Monitoring Report: Thermal insulation in Gorno-Badakhshan

GIZ Project "Sustainable Management of Natural Resources in Gorno-Badakhshan"

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Abbreviations

GIZ: Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH

MFI: Microfinance Institution

MJ: Mega Joule

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1. Introduction

1.1 Background and monitoring objectives

Gorno-Badakhshan is a mountainous region in Tajikistan, with cold winters and a semi-arid climate. Natural resources, such as wood from the river plain forests, the teresken shrub in the Eastern plains and dung, are used as fuels for cooking and heating. Yet these resources are scarce, and lacking former subsidized coal imports from the Soviet Union as well as due to a growing population, a big pressure is nowadays exerted on these natural resources. This has negative effects on the environment as well as for the local population. For example, heavily degraded areas are prone to soil erosion and to a loss of biodiversity. Families have to invest much of their time searching for the scarce fuels or are spending a big amount of their income buying expensive fuels.

Since 2008 the GIZ, working on behalf of the German Federal Ministry of Economic Cooperation and Development, has propagated thermal insulation in the region to reduce the pressure on natural resources and to improve the livelihoods of the rural population. The GIZ projects "Sustainable Management of Natural Resources in Gorno-Badakhshan" and "Support of Microfinance Services in Rural Regions of Tajikistan" worked together with the microfinance institutions (MFI) Madina va Hamkoron ,MFI Haqiqi-Jahon, MFI Rushdi Ishkashim and MFI Rushdi Vodii Zerafshan to develop the microcredit scheme "Warm Comfort: Microloans for Thermal Insulation". Earlier the project "Sustainable Management of Natural Resources in Gorno-Badakhshan" together with local craftsmen had developed products for thermal insulation, such as double glazed windows and well closing wooden doors. These craftsmen have formed a cooperative in 2010 and now work closely together with the above mentioned microfinance institutions. Further information on the microcredit scheme and the cooperative can be found in annexes 1 and 2.

This monitoring report is conducted by the GIZ project "Sustainable Management of Natural Resources in Gorno-Badakhshan" and assesses the effect of thermal insulation measures installed during the year 2011, with regard to the GIZ project's "Sustainable Management of Natural Resources in Gorno-Badakhshan" goals: sustainable use of natural resources and improvement of living conditions of the local population. The monitoring took place in March and April 2012. This monitoring report builds on two previous reports conducted in the years 2010 and 2011. The monitoring procedure and methodology is as similar as possible to the ones used in the former reports to ensure a good comparability.

The monitoring assesses:

- Impacts of thermal insulation on fuel consumption.
  a) Fuel use of thermally insulated households compared to not insulated neighbour households.
  b) Fuel use before and after thermal insulation.
- Impacts of thermal insulation on natural resources.
  a) Biomass consumption of thermally insulated households compared to not insulated neighbour households.
  b) Biomass consumption before and after thermal insulation.
- Insulating effect of insulation measures.
  a) Indoor temperature, measured with dataloggers, of thermally insulated households compared to not insulated neighbour households.
  b) Evaluation of the effect of insulation measures though infrared photographs.
- The perception of the household members on changes due to thermal insulation.
- Assessment of MFI Madina va Hamkoron's and the construction workers' work.

1.2 Main results

Households with thermal insulation measures save fuel. This is true for the comparison between thermally insulated households and neighbouring households without thermal insulation as well as the comparison between households before and after the installation of thermal insulation measures. On average over the last years households could save around a third of their fuel consumption. Households have thus saved time and money collecting or buying fuel. Furthermore when asked in an open question what has changed most since installation of the thermal insulation measures, households answer that it is warmer and more comfortable. The improvement of the livelihoods of the local population, one of the GIZ project's goals, is thus being reached.

The temperature curves determined through the dataloggers cannot entirely confirm the results obtained by the questionnaire. Only in one out of three cases a significant temperature difference was found when comparing households with thermal insulation measures and households without thermal insulation measures. Yet due to the small resources available to conduct the monitoring, the sample is very small and single factors, such as a large amount of children living in a household, might be decisive. A bigger sample might have shown a different picture.

Most importantly the results of the questionnaire show that households save biomass, in other words, natural resources, a second goal of the GIZ project "Sustainable Management of Natural Resources in Gorno-Badakhshan". Around 40% of biomass could be saved last winter due to thermal insulation measures when comparing households with thermal insulation measures and their neighbouring households without thermal insulation measures and as well when comparing households before and after thermal insulation measures were installed.

The high usage of coal by Murgab households with thermal insulation in this year's monitoring in comparison to households without thermal insulation (+34%) could be an indicator of the good socioeconomic situation of the families which have thermal insulation measures. It allows them to buy expensive coal, which is worthwhile because coal has a far bigger fuel value than dung or teresken (the other fuels available in the region). These results corroborate the fear, already raised in the last monitoring report, that the microcredits for thermal insulation could be mostly affordable for households with middle incomes. The poorest households are therefore not reached on a large scale, yet these are the households which would profit the most from savings in expenditures for fuel and are the target group of the GIZ project.

Comparing households before and after thermal insulation the biggest savings were made in coal, 35%. This demonstrates that although households with the thermal insulation used more coal than households without thermal insulation, households use less coal after installing thermal insulation measures.

Regarding MFI Madina va Hamkoron's and the construction workers' work, it took an average of 18 days from the order until construction work started. The installation lasted 4.6 days on average. Most households with thermal insulation heard about the microcredit scheme from the local MFI Madina va Hamkoron's microcredit officers but just as important are friends and neighbours. 8 out of 22 households reported problems with their thermal insulation measure. The technical assessment by a microcredit officer of MFI Madina va Hamkoron shows that the biggest problems have to do with the size of the window, roetz or door not fitting the case properly and the insulating rubber being damaged or not having been installed on the window, roetz or door correctly.

In conclusion: Households with thermal insulation save fuel. This shows that thermal insulation pays off as less time and money is spent on acquiring fuel. Furthermore, households with thermal insulation use less biomass. This demonstrates that through thermal insulation some of the pressure exerted on the natural resources can be reduced. Further investigation could be made into the socioeconomic position

of the households which can afford the microcredit scheme for thermal insulation. If these are households with middle incomes, thought should be given on how to reach the poorest levels of society.

Thermal insulation in combination with the microcredit scheme helps to achieve the GIZ project's "Sustainable Management of Natural Resources in Gorno-Badakhshan" goals of sustainable use of natural resources and improvement of living conditions of the local population.

2. Sample and Method

2.1 Sample

25 households with and 25 households without thermal insulation were to be chosen in the town of Khorog and the three districts in which MFI Madina va Hamkoron gives the microcredit “Warm Comfort: Microloans for Thermal Insulation”. To qualify for the monitoring the households needed to have had thermal insulation installed in their houses in 2011 or to be a direct neighbour of such a household.

It was planned to choose 10 households in Khorog, Roshtkala and Shugnan and 20 households in Murgab, as in this district, due to its cold winters and very scarce vegetation, most microcredits for thermal insulation are given. Yet because demand for thermal insulation in Khorog and Shugnan is not that high, only 8 households in Khorog and 6 households in Shugnan could be chosen.

Table 1 gives an overview of the sample.

	No° households	No °insulation measures	No° window	No° ceiling	No° door	No° roof hatch window	No° wall	No° roof	No° floor	Average credit sum
Thermal insulation	**22**	**53**	**17**	**2**	**7**	**8**	**2**	**1**	**6**	**2837,06**
Khorog	4	6	2	1		1	1		1	6800,00
Murgab	10	28	7	1	5	1	1		3	2108,75
Roshtkala	5	13	5		2	4		1	1	3215,00
Shugnan	3	6	3			2			1	1633,33
No thermal insulation	**22**									
Khorog	4									
Murgab	10									
Roshtkala	5									
Shugnan	3									
Grand Total	**44**	**53**	**17**	**2**	**7**	**8**	**2**	**1**	**6**	**2837,06**

Figure 1 Sample monitoring 2012

When in chapter 3.2 the results of the three monitoring of the years 2010, 2011 and 2012 are compared, one has to keep in mind that the samples were different as the graph below shows.

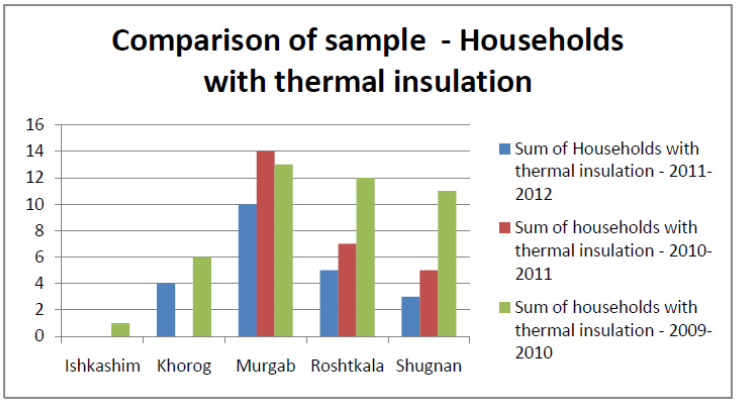

Figure 2 Comparison of the samples of 2010, 2011, 2012

Furthermore the temperature during the winters also varied. As an example the average temperature in Khorog for the month of January:

2012: average -9.4°C

2011: average -5°C

2010: average -2.7°C[1].

[1] http://www.tutiempo.net/en/Climate/KHOROG/389540.htm - 23.08.2012

2.2 Method

The method interview is the main means to obtain the data, just as in the monitoring of 2010 and 2011. Due to limitations of the quality of data obtained through interviews, additionally in this year's monitoring of 2012 the inside temperature in households with and without thermal insulation is compared through the installation of dataloggers. Through infrared photographs the effect of an insulation measure is evaluated. Additionally a quality control of the insulation measures and MFI Madina va Hamkoron's and the construction worker's work was carried out.

a) Interview

For the monitoring of 2012 a questionnaire, with similar questions as in the monitoring of the years 2010 and 2011, was designed to help lead the semi-structured interviews with the households. The questionnaire is to be found in annex 3. The interviews lasted around 40 minutes in households with thermal insulation and 20-30 minutes in households without thermal insulation.

