Community Involvement in Constructing Energy Efficent Houses in Rural Kyrgyzstan

Ruslan Isaev, CAMPalatoo, Kyrgyzstan

Living conditions and the energy situation in Central Asia

Living conditions have worsened in Central Asian mountain areas since independence. A major reason of this decline is that households have insufficient heating to cope with temperatures, which can drop to as low as minus 40°C. This also affects people's health, in particular women, children and the elderly who stay at home in winter. At the same time people still expect to consume energy without paying for it since in Soviet times energy was provided free of charge. Now however, households must pay for their energy needs, but an insufficient supply and the lack of purchasing power make this an ongoing struggle.

In Tajikistan, Kyrgyzstan and Kazakhstan the process of privatising the energy sector is ongoing but is taking place under different conditions and following different strategies. In many mountain villages the supply of electricity, coal, gas or fuel is often no longer provided. Therefore villagers mostly turn to cheap and accessible energy sources such as dung and wood. On an average a household uses up to three tons of biomass per year creating further problems:

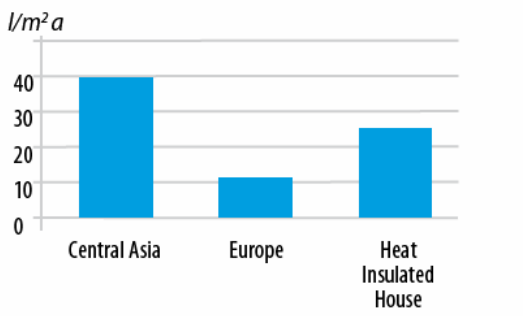
- The use of dung as a fuel instead of as fertilizer leads to soil degradation and smaller yields.
- The uncontrolled use of wood and bushes is leading to erosion, which reduces the productivity of the pastures.
- Privatisation of the energy sector will most probably not benefit the local people as the energy is produced for urban centers and for export. Moreover electricity prices are likely to further increase.

Shortage of energy resources

Energy saving and the efficient use of energy are key elements of any sustainable development. In Central Asia, the disintegration of the former centralized and large scale energy systems as well as the constant gradual increase of costs for energy carriers has led to serious social and economic problems affecting particularly the inhabitants of remote mountain villages. As a consequence, in rural areas about 50% of the annual household budget is spent on heating purposes. This is mainly because houses are usually insufficiently insulated and fuels such as coal, wood and dung are used inefficiently. Due to the current difficult economic situation many households are forced to use their own energy sources i.e. dried manure (on average up to three tons per household per heating period). This leads to a decrease in soil fertility since less manure is available as fertilizer. Moreover the cutting of trees and forests contributes to soil erosion.

Ultimately all these processes contribute to the increase of carbonic acid in the atmosphere, the destruction of natural resource cycles, and global

warming. This explains why improving energy efficiency at different levels is crucial for Central Asia which can benefit both local population (e.g. by improving health, saving household expenditures and decreasing women's and children's work load related to fuel wood collection) as well as the environment (e.g. by reducing CO2 and slowing down the degradation of resources). This is why one of the major goals of the CAMP Program is to raise awareness about energy saving and to propose ways and means to the local population on how to improve their living conditions.



Fuel consumption in 2001 in liters of oil per square meter and year

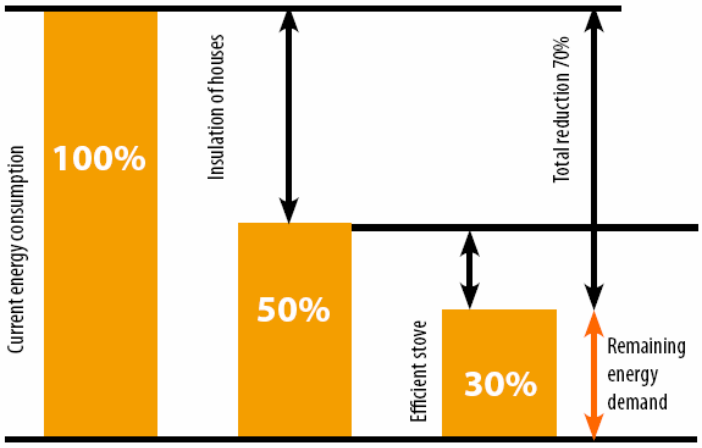
Low energy efficiency

Almost all private and public buildings are poorly insulated. In colder areas, private households spend between 30 and 50 percent of their income on energy - a figure that continues to rise. 80 percent of household energy use is spent on heating and cooking. Better insulation could potentially cut energy consumption by about 30 to 60 percent.

