Final Report – Demonstration Energy Efficiency Building

(June – December 2011)

Author / Date	Reviewed / Date	Approved / Date
Shane Stevenson	Carly McShee	R. Alieva
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1. Aim

To establish a village level 'Demonstration Energy Efficiency Building' which will included the application of renewable energy techniques.

2. Site Selection

CAMP Kuhiston has concentrated it projects in the Nurobod area of the RRP district of Tajikistan. Nurobod.

2.1. Background Information

There has been political instability in the Nurobod area as recently as in April 2011 with incidences of fighting between government troops and the opposition. However, the security situation is slowly improving, and a level of normality is returning to day to day living. The inhabitants are very suspicious of external organisations working in the area. At present Nurobod receives very little support from International Non-Governmental Organisations, with cessation of operations in the last few years by numerous organisations (e.g. Merlin, WHH, UNDP, Carec, Save the Children), leaving only World Food Programme (WFP), CAMP Kuhiston, and MSDSP working on small scale environmental projects. The WFP Integrated Food Security Phase Classification in April 2011, ranked the region as high risk with an estimated 15% of the population requiring humanitarian assistance due to an increase in the prices for consumer goods, (e.g. food and fuel) and a reduction in the remittances support. The Eastern Regional Subordination, which includes Nurobod, was identified as the region most susceptible to the impacts of Climate Change in the World Bank Policy Research Working Paper on 'Mapping Vulnerability to Climate Change in Tajikistan, 2011'

2.2. CAMP's Previous Work

CAMP Kuhiston has been working for over two years in the Jamoats of Hakimi and Mudjiharf undertaking a range of natural resourced based projects. Some of these have been documented within the WOCAT international online database. These have included:

- Disaster Risk Reduction Training
- Soil and Water Conservation Training
- Pasture Management Training
- Fruit Tree Cultivation Training
- Energy Efficient Stove Training
- Planted 2000 fruit trees

Over this time CAMP has signed MOU's with the head of Jamoats and the Khukumat to undertake these particular activities. It was therefore a natural choice to continue work in these communities and combine the demonstration energy house with the funding from the Jephcott Foundation on training local people on the construction of an energy efficient two room stove for households.

2.3 Building Selection

The long term strategy of CAMP is to develop the village of Shahtuti Bolo as an energy demonstration centre for the region. The energy usage figures of the village have already been collated and processed and are available in a report 'Shahtuti Bolo – A socio-energy assessment of a small village in Nurobod'. However, after the site selection process started it became apparent that there were more suitable sites to transform into an energy demonstration centre. An action plan for the implementation of the programme is shown in Annex 1.

Below is an overview of the selection process undertaken by CAMP

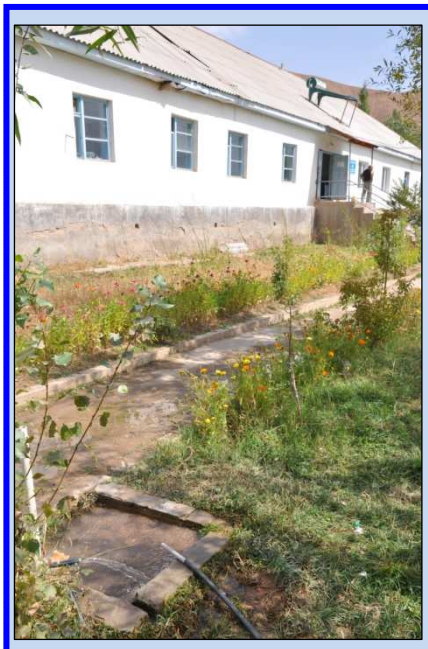

Photo 1: Shows the hospital. The only source of water is the pipe shown in the foreground. The hospital has 14 rooms and is also used by the local police force.

At the beginning of July we met with head of Hakimi Jamoat Fayzali Sharipov. The aim of the meeting was to explain the goal of the project and to select a site for the implementation. First we wanted to implement project activities in a private house, then after discussion we understood that they are interested (and need) more to implement in a public building. People in jamoat proposed three options: old jamoat building, building of the secondary school in Shahtuti bolo village and building of hospital, but priority the last one. Because the situation in the hospital was not good. Patients during winter mostly stay at daytime, at night most of them go to their houses because the rooms were cold. Next time we visited all these three sites with the technical staff to evaluate possibility of implementation from technical side. Technically all the sites were ok, but we selected hospital because of needs of people in jamoat, it was technically suitable and large number of beneficiaries. Then we (Roziya Alieva and Mirzo Pochoev) met with deputy of chairman of Nurabad district (Dustov Hasan Taqdirovich) and agreed our choice.