As stated above the results of the interviews have some limitations:

- Many respondents had difficulties remembering the amount of fuel they used per winter, as wood, dung and teresken are often collected by the families themselves continuously and not bought, thus they do not know the exact amount. The figures concerning the use of coal seem to be quite exact, as coal is bought once a year in autumn. To encounter the problem of respondents not knowing the spent amount of fuels per winter (which already had been identified as a problem in the monitoring of 2010 and 2011), in this monitoring of 2012 a question was added to the questionnaire concerning the *daily* usage of fuel in addition to the question about the usage of fuel *per winter*. Yet also the quality of the answers to this question has limitations, as often in the "tazik" (bowl in which the fuels are brought into the house) the different fuels are all mixed. In this monitoring report when talking about fuel use, it is the fuel use *per winter*, unless indicated otherwise.
- The interviewees had varying knowledge on the amount of fuel their household had spent or purchased, because the person responsible for fuel purchase could not always be encountered at home. Due to time constrains, no second meeting with the responsible person for buying fuel could be arranged.
- Winter rooms vary in size, which has an effect on fuel use and temperature inside the room. For this reason the interviews include the question about the size of the winter room, the winter rooms in Khorog and Murgab being smaller than in the other districts (see annex 5).

- The number of insulation measures installed in a household also has an influence on fuel use. For this reason it was decided at the beginning of the monitoring to choose an equal number of households with more than three insulation measures and less than three insulation measures. Yet because of the limited number of households which qualified for the sample, this was not possible.
- The districts are situated in different altitudes, this having an effect on the average outdoor temperature, which has an effect on fuel use and the indoor temperature (see annex 5). For this reason an equal distribution of households situated in different altitudes was aimed at.
- Different temperatures in different winters has an effect on fuel consumption:
- Availability of fuel also influences fuel consumption.

b) Dataloggers

To encounter the problem of the limitations to the quality of data of the interviews, additional data was collected, which reflects the temperature in thermally insulated and not thermally insulated households. Dataloggers[2] were installed in three houses with thermal insulation and in three neighbouring houses without thermal insulation in the Shugnan district. The households are part of the general sample. Shugnan is in proximity of the project's office and was still accessible in December, while other districts were difficult to access because of snow falls. In these households one datalogger was installed in the winter room and measured the indoor temperature every 10 minutes from 28.12.11 to 19.04.12. This room is the heart of the traditional houses in the region and the only heated room in winter, in which the whole family lives together.

The cause for a higher temperature could be thermal insulation measures, yet it should not be forgotten that a higher temperature could also stem from a bigger fire or a higher heating frequency and that the number of insulation measures also plays a role. For this reason results are compared with the questionnaire's results on heating frequency, fuel use, size of winter room and number of insulation measures.

[2] A datalogger is an electronic device that records data over time or in relation to location either with a built in instrument or sensor or via external instruments and sensors. Our dataloggers recorded the temperature and humidity in a specific location in a specific time span.

c) Infrared photographs

Photographs were taken with an infrared camera, to give clues on how well the thermal insulation measures insulate. Photographs were taken of thermally insulated houses and of not thermally insulated houses in Murgab, the coldest of the four districts, were the effects of thermal insulation, can best be seen. The households were chosen randomly and may not be part of our sample and insulation measures could be older than 2011.

d) Assessment of MFI Madina va Hamkoron's and the construction workers' work

The questionnaire included questions concerning the satisfaction of the customers of thermal insulation measures with the work of MFI Madina va Hamkoron and the construction workers. Additionally a staff member of MFI Madina va Hamkoron accompanied the monitoring team in the district capital Khorog and the district of Rosthkala and conducted a quality check of the thermal insulation measures.

3. Monitoring Results

3.1 Comparison of thermally insulated and not thermally insulated households

22 households with thermal insulation measures installed in 2011 through a credit of MFI Madina va Hamkoron and 22 neighbouring households without thermal insulation were compared. This chapter presents the results of this comparison. The households lie in the capital of Gorno Badakhshan (Khorog) and in three districts (Shugnan, Rosthkala, Murgab). The data was generated though semi-structured interviews, by measuring the indoor temperature with dataloggers and with infrared photographs. Whenever information from the monitoring report of 2011 exists, this information was added in this report for the sake of comparison. In the monitoring of 2010 no comparison between thermally insulated and not thermally insulated households was made, that is why no information from winter 2009/2010 can be found in chapter 3.1.

3.1.1 Fuel consumption

In this chapter the results of the comparison of the fuel use of households with thermal insulation and their neighbours without thermal insulation in the winter 2011-2012 are summarized. The results are the answers to the questions in the questionnaire “How much fuel did you use this winter until now?” and “How much fuel did you use yesterday?”. A differentiation according to types of fuel (dung, wood, teresken, coal) was made. Please see annex 3 for the full list of interview questions. Khorog is not included here, as the interviewed households all used electricity.

When comparing the fuel consumption in different winters, one has to account for that the outdoor temperature varies in the different winters (see annex 5) and this has an effect on fuel consumption. When it is colder, more heating is needed.

3.1.1.1 Average fuel consumption in MJ

2011-2012	Fuel use in MJ 11/12 Thermally insulated (22 households)	Fuel use in MJ 11/12 Control Group (22 households)	Savings %
Average fuel use in MJ	41,470	44,251	6%

Figure 3 Comparison of fuel use thermally insulated households with not thermally insulated households, monitoring 2012

2010-2011	Fuel use in MJ 10/11 Thermally insulated (26 households)	Fuel use in MJ 10/11 Control Group (20 households)	Savings %
Average fuel use in MJ	55,993	104,336	46%

Figure 4 Comparison of fuel use thermally insulated households with not thermally insulated households, monitoring 2011

In the tables above the average fuel consumption of a household in one winter in MJ is depicted. In the winter 2011-2012 the thermally insulated households merely used 6% less fuel than not thermally insulated neighbour households. Last winter the difference was 46%. The monitoring result of 2011/2012 is distorted by the results of the district of Murgab. Without including the results of Murgab average savings of fuel in the winter 2011/2012 compared to households without thermal insulation are 41% MJ.

Fuel used in average in kg	2011/2012 thermal insulated households Murgab	2011/2012 not thermally insulated households Murgab	Relative savings (%)	Total savings (kg)
Firewood	0	0	0%	0
Dung	2,439	3,561	32%	1,122
Teresken	1,020	2,801	64%	1,781
Coal	1,743	1,048	-34%	-695

Figure 5 Comparison of fuel use thermally insulated households with not thermally insulated households in Murgab, monitoring 2012

As can be seen in the table above, this has to do with the fact that in Murgab households with thermal insulation used in average 34% more coal than households without thermal insulation. As coal has the highest fuel value of all monitored fuels (teresken shrub, dung, firewood and coal), this difference weighs very strong in the overall results measured in MJ.

An explanation for the very high use of coal in thermally insulated Murgab households could be a good socioeconomic situation of these families, which allows them to buy expensive coal, which is worthwhile because coal has the biggest fuel value of all monitored fuels. Households without thermal insulation heat with other fuels.

This accords:

- with the fact that households with thermal insulation used very little of the teresken shrub, a fuel which is cheap or can be collected by the families themselves, but has the smallest fuel value of all monitored fuels,
- with the extraordinary high temperatures felt by the conductors of the monitoring in the households with thermal insulation in Murgab in comparison to the households with thermal insulation in the other districts.

These results corroborate the fear, already raised in the last monitoring report, that the microcredit scheme for thermal insulation is not affordable for households with very small incomes. Yet these are the households, who would profit the most from savings in expenditures for fuel and are the target group of the GIZ project.

As stated above excluding the results of the monitoring in Murgab, households with thermal insulation could save on average 41% MJ on fuel, which means that they had to spend less time preparing fuel and/or money buying fuel. Thus their living condition was improved and one of the project goals reached.

3.1.1.2 Average fuel consumption according to districts

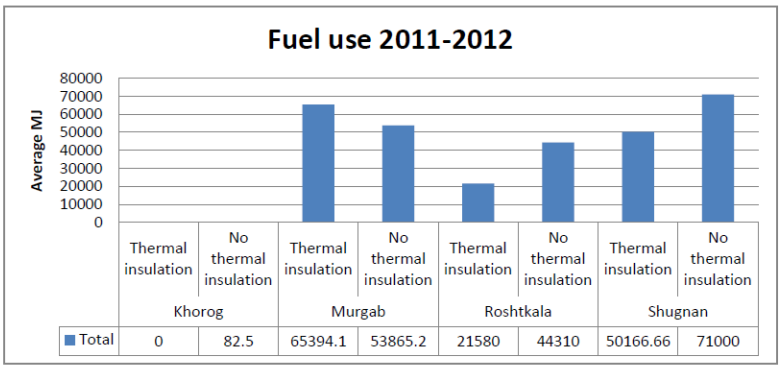

Figure 6 Comparison of fuel use thermally insulated households with not thermally insulated households according to districts, monitoring 2012

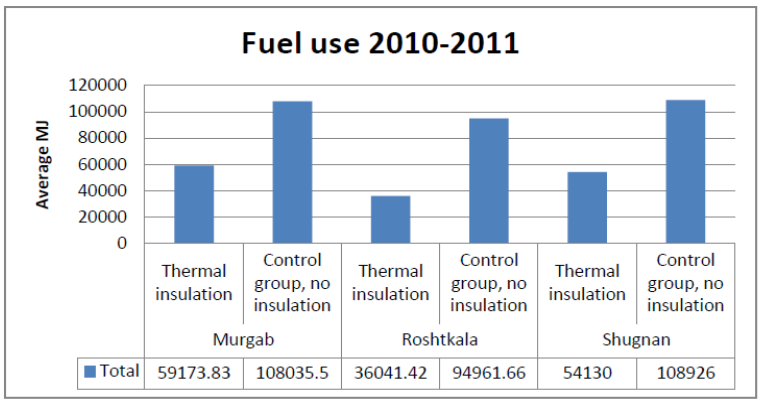

Figure 7 Comparison of fuel use thermally insulated households with not thermally insulated households, according to districts, monitoring 2011

Figures 6 and 7 show the average fuel use of households in the winter 2011/2012 and 2010/2011 in MJ, according to the different districts. In the districts Roshtkala and Shugnan the households with thermal insulation used less fuel than the households without thermal insulation. In Murgab it is the other way round. This is due to the high coal consumption of the thermally insulated households in Murgab, as explained in chapter 3.1.1.1.

3.1.1.3 Fuel consumption in kg according to different fuel types

Fuel used	2011/2012 thermally insulated households (kg)	2011/2012 not thermally insulated households (kg)	Relative savings (%)	Relative savings per day	Total savings (kg)
Firewood	11,300	13,630	17%	5%	2,330
Dung	36,313	59,220	39%	15%	22,907
Teresken	10,200	22,414	54%	42%	12,214
Coal	18,090	9,190	-49%	-9%	-8,900

Figure 8 Comparison of fuel use according to different fuel types of thermally insulated households with not thermally insulated households, monitoring 2012

The table above measures the fuel use in kg, differentiating between the different fuels used by the households. Measured in kg (and not average MJ) the savings between thermally insulated households and not thermally insulated households are quite significant. Apart from the relative savings per winter, the table also depicts the relative saving per day. The difference between the relative savings per winter and per day are very big, the savings per day being smaller. This could be due to the fact that the monitoring was done in March and April towards the end of winter, when people heated less as it was warmer.