Rationale and objectives

Since it was established, the CAMP Program has initiated natural resource management (NRM) activities in Kyrgyzstan, Tajikistan and Kazakhstan directed towards developing appropriate technologies for a more effective and sustainable use of renewable energy resources. The insulation of houses reduces heating costs and improves comfort. Heat insulation technology, based on the use of locally accessible materials is simple, easily implemented by villagers and doesn't require special skills, tools or assistance. The objectives are:

- To develop and promote the use of insulation materials produced from locally available and accessible raw material such as clay, hay, reed, sawdust, and wool.
- To train local people how to install simple yet effective insulation into their homes, cheaply, and with their own hands.



Current energy consumption (100%) and energy saving through insulation (50%) and efficient stoves (20%) (adapted from Jegge 2001)

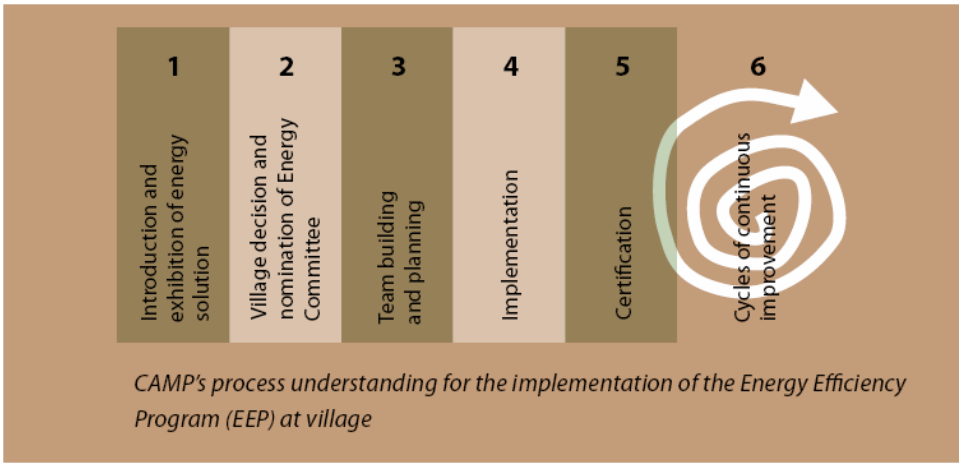
Identifying needs and setting priorities
The results of research into the current energy situation in three mountain villages in Kyrgyzstan were discussed during exhibitions and roundtables within the 'Dom Gor' project. Three main fields of priority intervention to improve the energy situation were identified:

- The insulation of rural houses using local materials.
- The technical improvement of stove systems.
- The rehabilitation of forests at a village level as a future fuel source

'The CAMP Program' then started projects regarding the first two fields of potential intervention.

Goal
Our main efforts are to promote more efficient use of energy resources through house insulation, thereby improving people's living conditions and preserving the natural resources of mountain communities.

Energy Efficiency Program
The EEP is aimed at reinforcing the idea of energy efficiency and the use of renewable energy sources at a village level. To achieve this, a six-stage process has been devised. The stages fall into two catagories: stages one, three and five are externally driven; stages two, four and six are internally driven by the energy committees and the village representatives.



CAMP's process understanding for the implementation of the Energy Efficiency Program (EEP) at village

Creation of Village Energy Committees (VECs)
So far, 25 VECs have been established in Kyrgyzstan (20), Tajikistan (3), and Kazakhstan (2). The main tasks of these energy committees are:

- to develop a long term energy strategy for the village and a corresponding concrete action plan for one year
- to promote energy saving activities and the use of renewable energy resources
- to promote awareness raising of villagers regarding energy saving measures
- to initiate and support the organization of practical trainings on house insulation and the construction of efficient stoves

- to support the creation of micro credit agencies at village level, and
- to disseminate relevant information among the villagers.

CAMP agencies are continuously helping in designing project proposals to promote the support for creating more VECs.

Reducing energy consumption by constructing efficient stoves

As in the rest of the world, the energy consumption of private and industrial buildings in Central Asia is steadily growing and the Earth's natural resources are rapidly diminishing. Moreover, the efforts required to extract new energy carrier is becoming more and more expensive in Central Asia. Heating rural housing is mainly done with individual stoves. In the majority of cases they are ineffective and don't meet conventional environmental protection standards. The construction of more efficient stoves can thus cut energy consumption by 20%.

Typical heating schemes and traditional stoves

Typically a house is heated solely by one oven without a specific distribution system. Usually, heating for different needs such as heating water, drying clothes and cooking are not provided by a single heating device. Ideally however, these various functions could be fulfilled by a single stove. Thus the continuous development of heating technologies tries to meet the following requirements:

Energy source	Without effective stove	With effective stove
Electricity	1000 kWh	200 kWh
Coal	4-5 t	2-2,5 t
Wood	2 t	0,5 t
Dung	3-5 t	1,5-2 t
Oil	50 l	20 l

Average annual household energy consumption without and with more effective stove (example of Jergetal village, Kyrgyzstan)

- become economically more efficient
- be better adapted to locally available fuel types
- be easy to learn with 'do it yourself' application
- be multifunctional.

