by accompanying interviewers (5%). At this stage, interviews were controlled by supervisors to make sure that interviewers:
- Comply with the selection;
- Have a good knowledge of tablet;
- Have a good understanding of questionnaire.

Second stage
Verification through household visits (5-10%). Verification was carried out by independent controllers hired by SocEconic.

Verification included:

- Finding out whether the interviewer visited, and held the interview;

- To check the answers, the respondent was asked few questions, answers to which, in our opinion, should not change.
- Asking question on the number of given household members.

Third stage

Control by office staff. As the survey was conducted with the use of tablets, office staff performed daily control over proper filling of questionnaires, completeness of answers as well as logical control. In case of questionnaires with mistakes, they would be returned to the interviewer with comments and clarifications. In addition, the program allowed us to track cluster visits on the map (as possible).

Findings of the interviewer performance control show reliability and quite high quality of raw data collection. Availability of clear verification mechanisms allowed us to reveal and eliminate following violations: In two of the clusters, preliminary selection of households was made from supplementary list. As the main and supplementary lists were identical in terms of selection, we decided not to repeat interviews.

DATA PROCESSING

We carried out the common database quality control, data alignment and correction. For this, we transferred the data to SPSS format, and subsequent processing was carried out using SPSS program.

SELECTION COVERAGE

The survey covered 1,500 households across the regions of the country. Interviews were held at each household covered by the survey, with complete interviews with 98.3%, and partial with 1.7% of the households.

Table 3. The result of the household survey

	Complete		Partial	
	N	%	N	%
Issyk-kul	108	100.0	0	0.0
Jalal-Abad	216	100.0	0	0.0
Naryn	60	100.0	0	0.0
Batken	108	100.0	0	0.0
Osh	216	100.0	0	0.0
Talas	48	100.0	0	0.0
Chui	137	95.1	7	4.9
Bishkek	485	96.2	19	3.8
Osh (city)	96	100.0	0	0.0
Total	**1474**	**98.3**	**26**	**1.7**

Percentage of household substitution made 14.2%.

Table 4. Percentage of household substituted by regions

Region	Survey from substituted household

	N	%
Issyk-kul	5	4.6
Jalal-Abad	34	15.7
Naryn	11	18.3
Batken	20	18.5
Osh	22	10.2
Talas	3	6.3
Chui	21	14.6
Bishkek	83	16.5
Osh (city)	14	14.6
Total	**213**	**14.2**

Population of 1,500 interviewed households per the list made 6,724 people with 65.8% at the age of 18 and over. Male and female ratio made 49.9 against 50.1 respectively. 4.5% of the total population were temporarily absent.

94.6% of the interviewed population noted that they are homeowners. About 1% have more than one housing facility for living during the heating season.

Over the half of the households use ordinary stove as the main source of heating, 23.7% use simple heating system.

83% of the households use coal as the main type of fuel for heating, 6.3% of the households use natural gas, and 7.4% - electricity.

For heating water, 42% of the households use coal and electricity during the heating season. For cooking purpose, about 40% of the households use coal, 20% - natural gas, and 27% - electricity.

Almost in all households, the heating season begins in November and ends in March. 80% of the households fire up the stove in the morning, about 33% - by noon, 65% - in the evening, and 20% in the nighttime.