3.1.2 Biomass consumption

One target of the monitoring is to assess the effect thermal insulation has on a reduction of the use of natural resources. This was found out through the question in the questionnaire "How much fuel did you use this winter until now?", only counting the answers for dung, teresken and wood. Khorog is not included here, as the interviewed households all used electricity. No edited information exists on biomass consumption for the winters 2009/2010 and 2010/2011.

	2011/2012 thermally insulated house	2011/2012 not thermally insulated house	Relative Savings %
Average use of biomass MJ 2011-2012	20,913	35,418	41%

Figure 9 Comparison of biomass consumption thermally insulated households with not thermally insulated households, monitoring 2012

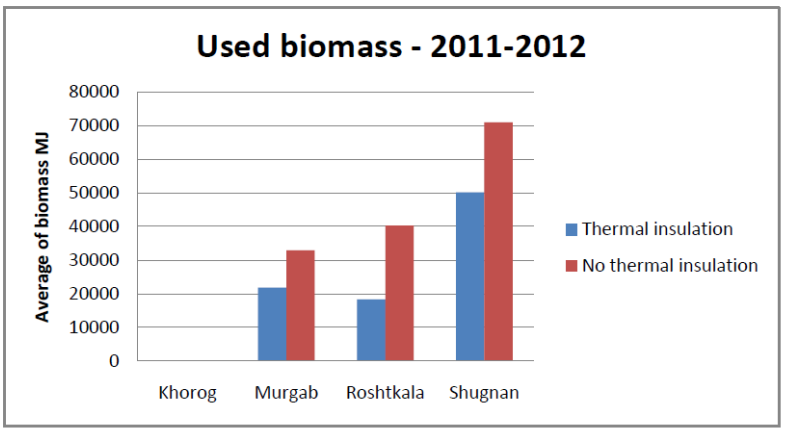

Figure 10 Comparison of biomass consumption thermally insulated households with not thermally insulated households, monitoring 2012

The table and the graph above show that 41% of biomass could be saved in households with thermal insulation, in comparison to households without thermal insulation. Biggest savings were made in Roshtkala, where about 21,000 MJ of biomass could be saved by thermally insulated households in comparison to households without thermal insulation. Thermal insulation thus leads to a reduction in the use of natural resources, one of the goals of the GIZ project "Sustainable Management of Natural Resources in Gorno-Badakhshan".

3.1.3 Indoor Temperature

In order to find out if there is an indoor temperature difference between thermally insulated and not thermally insulated households, in the Shugnan district dataloggers were installed in households with thermal insulation and in neighbouring households without thermal insulation. The indoor temperature can be influenced by factors such as fuel use, heating frequency, size of winter room and the number of insulation measures. The results of our questionnaire concerning these factors will be considered when evaluating the diagrams below.

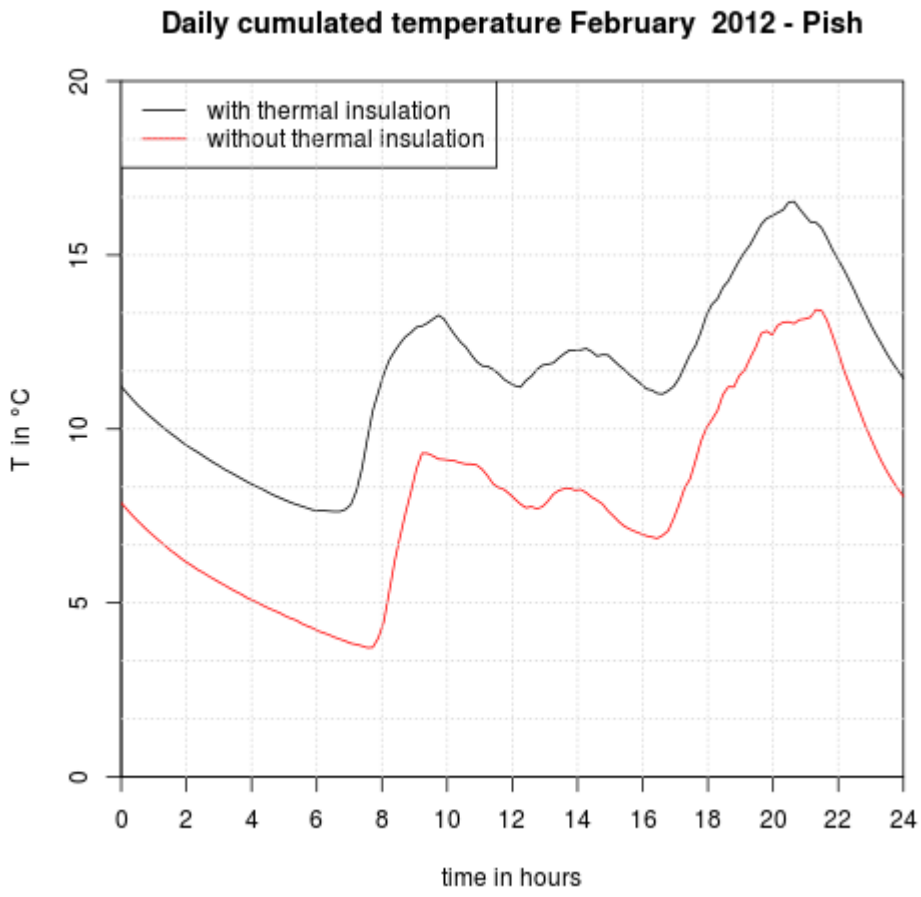

Figure 11 Comparison of indoor temperature thermally insulated households with not thermally insulated households, Pish, monitoring 2012

Household with thermal insulation

Fuel use: 46,500MJ in winter2011/2012

Heating frequency: all day

Size of winter room:56 m²

Number of insulation measures: 1 window

Household without thermal insulation

Fuel use: 34,250 MJ in winter 2011/2012

Heating frequency: all day

Size of winter room: 49 m²

Number of insulation measures: 0

The daily cumulated temperature curves of two households in the village of Pish show that it is around 5°C warmer in the household with thermal insulation, than in the households without thermal insulation. Interestingly a similar heating pattern and heating frequency in the household with and in the household without thermal insulation in Pish is to be observed.

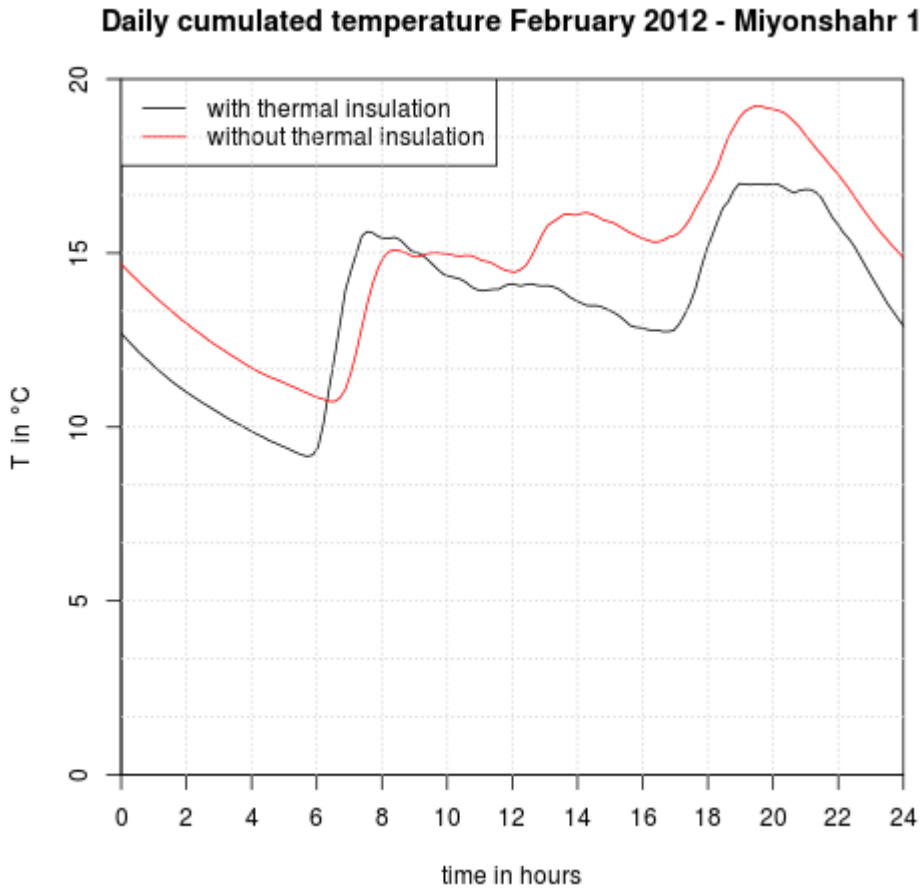

Figure 12 Comparison of indoor temperature thermally insulated households with not thermally insulated households, Miyonshar 1, monitoring 2012

Households with thermal insulation	**Household without thermal insulation**
Fuel use: 46,500 MJ in winter2011/2012	**Fuel use:** 46,500 MJ in winter 2011/2012
Heating frequency: all day	**Heating frequency**: all day
Size of winter room: 56 m²	**Size of winter room:** 49 m²
Number of insulation measures: 1 window, 1 roof hatch window	**Number of insulation measures:** 0

In Miyonshar 1 no significant temperature difference between the household with and the household without thermal insulation is measured, although both use the same amount of fuel. The winter room of the household without thermal insulation is smaller, this could have made it easier to heat and with the same amount of fuel, this could have led to the higher temperature. Another possibility could also be

that the house without thermal insulation also has good windows which have not been financed through a microcredit scheme of MFI Madina va Hamkoron.