'Miracle stoves' save money and improve living comfort

The development of multi-purpose ('miracle') stoves has many advantages for the household which invests in such new technology. Such stoves heat more than one room and can be used for baking. Moreover they are attractive pieces of furniture. However, rural inhabitants usually only pay attention to their stoves during the heating period while in spring and summer – when necessary maintenance work could be carried out – the financial means for reconstruction frequently lack. The construction of more effective stoves thus means:

- Less investment due to the use of local construction materials (100 – 150 USD/stove)
- Job opportunities in rural areas for local craftsmen specialised in stove construction
- In harmony with nature by preserving and protecting natural resources through their more efficient use.

More comfort and less expenditure with new multipurpose 'miracle stoves'

To date more than 50 stove craftsmen have been trained in local areas of Kazakhstan, Kyrgyzstan and Tajikistan to be able to construct such efficient stoves on their own. They were provided with practical workshops that included theoretical know-how about heating principles. Up to now more than 70 stoves have been constructed providing experience to these craftsmen and showing that there is a considerable demand for such stoves by villagers. This demand might increase even more in future, as the price of electricity is progressing too.

Shortcomings

The experience gained so far has shown that different obstacles have to be overcome to make 'miracle stoves' a success story:

- Provide continuous backstopping support to local craftsmen
- Ensure correct and sufficient instruction for owners regarding the use and maintenance (e.g. cleaning) of new stoves
- Develop fact sheets allowing calculating costs, duration of heat preservation of the stoves and saving potentials through different measures
- Create an understanding regarding the time needed for constructing high quality products among both customers and clients

Development of insulation technologies and training In spring 2002, insulation technologies for floors, walls and roofs using local materials such as straw, sawdust, loam, and cement were developed with the support of the 'Fachhochschule Beider Basel' (FHBB) and the 'Energy Fund of Basel' (Switzerland). Subsequently three seminars on the theory and practice of insulation were carried out in all three countries and co-organized by the FHBB, the CAMP Program and a local partner. This work also involved the Kyrgyz University of Statics, Transport and Architecture, the Tajik Technical University, and the Kazakh Energy Saving Department. The main purpose was to inform and train students and engineers. Later on, local specialists were trained during pilot insulation projects carried out in villages. For this, external backstopping was provided by Oekofacta, a Swiss company. From the beginning, activities in the field of energy efficiency were supported by several donors such as the Government of Liechtenstein, the GTZ-CCD/Batken, the SDC, and the Canton of Basel. The installation of insulation was usually followed by an awareness-raising seminar (L4S) on energy efficiency.

Walls *can be insulated from the outside. The insulating materials are fixed to the existing wall with a wooden structure and plastered with loam or a mixture of wood and loam, or filled into the gap between the wall and a thin wooden or reed wall. Possible material: straw and reed, saw dust, compact straw and loam, prefabricated straw and loam plates.*

Demand for vocational training by local craftsmen

During Soviet times the traditional local energy production and its distribution network were replaced by centralized large scale electrical

Floors *can be insulated from the top, from the bottom or both. The layer of insulating material is put over or under the existing floor and fixed with wood. Possible material: rolls from straw and loam, sawdust and cotton fiber, sawdust with a hermetical covering of tar paper, prefabricated straw and loam plates, pore concrete.*

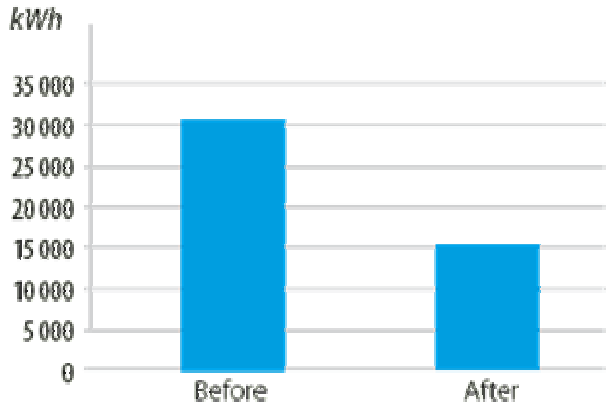
Ceilings *are insulated with a layer of material on the garret floor which is then covered with loam. Possible material: straw, sawdust, sawdust and reed, prefabricated straw and loam plates.*

stations with a wide distribution network. Electricity was considered a strategically important resource that was subsidized by the state. The regular use of electricity for heating led to the disappearance of stove-making skills. Therefore local craftsmen requested practical training and specific knowledge from external specialists. As a response to this demand, regional vocational training workshops were organized. The training was conceived as one of the job trainings where new stoves were installed in people's houses. The main implementation steps were:

