EXAMPLE OF VILLAGE DEVELOPMENT IN AFGHANISTAN BASED ON RENEWABLE ENERGY

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ABSTRACT

A model of village development based entirely on education and renewable energy is being implemented in the Afghan village of Bedmoschk.
Solar lamps, butter making machine, solar dryers, Scheffler reflectors, energy stations and small wind turbines are been developed or adapted to the local situation by the NGO Afghan Renewable Energy Center e.V. (ABS). Principal purpose**:** To create a model of village development that will spread over the neighbouring municipalities and beyond.
In this paper the autor will focus on solar drying and solar cooking/baking.

Keywords: Afghanistan, education, renewable energy, solar dryer, Solar Lantern, Scheffler Reflector, model village

1. INTRODUCTION and BACKGROUND

The village:

The village of Bedmoschk lies in a high valley (approx. 2300 m above sea level.) on the edge of the Hindu Kush in the province of Wardak, approx.. 100 km southwest of Kabul. Bedmoschk has approx. 600 inhabitants. The landscape around the village is barren. The weather in the course of the seasons is similar to central Europe, only much dryer. The intensive sunshine on 250 to 300 sunny days a year is a very good condition for the use of solar energy. People get water for their daily needs from a spring and transport it with plastic canisters and wheel barrels. The supply is thus limited. Because of missing rainfalls in the last 15 years the ground-water level sank considerably.

How do people cook:

In a roofed side area of each house within the fort a Tandor, the cooking place, is located. It consists of a large, open clay vessel submerged into the ground. approx. 80 cm deep (largest diameter = 70 cm). A hole in the roof of the kitchen serves as escape for the smoke. In a second room an other Tandor is built in, it is operated in winter for the floor heating system of the house. The warm air of the fire place passes through a duct system and thus heats the floors.

Women prepare the dough for bread the evening before. This way the yeast has time to rise. The tonaddor is used for cooking in the morning. Once the fire has burned down and the meals are cooked the pots are taken away and the Tandor is cleaned. The bread is then baked on the hot inner walls of the oven. This is arduous and also dangerous work, since the women must bend down deeply into the Tandor. In the summer temperatures of 114 -118° C prevail, above the remaining glowing coal approx. 180° C and the inner wall of the Tandor has around 220° C.

Women suffer from respiratory illnesses and eye irritation due to the smoke from the open fires employed for cooking and baking and due to the use of kerosene lamps for light. Cow dung is used for cooking on a daily basis. Burns are very common, too.

Drying fruit:

People live on agriculture and sell the surplus. As a grain wheat is cultivated. Potatoes and onions are grown to a lesser extent. Almost no machinery is available for agriculture: ploughs are drawn by cows. In the recent years many families in the valley changed to growing

fruit, as this provides a better income. The fruit is sold often directly of the trees, however for a lower price than for harvested fruit. People try to make use of the short fruit surplus during harvest time by drying apples and apricots on their roofs. Except drying no other methods of conservation are used.
Selling the agricultural products (fruit) results in very little income.

Picture 1: The village of Bedmoschk

Picture 2 : new primary school (left) and Center for Renewable Energy (right)

2. SOLAR DRYING

Afghanistan is famous for its tasty apples and apricots. Since storage of fresh fruit is difficult, these must be dried. The drying process takes place traditionally on roofs or other free surfaces. The cut fruit is simply spread out on a cloth or plastic sheet. Which leads to contamination of the fruit with dirt and dust. Therefore farmers obtain only a low price for their otherwise excellent product.

ABS built the first solar dryer in its Centre for Renewable Energy in Bedmoschk in 2004 with the purpose of adapting existing know how in solar drying to the afghan situation. The first dryer was of the cupboard type. It became clear that the construction of it is to complicated for the relatively little capacity it has. Handling of the dryer was not convincing to people.

Picture 3: cupboard type solar dryer

In August 2005 a different solar dryer, of the tunnel type, was built. Like the first solar dryer it uses direct solar radiation. To create hot air in the collector part of the equipment. With this design a PV-driven fan provides the necessary air flow over the fruit. It was tested drying apricots. Handling of the dryer is very similar to the traditional methods, as the fruit is simply spread on a flat surface. In this dryer 7 kg of apricots are dried within 3 to 4 days. This is very similar to when the fruit is spread in open air. But quality is much better through a more hygienic drying process: the fruit is protected against dirt, dust and animals. We decided to start with small dryers of 2m x 1m. This way the device can easily be carried and placed on roof tops. If more drying surface is needed further dryer modules of the same size can be added. A small ventilator bought on the local market is used to force the air through the dryer. The 9 W PV panel we use for the solar lanterns produced by ABS is enough to run 4 solar dryers of that size. Five more dryers have been built for the second phase of the project, which includes packing the dried fruit in a attractive, sealed bag and finding ways to sell the product. In Bedmoschk a fruit growers cooperative exists. After the first tunnel dryer was tested by ABS the cooperative showed interest and took the dryer for their own tests.