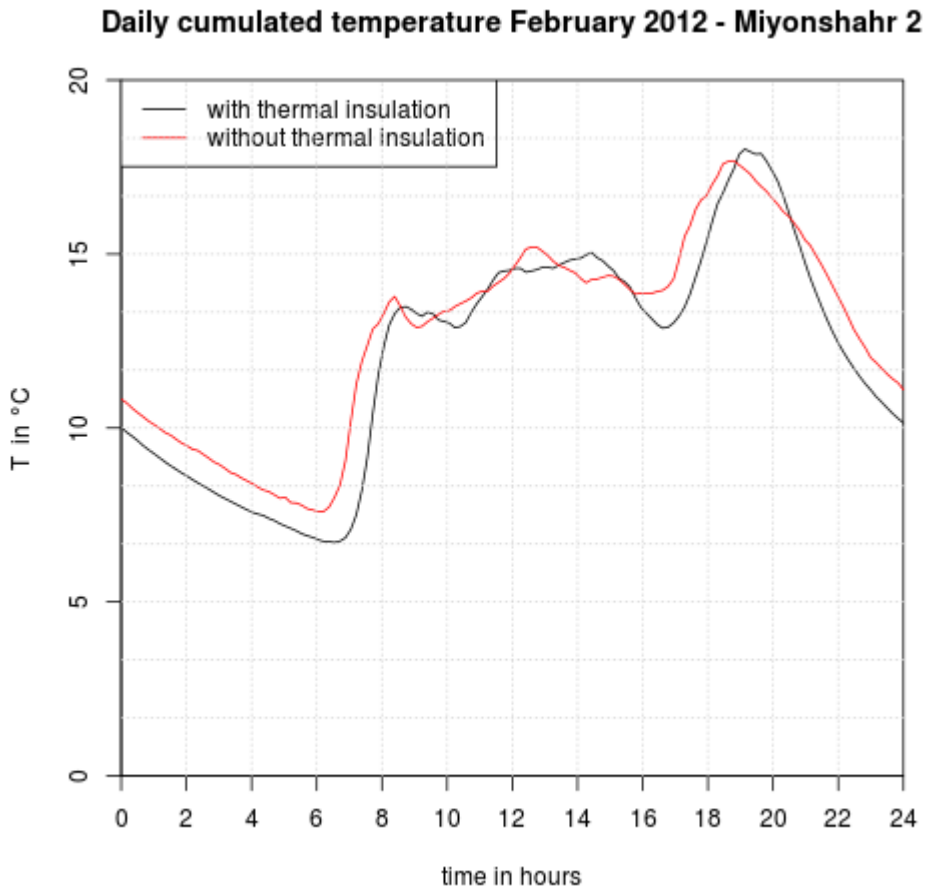

Figure 13 Comparison of indoor temperature thermally insulated households with not thermally insulated households, Miyonshar 2, monitoring 2012

Household with thermal insulation	**Household without thermal insulation**
Fuel use: 57,500 MJ in winter2011/2012	**Fuel use:** 132,250 MJ in winter 2011/2012
Heating frequency: all day	**Heating frequency**: all day
Size of winter room: 67 m²	**Size of winter room:** 46 m²
Number of insulation measures: 1 window, 1 roof hatch window, 1 floor	**Number of insulation measures:** 0

In Miyonshar 2 also no significant temperature differences between the household with and the household without thermal insulation were measured. Yet fuel consumption is much higher in the household without thermal insulation and the winter room is smaller. This might have led to the similar temperature in the household with and in the household without thermal insulation. The household without thermal insulation might have heated so much because 6 children are part of the family.

Households with small children and old people generally heat more. In the household with thermal insulation only two children live in the family.

In conclusion the temperatures measured in the different households give no clear indication on the effect that thermal insulation measures have on temperature. Yet due to the small resources available to conduct the monitoring, the sample is very small and single factors, such as a large amount of children living in a household, might be decisive. A bigger sample might have shown a different picture.

The results of the dataloggers and also of the questionnaire show that the heating frequency and the heating pattern of households with thermal insulation and households without thermal insulation are similar.

3.1.4 Insulating effect of insulation measures

Originally it was thought that in this section a comparison of infrared photos of houses with thermal insulation and houses without thermal insulation could be made. Yet, after some research, this did not seem feasible. The most important impeding factor is that all households would have to be heated over a longer period of time in a similar manner for a real comparison to be possible. Due to the limited resources of the monitoring team this was not workable.

Nevertheless the photographs indicate where the warmth leaves the room, thus if the thermal insulation measures as such are effective.

1. Windows

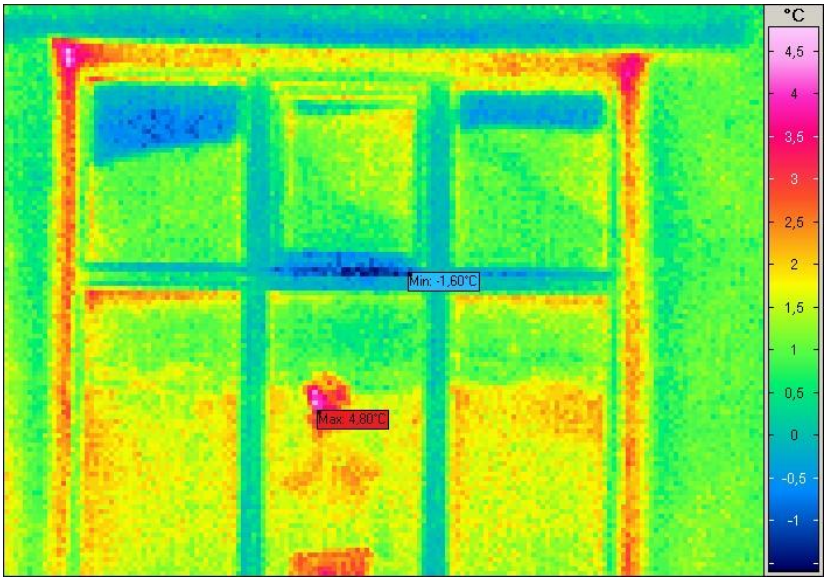

Figure 14 Double glazed window, Murgab

The double glazed window insulates well. The glass and the frame are cold, which means that no heat passes off through the window. The only weak point is the connection between the frame and the wall. This hast to be improved through a better installation of the window.

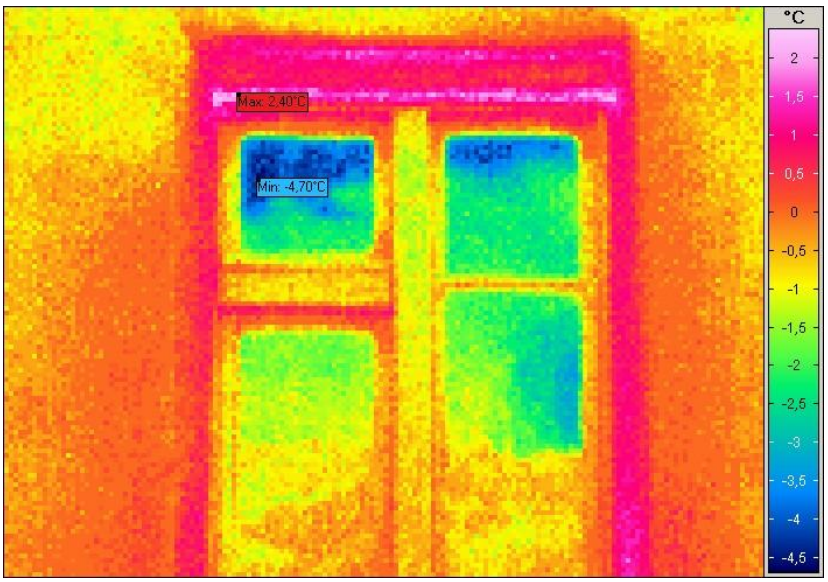

Figure 15 Single glazed window, Murgab

The left bottom casement window of this single glazed window seals badly or might not have a seal at all. The heat passes off through this point. Another big portion of the heat passes off through the wall and the window frame, as the window is very poorly installed.

2. Floor and walls

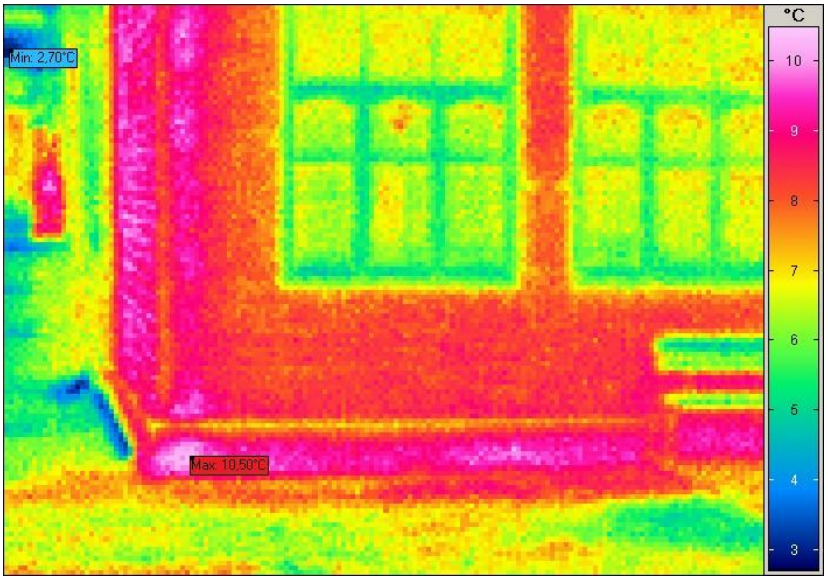

Figure 16 House with double glazed windows and insulated floor and walls, Murgab

The windows insulate better than the wall and the floor. This is strange as walls and the floor are insulated. One explanation is that during the afternoon the sun was shining and that the walls and the floor are still giving off the stored heat.

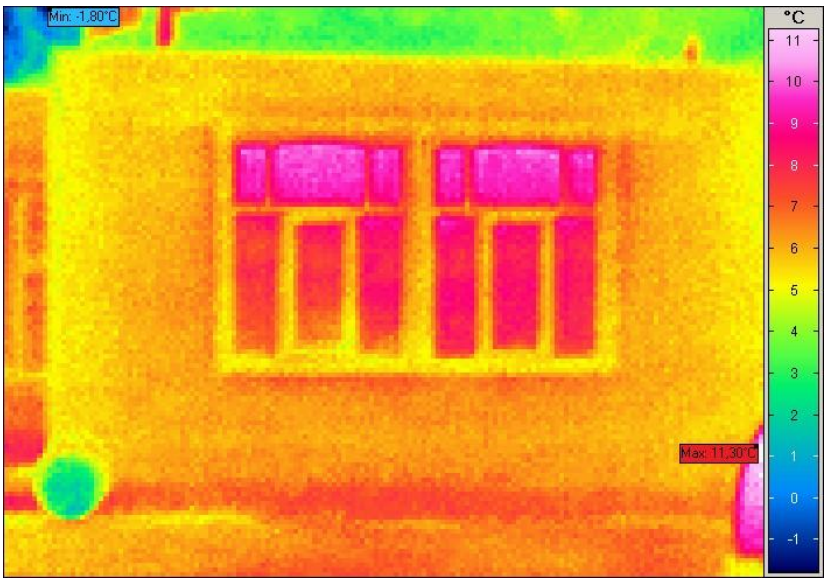

Figure 17 Not insulated house, Murgab

This is a house, which is not insulated. The ceiling insulates better than the walls and the walls insulate better than the windows. A lot of heat leaves the room via the floor. This household could be advised to insert first of all double glazed windows.