- To collect detailed information about typical stove facilities in rural areas and to analyse their efficiency
- To develop simple construction technologies for effective stoves
- To evaluate different construction materials and their economic costs
- To organise a regional vocational training for craftsmen concerning the construction of effective stoves
- To elaborate and publish a construction manual for effective stoves in rural areas by using local materials
- To disseminate the gained experience in rural areas through partners

Satisfaction

The results of the insulation were satisfying: in the insulated houses less wood, electricity or dung is needed for heating and more rooms can be heated with the same amount of fuel. People feel warmer, especially when sitting on the floor. The results of electricity and fuel saving as well as improvement of heat comfort evaluated on the basis of monitoring and calculations made in insulated houses during the heating season before and after the heat insulation, show energy savings of 40 to 60 percent.



Annual heat consumption of private houses before and after the heat insulation in Jardysuu village (Kyrgyzstan)

Obstacles

- The dissemination of heat insulation methods among villagers is poor due to the absence of concrete examples to convince the local people
- The lack of a clear pricing system and a transparent cost benefit analysis often put households off from installing insulation
- Villagers are often unaware of the advantages of heat insulation

Out of experiences made so far we can recommend to:

- Create construction teams consisting of energy craftsmen contributing to job creation and development at village level
- Establish micro credit agencies which provide financial support both for stove masters and clients
- Invest in improved stove construction only after insulating houses

- Conclude a contract between the master and the client to secure high quality services and further instructions and consultations
- Further study the multifunctionality of effective stoves for example as attractive furniture or useful element of the room.

Recommendations

- Carry out awareness raising activities in villages on the advantages and opportunities of heat insulation technologies
- Inform villagers and local management bodies about house insulation on a regular basis and in an accessible form
- Be guided by the experience, the ability of local masters and the results of local trials because the insulation technology varies from region to region depending on the quality, structure and composition of local materials, the climate, and other conditions of production
- Practical training on heat insulation should preferably target household with middle income and rich households first as they are more likely to be able to take action
- Create financial institutions at a village level for supporting heat insulation works based on small credits

Further development and dissemination

In order to promote the construction of efficient stoves in the pilot mountain villages, revolving funds were established in the form of public foundations ('Micro Credit Agency') in Jergetal and Balaaiylchy village providing financial support to both craftsmen and clients. For further dissemination of these energy saving measures, the help of other partner organizations and the financial support of the Small Grant Programs (SGP) will be crucial, as more and more villagers from different regions are asking for similar trainings. The dissemination of knowledge and experience regarding the technical improvement and construction of energy saving devices is becoming more and more relevant given the increasing efforts of villages to develop their own energy strategies. In this context the CAMP agencies understand the necessary process needed to promote the implementation of energy saving measures at village level by following the 6 steps. The first step consists of introducing and exhibiting energy solutions as a phase of broad information about energy efficiency and renewable energy options, conditions and benefits of taking part in CAMP's Energy Efficiency Program (EEP). The second step is devoted to village decisions and the nomination of a 'Village Energy Committee' (VEC) based on a formal application containing the list of energy members communicated to the CAMP agencies. The third step is devoted to team building and planning. A three day workshop conducted by the CAMP agencies for the members of the VEC and representatives of local authorities addresses the issue of a village energy strategy. The participants learn about team building, agree on individual roles and responsibilities, become familiar with decision-making processes and devise first ideas for a sustainable energy strategy for their village. Step four consists in implementing first concrete activities according to the developed action plan and in raising confidence among the members of the VEC and of the village population with regard to the committee. In step five first an evaluation is carried out assessing the EEP. It is usually conducted earliest in one year

after the team building and planning workshop. Finally step six seeks to support continuous improvement by permanent planning, implementation, certification and labelling which commonly starts right after the first certification. In order to support this approach, the organization of practical demonstrations for inhabitants, partner organizations, mass media and representatives of village administration in houses with already functioning devices during winter time, is envisaged.

Further dissemination

Due to villagers' poor awareness on effective energy resources they continue to use cheap energy resources. For the application and dissemination of more sustainable technologies the CAMP Program has developed tools within the Energy Efficiency Program (EEP). They support the development of sustainable energy supply and energy saving strategies at a village level. They involve various partner organizations including representatives of local self governance bodies and state structures. The proposed approach is directed at developing potential and providing support. This will allow villagers to develop measures, taking into account local factors, and implement them as part of a more sustainable energy saving system in villages.