2.4. The Building

The hospital building has a stone/concrete foundation with thick mud wall and asbestos sheeted roof. There are 14 rooms all roughly the same size which can be accessed by a central corridor, each with a window. There is a basement area used for storage. The front of the building faces South whilst the back of the building faces onto a cut out slope. The hospital sits in an elevated position overlooking the main access road that runs along the edge of bank of the river.

The hospital provides basic medical care for the 11,000 people of the Jamoat of Hakimi. The building although structurally sound has received no major investment other than ongoing repairs. There is no running water inside the building and the electric supply is limited to 4hrs during the winter months. There is no heating system within the building. Two rooms are used by the local police force.

At the beginning of July a MOU was signed MoU with the Jamoat and Hukumat (Annex 2 and 3) to undertake the work within the hospital. There was a requirement for the community to provide accommodation, food and labour for the project.

3. Methodology and Design

Due to budget constraints the scope of the work was limited to two rooms within the hospital. Two south facing rooms were chosen for refurbishment. In Tajikistan over the last few years more energy efficient produces have become available in the shops and markets. It was therefore decided to utilise wherever possible new materials and technologies. From previous project experience it is the new technologies that generate the most interest within the communities.

Below is breakdown of the energy efficiency measures employed:

3.1. Insulation

As there is already a basement underneath the rooms, the issue of damp seeping up the walls was not a priority, however the existing wooden floor nailed to batons was not insulated and resulted in drafts coming up through the floor boards. 10cm of insulated polystyrene (0.45 was laid on the floor and covered in a base layer of concrete up to 15cm thick to level the floor. As it is a hospital the floor was covered in tiles to ensure that the room could be hygienically cleaned and the walls were painted with gloss paint so that they could be wiped clean. Everything was in white so that dirt would show up.

The ceiling rafters were also covered in 10cm of polystyrene sheets and then covered with plastic sheeting. This was to reduce the amount of heat escaping through the ceiling and provide a hygienic surface for cleaning.

The windows and doors were replaced with UPVC materials, which seal to prevent drafts and heat loss. It is estimated that before the improvements were made there was approximately a 25% heat loss through the windows and doors, it is estimated that this heat loss has now been reduced to 2-3%.

The calculation for the thermal insulation savings for the ceiling and floor are shown in Box 1. The calculations show that there is a 77.5% improvement in the ceiling insulation and a 51.2% improvement in the floor insulation.

Box 1: **Floor** consists: 1) before insulation, from the bottom: concrete with halls inside, thickness δ =22cm, air gap – 5cm, wood – 2cm

$R_{general} = R_{in} + R_1 + R_{air\ gap} + R_2 + R_{outside}$ = 0.11+1.15+0.115+0.19+0.11+0.17=1.85 $m^{2o}c/W$

$$R_{in} = \frac{1}{\alpha_{in}} = \frac{1}{8.7} = 0.11\ m^{2o}c/W$$

$R_1 = 1.15\ m^{2o}c/W$

$$R_{in} = \frac{1}{\alpha_{in}} = \frac{1}{8.7} = 0.115\ m^{2o}c/W$$

$R_{air\ gap} = 0.19\ m^{2o}c/W$

$R_2 = 0.11\ m^{2o}c/W$

$$R_{out} = \frac{1}{\alpha_{out}} = \frac{1}{6} = 0.17\ m^{2o}c/W$$

2) after insulation: concrete with halls inside, thickness δ =22cm, polystyrene – 10cm, concrete 10 cm, tile 1,5 cm

$R_{general} = R_{in} + R_1 + R_2 + R_3 + R_4 + R_{outside}$ = 0.11+1.15+2.22+0.13+0.008+0.17=3.79 $m^{2o}c/W$ (norm, taking into energy efficiency R = 2.8 $m^{2o}c/W$)

$R_2 = 2.22\ m^{2o}c/W$

$R_3 = 0.13\ m^{2o}c/W$

$R_4 = 0.008\ m^{2o}c/W$

Saving = 1.85/3.79*100=48.8 100-48.8 = 51.2%

ceiling consist: 1) before insulation from the top: clay plaster, thickness δ =5cm,wood 3cm, air gap 15cm, plywood 0.05cm