3. Ceiling

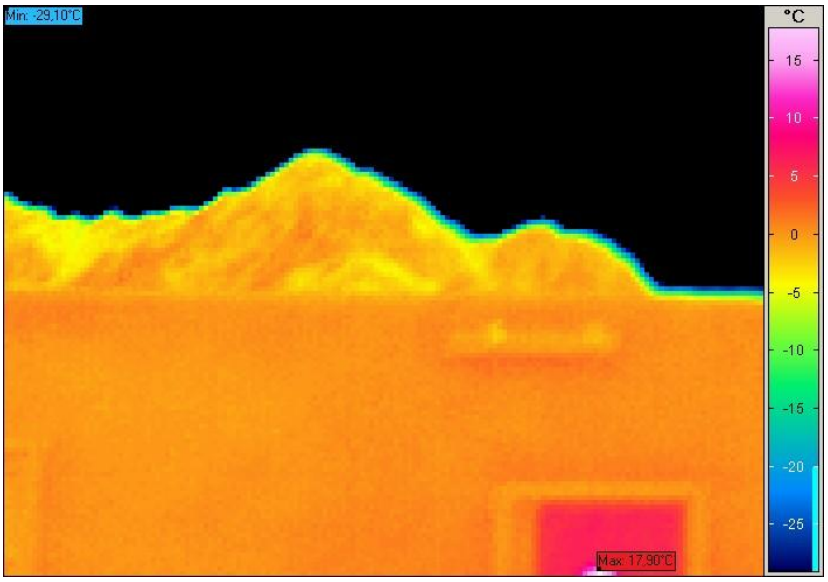

Figure 18 House with insulated ceiling, Murgab

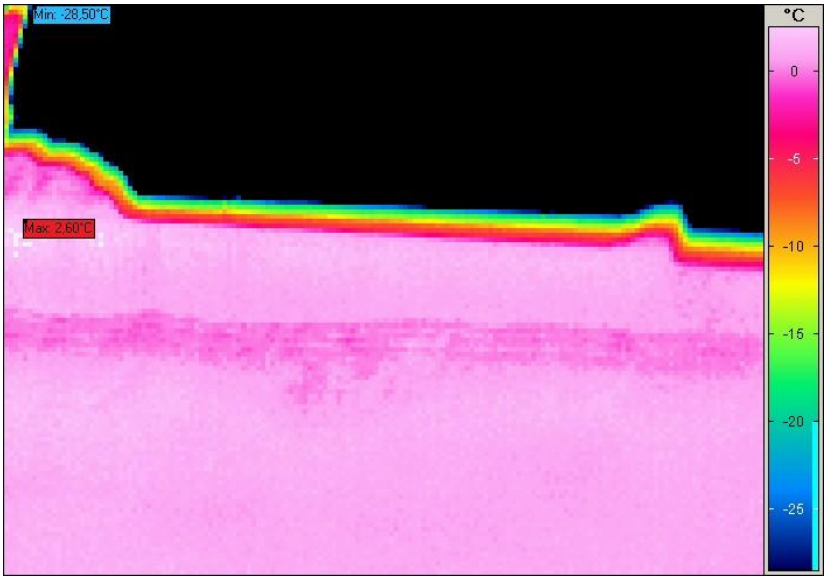

Figure 19 House without insulated ceiling, Murgab

No difference between the households with insulated and without insulated ceiling can be detected.

3.1.5 Additional data generated with the questionnaire

Below some additional data is listed, comparing thermally insulated houses with not thermally insulated houses. The data was generated through the questionnaire.

- Heating frequency:

Insulated households: on average 3.36 times a day

Not insulated households: on average 3.64 times a day

- Ventilation

a) How often (1 often (>2), 2 rare (1-2), 3 never):

Insulated households: on average 1.80

Not insulated households: on average 2.16

b) How long:

Insulated households: on average 29.3 minutes

Not insulated households: on average 50.6 minutes

- Temperature in winter room in comparison with last year (warmer1, colder2, same3):

Insulated household: on average 1.33

Not insulated household: 4x"1", 14x "2", 4x"3", on average 2

- Time warmth stays in the winter room after the fire has gone out:

Insulated houses: on average 3.02 hours

Not insulated houses: on average 1.28 hours

- Heating period winter 2011/2012:

Insulated households: on average 5.45 months

Not insulated households: on average 5.68 months

- What do you think about this winter is it .....than before? (warmer1, colder2):

Insulated household: on average 1.91

Not insulated household: on average 1.95

Heating frequency is similar between households with thermal insulation and households without thermal insulation. Yet the time the warmth stays in the room after heating is far higher in insulated

households. Insulated households also found the temperature indoors this year higher in comparison to last year. This could be indications for the positive effects of thermal insulation.

Insulated households ventilate more often than not insulated households, yet for a shorter period of time. This might indicate that MFI Madina va Hamkoron is doing a good technical consultation, because this is the advice, which should be given to insulated households, to ventilate more often than usual, but for a short period of time.

3.2 Households before and after thermal insulation

This chapter presents the results gathered through semi-structured interviews of 22 households with thermal insulation measures installed in 2011 financed by a credit of MFI Madina va Hamkoron. The households lie in the capital of Gorno Badakhshan, Khorog, and in the three districts Shugnan, Rosthkala, and Murgab. These are the areas in which Madina va Hamkoron runs the microcredit scheme "Warm Comfort: Microloans for Thermal Insulation".

3.2.1 Fuel consumption

In this chapter the fuel consumption before thermal insulation and after thermal insulation is analyzed. The data results from the questions in the questionnaire:

"How much fuel did you use this winter until now?"

"How much fuel did you use last winter?"

"How much fuel did you use yesterday?"

"How much did you use a day last winter?"

The results are compared with the monitoring reports of the years 2011 and 2010. Khorog is not included in this evaluation as all questioned households only used electricity for heating.

Regarding this comparison it must be noted that the temperatures vary in the different winters and this has an effect on fuel consumption. If it is colder, more heating is needed. Yet also the availability of fuel plays a role. The main road to Murgab was closed this year in winter for quite some time and thus families were not able to buy more coal on the market[3].

3.2.1.1 Average fuel consumption in MJ

2011-2012	Fuel use in MJ 11/12	Fuel use in MJ 10/11	Savings %
Average fuel use in MJ (22)	41,470	60,182	31%

Figure 20 Fuel use before and after thermal insulation, monitoring 2012

[3]Compare interviews of households H1, H4, H8, H9, C9.

2011-2010	Fuel use in MJ 10/11	Fuel use in MJ 09/10	Savings %
Average fuel use in MJ (26)	55,993	77,684	28%

Figure 21 Fuel use before and after thermal insulation, monitoring 2011

2010-2009	Fuel use in MJ 09/10	Fuel use in MJ 08/09	Savings %
Average fuel use in MJ (42)	36,105	57,230	37%

Figure 22 Fuel use before and after thermal insulation, monitoring 2010

As can be seen from the tables above there are some significant savings in average fuel use per winter in MJ before and after thermal insulation.

3.2.1.2 Average fuel consumption according to districts

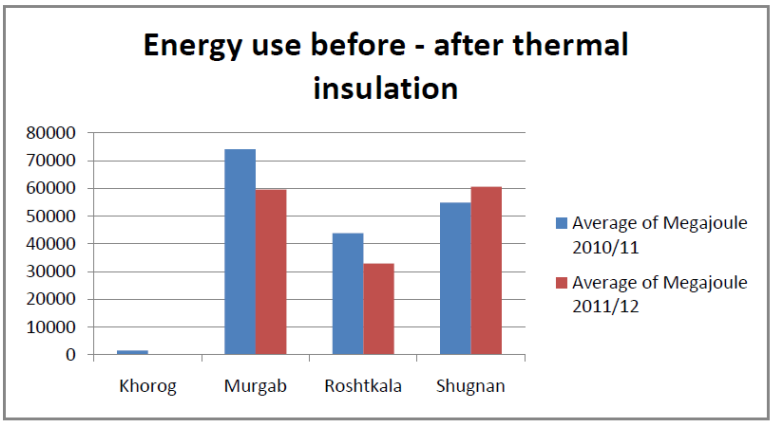

Figure 23 Fuel use before and after thermal insulation according to district, monitoring 2012

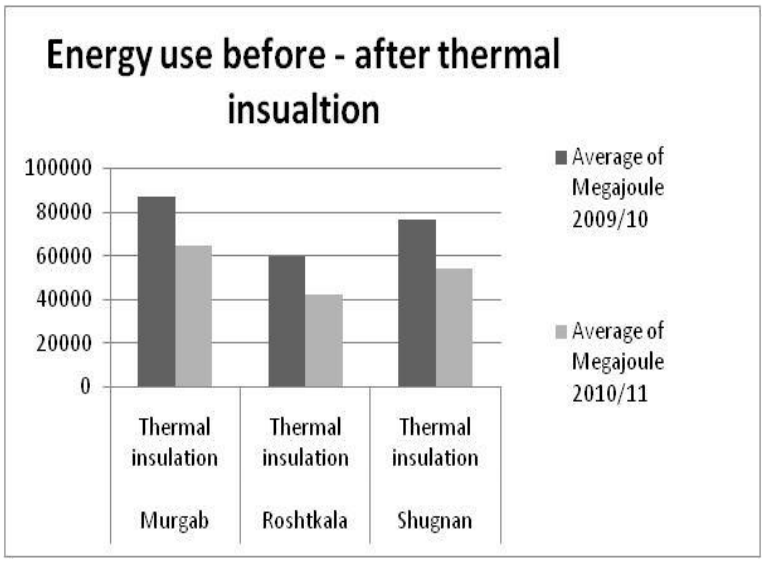

Figure 25 Fuel use before and after thermal insulation according to district, monitoring 2011

