

# EVALUATION OF 3 SOLAR COOKER PROJECTS IN BURKINA FASO/WEST AFRICA

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## ABSTRACT

In this paper three different projects with the parabolic cookers **Bamako (SK 14)** and **Papillon** are being evaluated.

The **Papillon** was developed from the SK 14 and its performance is 50 % higher.

Two different target groups got involved in the project: low budget families and families with a steady income. There were different payment conditions for these two groups. Nearly all families acquired a gas bottle, a gas cooker and a thermos basket together with the SC.

The objective of the evaluation was to find out the frequency of use of the solar cookers (SC), the use of other fuel, the economies made by using the SC. Finally we wanted to identify the factors that contribute to the use of the SC's and the factors that inhibit it. Important factors are the family size, the family income, its living place, cooking times, number of meals cooked per day, the motivation of the cook.

**Key words:** SC Bamako and Papillon, frequency of use, cooking process, facilitating and inhibiting factors.

## 1. INTRODUCTION

In 2001 I moved to Burkina Faso with my family. In view of the deforestation and the erosion of soil (1) apparent around the city of Bobo Dioulasso in the southwest of the country I became interested in the activities of local solar energy organizations.

These were above all scarce. Only a protestant organization had started a program for the promotion of solar cookers (SC).

In spring 2002 I myself acquired a SC of the **Bamako** type (SK 14) and one year later a **Papillon**. Both cookers are in daily use ever since – weather permitting – in our 10 head household, thus saving about 50 % of gas.

In the following years I got involved in the promotion of SC in Bobo Dioulasso as well as in Gorom Gorom in the north of the country. Apart from the introduction of SCs I wanted to find out how effectively SCs work and which conditions contribute to or inhibit their use.

My study is a contribution along these lines. By questioning users and monitors as well as by personal observations, three minor projects conducted with SCs **Bamako** and **Papillon** in Bobo Dioulasso in the years 2001-2005 have been evaluated.

(1) See: Paul Krämer: Die Holzknappheit im Sahel und das Potential der Solarkocher, Gaia 12 (2003) S. 212-214

## 2. THE DIFFERENT TYPES OF SOLAR COOKERS

For Project 1 **A Bamako for Low Budget Families in Bobo Dioulasso** a fix focus cooker called **Bamako** was used. This SC is based on a model that had been developed by the GTZ (Gesellschaft für technische Zusammenarbeit) in Mali in the 70's and became very widespread afterwards.

The mirror is 1.4 m in diameter and the focal distance is 0.26m. The reflector consists of aluminium segments that concentrate the sun beams on the bottom of the pot that is placed in the middle of the SC. With best conditions 6.27 l of water boil within an hour.

In the two other projects the newly developed cooker **Papillon** (butterfly) was introduced. The **Papillon** has been developed in 1997 by Dipl. Ing. J. Dessel in collaboration with Prof. Bernd Hafner and the Solar Institute in Jülich/Germany.

Its construction was based on the experiences and suggestions of the users of the Bamako.

**Characteristics:**

- The performance of the Papillon is 50 % higher than that of the Bamako. With best conditions 10.75 l of water boil within an hour.
- The cook can approach the pot directly, so that cooking is easier.
- The cook isn't blinded when working behind the mirrors.
- The reflector panels are not situated under the pot. Thus they get dirty less quickly
- The Papillon has wheels and its wings can be folded up so it can be transported by only one person.



**Solar cooker Papillon**

The disadvantage consists in the more complicated technical production. If the dimensions aren't correct, the cooker doesn't perform at its best. At this moment the **Papillon** is produced only in Burkina Faso only in Ouagadougou, the capital.

Another disadvantage is lack of stability. The rough winds of the North make it turn over if not placed in a calm corner.

However most of the clients prefer the **Papillon** because of its higher performance.

### 3. PROJECTS

#### 3.1 A Bamako for 10 low budget families in Bobo Dioulasso

From 2001 to 2004 the Protestant development organization ACCEDES realized a project that benefited 70 families. Each family obtained the following equipment: a Bamako SC, a bottle of gas (12.5 kg), a gas cooker and a thermos basket for retained heat cooking for 135,000 FCFA. The payment was done by instalments. As the down payment and the instalments were relatively high only families with a steady income could afford the SC this way.