$R_{general} = R_{in} + R_1 + R_2 + R_{air\ gap} + R_3 + R_{outside}$ = 0.11+0.05+0.17+0.19+0.03+0.083=0.63 $m^{2o}c/W$

$$R_{in} = \frac{1}{\alpha_{in}} = \frac{1}{8.7} = 0.11\ m^{2o}c/W$$

$R_1 = 0.05\ m^{2o}c/W$

$R_2 = 0.17\ m^{2o}c/W$

$R_{air\ gap} = 0.19\ m^{2o}c/W$

$R_3 = 0.03\ m^{2o}c/W$

$R_{out} = \frac{1}{\alpha_{out}} = \frac{1}{12} = 0.083\ m^{2o}c/W$

2) after insulation: from the top: clay plaster, thickness δ =5cm, wood – 3cm, polystyrene – 10cm, air gap – 5cm, plastic – 0.05cm

$R_{general} = R_{in} + R_1 + R_2 + R_3 + R_{air\ gap} + R_4 + R_{outside}$ = 0.11+0.05+0.17+2.22+0.15+0.008+0.083=2.79 $m^{2o}c/W$ (norm, taking into energy efficiency R = 2.8 $m^{2o}c/W$)

$R_3 = 2.22\ m^{2o}c/W$

$R_4 = 0.008\ m^{2o}c/W$

Saving = 0.63/2.79*100=22.5 100-22.5 = 77.5%

.*The R-value being discussed is the unit thermal resistance. This is used for a unit value of any particular material. It is expressed as the thickness of the material divided by the thermal conductivity. For the thermal resistance of an entire section of material, instead of the unit resistance, divide the unit thermal resistance by the area of the material.

3.2. Solar Hot Water System

CAMP employed the services of Mr. Fazliddin Abdusamiev (independent consultant) and Zarif Ruziev (Assistant) for the implementation of solar equipments.

A 140 litre solar hot water heater was placed on the south facing side of the roof. It is fed by a 500litre storage tank that is fed by an external 100m pipe that supplied water from a spring on the hill on the north side of the hospital. If there is water available form the spring it will go directly to the solar water heater.

The heated water provides hot water to two wash basins within the room. This is the first time the hospital has had internal running water, and in this case hot water as well. The solar water heater was $500 but with the additional materials the total instillation costs were in the region of $1500.

DEMO EE Building

3.3 Solar Panel

A 0.75 Watt /hr ($400) solar panel on the south facing side of the roof. The solar panel will provide enough energy to power the lighting system in room and when it is not been used to provide direct power to the lighting circuit, it will charge a 12V storage battery so that the power can be accessed through a transformer to provide 220V power when it is required.

3.4 Heating

CAMP Kuhiston used funding from another project funded by the Jephcott Charitable Trust to construct a two room brick stove between the two rooms. The stove based upon a traditional Soviet design was updated by a Swiss expert several years ago. CAMP's stove trainer, Mr Kaharov Bakhtiyor used the opportunity to train a local inhabitant on the stove design. The stove takes four days to build and requires over 400 bricks, of which 50 are fire bricks for the fire chamber. The stove can burn both wood and coal and the hospital staff were trained in the cleaning and maintenance procedures. (Annex 4: Cleaning Instructions)The stove will effectively heat the two rooms and provide two cooking plates in one of the rooms. Due to the intermittent electrical supply and lack of functioning heating system in the hospital the stove will make a big difference to the quality of life to the patients and staff.

4. Training

The project has involved numerous people with different skills sets. At each opportunity practical training was conducted during construction work in the hospital, period was from August 20 till October 15 2011. (Please see Annex 5: Training Programme).

- One community member on stove construction
- One community member on use of insulation of materials
- Hospital staff on use and maintenance of solar panel and solar water heater, maintenance and cleaning of stove, cleaning and need for through cleaning of the new rooms.
- Members of the clinic and Local Authority participated in the insulation of the solar heater and panels.

Box 2: Abdulloev Saifullo – Stove Apprentice
For 10 days I was taught how to build an energy-efficient stove. The training was very interesting; we built one energy-efficient stove in the hospital in Jamoat Hakimi. Learning how to build this oven is not difficult, if we are careful. To strengthen my skills I have built three stoves in my village of Shahtuti Bolo. These were checked by the stove master to see that I built them correctly. Now I am able to build stoves for any household. My thanks to CAMP Kuhiston for what they taught me.

5. Feedback

CAMP signed MOU with the local government to actively engage them in the process and secure their support. Box 3 are some of the key comments from the Khukumat Chairman.

Box 3: Mr. Siemardov Saidamir, the Chairman of Khukumat of Nurobod District,

The construction of Rogun Dam resulted in the administrative center of Nurobod being moved further East up the Rasht Valley for 25 km. Currently, as now people have called the "new Nurobod" the new administrative center, constructed buildings such as schools, hospitals, dining room, Khukumat building, new residential stored buildings for citizens, all moved from the "old center Nurobod" To the new one.