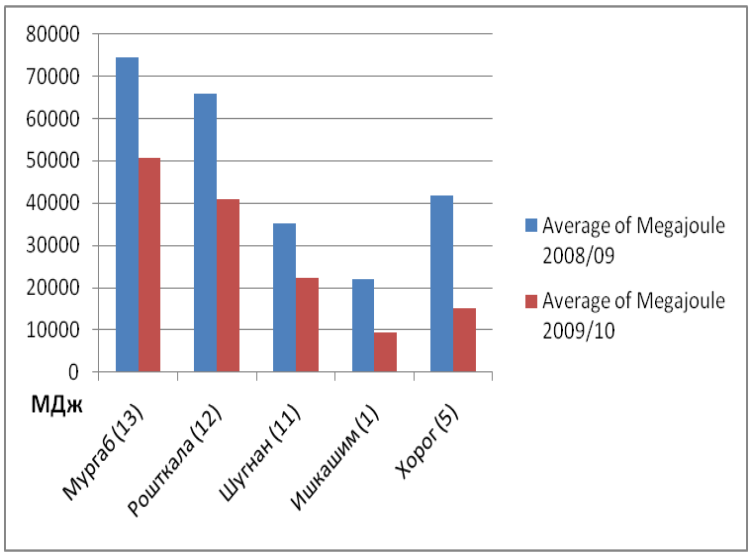

Figure 24 Fuel use before and after thermal insulation according to districts, monitoring 2010

The graphs above show the average fuel use in MJ according to districts, in three winters. More fuel was used before thermal insulation than after thermal insulation. In the winter 2011/2012 the Shugnan district is an exception, as after thermal insulation more fuel was used than before thermal insulation. Yet the sample in Shugnan was very small, only three households could be interviewed, this not being representative and single factors could have a much stronger weight in a small sample than in a big sample. It could be that this winter the households used more fuel, because it was colder than last winter or because they had more funds available to buy or collect fuel this winter than last winter. Furthermore it could be that this winter a new born baby was living in the household, the households heating much more than they usually would.

2.2.1.3 Fuel consumption in kg according to different fuel types

Fuel used	2010/2011 (kg)	2011/2012 (kg)	Relative Savings (%)	Relative Savings per day	Total Savings (kg)
Firewood	10,700	11,300	-6%	5%	-600
Dung	47,147	36,313	23%	24%	10,834
Teresken	11,340	10,200	10%	10%	1,140
Coal	27,630	18,090	35%	22%	9,540

Figure 27 Fuel use before and after thermal insulation according to different fuel types, monitoring 2012

Fuel used	2009/2010 (kg)	2010/2011 (kg)	Relative Savings (%)	Total Savings (kg)
Firewood	45,410	46,397	-2.1%	-987
Dung	86,154	50,847	40.1%	35,307
Teresken	19,327	8,525	55.9%	10,802
Coal	25,910	18,443	28.8%	7,467

Figure 28 Fuel use before and after thermal insulation according to different fuel types, monitoring 2011

Fuel used	2008/2009 (kg)	2009/2010 (kg)	Relative Savings (%)	Total Savings (kg)
Firewood	60 130	44 575	28%	15 555
Dung	90 840	62 933	31%	27 907
Teresken	10 770	10 255	5%	515
Coal	32 000	20 650	36%	11 350

Figure 29 Fuel use before and after thermal insulation according to different fuel types, monitoring 2010

The tables above show fuel consumption before and after thermal insulation in kg according to fuel types. In the winter of 2011-2012 there were savings in fuel use after thermal insulation measures were installed. The exception is firewood, more firewood being used after thermal insulation, than before thermal insulation. Factors such as availability and price of firewood could have influenced this result. Furthermore the number of households using firewood is very small, only 8 households, which is not very representative.

In the table for the winter 2011-2012 additionally to the savings per winter also the savings per day are depicted. This data is the result of the answers to the questions

"How much fuel did you use yesterday?"

"How much did you use a day last winter per day?".

Some differences can be found between the savings per winter and the savings per day for firewood and coal. Regarding coal the savings are 35% per winter and 22% per day. This could be because the winter this year was very cold. The colder a winter is, the more should the effect of thermal insulation be felt. The savings per day could be smaller than the saving per winter because the interviews were held in March. In March it is not as cold as in January or February. The people were heating less and the effect of thermal insulation is not as strong.

The households used 6% more firewood this winter than last winter, yet when asked per day they used 5% less this winter than last winter. This difference cannot be explained, except by the fact that the sample is very small, comprising 8 households. This means the sample is not representative and single factors can have a big weight and change the overall result.

3.2.2 Biomass consumption

The reduction of the use of natural resources is one of the main goals of the project. Therefore, the impact of thermal insulation on biomass consumption of households before and after thermal insulation was monitored and the results are depicted in the graphs below. The data stems from the answers to the questions in the questionnaire “How much fuel did you use this winter until now?” and “How much fuel did you use last winter?”. Only answers regarding use of dung, teresken and wood are included in the graphs. Khorog is not considered in this evaluation as all questioned households only used electricity for heating.

	Before thermal insulation 2010/2011	After thermal insulation 2011/2012	Savings
Average use of biomass MJ	37,649	20,913	44%

Figure 30 Biomass consumption before and after thermal insulation, monitoring 2012

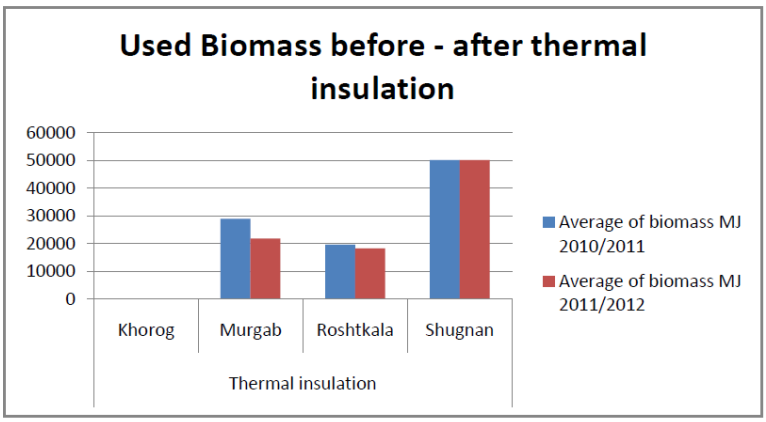

Figure 31 Biomass consumption before and after thermal insulation, monitoring 2012

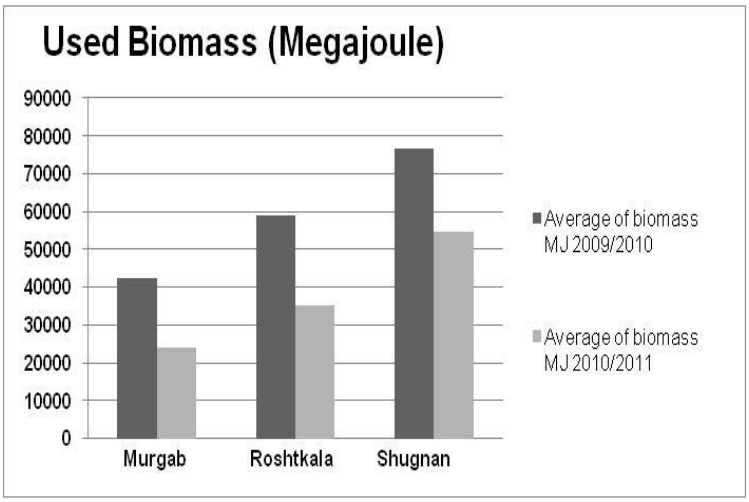

Figure 32 Biomass consumption before and after thermal insulation, monitoring 2011

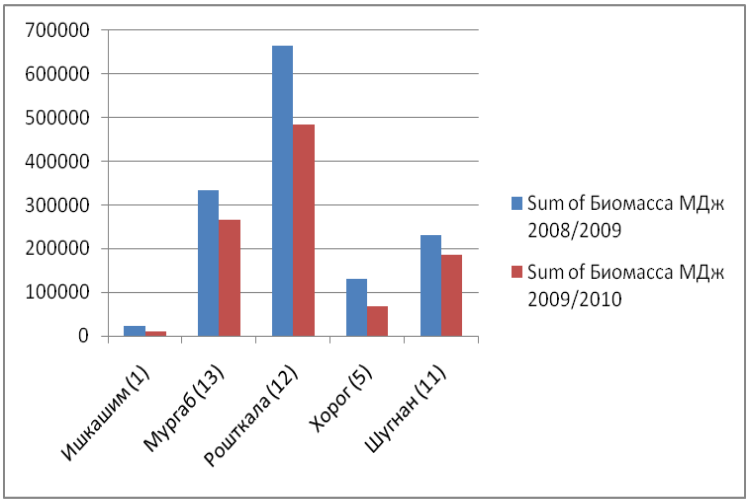

Figure 33 Biomass consumption before and after thermal insulation, monitoring 2010

In the winter 2011-2012 the households saved 44% on biomass after installing thermal insulation measures in their houses in 2011. In Murgab the biggest difference can be noted, a little below 10,000 MJ. In Shugnan no difference was noted. This correlates with the results of chapter 3.2.1.2 that in Shugnan on average more fuel was used after thermal insulation than before thermal insulation.

3.2.3 Perception of changes due to thermal insulation

One objective of the monitoring was to find out what the households felt had changed due to thermal insulation. The open question was posed “What changed with thermal insulation?”.