Over 59% of the households assume acceptable the atmospheric air pollution around their houses, 24.9 consider the air as very polluted, and 2.6 as extremely polluted.
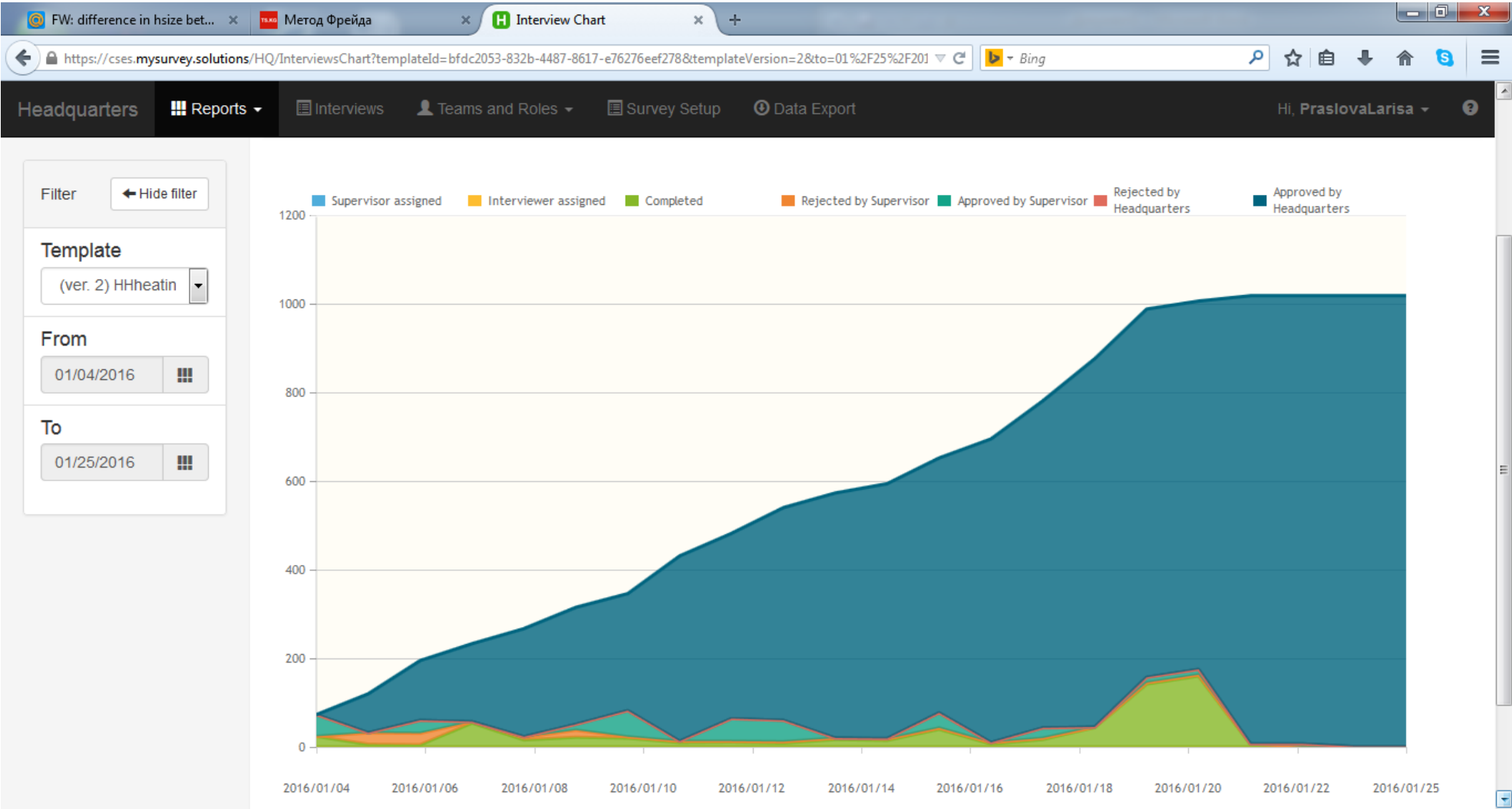
Annex