**Thus in 2003 10 cookers plus gas and thermos baskets got an additional subsidy to make it possible for low-budget families to buy a SC, too. Now the total amount to be paid was:**

**Subsidies: 70 %**

**Price: 50,000 FCFA (78 €)**

**Payment conditions: low down payment and low instalments (5000 FCFA)**

#### 3.2. Papillons for the women of the UFD in Ouagadougou

The **Union des Femmes pour le developpement (UFD)** is a parent organization that covers about 30 women organizations with in total more than 1000 members in four different quarters of the capital and four surrounding villages.

From 2004 onward the UFD has been realizing a project starting with 35 SCs. The SCs are sold on credit together with a thermos basket and a big black pot, size 6 (18 l).

**Subsidies: none**

**Price of all: 133,500 FCFA (200 €)**

**Payment conditions: high down payment (12 500 F CFA), low instalments (4 500 FCFA)**

The instalments equal the amount that can be saved in fuel if the SC is frequently used. These repayments are used to buy further SCs. In addition they pay for the monitoring and the administration costs of the project.

In March and April 2004 the **Papillons** were delivered to the households and the monitor visited the different families 2 or 3 times to train the buyer and/or the housemaid in cooking with the SC. Furthermore she had to collect the monthly instalments and inspect the SC.

#### 3.3. Papillons for the Protestants in Bobo Dioulasso

In the spring of 2005 a small project with 16 SCs was executed in BD by **Tle Nafa** (in Dioula language: advantages of the sun).

**Tle Nafa** is a local association cooperating with ACCEDES with the objective of promoting SCs.

If they wanted to, the women could buy a thermos basket and a gas bottle with integrated cooker.

**Subsidies: 20 %**

**Price of the SC: 80,000 FCFA (125 €)**

**Payment conditions: Low down payment and low instalments (5000 FCFA)**

The buyers of the SCs were in part members of the staff of ACCEDES or familiar with the organization.

The delivery of the cookers and the rest of the equipment, the training and supervision and the collection of the monthly payments were the task of an experienced female monitor.

### 4. RESULTS OF THE INTERVIEWS

The users of the SCs were visited and interviewed at home and the SCs were checked as well by the author and the monitor. Unfortunately we could only visit the women of the Bamako project in the dry season. The other women were interviewed in the rainy season where cooking with the SC often is impossible.

Here some of the results are presented in tables.

#### 4.0 In which condition are the solar cookers?

<b>Projekt 1:</b> 9 of the 10 <b>Bamakos</b> are working well. The lock of the cookers had been damaged for 5 weeks. The blacksmith has already been informed by the monitor.
<b>Projekt 2:</b> 12 of the 15 <b>Papillons</b> in Ouaga are in a good condition. 3 SCs are damaged, two are still working, one not.
<b>Projekt 3:</b> The 13 <b>Papillons</b> we checked in Bobo were in a good condition after 4 months of use.

4.1 How often are the sc's used?

	<b>Bobo: Bamako</b>		<b>Ouaga: Papillon</b>		<b>Bobo: Papillon</b>	
When the sun is shining	8	80 %	6	46 %	8	73 %
3 - 4 times a week	1	10 %	3	23 %	1	9 %
1 - 2 times a week	1	10 %	4	30 %	2	18 %

These data refer to the dry season (October until May)

4.2 Which fuel is being used?

	<b>Ouag: Pap</b>		<b>Bobo: Pap</b>	
<b>wood</b>				
yes	8	62%	9	72%
no	5	38%	2	18%
<b>charcoal</b>				
yes	6	46%	5	46%
no	7	54%	6	54%
<b>gas</b>				
yes	12	92%	10	81%
no	1	8%	1	9%