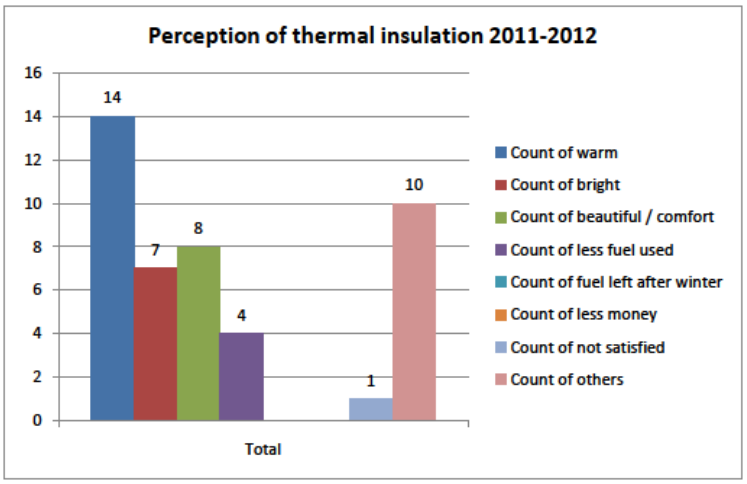

Figure 34 Perception of changes due to thermal insulation, monitoring 2012

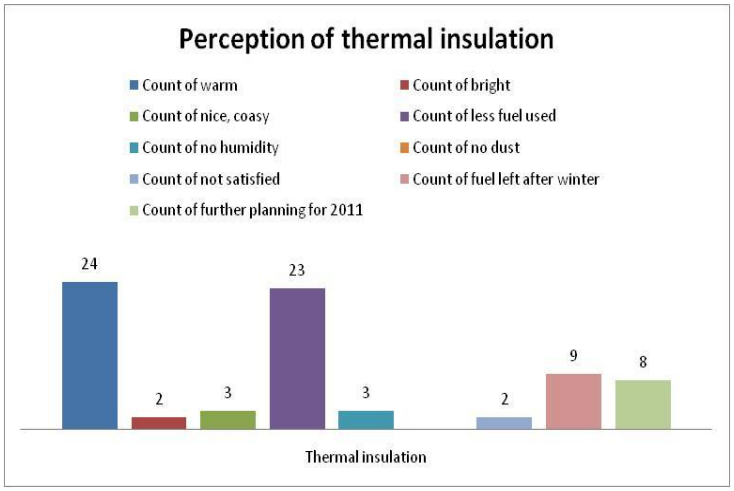

Figure 35 Perception of changes due to thermal insulation, monitoring 2011

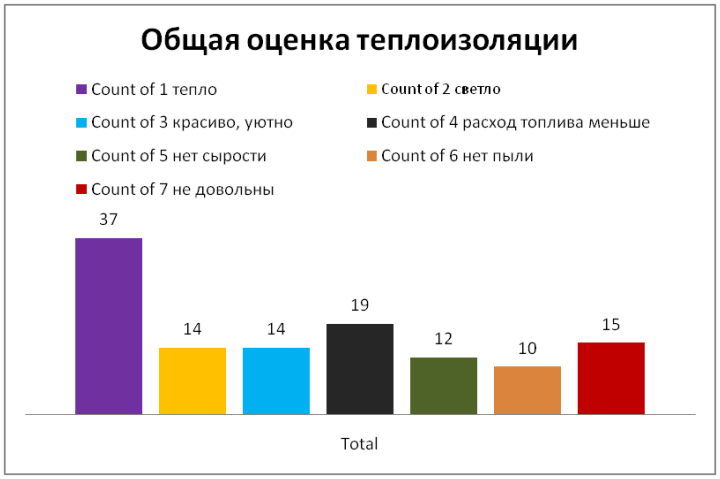

Figure 36 Perception of changes due to thermal insulation, monitoring 2010

In the monitoring 2012 the count of “warm” (14) and “others” (10) was most often, followed by “beautiful/comfort” (8) and “bright” (7) (number in brackets indicate number of households). It seems that people are more aware of the added comfort through thermal insulation and not so much of saving in fuel. Yet this open question on changes was posed after eight questions concerning fuel use, this might have affected the answers.

The count of “others” includes:

- five counts that there is less draft which leads to less dust in the house,
- two counts that the house is cleaner, because before the households had an earth floor,
- one count that the door closes properly, in comparison to the one before,
- one count of less noise due to the new double-glazed window and no bad fumes coming from wooden window in comparison to the old plastic window and
- one count of less time needed for heating.

The monitoring team furthermore specifically asked the households it family members were getting less sick because of thermal insulation. Five out of 22 households said that their family members were getting less sick.

Comparing the three monitorings of 2010, 2011 and 2012, in all years the answer most often given was that it was warmer due to thermal insulation.

3.3 Assessment of MFI Madina va Hamkoron's and the construction workers' work and the quality of insulation measures

The results regarding MFI Madina va Hamkoron's and the construction workers' work have been generated through the questionnaire for the first time in 2012. Furthermore a co-worker of MFI Madina va Hamkoron has done a technical assessment in some houses in the districts of Roshtkala and in the district capital Khorog. This technical assessment will be presented further on in the chapter.

3.3.1 Results of the questionnaire

- Time from the placement of an order until the construction works start:

In average it took 54 days from the order with MFI Madina va Hamkoron until construction works started. Yet this includes five cases, where an order was given in autumn/winter and the construction works could only be started in spring. Not including these five cases the average time was 18 days.

- Time to finish installing the insulation measures per household:

It took an average of 4.6 days to finish installing the ordered insulation measures. Yet these orders can range from one insulation measure to four insulation measures.

- Source of information on thermal insulation:

Most households with thermal insulation heard about the thermal insulation from a local MFI Madina va Hamkoron credit officer (8) (number in brackets representing number of households). Nearly as important are friends and neighbours (7) or seeing the nice looking double-glazed windows installed in other houses, this catching the attention of the people (4). One household claims to have seen a TV spot about MFI Madina va Hamkoron on TV Badakhshan.

- Source who explained about the microcredit scheme:

When asked who explained the process of the microcredit to the households most households, 16, were contacted by a representative of the MFI Madina va Hamkoron. One household contacted MFI Madina va Hamkoron by themselves. Local craftsmen explained the process of the microcredit to two households, one household contacting the local craftsman, in the other case the local craftsman contacting the household.

In another case the neighbour explained the microcredit process to one household.

- Problems with thermal insulation measures:

8 out of 22 households reported different problems with the thermal insulation measures installed in their households.

In two households (Murgab, Roshtkala) the window was not installed properly, there being a crack between window and wall, this being a problem of installation. One household in Khorog reported the windows were not closing properly. This could be a problem with the construction of the window as such or with the installation of the window in the house.

In two households (Murgab, Shugnan) problems with mould occurred. Households with thermal insulation are advised to ventilate more often than without thermal insulation. It could be that there was mould because these two households did not change their ventilation pattern.

One household in Murgab stated that it was colder in their winter room with thermal insulation measures, than last year without thermal insulation measures. The warmth would only stay inside the room for 0.5 hour after heating. The household has three new big double-glazed windows (before it had none), but no other thermal insulation measures. Maybe here three big windows actually make the room colder. Here the technical advice promised to the customers of the microcredit scheme might have been wrong.

In Roshtkala district a door does not close properly. Yet it is a door meant for inside, which is being used as the front door. This could be a case of the technical consultation of MFI Madina va Hamkoron not being done very well or customers not listening to the technical advice given.

In one household in Murgab it took very long to install the door, as the household first received two broken doors and only the third could be installed. This highlights the problem of transportation on very bad roads from Khorog (where the cooperative Zindagi is situated) to Murgab.

3.3.2 Results of the technical assessment

A microcredit officer of MFI Madina va Hamkoron accompanied the GIZ project monitoring team during the monitoring in Khorog and in the district of Roshtkala. There he conducted a quality control of the thermal insulation measures installed in the years 2009-2011.

1. Window

Total: 17

2011: 6

2010: 2

2009: 4

No indication of year: 5

Biggest problems:

The size of construction is not as ordered

Total	6
2011	2
2010	1
2009	3
No indication of year	0

The insulating rubber is not straight and does not hold glass and wood together without gaps

Total	5
2011	2
2010	0
2009	1
No indication of year	2

Rubber insulation is not installed without gaps at the corners and is not tightly secured at an angle of 45 degrees

Total	5
2011	2
2010	0
2009	1
No indication of year	2

2. Door

Total: 4

2011: 2

2010: 0

2009: 2

No indication of year: 0

Biggest Problems:

The door does not fit the door case, the door does not close properly

Total	3
2011	2
2010	0
2009	1
No indication of years	0

The rubber was damaged (e.g. enamel varnish)

Total	2
2011	1
2010	0
2009	1
No indication of years	0

3. Roetz

Total: 9

2011: 2

2010: 2

2009: 3

No indication of year: 2

Biggest Problems:

The size is not as ordered

Total	7
2011	3
2010	1
2009	1
No indication of years	2

Rubber insulation is not installed without gaps at the corners and is not tightly secured at an angle of 45 degrees

Total	3
2011	
2010	2
2009	
No indication of years	1

The rubber was not put inside without damaging the rest of the window (enamel varnish)

Total	3
2011	
2010	2
2009	
No indication of years	1

Glass has cracks

Total	5
2011	1
2010	2
2009	1
No indication of years	1

The handle is not mounted on the frame

Total	3
2011	
2010	1
2009	1
No indication of years	1

Annex 1 Microcredit scheme "Warm Comfort: Microloans for Thermal Insulation"

Warm Comfort: Microloans for Thermal Insulation

Dissemination of Innovative Technologies via Microloans in Gorno-Badakhshan Autonomous Oblast (GBAO), Tajikistan

Background

The Pamir region of Tajikistan suffers from long and cold winters, which last from October until March, and in which temperatures often reach -40°C. Due to poorly insulated houses and inefficient stoves, a lot of fuel is thus required for heating and cooking, which creates a significant pressure both on the household budget and on natural resources.

The microloan product "Warm Comfort" is a useful means to incentivise households to invest into thermal insulation and other innovative technologies. From an economic perspective, "Warm Comfort" helps people to save money on fuel for heating and creates local employment opportunities. Moreover, thermal insulation reduces pressure on the environment and in the long run decreases desertification and erosion processes.

Approach

The dissemination approach of thermal insulation using local market mechanisms helps to reduce the pressure on the natural resources: As a first step, our implementing partner, the microfinance institution MADINA VA HAMKORON, sends a technical consultant to advise interested households on the different insulating possibilities for their homes. After the latter have been advised and checked for their creditworthiness, MADINA VA HAMKORON offers microcredits in the form of insulation technologies to interested clients. This means that the microcredit is not paid out in cash, but that MADINA VA HAMKORON purchases the insulating material and organizes the construction and installation process of thermal insulation measures. Wooden constructions such as quality double-glazed windows, roof-hatch windows and doors are supplied to MADINA VA HAMKORON by the retailers cooperative ZINDAGI. Upon the collection of all necessary material, trained construction workers are sent to install the technologies in the client's house under the supervision of the technical consultant. Upon the latter's acceptance of the construction work, the clients pay back their loans with an interest of 2.5% per month within twelve months time.

Impacts

Economic Impacts

The dissemination approach has a positive economic impact on both clients and manufacturers:Manufacturers, on the one hand, are empowered to develop high quality products self-consistently. Moreover, "Warm Comfort"helps to increase the demand for craftsmen and construction workers as well as for transportation services, which takes pressure off the labour market. Clients, on the other

hand, benefit as well: Living in newly insulated houses, they use, on average, 30% less fuel and can keep their living space warmer during winter time. This does not only improve their health conditions, but helps them to save money and time, which they earlier needed to either purchase the fuel on the market or to directly collect it (e.g. dung, teresken or firewood). On average, households can compensate for their investment into thermal insulation within two years.