Verification of fieldwork progress

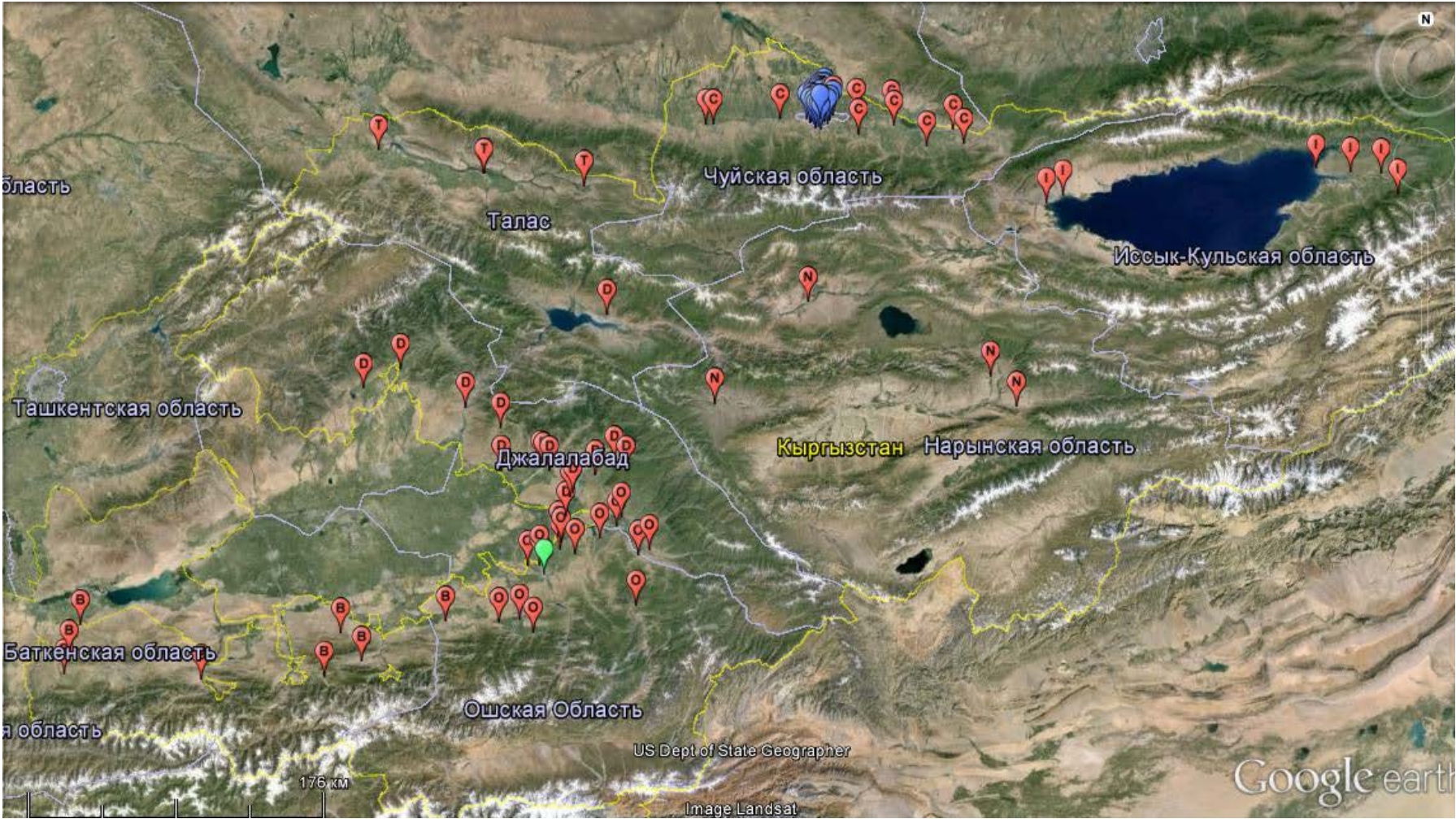| №	Region	City/Village	Number of addresses for verification	Verification method	Comments of supervisor
1	Bishkek	Bishkek	40	Visit- 40 HHs	No one home at ten addresses but neighbors confirmed that specified people reside at the mentioned addresses, remaining interviews confirmed.
2	Chui	Kara-Balta	10	All addresses were verified through visits	All respondents confirmed participation in the survey.
3	Issyk-Kul	Balykchy	5	All addresses were verified through visits	Three respondents confirmed; no one home at other two addresses.
5	Osh	Osh	36	All addresses were verified through visits	No one home at eight of the addresses but neighbors confirmed that specified people reside at the mentioned addresses. Two respondents refused to answer questions, remaining addresses confirmed.
7	Jalal-Abad	Jalal-Abad	5	All addresses were verified through visits	Two respondents confirmed, one confirmed by neighbor and no one home at two.
9	Batken	Aydarken	5	All addresses were verified through visits	Two of the respondents confirmed participation, no one home at other addresses.