4.3. How much fuel is being saved?

	<b>Ouaga: Pap</b>		<b>Bobo: Pap</b>	
1 000 FCFA	1	8 %	0	0 %
1 500 FCFA	3	23%	0	0 %
2 000 FCFA	0	0 %	0	0 %
2 500 FCFA	0	0 %	1	9 %
3 000 FCFA	1	8 %	4	36 %
3 500 FCFA	1	8 %	0	0 %
4 000 FCFA	0	0 %	0	0 %
4 500 FCFA	1	8 %	0	0 %
a bit	2	15 %	1	9 %
don't know	4	30 %	5	46 %
total	13	100 %	11	100 %

4.4 For how many persons a day cooked meals are prepared ?

	<b>Bobo: Bamako</b>		<b>Ouaga: Papillon</b>		<b>Bobo: Papillon</b>	
1 – 5	1	10 %	2	15 %	2	18 %
6 –10	6	60 %	6	46 %	8	73 %
11 – 15	2	20 %	4	30 %	1	9 %
16 - 20	1	10 %	1	8 %	0	0 %
total	10	100 %	13	100 %	11	100 %

4.5 How often cooking is done per day?

	<b>Bobo: Bamako</b>		<b>Ouaga: Papillon</b>		<b>Bobo: Papillon</b>	
1 time	6	60 %	4	30 %	7	64%
1 – 2 times	3	30 %	1	8 %	2	18 %
2 times	2	20 %	8	62 %	1	9 %
1 time in 2 days	0		0		1	9 %
total	10	100 %	13	100 %	11	100 %

4.6 Which meals do you prepare on the sc?

	<b>Bobo: Bamako</b>		<b>Ouaga: Papillon</b>		<b>Bobo: Papillon</b>	
rice	8	80%	12	92%	10	91%
mush	1	10%	7	54%	7	64%
saucers	9	90%	12	92%	11	100%
water	-	-	11	84%	11	100%

## 5. CONCLUSIONS

### 5.1 How often are the SC's being used?

In Bobo Dioulasso the **Bamako** is frequently used by the women with low incomes. Eight of ten women declare to use it daily – weather permitting. Also the majority of the **Papillon** owners in Bobo say they use it daily (73 %). In Ouagadougou only 46 % of the buyers use it daily. (Table 4.1.)

These results are according to the information the women give about the fuel savings. In Bobo the women save more than in Ouaga. **In general the amount of fuel being saved permits the conclusion that only a part of the women use the cooker to the full extent.** This is confirmed by the use of the SC during the raining season. In Bobo 55 % of the families continue to cook with it, in Ouaga, however, it's only 38 %.

### 5.2 Which fuel is being used?

**One household uses mostly wood, the next nearly exclusively charcoal and the other mostly gas. However most of the households combine in different ways wood, charcoal and gas with the SC.** (Table 4.2.)

Families who possess a gas cooker and a gas bottle do not automatically use **only** gas and sunshine as it was intended by the projects in Bobo. Only one family in Bobo and one in Ouaga use exclusively gas and the SC. The reason is probably the lower price of wood and charcoal compared to gas.

### 5.3 Time factor

Most of the housewives and maids in BF go to the market in the morning to buy the ingredients for the warm meal at lunch time. Afterwards cooking begins. **When the meal has to be ready at 12.00 or 12. 30 p.m. often – dependant on the size of the family - only a part of it can be cooked on the SC.** When cooking is done twice a day the preparations for dinner begin often late in the afternoon. Then it's too late for the SC.

Nearly all households need warm water for washing. For that the SC is an excellent solution. A part of the water can be kept warm in the thermos basket.

### 5.4 Family size and number of meals cooked per day define the SC's usefulness

In a lot of families in BF cooking is done only once a day. In the evening the meal is just warmed up. This is the case also in a lot of our households (Table 4.5.) In addition there are some relatively large families. (Table 4.4.).

**For large families (10 persons and more) when cooking is done only once a day the Papillon and even more the Bamako reach the limits of their performance capacity.** Especially when rice or mush of corn or millet is prepared.

The pots sizes 5 (15 l) and 6 (18 l) that are used for large amounts still fit in the holder of the SC but the heat necessary for a successful meal can only be achieved on very clear days.