Environmental Impact

The direct effect of thermal insulation is the reduction of natural resources being used as fuel material. Using less firewood and teresken shrubs for heating and cooking and using manure as fertilizer improves the condition of the sensitive soils in high mountainous areas, which in turn increases harvests. As especially in the sparsely vegetated areas of the Tajik Pamirs most fuels have to be bought on the market, there is a strong economic incentive to use less of these fuels by insulating houses. The decreased use of natural resources will in turn contain the process of desertification and soil erosion. In the long run, this helps to combat the threat of natural hazards, which the region is especially prone to due to the ongoing global climate change.

The Product Development

"Warm Comfort: Microloans for Thermal Insulation" was implemented by the GIZ projects "Sustainable Management of Natural Resources in Gorno-Badakhshan" and "Support of Microfinance Services in Rural Regions of Tajikistan" on behalf of the German Federal Ministry of Economic Cooperation and Devlopment. The projects hereby supported the microfinance institutions (MFI) MADINA VA HAMKORON , MFI Haqiqi-Jahon, MFI Rushdi Ishkashim and MFI Rushdi Vodii Zerafshan. Since 2012 "Warm Comfort" is supported by AFC Consulting on behalf of the GIZ Program „Framework and Finance for Private Sector Development in Tajikistan" working for the German Federal Ministry of Economic Cooperation and Development.

A Self-Sustainable approach

The described microloan product combines technical consultation with the provision of financial access to investments into energy efficient technologies. As the microloan organisation is hereby holding the coordinating position of the process, the sustainability of the process can be guaranteed. Furthermore, the different parties of the value chain are economically incentivised in a way that allows a reliable functioning of the complementary services. Experience shows that after a certain amount of time people have started to address the microloan organisation by themselves, without the need of any additional marketing.

Bekchoroev Khomakmat, Micro Loan Client, Murgab, Tajikistan

"I took a 500 dollars (2,200 Somoni) micro loan in 2008 and used it to insulate the floor, the ceiling and the window of our winter room. Here on the high plains of the Eastern Pamirs, we use coal and teresken shrubs for heating. In earlier times we needed three tons of coal and 100 bunches of teresken, spending more than 3,000 Somoni per winter. After implementing the thermal insulation measures, however, we only consume half the amount of fuel, saving some 1,500 Somoni each winter. So in our case the micro loan already paid off after two years.

Annex 2 Retailers Cooperative Zindagi

Retailers Cooperative ZINDAGI - investing in Green Economy

An exemplary business and organizational model in the Tajik Pamirs

Transition towards market-economy by small enterprise development

Regardless of 20 years of political independence after the breakdown of the Soviet Union followed by economic transition, the Tajik economy is still predominantly driven by the primary sector. Rudimentary processing industries do exist, nevertheless are working with quite out-of-date technologies. The small and medium enterprise (SME) sector is the driving engine for economic growth in Tajikistan, providing a source of livelihoods for a significant portion of the domestic population and accounting for 43 per cent of the GDP. Nonetheless the sector is underutilizing its potential, due to the lack of business management skills, infrastructure, access to finance, business advisory services and advocacy for improving the business environment.

The Tajik Pamirs - where global thinking meets local action

The GIZ Project on "Sustainable Management of Natural Resources in Gorno-Badakhshan", together with local craftsmen, has developed a range of innovative products, aiming at enhancing energy efficiency, irrigation technologies and livelihoods of households in the Tajik Pamirs. These products include double-glazed windows, roof-hatch windows and tightly closing doors, insulation measures for floors, walls and ceilings, fuel-efficient heating and cooking stoves, solar water heaters, heat exchangers as well as water pumps. Local craftsmen have been trained to produce and to install these products.

Double-glazed insulating window in the Eastern Pamirs

Nevertheless, despite the stable demand for these products, limiting factors in meeting the demand are: the production capacity (inefficient working processes, lack of machinery and material supply) as well as limited marketing channels for the supply of villages and regional markets.

In order to overcome these bottlenecks a retailers cooperative has been set up through the joint efforts of the GIZ Project "Sustainable Management of Natural Resources in Gorno-Badakhshan" and the GIZ Program „Framework and Finance for Private Sector Development in Tajikistan" on behalf of the German Federal Ministry of Economic Cooperation and Development. Rationale for the legal form of the organization is that a cooperative functions around the principle of commitment to serving its members and the community.

The name of the retailers' cooperative ZINDAGI, meaning "life" in Tajik language, stands for its mission: to improve the living conditions in the Tajik Pamirs by implementing an approach, which promotes the conservation of natural resources through private sector development. Since its foundation in September 2010 with 16 members, ZINDAGI has been technically and financially supported by a GIZ development worker

and AFC Consulting on behalf of the GIZ Program „Framework and Finance for Private Sector Development in Tajikistan“. Through this support ZINDAGI is striving to expand its services to customers and members of the cooperative.

Stimulus for green growth

On the way to Rio+20, Green Economy gives a new dimension to the increasing importance of the value chain debate. The concept introduces new business opportunities arising from the challenges associated with climate change, such as energy efficiency, the use of renewable energy and products and services for a sustainable economy. The establishment and further development of the retailers cooperative ZINDAGI, sets incentives through increased financing and investment, as well as building skills and innovation capacities to take advantage of opportunities arising from a green economy. Through the provision of

Its services, the retailers cooperative ZINDAGI (i) ensures a reliable supply of materials and provides a basis for continuous production; (ii) utilizes economies of scale, thereby making materials available at a more favourable price to its members, and (iii) enhances the quality of the products, increases demand for those and thus, the competitiveness of the local craftsmen. Furthermore, due to economies of scale, job creation and energy saving, there is a significant marginal value produced locally, remaining in the region. Thus, ZINDAGI gives stimulus to local economic growth and through its products, is lowering the pressure on natural resources. In this sense, it is an exemplary model of local economic development where green growth meets sustainable development.

Sabrali Lutfaliev, founding and board member of ZINDAGI:

Trained by the GIZ, carpenter Sabrali Lutfaliev is running a micro-business producing energy efficient wooden constructions such as double-glazed windows including the traditional Pamiri roof-hatch window „rüdz“ and doors. Following the fruitful cooperation between Sabrali and the project, he was one of the pioneers to support the idea of setting up a cooperative of craftsmen. Today, he admits that at the time of the establishment of the cooperative he liked the idea, but nevertheless did not know much about how it would work. Now Sabrali is confident that he made the right decision in trusting and joining “ZINDAGI.

Business Development Services of ZINDAGI

- Raw material supply for the production of innovative products including purchase, storage and distribution;
- Financing services of the cooperative for the members aiming at a continuous production process and thereby enabling an increased sales volume and higher benefits;
- Provision of business management consultancy including price-calculations and accounting;
- Production of semi-finished products;
- Further development of the already existing marketing channels as well as new distribution channels for the sales of the products;
- Advising and supporting the members in the purchase of qualitative machinery and tools;
- Further training of members in technical as well as business management skills;
- Planning and implementation of tailor-made practical trainings directed at further qualifying young apprentices as craftsmen and micro-businessmen.

Annex 3 Interview questions

General household features						
Name of surveyer						
Date						
Name of interviewee						
Address						
Number of persons in household	children (< 14 years)		old people	adolescent, adult (> 14 years)		
Number of insulation measures	window/year	door/year	roetz/year	floor/year	roof/year	ceiling/year
Hight of credit sum						
Did you live in the same winter room last year?						
Size of the winter room						
Next insulation step planned for this year?	No	yes	don't know			
Comments						
Fuel sources and heating habits	Kizjak	Teresken	Wood	Coal	Electricity	
How much fuel did you use yesterday?						
How much did you use a day last winter?						
How much fuel did you use this winter until now?						
How much fuel did you use last winter?						

How much did you pay for fuel 2010/2011?						
How much have you paid for fuel this winter season until now?						
What is the price of fuel?						
How much fuel will you buy/prepare next autumn compared to the winter 11/12? Why?	more	same	Less			
Have you saved time due to thermal insulation?	yes					
How often do you heat per day?	1	2	3	4		
Did you ventilate?	No	yes				
How often?						
How long for?						
How long does the warmth stay in the room after heating?						
Which temperature did you have in your winter room this year in comparison with last year?	warmer	same	Colder			
What do you think about this winter it is … than the winters before?	warmer	same	Colder			
When did the heating season start in 2011?						
What changed with thermal insulation?						
warm						
bright						

beautiful, comfort						
less sickness						
no humidity						
less fuel used						
fuel was left after winter						
problem?						
less money						
others						
Evaluation of services of the craftsmen and Madina va Hamkoron						
How long did it take from the confirmation with MADINA VA HAMKORON until the construction works started?						
How long did it take to install the insulation measures?						
Did the craftsmen do all the works you expected?						
From whom did you here about the credit and the products of Zindagi?						
Who explained the process to you?						

Annex 4 Conversion factors

Coal

1 bag = 50kg

1 bowl (tazik) = 10kg

1 bucket = 8 kg

Dung

1 truck load (zil) = 3.500kg

1 m^3 = 400kg

1 bag = 15kg

1 bowl (tazik) = 4kg

Wood

1 truck load (zil) = 2.000kg

1 m^3 = 500kg

1 bowl = 2.5kg

Teresken

1 bundle (viszjanka) = 15kg

Annex 5 Overall statistics concerning the sample

- Average household size: 5.61 people
- Altitude above sea level[4], figures in brackets are the number of households included in our sample:

  Khorog (8): 2100m a.s.l.

  Murgab district (20):

  Murgab centre: 3600m a.s.l.

  Roshtkala district (10):

  Dirshid (4): 2600m a.s.l.

  Barotsch (2): 2600m a.s.l.

  Roshtkala Centre (2): 2700m a.s.l.

  Barvoz (2): 2800m a.s.l.

  Shugnan district (6):

  Miyonshar (4): 3050m a.s.l.

  Pish (2):3000m a.s.l.
- Use of electricity:

  Khorog: All 8 households in Khorog used only electricity for heating

  Roshtkala district: Three households out of 10 used electricity for heating additionally to the traditional stove.
- Average winter room size:

  Khorog: 22.33 m²

  Murgab district: 29.16 m²

  Roshtkala district: 55.43 m²

  Shugnan district: 54.75 m²
- Average number of insulation measures: 2,65

[4] http://www.fallingrain.com/world/TI/00/Baradzh.html, monitoring report 2010/2011 and GIS maps of GIZ project "Sustainable Management of Natural Resources in Gorno Badakhshan".