Supervisor activity log

Протокол контроля супервайзера через сервер

Supervisor	12/26/2015	9:38:33	"Если Самодельная система, то должно быть ""сделал сам"" раздел В"
Supervisor	01.05.2016	7:09:35	"В вопросе ""перечислите всех кто проживает в домохозяйстве"" надо написать имена тех кто проживает в домохозяйстве. И затем по каждому чело?
Supervisor	01.05.2016	7:30:36	не отмечена теплоизоляция стен и пола.Электрический котел для отопления используется для нагрева воды и приготовления пищи - это правильн?
Supervisor	01.05.2016	7:38:59	"нет отметки о теплоизоляции пола и окон (занавески, пленка).Обратите внимание: если печь топится непрерывно в течении дня, то надо отметить
Supervisor	01.05.2016	13:46:12	Не указана теплоизоляция стен и окон(занавески, пленка)
Supervisor	01.06.2016	8:47:48	Количество семей (8) проживающих в доме больше, чем человек(5) проживающих в доме
Supervisor	01.06.2016	16:38:20	"Уголь разжигали дровами, А в вопросе Использования дров отметили ""нет"""
Supervisor	01.06.2016	17:15:20	"Для розжига угля используют дрова, а в вопросе об использовании дров отмечено ""нет"""
Supervisor	01.08.2016	3:47:16	нет отметки о теплоизоляции стен, полы, окон(занавески, пленка). В вопросах о стенах, полах и окнах множественный ответ и надо обязательно от
Supervisor	01.08.2016	10:31:17	не отмечено теплоизоляция стен и пола
Supervisor	01.09.2016	11:13:01	нет отметки о теплоизоляции пола и не отмечен тип окон, если окна пластиковые, то это стеклопакеты
Supervisor	01.10.2016	11:48:55	Площадь дома 246 квадратов !! это действительно так????
Supervisor	01.10.2016	11:57:36	"расходы на растительное масло 5 сом - это слишком мало "
Supervisor	01.11.2016	4:50:08	не забывайте отмечать теплоизоляцию окон (занавески, пленка)
Supervisor	01.11.2016	4:52:50	"пропущен вопрос ""Характеристики оборудования используемого для отопления: Простая система отопления (котел на угле,газе)"" Сколько в нали?
Supervisor	01.11.2016	10:28:19	не отмечена теплоизоляция стен и пола
Supervisor	01/13/2016	13:45:21	"Вопросы о ""Работе системы отопления"" остались не заполненными."
Supervisor	01/13/2016	13:48:15	"Не заполнен раздел о загрязнении атмосферы, а результат интервью отмечен ""Проведен"". Либо заполните раздел, либо измените результат интервью"
Supervisor	01/18/2016	16:57:30	не выбран регион
Supervisor	01/20/2016	11:20:26	1 - нет информации о теплоизоляции стен и пола, нет информации об использовании занавесок и пленки на окнах2 - Уточните систему отопления.
Supervisor	01/20/2016	12:22:22	Для отопления действительно используется сжиженный газ в баллонах?
Supervisor	01.05.2016	7:18:26	нет отметки о загрязнении воздуха около дома
Supervisor	01.05.2016	7:47:37	не отмечен другой вид топлива и нет данных о загрязнении воздуха около дома
Supervisor	01.05.2016	13:40:50	Уточните тип строения. У Вас отмечен шлакоблочный, а стены из самана.
Supervisor	01.06.2016	17:02:34	Не указана теплоизоляция пола и окон(занавески, пленка)
Supervisor	01.06.2016	17:08:42	"Тип строения отмечен как саманный, а стены кирпичные??? Не указана теплоизоляция стен и пола "
Supervisor	01.06.2016	17:17:40	Не указана теплоизоляция стен и пола и окон(занавески, пленка)
Supervisor	01.06.2016	17:19:32	" Не указана теплоизоляция стен и пола"
Supervisor	01.08.2016	3:20:44	Домохозяйство использует просто печь и систему отопления - это как? Если у них есть система отопления(т.е. батареи в комнатах), тогда зачем печь в доме?
Supervisor	01.08.2016	3:52:57	нет отметки о теплоизоляции стен, полы, окон(занавески, пленка).
Supervisor	01.08.2016	3:53:17	нет отметки о теплоизоляции стен, полы, окон(занавески, пленка).
Supervisor	01.08.2016	3:53:34	нет отметки о теплоизоляции стен, полы, окон(занавески, пленка).
Supervisor	01.08.2016	16:27:44	"Айпери, попытайтесь записать координаты. "
Supervisor	01.09.2016	10:46:59	потребительские расходы на питание цифры не правдоподобные. Хлеб и прочее всего 5 сом????? Растительное масло - 1 сом ?????
Supervisor	01.11.2016	10:15:28	нет отметки о теплоизоляции стен и пола
Supervisor	01/14/2016	12:00:31	нет отметки о теплоизоляции стен, пола и окон(занавески, пленка)
Supervisor	01/15/2016	11:07:41	В анкете отмечено, что уголь и дрова покупали мешками, а по месяцам ничего не отмечено - зайдите в разделы приобретения угля и дров и заполните вопросы.
Supervisor	01/15/2016	11:19:05	Отмечено. что уголь покупали мешками, а по месяцам нет данных. Исправьте.
Supervisor	01/16/2016	7:51:26	нет отметки о теплоизоляции стен, пола, окон(занавески, пленка)

Cumulative Interview Chart

Distribution of selection. National level

Distribution of selection. Bishkek