We are well aware of the activities of the NGO CAMP Kuhiston in energy efficiency; on how local craftsmen trained to build energy efficient stoves in homes in the area of Nurobod. And I had the idea to extend this experience to build stoves in the new area of Nurobod. It should be noted that the villagers involved in beekeeping, growing fruit and vegetables. The executive board at the village level, farmers, villagers need to improve their institutional capacity, need in raising their awareness on the rational, sustainable use of natural resources and the fact that CAMP Kuhiston has a very large and positive experience in their work with the mountain communities, residents of the area, representatives of the Jamoat Nurabad area interested in further fruitful collaboration with this organization.

Mr. Faizali Sharipov is the chairman of the Hakimi Jamoat and he has over all responsibility for the people in this remote watershed.

Box 4: Sharipov Faizali - Chairman jamoat Hakimi Nurabad area

We have cooperated with CAMP Kuhiston over a period of 3 years and would like to thank the organization for the work they are doing to develop our Jamoat. The project "Demonstration Centre for Renewable Energy", which introduced Kuhiston CAMP – is really a demonstration, because the district does not have such equipment, which operate on solar energy. Now, we have the most advanced hospital in the area, in terms of utility conditions. In our hospital there is hot water, and electricity constantly. As we all know, providing electricity to homes and buildings is very difficult in the winter months due to lack of electricity. I wish CAMP Kuhiston success in their future work and new ideas for sustainable development in mountain regions.

The Chief Physician has been assigned to maintain all the equipment and the rooms. His comments on the project are below in Box 5:

Box 5 : Amonov Mahmadyusuf - Chief Physician, Hospital Jamoat Hakimi

When I was told that the CAMP organization will implement a renewable energy projects in our hospital, to be honest, I was very happy, because there are no organizations working in this field in our territory. We have only two organizations that help with medicines. The conditions in the hospital are very *heavy*, especially in winter. Electricity is limited to 8-10 hours a day, the heating has not worked for several years. It is necessary to heat the hospital with iron stoves.

CAMP Kuhiston organization installed a solar water heater, a solar panel, made major repairs and insulation in two wards and built an energy-efficient stove. We now have hot water, which we use every day, more than 100 liters of hot water without spending it on heat. We also have lighting in the two wards. All this at the expense of solar energy! Now is the month of November, it is cold outside. Therefore, we heat the stove, which heats two rooms simultaneously. Indeed, after warming, the room quickly heats to the desired temperature. It uses less fuel compared to the iron stoves that we had before.

Using the chance, I want to thank this organization for their work and those who supported the money

One of the community members from Shahtuti Bolo explained the need for the work Box 6.

Box 6: Zoirov Sahrobek - Villager, Shahtuti Bolo.

Our village is located 6 km from the hospital. It is the only hospital in Jamoat. If necessary, people from all the villages jamoat Hakimi go to the hospital. Winter is harsh and the road is in poor condition. Because of rain and snow is very hard to get to the hospital. When the people in the far villages go to hospital to be treated they have to come back after all the procedures due to the conditions in the hospital. This is a big problem in the winter due to lack of electricity and large amounts of snow fall. I recently visited the hospital, and CAMP Kuhiston improved conditions in the hospital. The two wards are very warm and comfortable, and there is lighting, and hot water. I hope that this winter will be easier for doctors to treat patients in the hospital.

6. Work to be Completed and Planned Events

There are a limited number of (I)NGOs working in the field of renewable energy and energy efficiency. Therefore, due to this limited number cooperation and collaboration between organizations has and still remains relatively effective. Even within Nurobod, CAMP has used technologies from Caritas Switzerland and Welthungerhilfe.

In July, CAMP organised in collaboration with NGO's Geres and ASDP Nau, an International Training Event on Energy Efficiency in the Sugd region of Tajikistan. Attendees were representatives of several Tajik and Kyrgy's organization including GIZ's branch in Khorog and CAMP Alatoo, Kyrgystan. CAMP used this opportunity to share it experiences of this project with other key organizations working on this issue in Central Asia.

The university of Central Asia funded the production of a film called 'One day in the Mountains'. The film is a comparative documentary of two vulnerable households, whereby one family had implemented a series of energy efficiency measures and the other family was surviving by traditional means. The film was shot in November and is due to be shown at Rio 20+ as an example of the some of the issues and solution of mountain communities in Central Asia with respect to energy use.

A brochure was produced in Tajik for the community on energy efficiency measures for mountain communities (see Annex 6: Renewable Energy Brochure). 20 copies of the brochure were published and distributed to the communities and local government of Nurobod District on the 27th October 2011. The head of the local government will distribute information and encourage other communities to implement energy efficiency measures during his monthly meeting with all the Jamoat heads. A soft copy of the brochure will be made available to other NGO's.