### 5.5 All local meals can be prepared

All local meals can be prepared on the **Papillon** and the **Bamako**. Important is the heating capacity of the SC and that the pot can be opened during the cooking procedure.

But the preparation of the mush of corn or millet, one of the principle meals in BF, is problematic.

**Only a small majority of the women cooking with the Papillon also use it for the preparation of the mush. The Bamako is used for it by only one woman.** (Table 4. 6)

All the women with Bamako complain about the insufficient heat and the uncomfortable position.

A few women with the **Papillon** also complain about the insufficient heat (7 of 24 women) and the uncomfortable position (6 of 24 women). However some women heat the water needed for the mush first on the **Papillon** before transferring it on the wood fire in order to save money.

### 5.6 There must be enough space and sunshine

Most people who buy the SC have their own courtyard and enough space. Families living in crowded courtyards may lack the space and the neighbours may be suspicious. Sometimes there is not enough sunshine in the courtyard.

### 5.7 The motivation of the female cook is what makes all the difference.

**Women who have opted for the SC are supposed to make frequent use of it. This is not always true for maids.**

In **Project 1** the buyer of the SC and the cook are always the same. Most of the SCs are used frequently (Table 4.1)

In the **Papillon project in Ouaga** housemaids are cooking in 73 % of the families, in Bobo it's 46 %.

It depends also on the motivation of the housemaid whether the SC is used at its best. A secretary in OU (7 persons/ 2 cooking procedures a day) says: *My housemaid wants to finish her job quickly. She finds the SC too slow. During the week she prepares mainly rice with the SC.*

The motivation of the cook is also determined by the income situation of the family. In Ouagadougou some families were rather rich. Probably the motivation to

save fuel is higher in middle and lower income families.

Another factor is perhaps that the Bobo people were well informed about the SC. Two women who inscribed for a **Papillon** had even already acquired a **Bamako** two years ago. Now they wanted the new model.

#### 5.8 Solar cooking requires a readiness for learning and flexibility

As mentioned before cooking with the SC takes more time. This means that the cook has to put on the water for the mush or the rice before she goes to the market. It also means that she finishes later. That she may have to transfer the pot from the SC to the gas or the cook stove.

Especially on sunny days during the rainy season one has to be flexible. Sometimes the sky is clear at 9 or 10 a.m. but first clouds appear at 11 a.m. The lifting of the heavy pot is not everybody's cup of tea. Those who declare to go on cooking during the rainy season probably possess a high motivation for the use of the SC.

In Ouaga these are 5 of 13 households, in Bobo 6 of 10.

**Intensive training of the buyer and the cook is crucial for a good use of the SC. When maids are cooking, they, too, must be trained.**

#### 5.9 Payment conditions

We found out that nearly all buyers of the **Papillon** have a steady income. Surely this is one reason for the correct repayment of the credit in both cities. Many of the buyers have even made a higher down payment than necessary and pay back faster.

**This means that the (slightly subsidised) acquisition of a SC on credit is a suitable model for middle class households.**

In the first project, **A Bamako for low income families**, 10 women decided to buy a SC. It took some of them, however, months to make the down payment and the instalments were often not paid in time.

It's easy to claim that by using the SC money is saved every day. But when there is little money anyway and the situation is aggravated for example by sickness or high corn prices it gets difficult to make payments on time.

Furthermore the savings of fuel are less than calculated. The repayment schedule of the UFD in Ouaga was based on savings of 150 F CFA per sunny day (250 days a year). This would mean monthly savings of 4 687 F CFA in the dry season. (8 months) The results of the interviews, however, show that the savings are often lower – of course partly due to the insufficient use of the SC.

**In view of these facts we conclude that the price of the SC and the monthly instalments must be**

**lowered, in order to reach lower budget families that form the majority of the urban population of Burkina Faso.**

#### 5.10 After sale service is highly recommended

The correct handling of the SC and of the thermos basket must be learned. The new cooking habits have to be encouraged and practised. Then the women will easily get used to them.

In case of a cooker defect the repair service must be reached easily and make the cooker work properly.