Picture 4: Solar tunnel dryer, 2mx1m

By introducing the solar dryers ABS wants to address three of its aims:

- creation of jobs and income in the village
- possibility to reduce migration
- making women's work easier by this new equipment (as the dryers protect fruit from dust and sand)

By autumn 2006 ABS will offer the solar dryer to the farmers for a reasonable price.
If farmers show interest, a bigger version of the tunnel dryer will also be offered.

3. SCHEFFLER REFLECTOR

In summer 2005 one reflector of 10m² was built in our Centre for Renewable Energies in Bedmoschk and is installed there for demonstration purposes. Advantages of the system: Environmental protection and alleviation of women's work, because firewood is scarce; women have to walk far to collect it. Inhalation of poisonous gases from open wood fires and burning cow dung are prevented. Local co-workers learn methods and procedures of manufacturing. The aim is to put production and sales into local hands at a later stage.

Picture 5: Scheffler Reflector at the Center for Renewable Energy in Bedmoschk. A traditional Tandor oven is heated with solar power.

After a lot of experiance with "modern" type baking ovens for Scheffler Reflctors this is the first time that a traditional Tandor oven is combined with a Scheffler Reflector.
In September 2005 Solare Brücke e.V. conducted tests in their centre in Aislingen, Germany, to find out which way most features of the traditional Tandur could be kept when adapting it for solar use.
To simulate a Tandur two big flower pots of a total weight of 24kg were used. Different pieces of iron were added as thermal mass, but a real Tandur weighs around 70kg. Test were done with around 35kg of oven weight.
A 8m² Reflector was used to heat the Tandur.

Picture 6 : two flower pots to simulate a Tandor oven

Picture 7: complete test set-up (with out cover from sheet aluminium)

Picture 8: Result

Result of the tests:

- The Tandur needs to be well insulated with around 10cm of mineral fibre
- Ideal temperature for baking Nan is between 360 and 450 C°
- The oven needs around 2,5 hours to preheat to 450 C°
- Nan will take between 2 and 3 minutes to get done (just like in a conventional Tandur)
- On its own the Tandur cools by 60C° per hour, this means that with this setup heat can not be stored over a longer time.
- 6,5kg of Nan can be baked in 50 minutes
- the opening of the Tandur needs to be covered with a heat resistant glass lid (for example a pyrex pan lid) during preheating, to prevent hot air from escaping.
- Whilst Nan is baking it is highly recommendable to close the class lid.
- Handling: it is uncomfortable to use the solar Tandor whilst heating it with the reflector. The recommended mode of use is to preheat it and the turn the reflector out of focus. This way the cook can operate without getting in contact with the concentrated sun light.

When the first Scheffler Reflector in Bemoschk was inaugurated it was used to heat a traditional Tandur that was built on site. Nan and Chapati (a thin flat bread, without yeast) were baked. The Tandur was preheated for about 2,5 hours and the result was a success.
The oven weighs 70kg and is built into the ground. 10cm of glass fibre insulation surround the clay vessel. The complete oven area has a finish of clay. As glass lid a flat plate of Borofloat (heat resistant, high transmission) was used. It cracked after some days of use, probably due to thermal expansion of its metal frame. Now a different glass type (Robax) , usually used for chimney doors is being tested.

Picture 9: taking ready made Nan out of the Tandur in Bedmoschk

Picture 10: preheating the Tandur in Bedmoschk

The social structure in afghan villages will make it very difficult for families to share one reflector with a Tandur. For an individual rural family a 10m² Scheffler Reflector will be to costly, the manufacturing cost comes to 1.500$. This is only feasible for institutions.
For institutional baking a different type of baking oven has been tested. Christoph Müller (www.hc-solar.de) developed it for use in Argentina. ABS is installing a demonstration unit in Kabul.

Picture 11 and 12: test of "modern" Backing Oven (design of Christoph Müller)

Manufacturing of 10m² Scheffler Reflectors started in winter 05/06 in Kabul. At the moment (Mai 06) the second series of 5 reflectors is being built. Training for construction of 2,7m² Scheffler Reflectors was started in April 06 and will be completed in August 06.