The Microfinance Bank conducted a day's training on the borrowing of micro credit to fund energy efficiency measures. 11 attendees, including farmers and local government representatives received training from the local branch. A copy of the information distributed by the micro credit company is shown in Annex 7. Mr. Kosimjon from the Microfinance bank will continue to conduct further trainings in the district.

From the 9-11th November the Mountain Partnership Secretariat and the University of Central Asia in collaboration with the government of Tajikistan held a regional technical consultation meeting in the framework of the World Bank's Development Grant Facility on climate change impacts and adaptive capacity. There were 35 attendees that included representatives from Azerbaijan, Iran, Kyrgyzstan, Kazakhstan, Mongolia and Tajikistan (Annex 8: List of Participants). The consultation meeting was chaired by the Government of Tajikistan. To conclude the consultation a field trip was held to Nurobod district to share the work of CAMP Kuhiston with the representatives (Annex 9: Field Day Programme). The field trip also included beneficiaries, stakeholders and local government officials (Annex 3: list of participants) and served as a feedback and *share* event.

The activities of this project were shown and discussed. Mirzo Pochoev and Faizali Shapirov presented the work to the delegation in a question and answer session. There were key discussions over the cost of the project, the capacity of the photo voltaic cells, the angle of the solar water heater and the storage of medicines and vaccines. All these proved to be positive points of learning for all involved. It is hoped that the Mountain Partnership will proved additional funding for a second solar cell to power a fridge for the storage of medicines and vaccines. A series of photos from the field trip are provided in Annex 10 and the field trip was filmed so that the nature of the activities can be shown by the Mountain Partnership Secretariat at a global level.

7. Lessons Learnt

6.1. The project implementation period was not ideal as it fell over Ramadam and the harvest time for fodder crops. There would have been much more interest had the project been held at a different time of the year.

6.2. The budget constraints were tight; this resulted in the purchase of a solar water heater with a limited guarantee. If the budget was more generous a high specification solar water heater would have been purchased.

6.3. The number of journeys between Dushanbe and the hospital was considerable. Dushanbe is the nearest major market hub but is still 2.5hrs away. The time spent on travelling and the associated transport costs that were not covered in budget.

6.4. Working in one location does provide the opportunity to combine projects, which in this case has considerably improve the output and outcomes of the project. (I.e. the two room stove).

6.5. The engagement of the local authorities is a difficult process; the MOU only carries a certain amount of influence. Repeated visits have reduced some of the scepticism held by the local government and on the last monitoring visit they had pledged to replace the beds and mattresses in the hospital rooms. After some persuasion the local government fulfilled their promise and repaired part of the roof. This is perceived as a significant breakthrough in relations with the local authority and has built a positive platform for future programmes.

6.6. The inclusion of the micro credit training on the *back of* this project will as a minimum raise the awareness of the possibility to raise funds and also may lead to some longer term investment.

6.7. The field trip provided topics of debate; the angle of solar panel was disputed as being too steep. This will be investigated.

6.8. Sharing the information through other outlets will hopefully widen the scope of the beneficiaries.

8. Summary

The project has had a very positive output and will have a great impact on the working condition for hospital staff and the welfare and care of clients that are treated in the hospital. The work could potential benefit the entire population of the Hakimi Jamoat.

The energy efficiency of the two rooms has been significantly increased, and subsequently clients will be able to stay over night in the facility. Staff will have access to internal hot water and permanent lighting during the power shortages. The high finish to the rooms improves the hygienic conditions in which the staff has to work and should improve the care provided for the patients. Staff is now able to cook and heat extra water on the two room stove and is not reliant upon inefficient cast iron stoves that do not retain heat or the intermittent electricity supply.

There has been a relatively small amount of training but with the future planned activities and events awareness of the energy efficiency demonstration building will be wide spread within the district. The Khukhmat and CAMP in the hope that long term development plans can be established and implemented. The project also will serve as an example to other district hospitals and set a standard for work and care conditions.

The photo above shows the first baby to be born in the new warm and clean energy efficient rooms in the clinic in Hakimi.

9. Annexes:

1. Action Plan
2. MoU_Hakimi Jamoat
3. Minutes_Local governance_CKU
4. Stove_instruction
5. Instruction on solar panel
6. Instruction on water boiler
7. Practical training programme
8. Renewable Energy Brochure
9. TJ Credit Policy March 28 2011 (used for distribution at the microcredit training)
10. Monitoring & Evluation plan
11. Participants of the Field Trip
12. Field Trip Agenda
13. Photographs of the Field Trip